An Oshkosh Corporation Company

Service & Maintenance Manual

Liftlux

Models
153-12
180-12

Prior to S/N 20463
except S/N 18432 & 19930

3121310

June 27, 2008

ISO9001 REGISTERED COMPANY

An Oshkosh Truck Corporation Company

SECTION A. INTRODUCTION - MAINTENANCE SAFETY PRECAUTIONS

A. GENERAL

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

⚠ WARNING

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

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

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

⚠ WARNING

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

B. HYDRAULIC SYSTEM SAFETY

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

Relieve system pressure by cycling the applicable control several times with the engine stopped and ignition on, to direct any line pressure back into the reservoir. Pressure feed lines to system components can then be disconnected with minimal fluid loss.

C. MAINTENANCE

⚠ WARNING

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

- 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 SERVICE MANUAL.
- 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 SIZZOR UNTIL PLATFORM HAS BEEN SAFELY RESTRAINED FROM ANY MOVEMENT BY BLOCKING OR OVERHEAD SLING, OR SAFETY PROP HAS BEEN ENGAGED.
- BEFORE MAKING ADJUSTMENTS, LUBRICATING OR PERFORMING ANY OTHER MAINTENANCE, SHUT OFF ALL POWER CONTROLS.
- BATTERY SHOULD ALWAYS BE DISCONNECTED DURING REPLACEMENT OF ELECTRICAL COMPONENTS.
- KEEP ALL SUPPORT EQUIPMENT AND ATTACHMENTS STOWED IN THEIR PROPER PLACE.
- USE ONLY APPROVED, NONFLAMMABLE CLEANING SOLVENTS.

REVISION LOG

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1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

Description	153-12	180-12
Maximum Working Height	17.3 m (56.8 ft)	20 m (65.6 ft)
Maximum Platform Height	15.3 m (50.2 ft)	18 m (59 ft)
Turning Radius: Inside Outside	1.6 m (5.2 ft) 4.1 m (13.5 ft)	
Wheelbase	2.9 m (9.5 ft)	
Max Work Load (Capacity) - Main Platform/Platform Extension	500 kg (1100 lbs)	
Max Number of Persons	2	
Tools and Equipment	340 kg (749.6 lbs)	
Allowable Manual Force	400 N (90 lb ft)	
Tilt Sensor Setting	3°	2°
Maximum Operating Wind Speed	0 m/s (0 mph)	
Gross Machine Weight (Approximate)	7200 kg (15,873 lbs)	7700 kg (16,976 lbs)
Drive Speed (slow)	0.7 km/h (.4 mph)	
Drive Speed (fast)	2.5 km/h (1.6 mph)	
Lift Speed (platform empty)	75 sec	80 sec
Lowering Speed (platform empty)	50 sec	60 sec
Max Operating Hydraulic Pressure	185 bar (2683 psi)	195 bar (2828 psi)
Max. Ground Bearing Pressure	7.1 kg/cm^2 (101 psi)	8.1 kg/cm^2 (115 psi)
Max. Tire Load	3700 kg (8157 lbs)	3800 kg (8378 lbs)
Electrical System Voltage	48 V	
Gradeability (Machine Stowed)	20 %	

1.2 DIMENSIONAL DATA

Table 1-2. Dimensional Data

Description	153-12	180-12
Transport Height (rails down)	2.5 m (8.2 ft)	2.7 m (8.9 ft)
Platform dimensions (extension retracted)	4 x 1.2 m (13 x 4 ft)	
Platform dimensions (extension extended)	5.4m x 1.2 m (18 x 4 ft)	
Transport Dimensions	4 x1.2 x 2.5 m (13.5 x 4 x 8.2 ft)	4 x 1.2 x 2.7 m (13.5 x 4 x 8.9 ft)

1.3 CAPACITIES

Table 1-3. Capacities

Hydraulic Tank	55 L (14.5 gal)

1.4 TIRES

Table 1-4. Tire Specifications

Description	153-12	180-12
Size	630 x 460 x 220 (solid rubber)	
Wheel Lug Nut Torque: Front Axle: Rear Axle:	480 Nm 354 lb ft) 480 Nm (354 lb ft)	
Bolt Size	M18 x 1.5	
Max Load	2.9 t	3 t

NOTE: *JLG recommends that once any locknut is removed from the machine it is discarded and replaced with a new one.*

NOTE: *When maintenance becomes necessary or a fastener has loosened, refer to Figure 1-2., Torque Chart (SAE Fasteners - Sheet 1 of 3) through Figure 1-7., Torque Chart (METRIC Fasteners - Sheet 3 of 3) to determine proper torque value.*

1.5 BATTERIES

Table 1-5. Battery Specifications

Voltage (each)	24V
Amp Hours	350

1.6 PRESSURE SETTING

Cold temperatures have a significant impact on pressure readings. JLG Industries Inc. recommends setting the pressures with the operating temperature between 15°-20°C (59° - 68°F). JLG Industries Inc. also recommends the use of a calibrated gauge. The pressures may be set with a tolerence of ± 3 bar (43.5 psi).

Table 1-6. Pressure Settings

Description	153-12	180-12
Main Pressure Relief	185 bar (2683.1 psi)	195 bar (2828.2 psi)

1.7 CRITICAL STABILITY WEIGHTS

⚠ WARNING

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

Table 1-7. Critical Stability Weights

Component	Unit of Measure
Wheel and Tire Assembly (each)	67 kg (148 lbs)
Wheel/Tire and Drive Assembly (each)	113 kg (249 lbs)
Batteries - Standard (each) (2)	284 kg (626 lbs)

1.8 MAJOR COMPONENT WEIGHTS

Table 1-8. Component Weights

Description	153-12	180-12
Fixed Platform	450 kg (992 lbs)	
Chassis with Tires	2300 kg (5071 lbs)	
Arm Assembly	3900 kg (6598 lbs)	4100 kg (9039 lbs)
Lift Cylinder	270 kg (595 lbs)	

1.9 LIMIT SWITCHES

Platform Stowed

Senses when the platform is completely lowered. Enables drive when tilted.

High Drive Speed Cutout

When the platform reaches and exceeds a height of 3 m (9.8 ft) for the 153-12 and 3.2 m (10.5 ft) for the 180-12, the high drive speed will be cut back to the low drive speed. Once the platform is completely lowered the high drive speed is possible. The LED will remain illuminated when the EWP is being driven in slow speed.

Max Drive Height Cutout

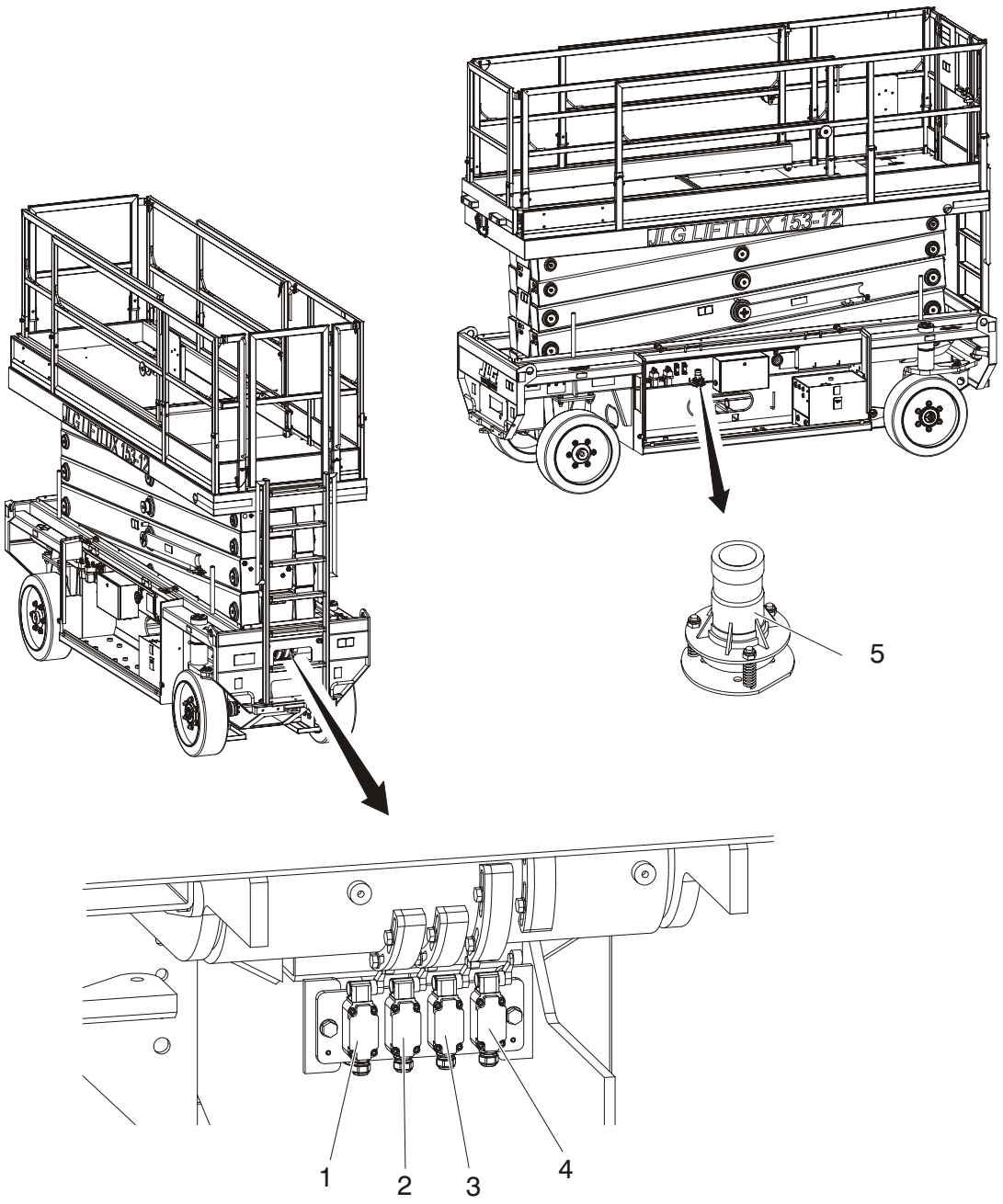
Once the platform has reached a height of 7 m (23 ft), the driving function will be disabled by the maximum drive height cutout switch. Once the limit is exceeded, only lifting/lowering will be allowed. The Drive Cutout LED on the platform control console will go out when the drive function is no longer available. The platform must be lowered to enable the drive function.

Max Height Cutout

Once the platform has reached it's maximum height of 15.3 m (50 ft) for the 153-12 and 18 m (59 ft) for the 180-12, the lifting function will be cut off by the maximum height limit switch. When maximum height is reached, the Lift Cutout Indicator LED on the control panel box will no longer be illuminated.

Tilt Alarm

The tilt switch cuts out lifting, driving, and steering once the platform reaches a tilt angle (slope) beyond 3° for the 153-12 and 2° for the 180-12, and the platform is raised by 2.5m (8.2 ft). At this point, the warning LED on the control panel box will no longer be illuminated and lowering is the only function possible.



1. Platform Stowed Limit Switch
2. High Drive Speed Cutout Limit Switch
3. Maximum Drive Height Limit Switch
4. Maximum Height Limit Switch
5. Tilt Sensor

Figure 1-1. Limit Switch Locations

1.10 LUBRICATION

Hydraulic Oil

Table 1-9. Hydraulic Oil

HYDRAULIC SYSTEM OPERATING TEMPERATURE RANGE	SAE VISCOSITY GRADE
-18° to -5°C (0° to +23°F)	10W
-18° to +100°C (0° to +210°F)	10W-20, 10W-30
+10° to +100°C (+50° to +210°F)	20W-20

NOTE: *Hydraulic oils must have anti-wear qualities at least to API Service Classification GL-3, and sufficient chemical stability for mobile hydraulic system service. JLG Industries recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity index of 152.*

NOTE: *Aside from JLG recommendations, 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. If use of hydraulic oil other than Mobilfluid 424 or DTE 13M is desired, contact JLG Industries for proper recommendations.*

Table 1-10. Mobil Hydraulic Oil Specs

	Mobil 424	Mobil DTE 13M
ISO Viscosity Grade	10W-30	#32
Specific Gravity	29.0	.877
Pour Point, Max	-43°C (-43°F)	-40°C (-40³F)
Flash Point, Min	228°C (442°F)	166³C (330³F)
Viscosity		
at 40°C (104°F) at 100°C (212°F) Viscosity Index	55 cSt 9.3 cSt 152	33 cSt 6.5 cSt 140

1.11 TORQUE CHARTS

VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY								
SAE GRADE 5 BOLTS & GRADE 2 NUTS								
SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	380	8 [.9]	6 [.7]		
	48	0.1120	0.00661	420	9 [1.0]	7 [.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 [3.5]	22 [2.5]		
	36	0.1640	0.01474	940	31 [4]	23 [2.6]		
10	24	0.1900	0.01750	1120	43 [5]	32 [3.5]		
	32	0.1900	0.02000	1285	49 [5.5]	36 [4]		
1/4	20	0.2500	0.0318	2020	96 [11]	75 [9]		105 [12]
	28	0.2500	0.0364	2320	120 [14]	86 [10]		135 [15]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	3340	17 [23]	13 [18]	16 [22]	19 [26]
	24	0.3125	0.0580	3700	19 [26]	14 [19]	17 [23]	21 [29]
3/8	16	0.3750	0.0775	4940	30 [41]	23 [31]	28 [38]	35 [47]
	24	0.3750	0.0878	5600	35 [47]	25 [34]	32 [43]	40 [54]
7/16	14	0.4375	0.1063	6800	50 [68]	35 [47]	45 [61]	55 [75]
	20	0.4375	0.1187	7550	55 [75]	40 [54]	50 [68]	60 [81]
1/2	13	0.5000	0.1419	9050	75 [102]	55 [75]	68 [92]	85 [115]
	20	0.5000	0.1599	10700	90 [122]	65 [88]	80 [108]	100 [136]
9/16	12	0.5625	0.1820	11600	110 [149]	80 [108]	98 [133]	120 [163]
	18	0.5625	0.2030	12950	120 [163]	90 [122]	109 [148]	135 [183]
5/8	11	0.6250	0.2260	14400	150 [203]	110 [149]	135 [183]	165 [224]
	18	0.6250	0.2560	16300	170 [230]	130 [176]	153 [207]	190 [258]
3/4	10	0.7500	0.3340	21300	260 [353]	200 [271]	240 [325]	285 [386]
	16	0.7500	0.3730	23800	300 [407]	220 [298]	268 [363]	330 [447]
7/8	9	0.8750	0.4620	29400	430 [583]	320 [434]	386 [523]	475 [644]
	14	0.8750	0.5090	32400	470 [637]	350 [475]	425 [576]	520 [705]
1	8	1.0000	0.6060	38600	640 [868]	480 [651]	579 [785]	675 [915]
	12	1.0000	0.6630	42200	700 [949]	530 [719]	633 [858]	735 [997]
1 1/8	7	1.1250	0.7630	42300	800 [1085]	600 [813]	714 [968]	840 [1139]
	12	1.1250	0.8560	47500	880 [1193]	660 [895]	802 [1087]	925 [1254]
1 1/4	7	1.2500	0.9690	53800	1120 [1518]	840 [1139]	1009 [1368]	1175 [1593]
	12	1.2500	1.0730	59600	1240 [1681]	920 [1247]	1118 [1516]	1300 [1763]
1 3/8	6	1.3750	1.1550	64100	1460 [1979]	1100 [1491]	1322 [1792]	1525 [2068]
	12	1.3750	1.3150	73000	1680 [2278]	1260 [1708]	1506 [2042]	1750 [2373]
1 1/2	6	1.5000	1.4050	78000	1940 [2630]	1460 [1979]	1755 [2379]	2025 [2746]
	12	1.5000	1.5800	87700	2200 [2983]	1640 [2224]	1974 [2676]	2300 [3118]

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

SAE GRADE 5 SAE GRADE 8

Figure 1-2. Torque Chart (SAE Fasteners - Sheet 1 of 3)

				VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY SAE GRADE 8 BOLTS & GRADE 8 NUTS, & SOCKET HEAD CAP SCREWS #6 THRU 1/4				
SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	LB	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]	IN-LB [N.m]
4	40	0.1120	0.00604	540	12 [1.4]	9 [1.0]		
	48	0.1120	0.00661	600	13 [1.5]	10 [1.1]		
6	32	0.1380	0.00909	820	23 [2.6]	17 [1.9]		
	40	0.1380	0.01015	920	25 [2.8]	19 [2.2]		
8	32	0.1640	0.01400	1260	41 [4.5]	31 [3.5]		
	36	0.1640	0.01474	1320	43 [5]	32 [4]		
10	24	0.1900	0.01750	1580	60 [7]	45 [5]		
	32	0.1900	0.02000	1800	68 [8]	51 [6]		
1/4	20	0.2500	0.0318	2860	144 [16]	108 [12]		160 [18]
	28	0.2500	0.0364	3280	168 [19]	120 [14]		185 [21]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	4720	25 [34]	18 [24]	22 [30]	30 [41]
	24	0.3125	0.0580	5220	25 [34]	20 [27]	25 [34]	30 [41]
3/8	16	0.3750	0.0775	7000	45 [61]	35 [47]	40 [54]	50 [68]
	24	0.3750	0.0878	7900	50 [68]	35 [47]	45 [61]	55 [75]
7/16	14	0.4375	0.1063	9550	70 [95]	55 [75]	63 [85]	80 [108]
	20	0.4375	0.1187	10700	80 [108]	60 [81]	70 [95]	90 [122]
1/2	13	0.5000	0.1419	12750	110 [149]	80 [108]	96 [130]	120 [163]
	20	0.5000	0.1599	14400	120 [163]	90 [122]	108 [146]	135 [183]
9/16	12	0.5625	0.1820	16400	150 [203]	110 [149]	139 [188]	165 [224]
	18	0.5625	0.2030	18250	170 [230]	130 [176]	154 [209]	190 [258]
5/8	11	0.6250	0.2260	20350	220 [298]	170 [230]	180 [244]	240 [325]
	18	0.6250	0.2560	23000	240 [325]	180 [244]	204 [277]	265 [359]
3/4	10	0.7500	0.3340	30100	380 [515]	280 [380]	301 [408]	420 [569]
	16	0.7500	0.3730	33600	420 [569]	320 [434]	336 [456]	465 [630]
7/8	9	0.8750	0.4620	41600	600 [813]	460 [624]	485 [658]	660 [895]
	14	0.8750	0.5090	45800	660 [895]	500 [678]	534 [724]	725 [983]
1	8	1.0000	0.6060	51500	900 [1220]	680 [922]	687 [931]	990 [1342]
	12	1.0000	0.6630	59700	1000 [1356]	740 [1003]	796 [1079]	1100 [1491]
1 1/8	7	1.1250	0.7630	68700	1280 [1735]	960 [1302]	1030 [1396]	1400 [1898]
	12	1.1250	0.8560	77000	1440 [1952]	1080 [1464]	1155 [1607]	1575 [2135]
1 1/4	7	1.2500	0.9690	87200	1820 [2468]	1360 [1844]	1453 [1970]	2000 [2712]
	12	1.2500	1.0730	96600	2000 [2712]	1500 [2034]	1610 [2183]	2200 [2983]
1 3/8	6	1.3750	1.1550	104000	2380 [3227]	1780 [2413]	1907 [2586]	2625 [3559]
	12	1.3750	1.3150	118100	2720 [3688]	2040 [2765]	2165 [2935]	3000 [4067]
1 1/2	6	1.5000	1.4050	126500	3160 [4284]	2360 [3200]	2530 [3430]	3475 [4711]
	12	1.5000	1.5800	142200	3560 [4827]	2660 [3606]	2844 [3856]	3925 [5322]

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

SAE GRADE 5 SAE GRADE 8

Figure 1-3. Torque Chart (SAE Fasteners - Sheet 2 of 3))

				JLG SPECIFICATION #4150701- MAGNA 565			
				SOCKET HEAD CAP SCREWS 5/16 & ABOVE			
SIZE	TPI	BOLT DIA	TENSILE STRESS AREA	CLAMP LOAD	TORQUE	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		IN	SQ IN	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	108 [12]		160 [18]
	28	0.2500	0.0364	3280	120 [14]		185 [21]
		IN	SQ IN	LB	FT-LB [N.m]	FT-LB [N.m]	FT-LB [N.m]
5/16	18	0.3125	0.0524	4720	18 [24]	22 [30]	30 [41]
	24	0.3125	0.0580	5220	20 [27]	25 [34]	30 [41]
3/8	16	0.3750	0.0775	7000	35 [47]	40 [54]	50 [68]
	24	0.3750	0.0878	7900	35 [47]	45 [61]	55 [75]
7/16	14	0.4375	0.1063	9550	55 [75]	63 [85]	80 [108]
	20	0.4375	0.1187	10700	60 [81]	70 [95]	90 [122]
1/2	13	0.5000	0.1419	12750	80 [108]	96 [130]	120 [163]
	20	0.5000	0.1599	14400	90 [122]	108 [146]	135 [183]
9/16	12	0.5625	0.1820	16400	110 [149]	139 [188]	165 [224]
	18	0.5625	0.2030	18250	130 [176]	154 [209]	190 [258]
5/8	11	0.6250	0.2260	20350	170 [230]	180 [244]	240 [325]
	18	0.6250	0.2560	23000	180 [244]	204 [277]	265 [359]
3/4	10	0.7500	0.3340	30100	280 [380]	301 [408]	420 [569]
	16	0.7500	0.3730	33600	320 [434]	336 [456]	465 [630]
7/8	9	0.8750	0.4620	41600	460 [624]	485 [658]	660 [895]
	14	0.8750	0.5090	45800	500 [678]	534 [724]	725 [983]
1	8	1.0000	0.6060	51500	680 [922]	687 [931]	990 [1342]
	12	1.0000	0.6630	59700	740 [1003]	796 [1079]	1100 [1491]
1 1/8	7	1.1250	0.7630	68700	960 [1302]	1030 [1396]	1400 [1898]
	12	1.1250	0.8560	77000	1080 [1464]	1155 [1607]	1575 [2135]
1 1/4	7	1.2500	0.9690	87200	1360 [1844]	1453 [1970]	2000 [2712]
	12	1.2500	1.0730	96600	1500 [2034]	1610 [2183]	2200 [2983]
1 3/8	6	1.3750	1.1550	104000	1780 [2413]	1907 [2586]	2625 [3559]
	12	1.3750	1.3150	118100	2040 [2765]	2165 [2935]	3000 [4067]
1 1/2	6	1.5000	1.4050	126500	2360 [3200]	2530 [3430]	3475 [4711]
	12	1.5000	1.5800	142200	2660 [3606]	2844 [3856]	3925 [5322]

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NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

SAE GRADE 5 SAE GRADE 8

Figure 1-4. Torque Chart (SAE Fasteners - Sheet 3 of 3)

			VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY CLASS 8.8 METRIC BOLTS CLASS 8 METRIC NUTS				
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE (DRY OR LOCTITE 263)	TORQUE (LUB)	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m	N.m
3	.5	5.03	2.19	1.3	1.0	1.2	1.4
3.5	.6	6.78	2.95	2.1	1.6	1.9	2.3
4	.7	8.78	3.82	3.1	2.3	2.8	3.4
5	.8	14.2	6.18	6.2	4.6	5.6	6.8
6	1	20.1	8.74	11	7.9	9.4	12
7	1	28.9	12.6	18	13	16	19
8	1.25	36.6	15.9	25	19	23	28
10	1.5	58.0	25.2	50	38	45	55
12	1.75	84.3	36.7	88	66	79	97
14	2	115	50.0	140	105	126	154
16	2	157	68.3	219	164	197	241
18	2.5	192	83.5	301	226	271	331
20	2.5	245	106.5	426	320	383	469
22	2.5	303	132.0	581	436	523	639
24	3	353	153.5	737	553	663	811
27	3	459	199.5	1080	810	970	1130
30	3.5	561	244.0	1460	1100	1320	1530
33	3.5	694	302.0	1990	1490	1790	2090
36	4	817	355.5	2560	1920	2300	2690
42	4.5	1120	487.0	4090	3070	3680	4290

5000029_H

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

METRIC CLASS 8.8

METRIC CLASS 10.9

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

			VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY CLASS 10.9 METRIC 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)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m	N.m
3	.5	5.03	3.13	1.9	1.4	1.5	2.1
3.5	.6	6.78	4.22	3.0	2.2	2.4	3.3
4	.7	8.78	5.47	4.4	3.3	3.5	4.8
5	.8	14.2	8.85	8.9	6.6	7.1	9.7
6	1	20.1	12.5	15	11	12	17
7	1	28.9	18.0	25	19	20	28
8	1.25	36.6	22.8	37	27	29	40
10	1.5	58.0	36.1	72	54	58	79
12	1.75	84.3	52.5	126	95	101	139
14	2	115	71.6	200	150	160	220
16	2	157	97.8	313	235	250	344
18	2.5	192	119.5	430	323	344	473
20	2.5	245	152.5	610	458	488	671
22	2.5	303	189.0	832	624	665	915
24	3	353	220.0	1060	792	845	1170
27	3	459	286.0	1540	1160	1240	1690
30	3.5	561	349.5	2100	1570	1680	2310
33	3.5	694	432.5	2600	2140	2280	2860
36	4	817	509.0	3660	2750	2930	4020
42	4.5	1120	698.0	5860	4400	4690	6440

5000029_H

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-6. Torque Chart (METRIC Fasteners - Sheet 2 of 3))

			JLG SPECIFICATION #4150701- MAGNA 565 CLASS 12.9 SOCKET HEAD CAP SCREWS M6 AND ABOVE			
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE	TORQUE (LOCTITE 262)	TORQUE (LOCTITE) (242 OR 271)
		sq mm	KN	N.m	N.m	N.m
3	.5	5.03			1.5	2.1
3.5	.6	6.78			2.4	3.3
4	.7	8.78			3.5	4.8
5	.8	14.2			7.1	9.7
6	1	20.1	12.5	11	12	17
7	1	28.9	18.0	19	20	28
8	1.25	36.6	22.8	27	29	40
10	1.5	58.0	36.1	54	58	79
12	1.75	84.3	52.5	95	101	139
14	2	115	71.6	150	160	220
16	2	157	97.8	235	250	344
18	2.5	192	119.5	323	344	473
20	2.5	245	152.5	458	488	671
22	2.5	303	189.0	624	665	915
24	3	353	220.0	792	845	1170
27	3	459	286.0	1160	1240	1690
30	3.5	561	349.5	1570	1680	2310
33	3.5	694	432.5	2140	2280	2860
36	4	817	509.0	2750	2930	4020
42	4.5	1120	698.0	4400	4690	6440

NOTE: THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS

5000029_H

METRIC CLASS 8.8 METRIC CLASS 10.9

Figure 1-7. Torque Chart (METRIC Fasteners - Sheet 3 of 3)

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.

Preparation, Inspection, and Maintenance

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

Pre-Start Inspection

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

Pre-Delivery Inspection and Frequent Inspection

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

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

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

Annual Machine Inspection

JLG recommends that the Annual Machine Inspection 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.

Preventive 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.
Load Sensing System Verification	Semi Annually	Owner, Dealer, or User	Factory Certified Service Technician (Recommended)	Operator and Safety Manual
Annual Machine Inspection	Annually, no later than 13 months from the date of the prior inspection.	Owner, Dealer, or User	Factory-Certified Service Technician (recommended)	Service and Maintenance Manual and applicable JLG inspection form.
Preventative Maintenance	At intervals as specified in the Service and Maintenance Manual.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual

2.2 SERVICE AND GUIDELINES

General

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

Safety and Workmanship

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

Cleanliness

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

Components Removal and Installation

1. Use adjustable lifting devices, whenever possible, if mechanical assistance is required. All slings (chains, cables, etc.) should be parallel to each other and as near perpendicular as possible to top of part being lifted.
2. Should it be necessary to remove a component on an angle, keep in mind that the capacity of an eyebolt or similar bracket lessens, as the angle between the supporting structure and the component becomes less than 90°.
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 Figure 2-1., Lubrication Diagram.

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 quantity of oil in supply tube.
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

1. Refer to Section 1 for recommendations for viscosity ranges.
2. JLG recommends Mobilfluid 424 hydraulic oil, which has an SAE viscosity of 10W-30 and a viscosity index of 152.

NOTE: *Start-up of hydraulic system with oil temperatures below -26°C (-15°F) is not recommended. If it is necessary to start the system in a sub-zero environment, it will be necessary to heat the oil with a low density, electrical heater to a minimum temperature of -26°C (-15°F).*

Changing Hydraulic Oil

1. Use of any of the recommended crankcase or hydraulic oils eliminates the need for changing the oil on a regular basis. However, filter elements must be changed annually unless operating in extreme conditions. 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 replace the filter and clean magnet 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.

Table 2-2. Lubrication Specifications

Key	Specifications
MPG	Multipurpose Grease having a minimum dripping point of 177°C (350° F). Excellent water resistance and adhesive qualities, and being of extreme pressure type. (Timken OK 40 pounds minimum.)
EPGL	Extreme Pressure Gear Lube (oil) meeting API service classification GL-5 or MIL-Spec MIL-L-2105.
HO	Hydraulic Oil. API service classification GL-3,e.g. DTE 11M.

2.4 OPERATOR MAINTENANCE

⚠ WARNING

TO AVOID PERSONAL INJURY, USE SAFETY PROP FOR ALL MAINTENANCE REQUIRING PLATFORM TO BE ELEVATED.

NOTE: *Be sure to lubricate like item on each side.*

NOTE: *Recommended lubricating intervals are based on machine operations under normal conditions. For machines used in multi-shift operations and/or exposed to hostile environments or conditions, lubrication frequencies must be increased accordingly.*

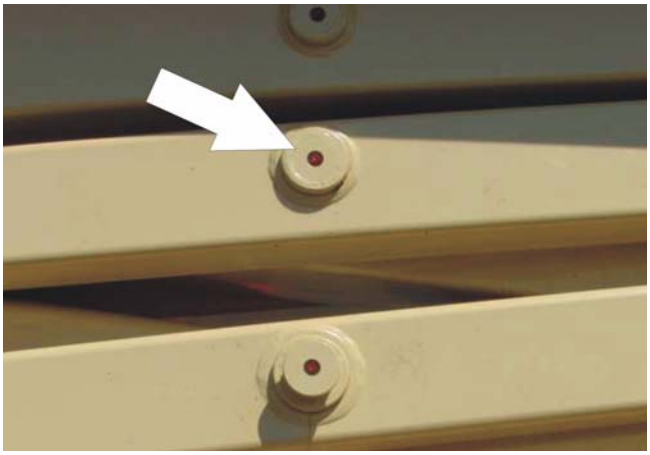
Operate hydraulic functions through one complete cycle before checking hydraulic oil level in tank. Oil should be visible in ADD sight window on hydraulic tank. If oil is not visible, add oil until oil is visible in both ADD and FULL sight windows on tank. Do not overfill tank.

1. Arm Pins
2. Lower Slide Pads
3. Upper Slide Pads
4. Hydraulic Oil Tank
5. Lift Cylinder Pin
6. Tie Rod Ends
7. Spindles

Figure 2-1. Lubrication Diagram

NOTE: *The following numbers correspond with those in Figure 2-1., Lubrication Diagram.*

1. Arm Pin

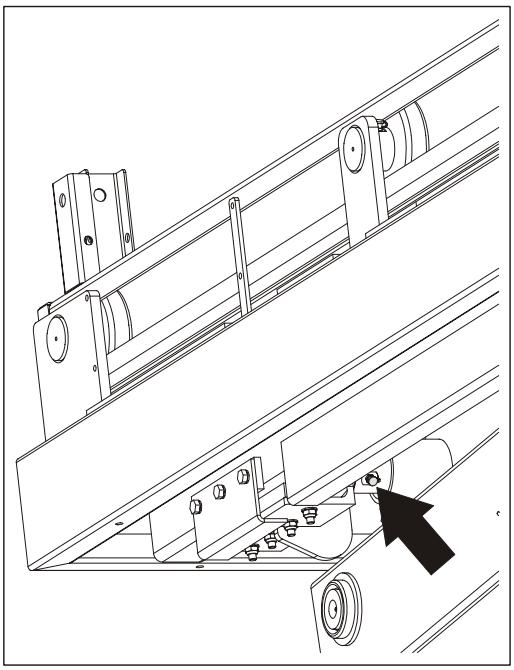


- Lube Points - 26 Grease Fittings
- Capacity - As Required
- Lube Type - MPG
- Interval - As Required

2. Lower Slide Pads

- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube Type - MPG
- Interval - As Required

3. Upper Slide Pad



- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube Type - MPG
- Interval - As Required

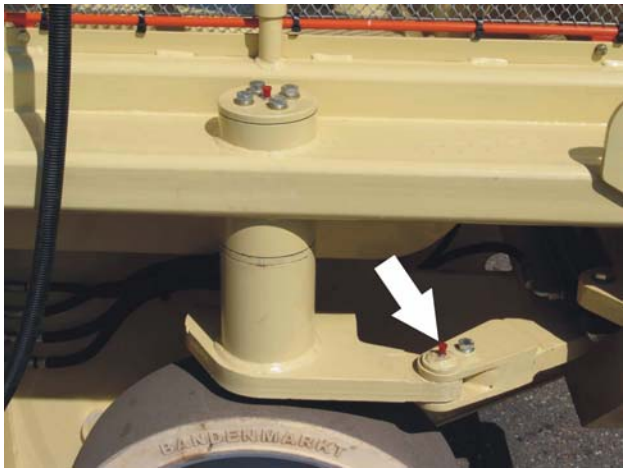
4. Hydraulic Oil Tank

- Lube Points - Fill Cap and Site Gauge
- Capacity - 55 L (14.5 gal)
- Lube Type - HO
- Interval - Check daily, change every 1200 hours of operation

5. Lift Cylinder Pin

- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube Type - MPG
- Interval - As Required

6. Tie Rod Ends



- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube Type - MPG
- Interval - As Required

7. Spindles

- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube Type - MPG
- Interval - As Required

2.5 CYLINDER DRIFT TEST

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

Platform Drift

NOTE: *Test cylinder drift with machine oil at ambient temperature.*

1. Place maximum work load onto platform (Refer to Table 1-1, Operating Specifications).
2. Extend lift cylinder to achieve a platform height 3 to 5 meters from fully stowed.
3. Wipe cylinder rod clean and place a mark on the rod 50mm from the cylinder head.
4. Wait 15 minutes.
5. Measure distance of mark from head.
6. Difference (cylinder drift) must not exceed 3mm.

NOTE: *If cylinder drift exceeds 3mm, repeat test. If still greater than 3mm, check holding valve (refer to Figure 4-32., Lift Cylinder Valve Block). If still greater than 3mm, replace cylinder seals (refer to Section 4.4, Cylinder Repair).*

2.6 PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE

The preventive maintenance and inspection checks are listed and defined in the following table. This table is divided into two basic parts, the “AREA” to be inspected and the “INTERVAL” at which the inspection is to take place. Under the “AREA” portion of the table, the various systems along with the components that make up that system are listed. The “INTERVAL” portion of the table is divided into five columns representing the various inspection time periods. The numbers listed within the interval column represent the applicable inspection code for which that component is to be checked.

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

⚠ IMPORTANT

JLG INDUSTRIES REQUIRES THAT A COMPLETE ANNUAL INSPECTION BE PERFORMED IN ACCORDANCE WITH THE "ANNUAL MACHINE INSPECTION REPORT" FORM.

NOTE: *This machine requires periodic safety and maintenance inspections by a JLG Dealer. Notify dealer if inspection is overdue.*

The inspection and maintenance code numbers are as follows:

1. Check for proper and secure installation.
2. Check for visible damage and legibility.
3. Check for proper fluid level.
4. Check for any structural damage; cracked or broken welds; bent or warped surfaces.
5. Check for leakage.
6. Check for presence of excessive dirt or foreign material.
7. Check for proper operation and freedom of movement.
8. Check for excessive wear or damage.
9. Check for proper tightness and adjustment.
10. Drain, clean and refill.
11. Check for proper operation while pump/motor is running.
12. Check for proper lubrication.
13. Check for evidence of scratches, nicks or rust and for straightness of rod.
14. Check for condition of element; replace as necessary.
15. Check for proper inflation.

Table 2-3. Preventive Maintenance and Safety Inspection

AREA	INTERVAL				
	Daily	Weekly	100 Hours (3 Months)	200 Hours (6 Months)	400 Hours (1 year)
PLATFORM					
1. Controller	1,11				
2. Switches	1,11				
3. Placards and Decals	1, 2				
4. Control Tags	1, 2				
5. Hoses and Cables		4,8			
6. Wear Pads				8,12	
7. Handrails and Chains	1, 4				
CHASSIS					
1. Battery	3	5			
2. Hydraulic Pump	1	5			
3. Valves	1	5			
4. Hydraulic Filter	ANNUAL				
5. Hydraulic Hoses and Tubing	1	5			
6. Hydraulic Oil Tank		5		3, 4	
8. Lift Cylinder	1,12	5, 6,13		4	
9. Limit Switch	1, 7				
10. Tilt Alarm Switch					1,7
11. Placards and Decals	1, 2				
12. Wheel and Tire Assemblies	1	8, 9			
13. Drive Motors		1,5,6			
14. Drive Brakes		1,6		8	
15. Drive Torque Hubs		1, 3, 5, 6			
16. Steer Cylinder	1	5, 6,13		4	
17. Steer Components	1	4, 6		8	
18. Wheel Bearings				8	12
19. Scissor Arms	1, 4				
20. Safety Props	1,4				
21. Sliding Wear Pads				8,12	
22. Pivot Pins/Bolts	1,4			7,8	
23. Switches, Ground Control	1,11				
24. Control Tags	1, 2				

NOTES:

SECTION 3. CHASSIS, PLATFORM & SCISSOR ARMS

3.1 WHEEL ASSEMBLY

Drive Hub

⚠ IMPORTANT

DRIVE HUB UNITS SHOULD ALWAYS BE ROLL AND LEAK TESTED BEFORE DISASSEMBLY AND AFTER ASSEMBLY TO MAKE SURE THAT THE UNIT'S GEARS AND SEALANTS ARE WORKING PROPERLY.

The following information briefly outlines what to look for when performing these tests.

⚠ WARNING

IF THE MACHINE IS ON ANY INCLINE, THE WHEELS MUST BE ADEQUATELY BLOCKED PRIOR TO MANUALLY DISENGAGING THE BRAKES. FAILURE TO DO SO MAY RESULT IN INJURY OR EVEN DEATH.

Roll Test

The purpose of the roll test is to determine if the unit's gears are rotating freely and properly. You should be able to rotate the wheel or hub of the gearbox by hand. If you feel more drag in the gears only at certain points, then the gears are not rolling freely and should be examined for improper installation or defects. Some gear packages roll with more difficulty than others. Do not be concerned if the gears in your unit seem to roll hard as long as they roll with consistency.

Leak Test

The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your leak checking fitting starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal or wherever o-rings are located. The exact location of a leak can usually be detected by brushing a soap and water solution around the main seal and where the o-rings or gaskets meet on the exterior of the unit, then checking for air bubbles. If a leak is detected in a seal, o-ring or gasket, the part must be replaced, and the unit rechecked. Leak test at **10 psi** for 20 minutes.

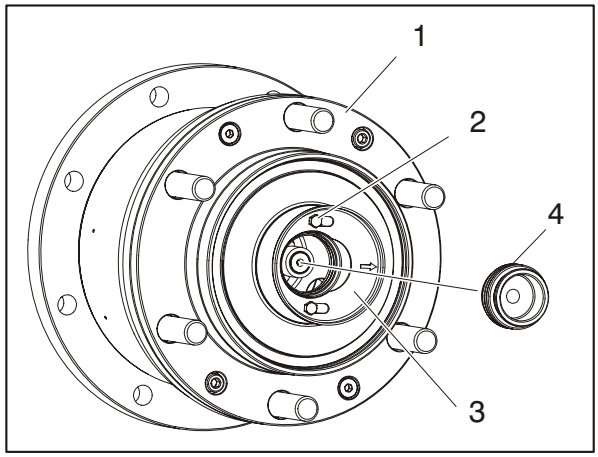
NOTE: *Due to the small air volume inside this Torque-Hub, it will pressurize to 10 psi very quickly. If the pressure becomes excessive in the unit the seals will be destroyed.*

Lubricant

The torque hub unit is shipped with 90W gear oil. It is designed to utilize the same oil throughout its service life. However, should it need to be serviced the oil will need to be drained and replaced.

In the event of servicing, fill the unit with Arco H.D. 120# Drum or Exxon GX 80W-90.

Drive Hub



1. Drive Hub
2. Screw
3. Circlip
4. Pin

Figure 3-1. Drive Hub

Hub Disengaging and Oil Checking Procedure:

1. Loosen the two Screws (2) securing the Circlip (3).
2. Slide the Circlip (3) in the direction of the arrow.
3. Remove the Pin (4).
4. The proper gear oil level should be to the base of the opening. Add gear oil if needed.
5. Turn the Pin (4) around and place back onto Hub (1).

NOTE: *Side of Pin that was facing outside should now be facing the inside of the hub.*

6. Slide Circlip (3) in opposite direction of arrow to secure the Pin. Tighten Screws (2) to secure the Circlip in place.

Table 3-1. Drive Hub Technical Specifications

Max Torque	5,5 kNm
Max Input Speed	4000 rpm
Weight	46 kg (101.4 lbs)
Brake	
Static Torque	200 Nm (147.5 lb ft)
Releasing Pressure	12-15 bar (174-217.5 psi)
Max Pressure	100 bar (1450.3 psi)
Max Input Torque	200 Nm (147.5 lb ft)

Tire Replacement

JLG recommends a replacement tire be the same size, ply and brand as originally installed on the machine. Please refer to the JLG Parts Manual for the part number of the approved tires for a particular machine and model. If not using a JLG approved replacement tire, it is recommended that replacement tires have the following characteristics:

- Equal or greater ply/load rating and size of original.
- Tire tread contact width equal or greater than original.
- Wheel diameter, width, and offset dimensions equal to the original.

When selecting and installing a replacement tire, ensure that all tires are inflated to the pressure recommended by JLG, if applicable. Due to size variations between tire brands, both tires on the same axle should be the same.

Wheel Replacement

The rims installed on each product model have been designed for stability requirements which consist of track width, tire pressure, and load capacity. Size changes such as rim width, center piece location, larger or smaller diameter, etc., without written factory recommendations, may result in an unsafe condition regarding stability.

Wheel Installation

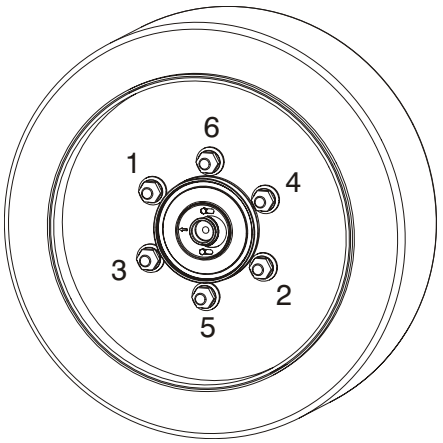
It is extremely important to apply and maintain proper wheel mounting torque.

⚠ WARNING

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

Tighten the lug nuts to the proper torque to prevent wheels from coming loose. Use a torque wrench to tighten the fasteners. If you do not have a torque wrench, tighten the fasteners with a lug wrench, then immediately have a service garage or dealer tighten the lug nuts to the proper torque. Over-tightening will result in breaking the studs or permanently deforming the mounting stud holes in the wheels. The proper procedure for attaching wheels is as follows:

1. Start all nuts by hand to prevent cross threading. DO NOT use a lubricant on threads or nuts.
2. Tighten nuts in the following sequence:



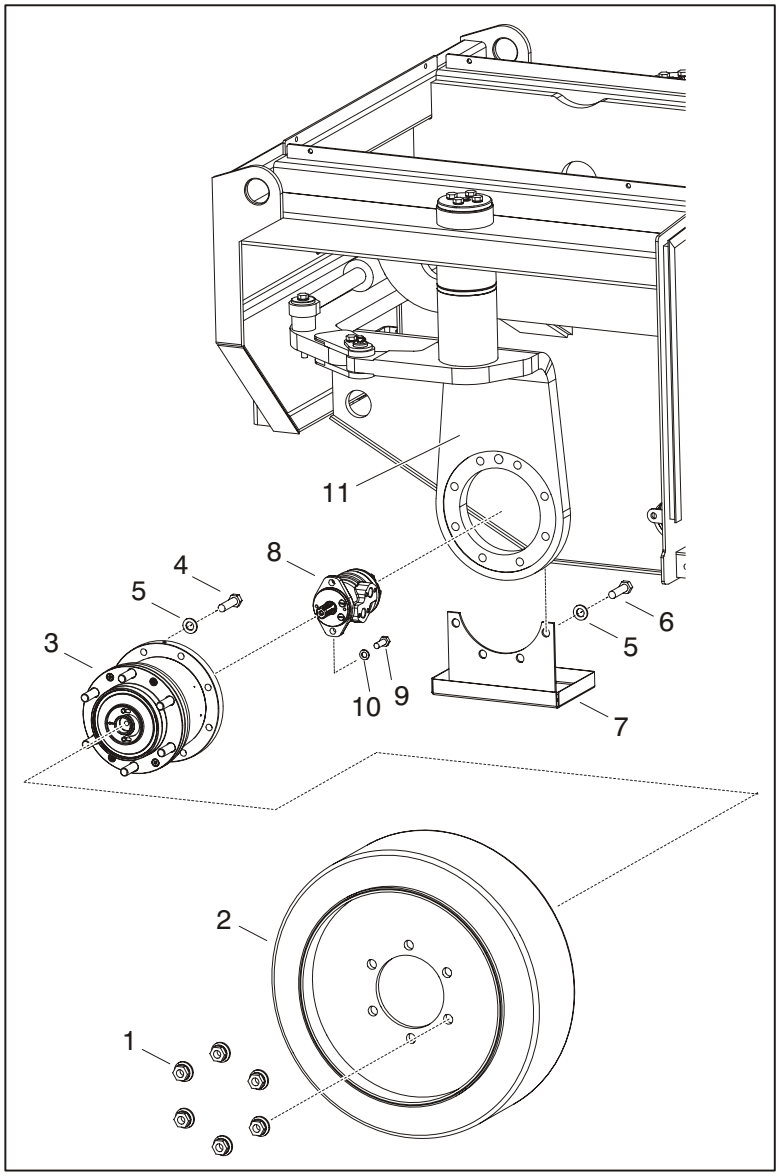
6 LUG PATTERN

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

Table 3-2. Wheel Torque Chart

TORQUE SEQUENCE		
1st Stage	2nd Stage	3rd Stage
210 - 270 Nm (150-190 ft lbs)	320-380 Nm (230 - 270 ft lbs)	440 - 480 Nm (305 - 343 ft lbs)

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



1. Wheelnut (6 per wheel)
2. Tire
3. Drive Hub
4. Bolt, M16 x 55mm
5. Washer, M16
6. Bolt, M16 x 60 mm
7. Oil Pan
8. Drive Motor
9. Bolt, M12 x 35mm
10. Lockwasher, M12
11. Spindle

Figure 3-2. Wheel Assembly Removal

⚠ WARNING

SECURE MACHINE WITH JACKS AND CHALK BLOCKS WHEN REMOVING AND/OR INSTALLING WHEELS.

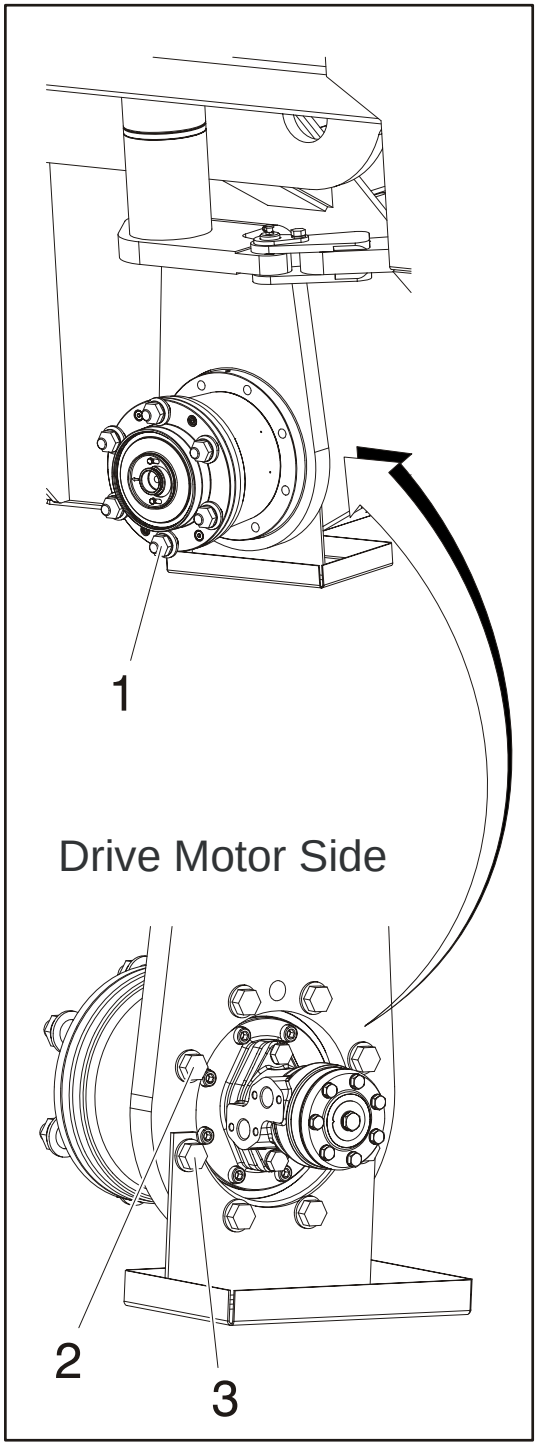
NOTE: *Follow the below steps when servicing/replacing the wheel/tire assembly.*

Removal:

1. Elevate machine with jacks or other suitable device and secure.
2. Remove 6 Wheelnuts (1).
3. Carefully remove Tire (2) from Drive Hub (3).
4. Disconnect all hoses/wires from Drive Motor (7).
5. Remove two Bolts (8) and Lockwashers (9) attaching the Drive Motor to the Drive Hub. Carefully remove the Drive Motor.
6. Remove the eight Bolts (4) and Washers (5) attaching the Drive Hub and Oil Pan to the Spindle (10). Carefully remove the Drive Hub and Oil Pan.

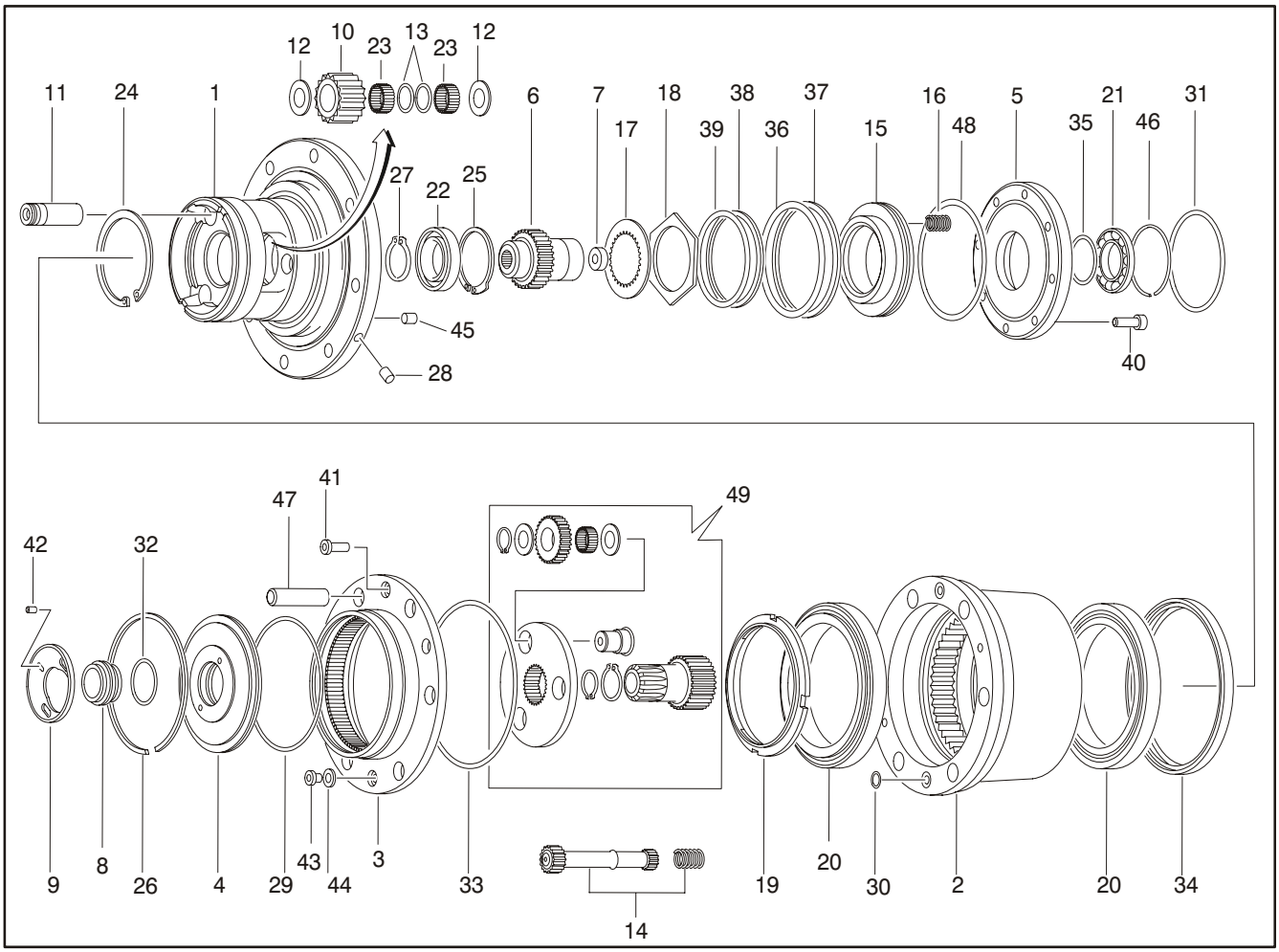
Installation:

- Follow the removal steps in reverse order when installing the wheel assembly.



1. Torque to 480 Nm Dry (354 lb ft)
2. Torque to 313 Nm Dry (230.9 lb ft)
3. Torque to 313 Nm Dry (230.9 lb ft)

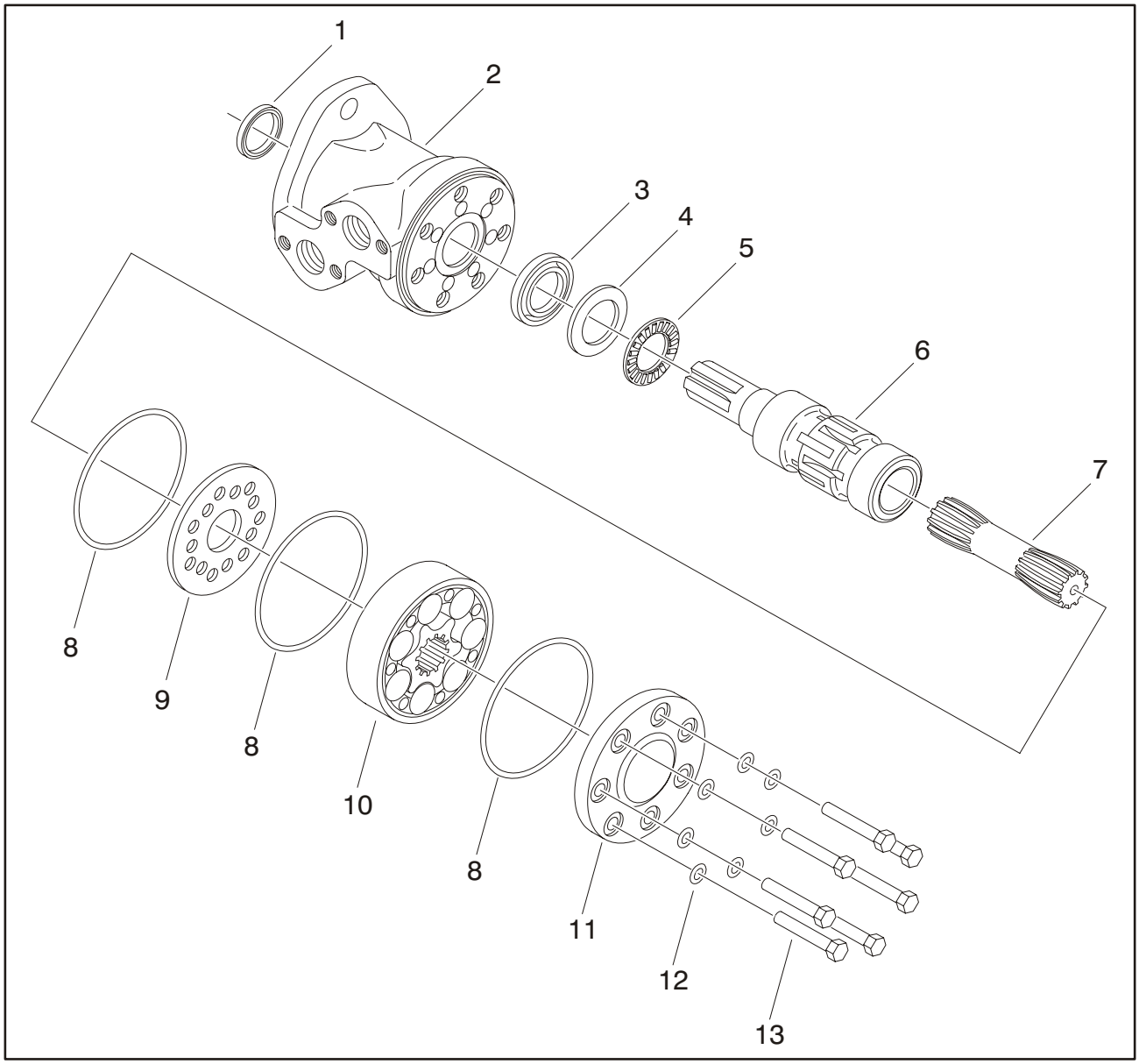
Figure 3-3. Hub Torque Values



1. Spindle	14. Sun Pinion	27. Circlip	40. Screw
2. Hub	15. Piston	28. Plug	41. Screw
3. Gear Ring	16. Spring	29. O-Ring	42. Screw
4. Cover	17. Disc	30. O-Ring	43. Plug
5. Flange	18. Disc	31. O-Ring	44. Washer
6. Coupling	19. Lock Nut	32. O-Ring	45. Plug
7. Thrust Washer	20. Bearing	33. O-Ring	46. Disc
8. Thrust Washer	21. Bearing	34. Oil Seal	47. Threaded Stud
9. Circlip	22. Bearing	35. Gasket	48. O-Ring
10. Planetary Gear	23. Bearing	36. O-Ring	49. Reduction Gear Kit
11. Pin	24. Circlip	37. Blocking Ring	
12. Thrust Washer	25. Circlip	38. O-Ring	
13. Spacer	26. Disc	39. Blocking Ring	

Figure 3-4. Drive Hub Assembly

3.2 HYDRAULIC MOTOR



1. Dust Seal
2. Motor Housing
3. Shaft Seal
4. Bearing Race
5. Axial Needle Bearing
6. Output Shaft
7. Cardan Shaft
8. O-Ring
9. Distributor Plate
10. Gearwheel Set
11. End Cover
12. Washer
13. Screw

Figure 3-5. Hydraulic Motor - (OMR 80)

Table 3-3. Drive Motor Specs

Displacement	80.3 cm^3
Max Speed	750 rpm
Max Torque	195 Nm (143.8 lb ft)
Max Power	12.5 kw
Max Oil Flow	60L/min (19 gal/min)

Motor Disassembly

NOTE: *For numbers in ( ), refer to Figure 3-5., Hydraulic Motor - (OMR 80).*

4. Use a 13mm spanner socket to remove the screws (13) and washers (12).
5. Remove the End Cover (11) sideways.
6. When removing the Gear Wheel Set (10) and two O-Rings (8), keep fingers under the the gearwheel set to prevent the parts from falling out.
7. Remove the Cardan Shaft (8).
8. Remove the Distributor Plate (9) and O-Ring (8).
9. To remove the Output Shaft (6), place the motor housing (2) on a work bench and press the shaft out of the motor housing
10. Remove the Bearing Race (4) from the motor housing (2).
11. Remove the Axial Needle Bearing (5).
12. With a mandrel and plastic hammer, carefully knock out the Shaft Seal (3) and Dust Seal Ring (1).

NOTE: *When cleaning parts, clean parts carefully with low aromatic kerosine.*

NOTE: *Check all parts carefully and replace if necessary.*

NOTE: *Before assembly, lubricate all parts with hydraulic oil and grease rubber parts with vaseline.*

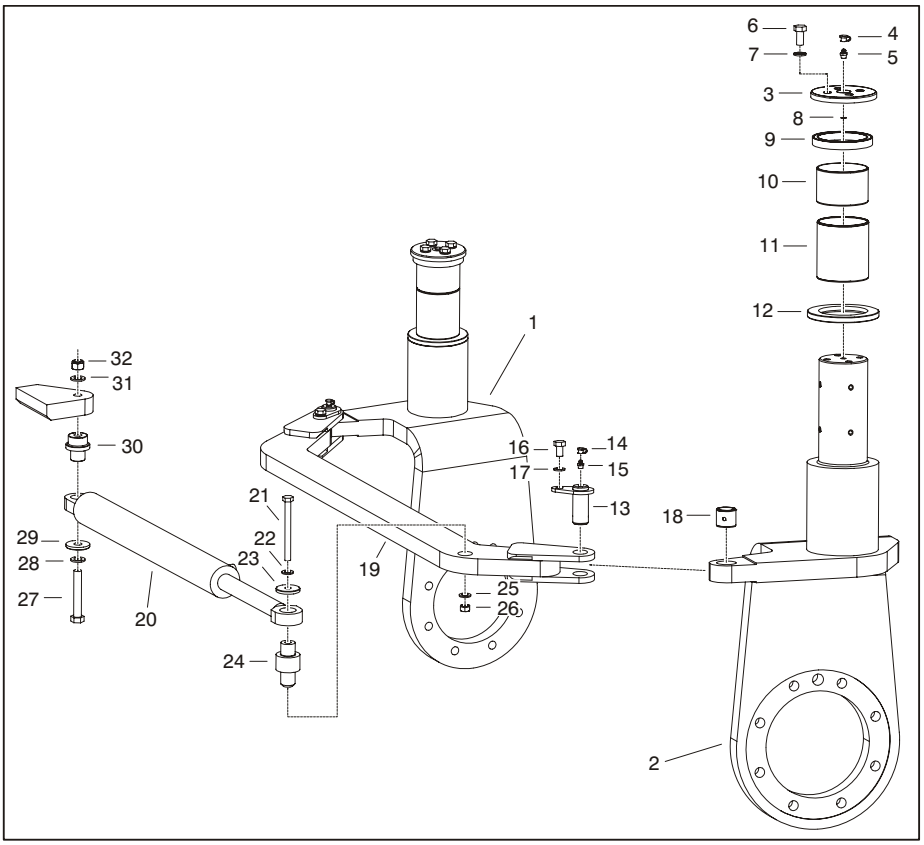
Motor Assembly

1. Place the Motor Housing (2) in a holding tool with the flange upwards.
2. Lubricate the Shaft Seal (3) on the outside with hydraulic oil. Fit the shaft seal correctly onto the mandrel and carefully press the shaft seal into position into the motor housing.
3. Place the Dust Seal Ring (1) in the spigot flange and knock it into position with a plastic hammer and appropriate mandrel.
4. Fit the Bearing Race (4) onto the shaft and mount together with the shaft.
5. Place the Axial Needle Bearing (5) back onto shaft.
6. Output Shaft (6): Grease the journals with hydraulic oil. The rear shaft end must be marked before fitted. The mark must be positioned vertically above a commutation slot leading up to the front annular channel.
7. Grease the O-Ring (8) and put it in the O-ring groove of the housing.
8. Turn the Distributor Plate (9) so that the holes line up.
9. Guide the Cardan Shaft (7) down into the motor housing. In case of different splines lengths, turn the cardan shaft to ensure the long splines end is fitted in the output shaft. Transfer marking from output shaft to cardan shaft.
10. Place the two O-Rings (8) (greased) in the O-ring grooves of the Gearwheel. In gearwheels with non through splines, place the gearwheel with the recess in the spline hole facing down towards the housing. Place the Gearwheel Set (10) on the cardan shaft so that the top o fa tooth in the external teeth of the gearwheel are vertically above the mark on the cardan shaft. Turn the gearwheel set counterclockwise until the cardan shaft and the gearwheel start to mesh (15°). Turn the gearwheel rim so that the holes made for the screws line up.
11. Turn the End Cover (11) so that the holes line up.
12. Place the Washers (12) onto the Screws (13). Use a 13mm spanner socket to tighten the screws.

Table 3-4. Tightening Torques

Item	Torque
Screws (item 14 in Figure 3-5.)	3.0 - 3.5 daNm (270 - 315 lbf in)

3.3 STEERING ASSEMBLY



1. Right Spindle	9. Sealing Ring	17. Lockwasher, M12	25. Washer, M12
2. Left Spindle	10. Bushing	18. Bushing	26. Nut, M12
3. Cap	11. Bushing	19. Tie Bar	27. Bolt, M16 x 100mm
4. Grease Fitting Cap	12. Trust Bearing	20. Steer Cylinder	28. Washer, M16
5. Grease Fitting	13. Pin	21. Bolt, M12 x 130mm	29. Steering Washer
6. Bolt, M12 x 25mm	14. Grease Fitting Cap	22. Washer, M12	30. Pin
7. Lockwasher, M12	15. Grease Fitting	23. Steering Washer	31. Washer, M16
8. O-Ring	16. Bolt, M12 x 20mm	24. Pin	32. Locknut, M16

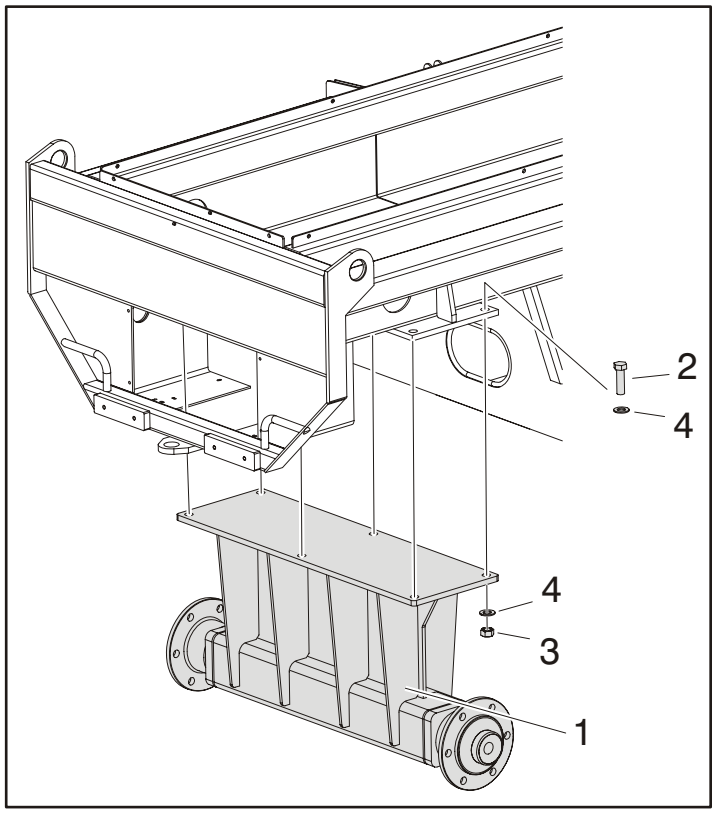
Figure 3-6. Steering Assembly

NOTE: *Remove wheel and tire assemblies before attempting to service the steering assembly. Disconnect electrical supply and any wires and/or hoses. Secure machine with proper stabilizing devices.*

Removal:

1. Remove Steer Cylinder (20) by removing Bolts (21, 27), Washers (22, 25, 28, 31), Steering Washers (23, 29), and Pins (24, 30).
2. Disconnect Tie Bar (19) from both Spindles (1, 2) by removing Bolts (16), Lockwashers (17), Pins (13), and Bushings (18). Remove Tie Bar.
3. Spindles can now be removed from the chassis. Secure Spindle. Remove Grease Cap (4) and Fitting (5). Remove Bolts (6), Lockwashers (7), Caps (3), O-Rings (8), Sealing Rings (9), Bushings (10, 11), and Trust Bearings (12). The spindle can now be removed for repair/replacement.

3.4 REAR AXLE ASSEMBLY



1. Rear Axle Weldment
2. Bolt, M20 x 70mm
3. Nut, M20
4. Washer, M20

Figure 3-7. Rear Axle Removal

⚠ IMPORTANT

SECURE THE MACHINE AND AXLE WELDMENT WHEN SERVICING/REMOVING. THE AXLE WEIGHS APPROXIMATELY 147.5 KG (325 LBS).

NOTE: *Remove the tire and wheel assemblies before removing the axle. (Refer to Figure 3-2., Wheel Assembly Removal).*

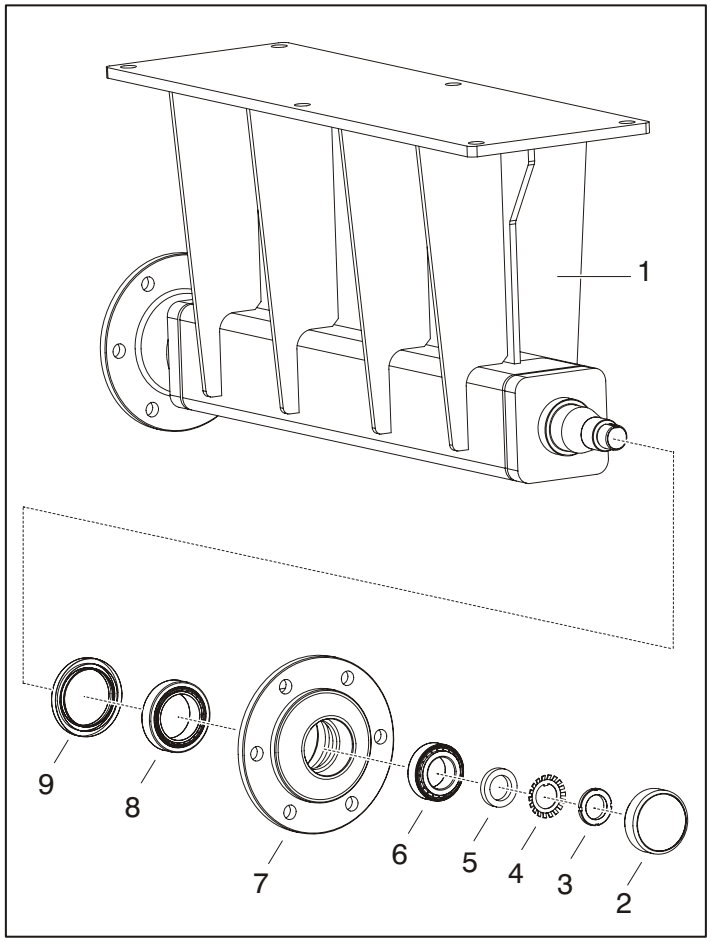
Removal:

1. Remove the six Bolts (2), Nuts (3), and twelve Washers (4) attaching the Rear Axle Weldment (1) to the frame.
2. Carefully remove the Rear Axle.

Installation:

1. Raise Axle to the frame.
2. Secure the axle to the frame using the eight Bolts (2), Nuts (3), and sixteen Hardened Washers (4).
3. Torque Bolts to 610 Nm (450 lb ft) dry.

Rear Hub Assembly



1. Rear Axle Weldment
2. Hub Cap
3. Hub Nut
4. Hub Nut Lock
5. Washer
6. Outer Bearing
7. Hub
8. Inner Bearing
9. Seal

Figure 3-8. Rear Hub Assembly

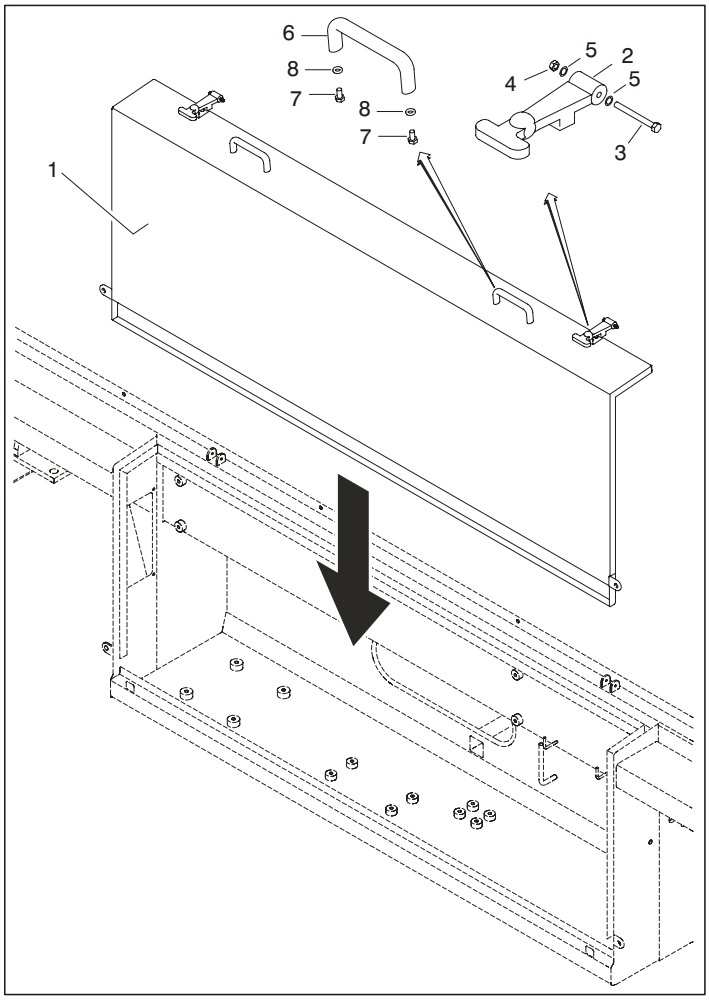
Removal:

1. Remove the Hub Cap (2).
2. Remove the Hub Nut (3), Hub Nut Lock (4), Washer (4), and Outer Bearing (5).
3. At this point the Hub (6) can be removed.
4. Once the Hub is removed, the Inner Bearing (7) and Seal (8) can be removed from the inside of the Hub.

Installation:

1. Replace the Inner Bearing (7) and Seal (8) on the inside of the Hub (7).
2. Place Hub onto Rear Axle (1).
3. Replace Outer Bearing (6), Washer (5), and Hub Nut Lock (4). Secure with Hub Nut (3).
4. Place the Hub Cap (2) back onto the Hub.

3.5 SIDE COMPARTMENTS



1. Hood
2. Hood Strap
3. Bolt, M5 x 55
4. Locknut, M5
5. Washer, M5
6. Handle
7. Bolt, M6 x 12
8. Lockwasher, M6

Figure 3-9. Hood Assembly

NOTE: *The below procedures apply to both the left and right side compartments.*

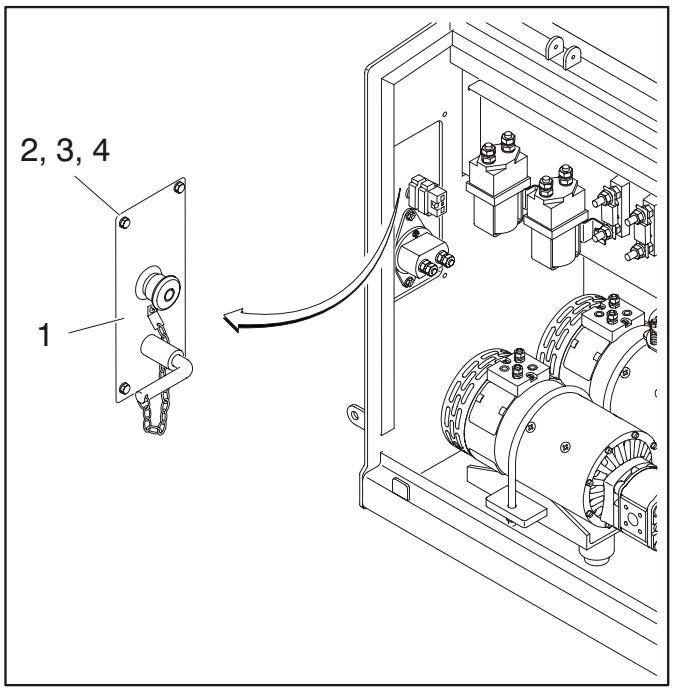
Removal:

1. Lift Hood Straps (2).
2. Grasp Hood (1) by the two Handles (6) and lift up and away from the machine.
3. The Hood Straps (2) can be removed by removing the Bolts (3), Locknuts (4), and Washers (5).
4. The Handles (6) can be removed from the Hoods by removing the Bolts (7) and Lockwashers (8).

Installation:

1. Follow the removal steps in reverse order to re-attach the Handles (6), Hood Straps (2), and Hoods (1).

Ground Control Panel



1. Ground Control Panel
2. Bolt, M6 x 20mm
3. Washer, M6
4. Nut, M6

Figure 3-10. Ground Control Panel Removal

Removal:

⚠ IMPORTANT

DISCONNECT GROUND CONTROL PANEL (1) FROM BATTERY BEFORE REMOVING AND/OR SERVICING.

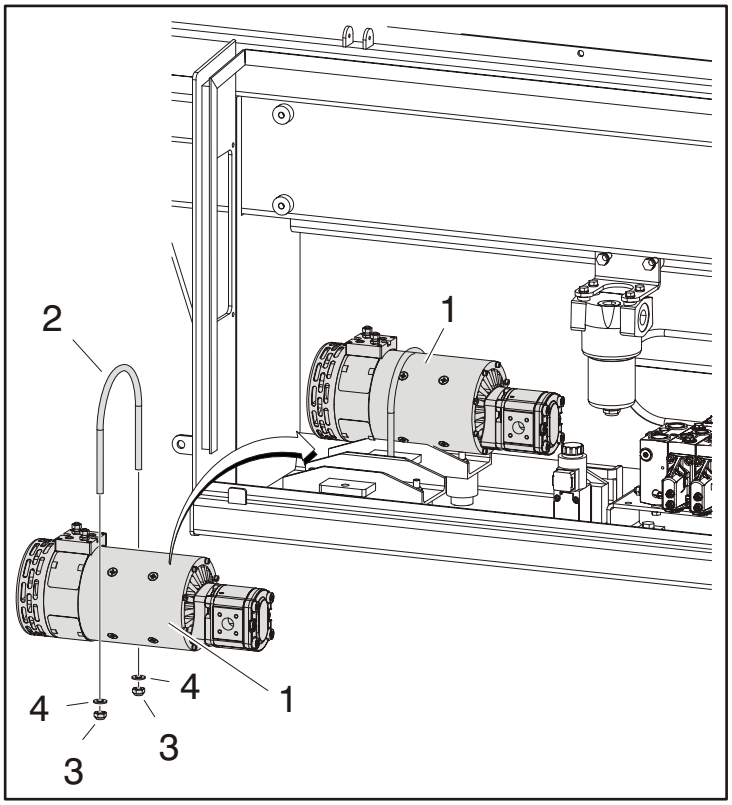
1. Disconnect all plugs and wires from the back of the control panel.
2. Remove the panel from the Electrical Compartment (2) by removing the four Bolts (2), Nuts (4), and eight Washers (3).

NOTE: *When removing the control panel, take care not to damage any plug receptacles and switches.*

Installation:

1. Attach the Ground Control Panel to the Electrical Compartment with the Bolts, Flatwashers, and Nuts.
2. Carefully attach all wires and reconnect to battery.
3. Make certain all components work properly.

Electric/Hydraulic Pump



1. Electric/Hydraulic Pump
2. Mounting Clamp
3. Nut, M10
4. Washer, M10

Figure 3-11. Electric/Hydraulic Pump Removal

⚠ WARNING

DISCONNECT BATTERY SUPPLY BEFORE REMOVING MOTORS/ PUMPS.

NOTE: *Procedures apply to both motors/pumps.*

Removal:

1. Remove cables from the top of the motor by removing the nuts and washers. Remove hydraulic lines from the end of the motor.
2. Remove Mounting Clamp (2) by removing the Locknuts (3) and Washers (4).
3. Carefully remove the Motor/Pump (1).

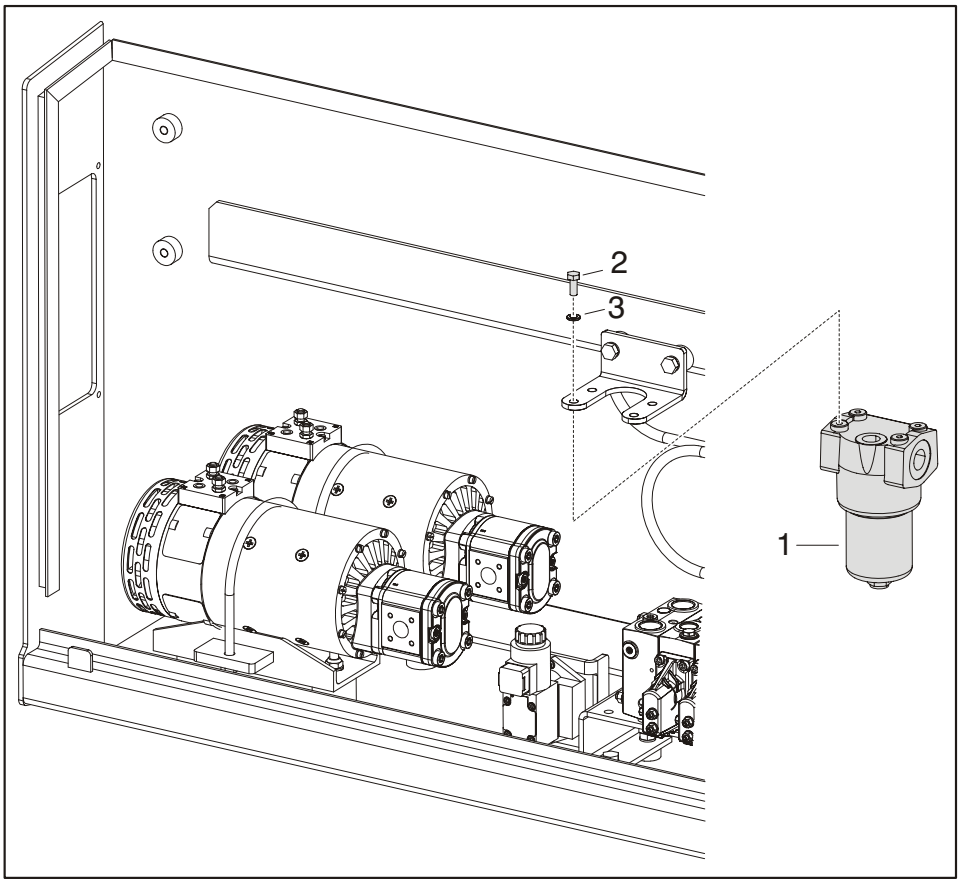
Installation:

1. Position Motor/Pump (1) on mounting bracket and secure with the Mounting Clamp (2). Secure clamp with Washers (4) and Locknuts (3).
2. Place cables back onto top of Motor/Pump (see electrical schematic in section 6). Secure cables with washers and nuts. Reconnect hydraulic lines to end of motor (see hydraulic diagram in section 6).
3. Reconnect battery supply.

Table 3-5. Motor/Pump Specs

Motor Size (diameter)	150 mm
Voltage	48V
Power	3700W
Displacement	8 cm^3/rev
Maximum Continuous Pressure P_1	250 bar (3626 psi)
Maximum Intermittent P_2	280 bar (4061 psi)
Maximum Pressure Peak P_3	300 bar (4351 psi)

Pressure Filter



1. Pressure Filter
2. Bolt, M8 x 20mm
3. Lockwasher, M8

Figure 3-12. Pressure Filter Removal

NOTE: *Shut off flow of hydraulic fluid via the shutoff valve lever on the hydraulic tank before removing the pressure filter.*

Removal:

1. Disconnect hose(s) from the Pressure Filter (1).
2. Loosen and remove the four Bolts (2) and Lockwashers (3).
3. Remove the Pressure Filter.

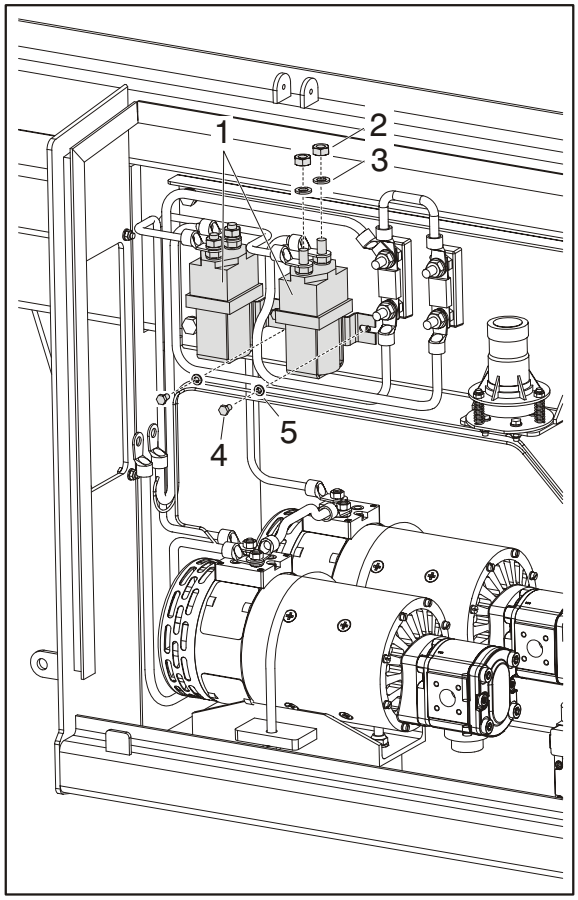
Installation:

1. Align the pressure filter so that the bolt holes match up with the bolt holes on the holding bracket.

NOTE: *Make sure arrow on top of filter points towards the hydraulic tank.*

2. Insert the four Lockwashers and Bolts into the holes and tighten.
3. Reconnect any hose(s) disconnected during removal.

DC Contactor



1. DC Contactor
2. Nut, M10
3. Lockwasher, M10
4. Bolt, M6 x 10mm
5. Lockwasher, M6

Figure 3-13. DC Contactor Removal

⚠ WARNING

DISCONNECT BATTERY SUPPLY BEFORE REMOVING CONTACTORS.

Removal:

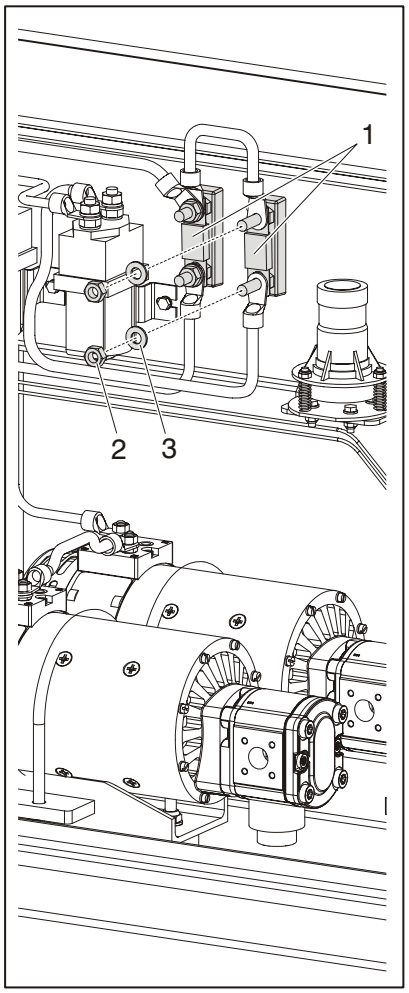
NOTE: *Procedures apply to both DC Contactors (1).*

1. Remove the cables attached to the Contactor (1) by removing the two Nuts (2) and Lockwashers (3). Lift cables off the bolts.
2. Remove the two Bolts (4) and Lockwashers (5) attaching the Contactor to the electric tray. Remove the Contactor.

Installation:

1. Attach the Contactor (1) to the electric tray with two Bolts (4) and Lockwashers (5).
2. Place cables back onto Contactors (refer to electrical schematic in Section 6). Secure cables with two Nuts (2) and Lockwashers (3).
3. Reconnect battery supply.

Fuses



1. Fuse Strips
2. Nut, M10
3. Lockwasher, M10

Figure 3-14. Fuse Removal

⚠ WARNING

DISCONNECT BATTERY SUPPLY BEFORE REMOVING CONTACTORS.

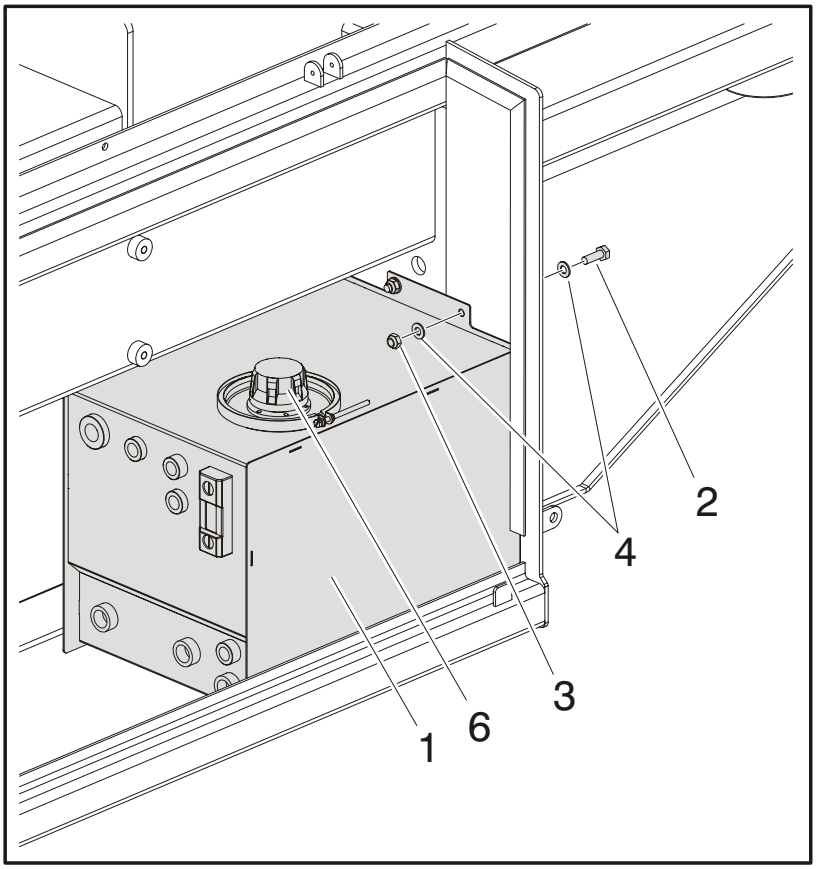
Removal:

1. Remove the cables attached to the fuse holder by removing the two Nuts (2) and Lockwashers (3).
2. Remove the Fuse Strip (1).

Installation:

1. Place Fuse Stip on the bolts of the fuse holder.
2. Place cables on bolts (refer to electrical schematic in section 6). Secure Fuse Strip and cables with Lockwashers (3) and Nuts (2).
3. Reconnect battery supply.

Hydraulic Tank



1. Hydraulic Tank
2. Bolt, M10 x 30mm
3. Nut, M10
4. Flatwasher, M10
5. Shutoff Valve Levers

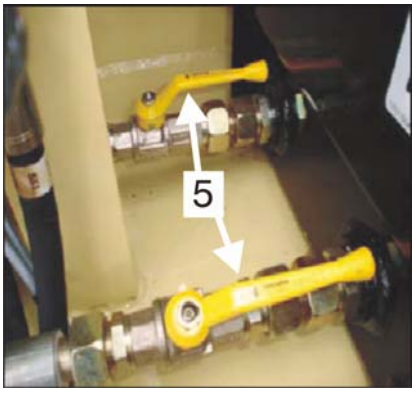


Figure 3-15. Hydraulic Tank Removal

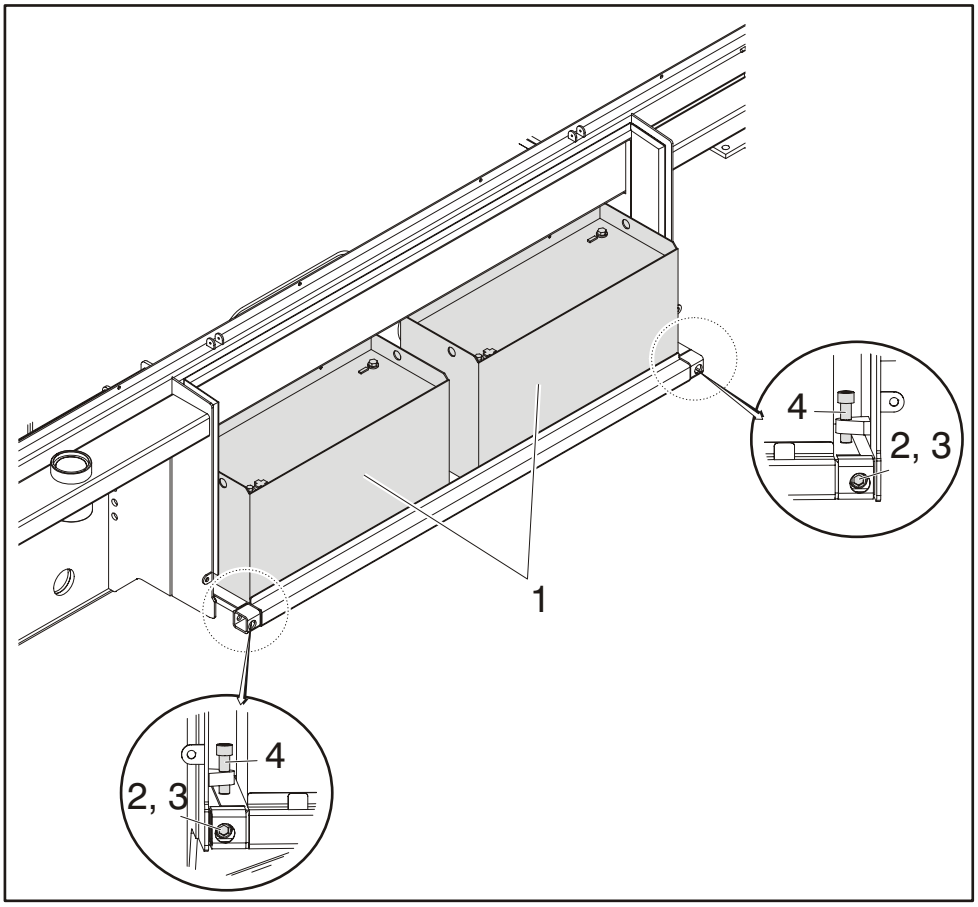
Removal:

1. Shut valve levers (5) to turn off flow of hydraulic fluld. Drain hydraulic fluid from the Hydraulic Tank (1). Store fluid in appropriate receptacle. Disconnect all hoses.
2. Remove hydraulic tank by removing the two Bolts (2), Nuts (3) and four Flatwashers (4).
3. Carefully remove the tank from the side compartment.

Installation:

1. Place tank into side compartment lining up the bolt holes.
2. Replace the Bolts, Flatwashers and Nuts into their respectable holes. Tighten.
3. Reconnect all hydraulic hoses (refer to hydraulic diagram in section 6).
4. If required, replace Filter (see Figure 3-12., Pressure Filter Removal).
5. Remove Filler cap (6) and fill tank with hydraulic fluid to its designated capacity, 55 L (14.5 gal).
6. Open valve levers to turn on flow of hydraulic fluid.

Batteries



1. 24V Batteries
2. Bolt, M16 x 30mm
3. Lockwasher, M16
4. Bolt, M16 x 60mm

Figure 3-16. Battery Removal

⚠ WARNING

USE CAUTION WHEN HANDLING THE BATTERIES.

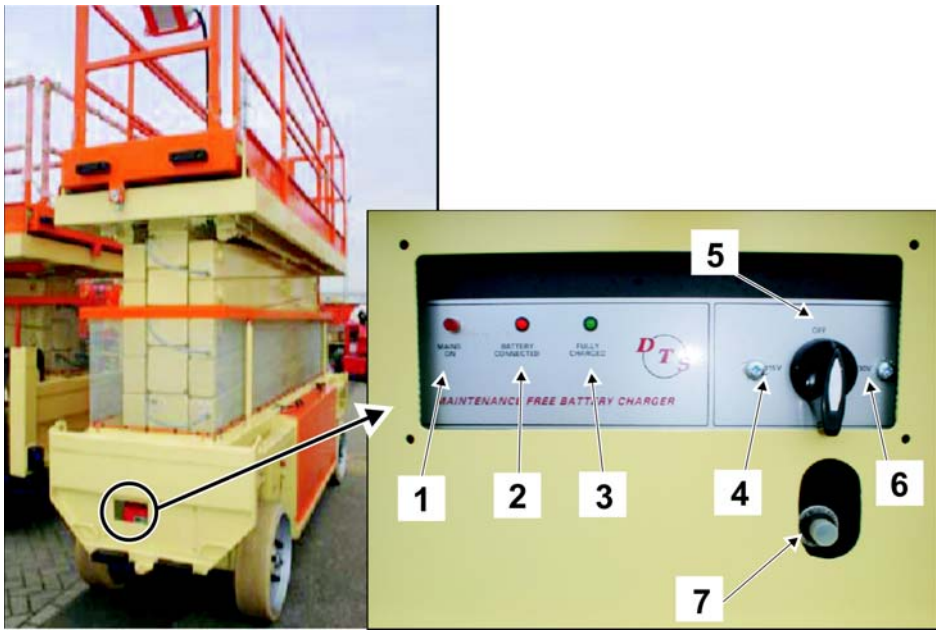
Removal:

1. When removing the Batteries (1), the battery tray can be slid out to allow for better accessibility. Remove the two Bolts (2) and Lockwashers (3) from each end of the tray. Loosen the two Bolts (4) and slide the tray outward.
2. Disconnect any cables going out from the battery.
3. Remove the batteries.

Installation:

1. Place Batteries (1) back onto battery tray.
2. Reconnect cables.
3. Push tray back into side compartment. Tighten the two Bolts (4). Replace the two Bolts (2) and Lockwashers (3).

3.6 BATTERY CHARGERS



1. Mains Connected
2. Battery Connected
3. Charge Complete
4. Select 115v
5. Charger Off
6. Select 220v
7. Circuit Breaker

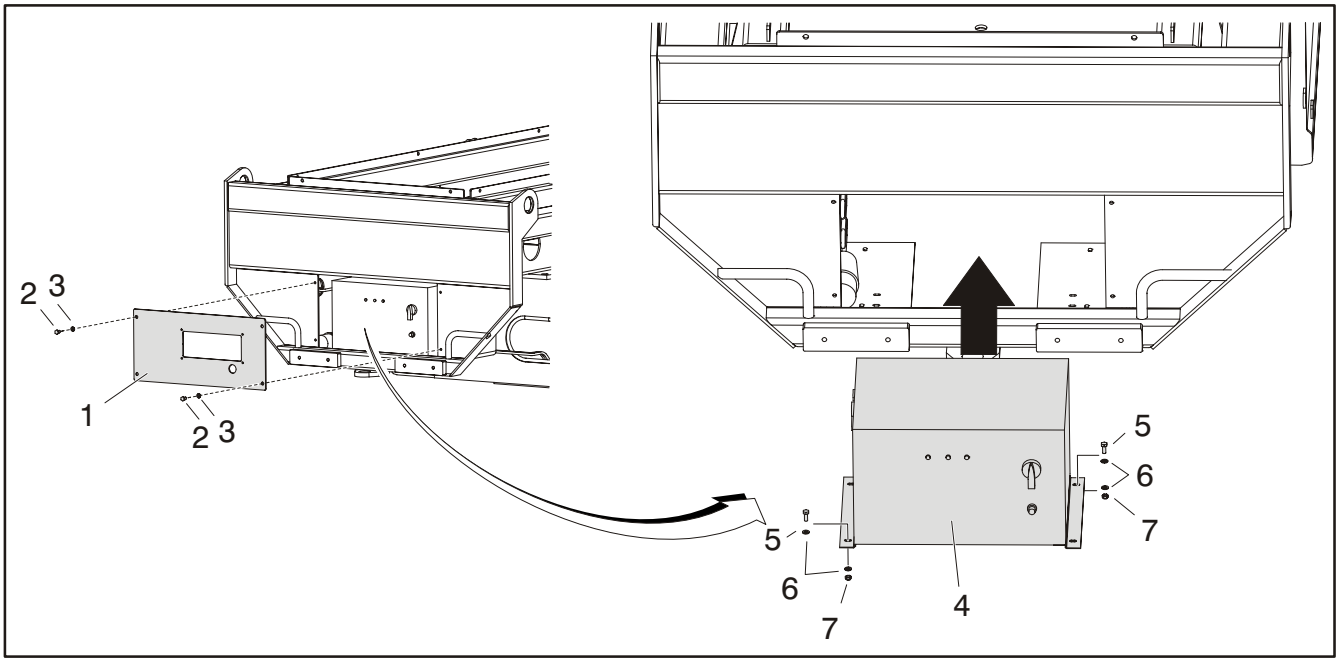
Figure 3-17. Dual Voltage Charger Control

Table 3-6. Dual Voltage Charger Specs

Description	Dual Voltage Charger
Type	48V DC 40amp output - 105/230V AC Input
Rating	3300W - 50Hz
Compliance	EU Directives 93/69/EEC and 92/31/EEC
Interlock	Internal N.C. Interlock Relay. Open under AC power in
Cables	Fitted with separate 115 and 230 power plugs

Table 3-7. Single Input Charger Specs

Description	Single Input Charger
Type	48V DC 50amp output - 230V AC
Rating	2700W - 50/60Hz



1. Coverplate
2. Bolt, M8 x 14mm
3. Lockwasher, M8
4. Dual Voltage Charger
5. Bolt, M6 x 16mm
6. Washer, M6
7. Nut, M6

Figure 3-18. Dual Voltage Charger Removal

⚠ WARNING

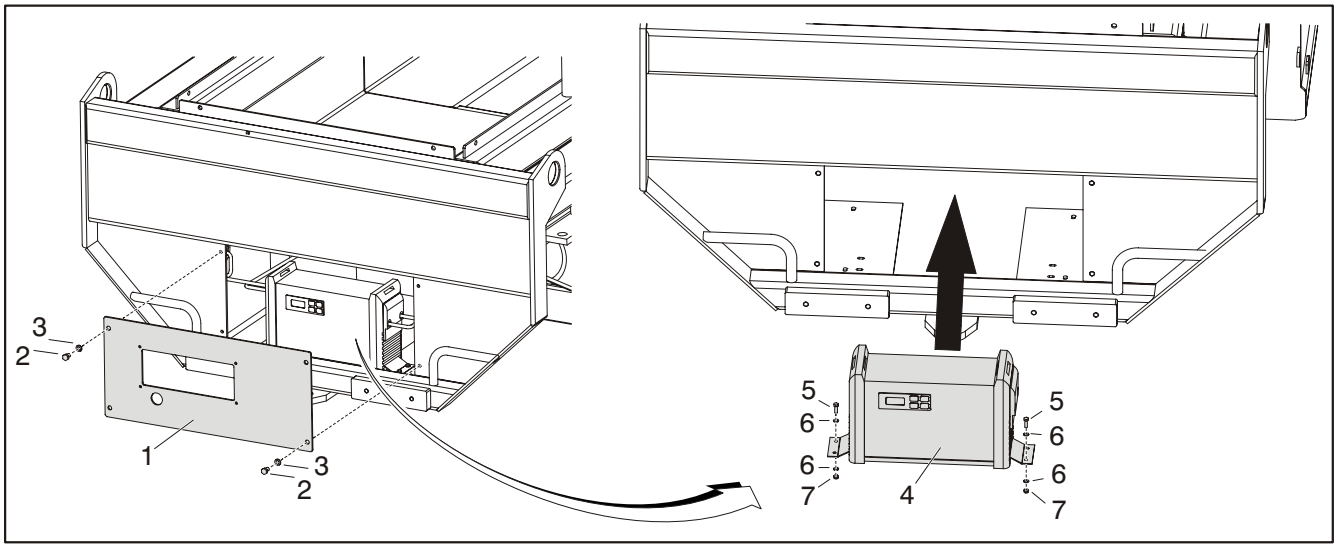
DISCONNECT BATTERY SUPPLY BEFORE ATTEMPTING TO REMOVE OR REPLACE THE BATTERY CHARGER.

Removal:

1. Remove the Coverplate (1) by removing the four Bolts (2) and Lockwashers (3).
2. Disconnect all cables going out from the Charger (4).
3. Remove the four Bolts (5), Nuts (7), and eight Washers (6) attaching the charger to the chassis.
4. Carefullly remove the charger.

Installation:

1. Place Charger (4) back into mounting area on the chassis.
2. Attach charger to the frame by replacing the four Bolts (5), Nuts (7), and eight Washers (6).
3. Reconnect all cables.
4. Attach the Coverplate (1) back onto the frame using the four Bolts (2) and Lockwashers (3).
5. Reconnect battery supply to ensure proper functioning of the battery charger.



1. Coverplate
2. Bolt, M8 x 14mm
3. Lockwasher, M8
4. Charger
5. Bolt, M5 x 16mm
6. Washer, M5
7. Nut, M5

Figure 3-19. Single Input Charger Removal

⚠ WARNING

DISCONNECT BATTERY SUPPLY BEFORE ATTEMPTING TO REMOVE OR REPLACE THE BATTERY CHARGER.

Removal:

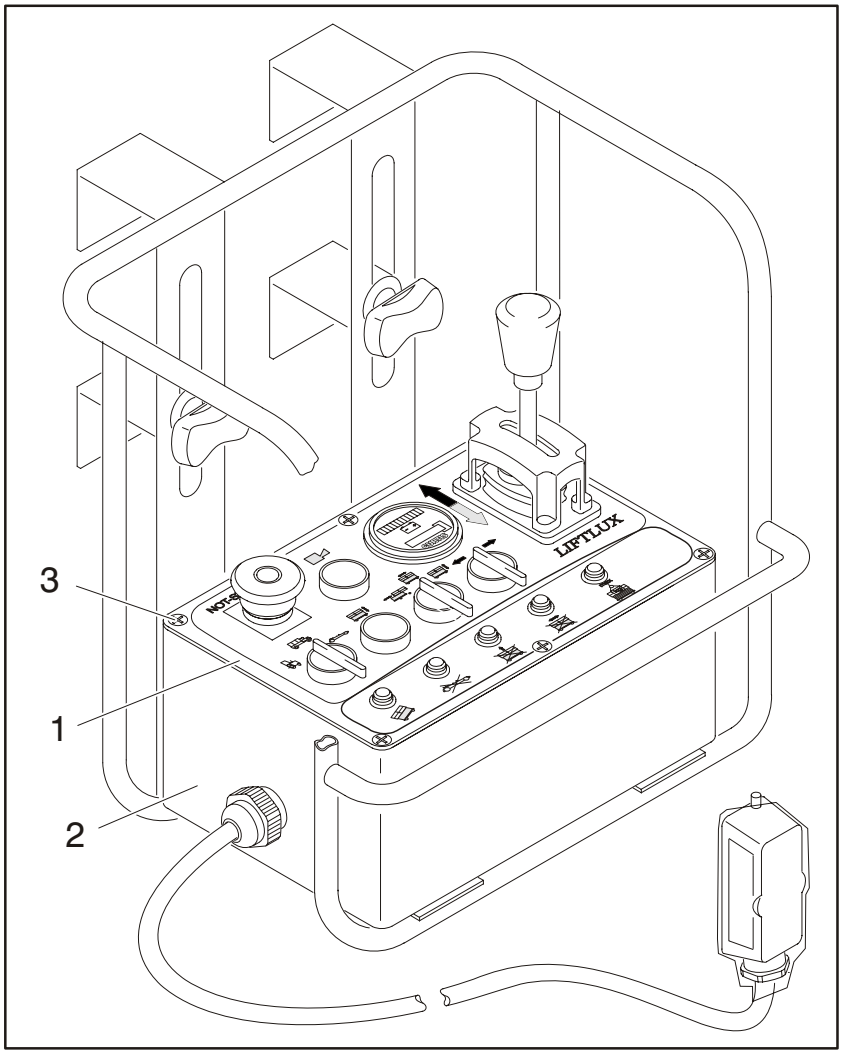
1. Remove the Coverplate (1) by removing the four Bolts (2) and Lockwashers (3).
2. Disconnect all cables going out from the Charger (4).
3. Remove the four Bolts (5), Nuts (7), and eight Washers (6) attaching the charger to the chassis.
4. Carefullly remove the charger.

Installation:

1. Place Charger (4) back into mounting area on the chassis.
2. Attach charger to the frame by replacing the four Bolts (5), Nuts (7), and eight Washers (6).
3. Reconnect all cables.
4. Attach the Coverplate (1) back onto the frame using the four Bolts (2) and Lockwashers (3).
5. Reconnect battery supply to ensure proper functioning of the battery charger.

3.7 PLATFORM

Platform Control Box



1. Control Box Lid
2. Control Box
3. Screw

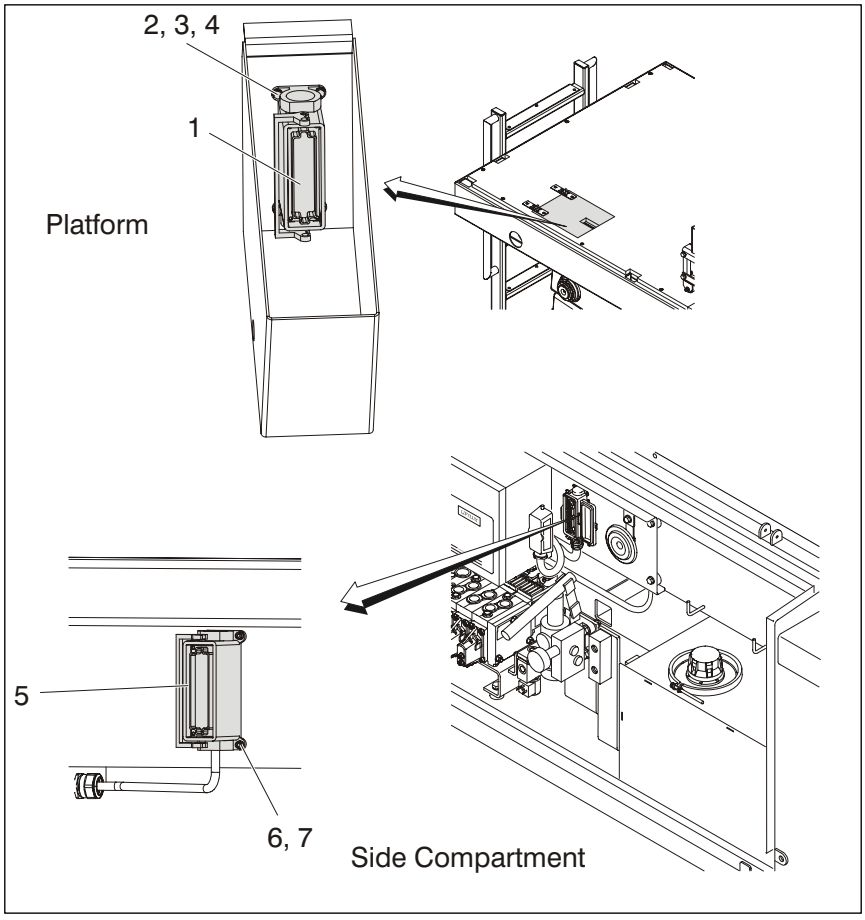
Figure 3-20. Platform Control Box

For access to the inside of the platform control box, follow these steps:

1. Disconnect platform control box connector from the machine.
2. Remove the six Screws (3) securing the Control Box Lid (1) to the Control Box (2).
3. Carefully lift the lid from the box.
4. At this point, wires, plugs, and other parts may be disconnected for repair/replacement.

NOTE: *When assembling the platform control box, be careful not to pinch wires when replacing the lid back onto the box.*

Receptacles



1. Platform Receptacle
2. Bolt, M5 x 16mm
3. Flatwasher, M5
4. Nut, M5
5. Ground Receptacle
6. Bolt, M5 x 10mm
7. Lockwasher, M5

Figure 3-21. Receptacles Removal

Removal:

⚠ WARNING

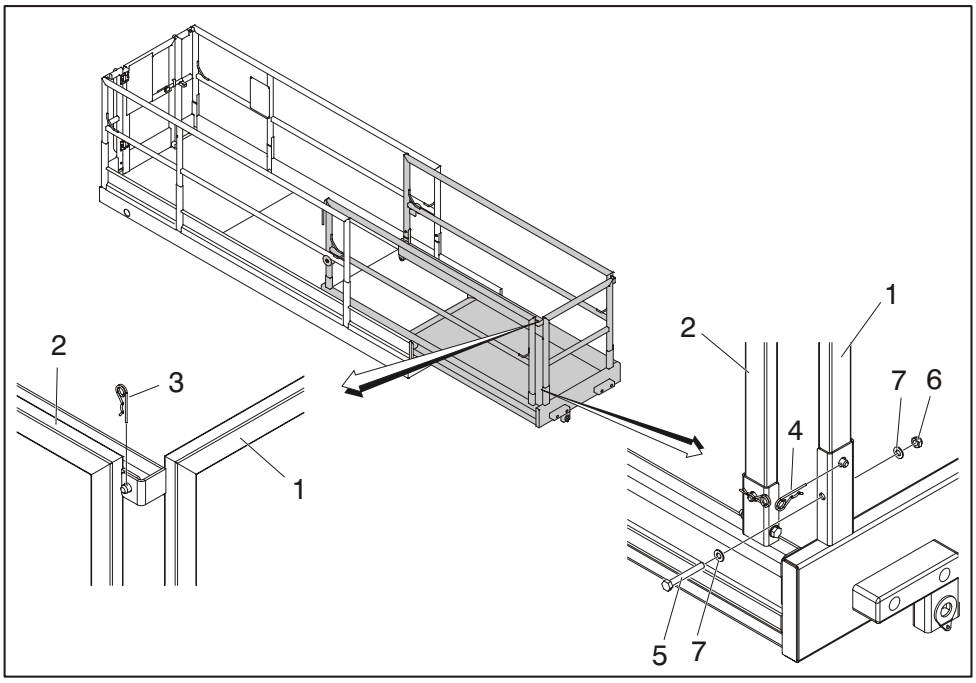
DISCONNECT BATTERY SUPPLY BEFORE REMOVING RECEPTACLES.

1. Remove the Platform Receptacle (1) by removing the four Bolts (2), Nuts (4), eight Flatwashers (3).
2. Remove the Chassis Receptacle by removing the four Bolts (6) and Lockwashers (7).

Installation:

1. Follow the removal procedures in reverse order.
2. Reconnect the battery supply via the ground control panel and ensure the receptacles are functioning properly.

Extension End Rail



1. Extension End Rail
2. Extension Side Rail
3. Cotter Pin
4. Cotter Pin
5. Bolt, M10 x 80mm
6. Nut, M10
7. Flatwasher, M10

Figure 3-22. Extension End Rail Removal

NOTE: *Remove the Cotter Pins from the Extension Hooks and turn the hooks inward to disconnect the extension Side Rails from the Main Platform Side Rails.*

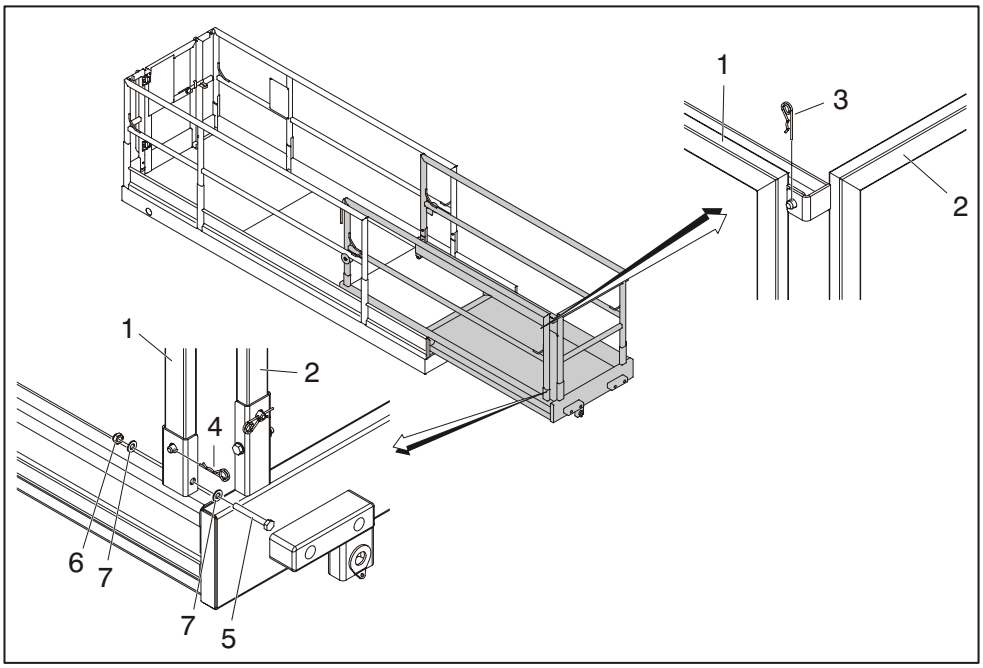
Removal:

1. Disconnect End Rail (1) from Side Rail (2) by removing the two Cotter Pins (3) from both sides.
2. Remove the two Cotter Pins (4) on both legs of the End Rail. Carefully fold the end rail inward to its stowed position.
3. The End Rail can be removed by removing the Bolts (5), Nuts (6), and Flatwashers (7) on both legs of the End Rail.

Installation:

1. Lay End Rail on the platform deck in the rails stowed position. Line up the bolt holes on the End Rail with the apporpriate connection points on the platform.
2. Follow the removal instructions in reverse order.

Extension Side Rails



1. Extension Side Rail
2. Extension End Rail
3. Cotter Pin
4. Cotter Pin
5. Bolt, M10 x 80mm
6. Nut, M10
7. Flatwasher, M10

Figure 3-23. Extension Side Rails Removal

Removal:

NOTE: *Procedures apply to both the left and right side rails.*

1. Remove the Cotter Pins on each leg of the Side Rail.
2. Carefully fold the rail inward to the stowed position.
3. Remove the rail by removing the Bolts (5), Locknuts (6), and Flatwashers (7) from each leg of the rail.

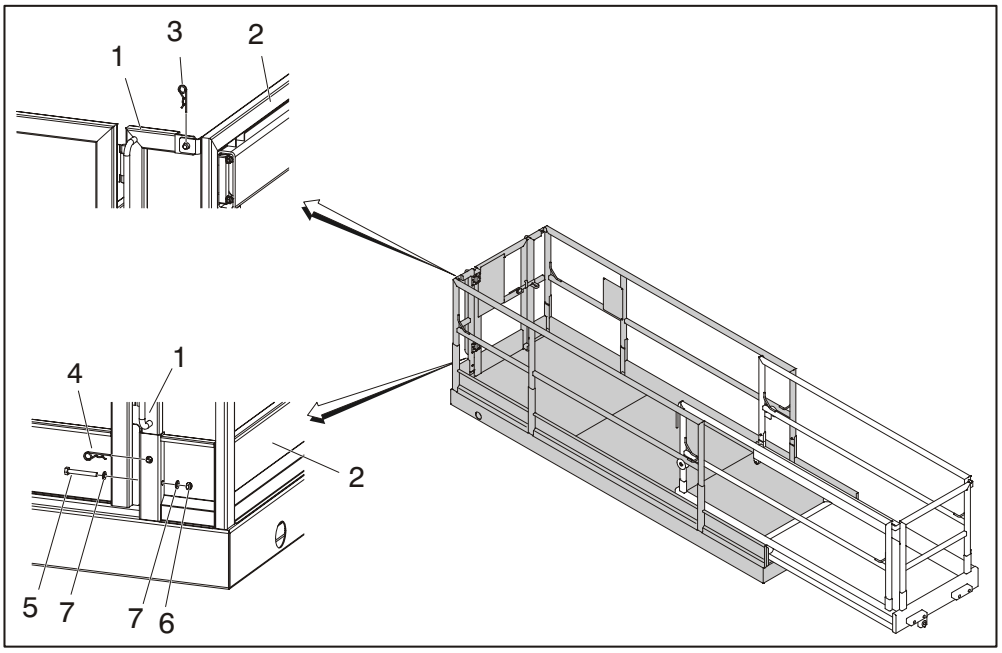
NOTE: *Extension Side Rails weigh approximately 13.4 kg (30 lbs) each.*

Installation:

NOTE: *Procedures apply to both the left and right sides..*

1. Carefully place the Extension Side Rails on the platform in their stowed postion, lining up the bolt holes on the rail legs with the appropriate connecting points on the platform.
2. Follow the removal procedures in reverse order.

Main Platform End Rail



1. End Rail
2. Side Rail
3. Cotter Pin
4. Cotter Pin
5. Bolts, M10 x 80mm
6. Nut, M10
7. Flatwasher, M10

Figure 3-24. End Rail Removal

Removal:

1. Disconnect the End Rail (1) from the side rails (2) by removing the Cotter Pins (3) from the tops of both sides.
2. Remove the Cotter Pins (4) on each leg of the End Rail.
3. Carefully fold the end rail inward to its stowed position.
4. Remove the End Rail by removing the Bolts (5), Nuts (6), and Flatwashers (7) from both legs.

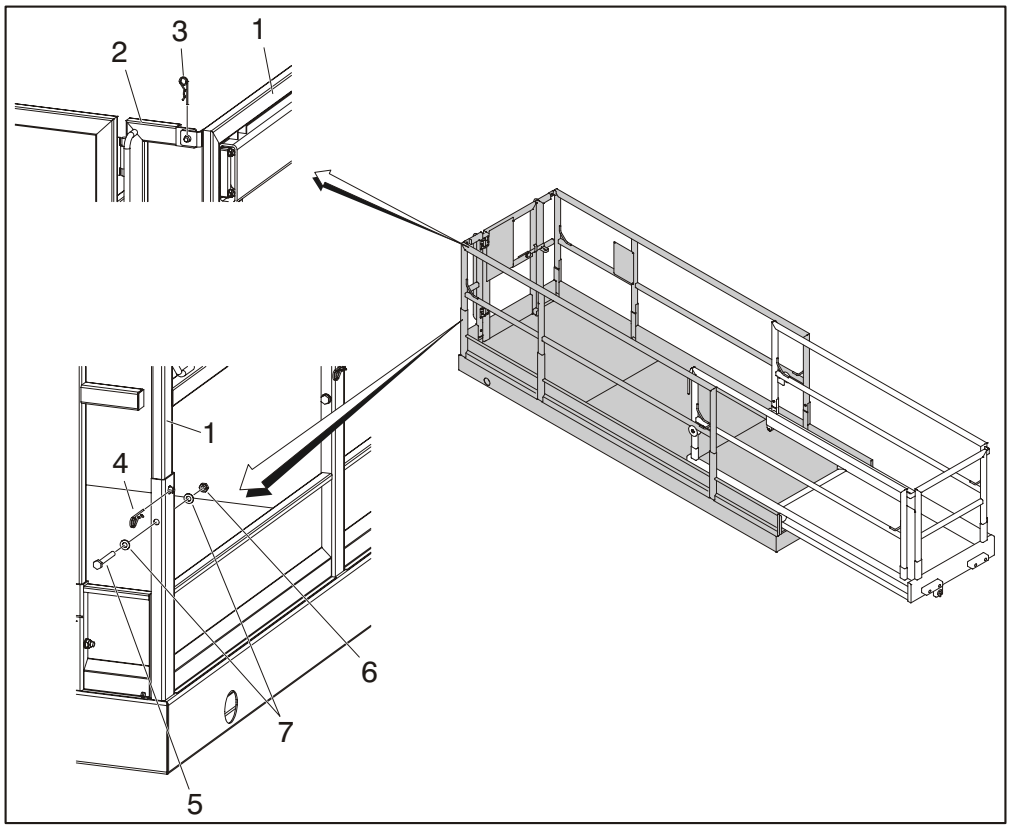
NOTE: *The gate can be detached from the End Rail by removing the screws on the two hinges.*

Installation:

1. Lay End Rail on the platform in the rails stowed position, lining up the bolt holes with the appropriate connection points on the platform.
2. Follow the removal procedures in reverse order.

NOTE: *The gate can be attached to the End Rail by replacing the screws on the two hinges.*

Main Platform Side Rails



1. Side Rail
2. End Rail
3. Cotter Pin
4. Cotter Pin
5. Bolt, M10 x 80mm
6. Nut, M10
7. Flatwasher, M10

Figure 3-25. Side Rails Removal

NOTE: *Disconnect the Extension Side Rails and stow or remove the Extension Side Rails before attempting to remove the Main Platform Side Rails*

NOTE: *Procedures apply to both the left and right sides.*

Removal:

1. Remove the Cotter Pins (3) connecting the Side Rails (1) to the End Rail (2).
2. Remove the Cotter Pins (4) on each leg of the Side Rail.
3. Carefully fold the rails inward to their stowed position.
4. Remove the rails from the platform by removing the Bolts (5), Nuts (6), and Flatwashers (7) from each leg.

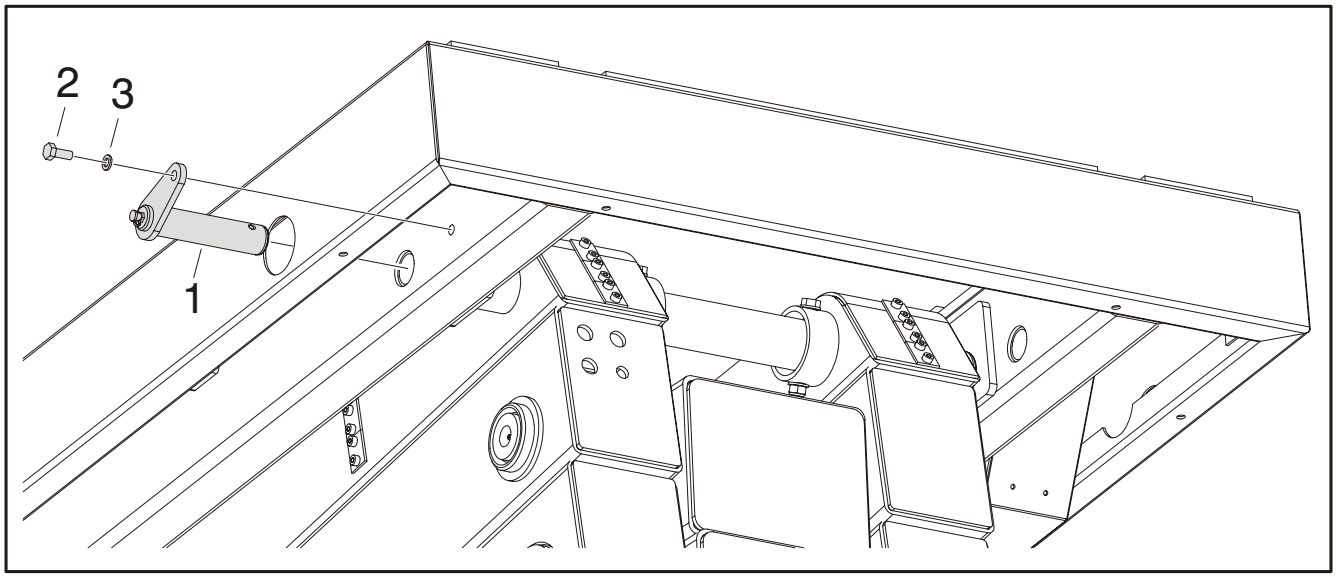
NOTE: *Each side rail weighs approximately 17.7 kg (39 lbs).*

NOTE: *The procedures below apply to both the left and right sides.*

Installation:

1. Carefully place the side rails on the platform in their stowed position, lining up the bolt holes on the rail legs with the appropriate connecting points on the platform.
2. Follow the removal procedures in reverse order.

Platform Removal



1. Platform Pivot Pin
2. Bolt, M10 x 25mm
3. Lockwasher, M10

NOTE: *Illustration shows scissor arm connection point to underside of platform at the front of the platform.*

Figure 3-26. Platform Removal - 1 of 2 (Front of Platform)

Machine Stabilization:

The arm stack can be supported by using an overhead crane, Figure 4-25., Arms and Platform Positioning and Support. If an overhead crane is not available the stack may also be lifted by using a forktruck using the following instructions:

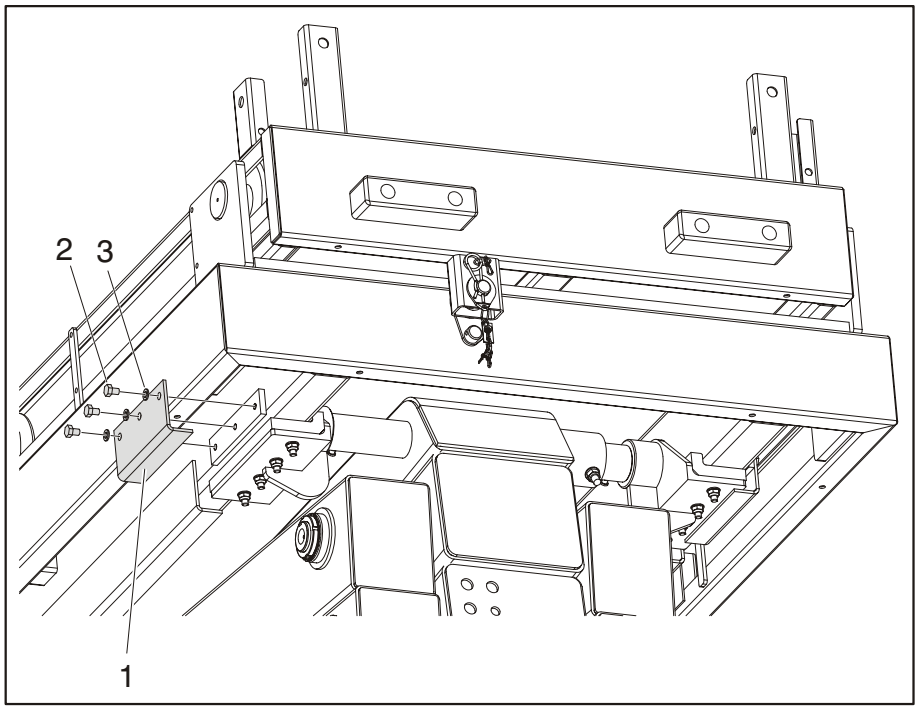
1. With the forks on the forktruck slid close together, enter from the front of the machine and place the forks on the cross tube of the second arm weldment below the platform.
2. Slowly lift the arm stack with the forktruck while the manual descent valve is being engaged (this allows the oil to drain back into the tank).
3. Place machine on safety prop and leave the forktruck in place.

If removal of the platform becomes necessary, use the above procedure to stabilize the platform for pin and platform removal.

NOTE: *Procedures apply to both left and right sides.*

Removal:

1. Disconnect all wiring and hydraulic lines attached to the platform or platform components.
2. Support the platform along the sides with the forktruck forks or use suitable straps or chains at the four corners of the platform.
3. Remove the Bolt (2) and Lockwasher (3) attaching the Platform Pivot Pin (1) to the Platform.
4. Continue on to the rear of the machine. (See next page)



1. Platform Slide Bracket
2. Bolt, M10 x 14mm
3. Lockwasher, M10

NOTE: *Illustration shows scissor arm assembly connection point to underside of platform at the rear of the platform.*

Figure 3-27. Platform Removal - 2 of 2 (Rear of Platform)

Platform Removal:

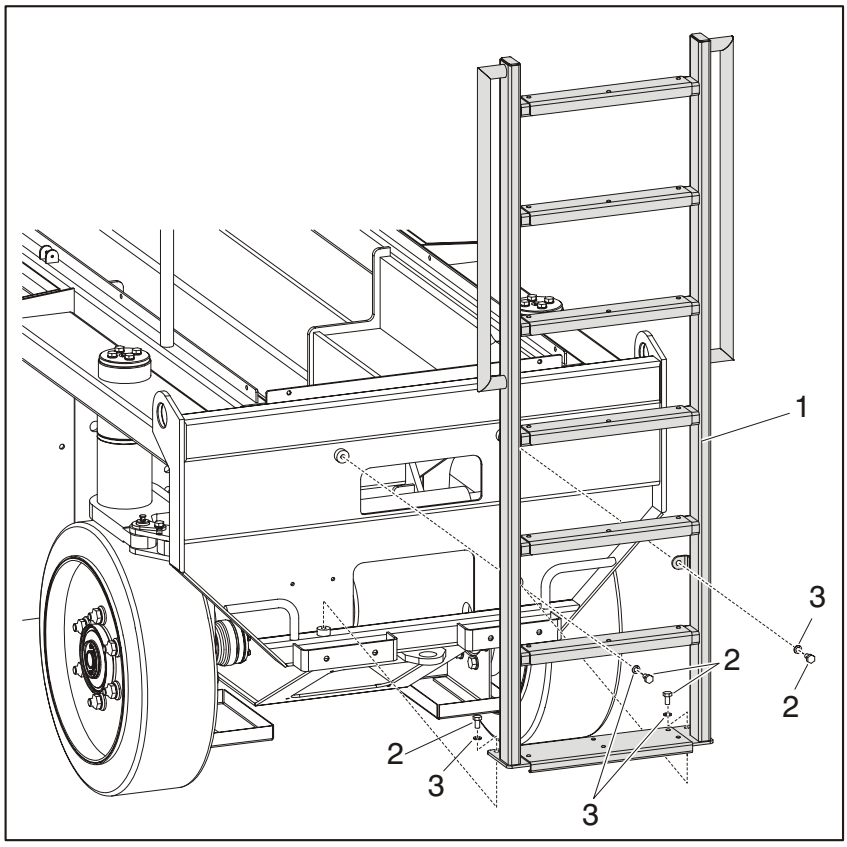
NOTE: *Procedures apply to both left and right sides.*

1. Support the platform along the sides with the fork-truck forks or use suitable straps or chains at the four corners of the platform.
2. Remove the three Bolts (2) and Lockwashers (3) attaching the Platform Slide Bracket (1) to the Platform.
3. Lift the platform from the armstack.

Installation:

1. Follow removal procedures in reverse order.

Ladder Installation



1. Ladder
2. Bolt, M10 x 20mm
3. Lockwasher, M10

Figure 3-28. Ladder Installation

Removal:

1. The Ladder (1) can easily be removed by removing the four Bolts (2) and Lockwashers (3).

⚠ CAUTION

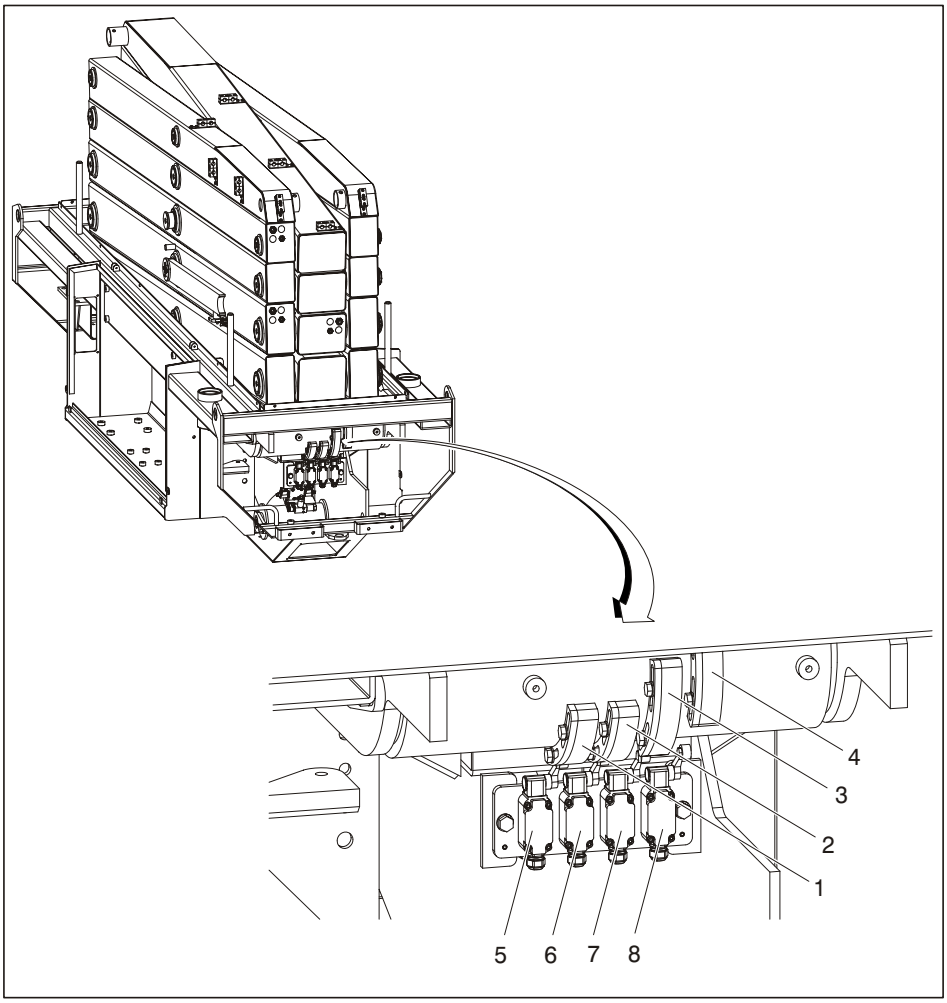
USE CAUTION WHEN REMOVING THE LADDER. THE LADDER WEIGHS APPROXIMATELY 31 KG (68 LBS).

Installation:

1. Lift the ladder so that the four mounting brackets align with the bolt holes on the chassis.
2. Secure ladder to the chassis with the four Bolts (2) and Lockwashers (3).

3.8 SCISSOR ARMS

Limit Switches



1. Cam 1
2. Cam 2
3. Cam 3
4. Cam 4
5. Platform Stowed Limit Switches
6. High Drive Speed Cutout Limit Switch
7. Max Drive Height Limit Switch
8. Max Height Limit Switch

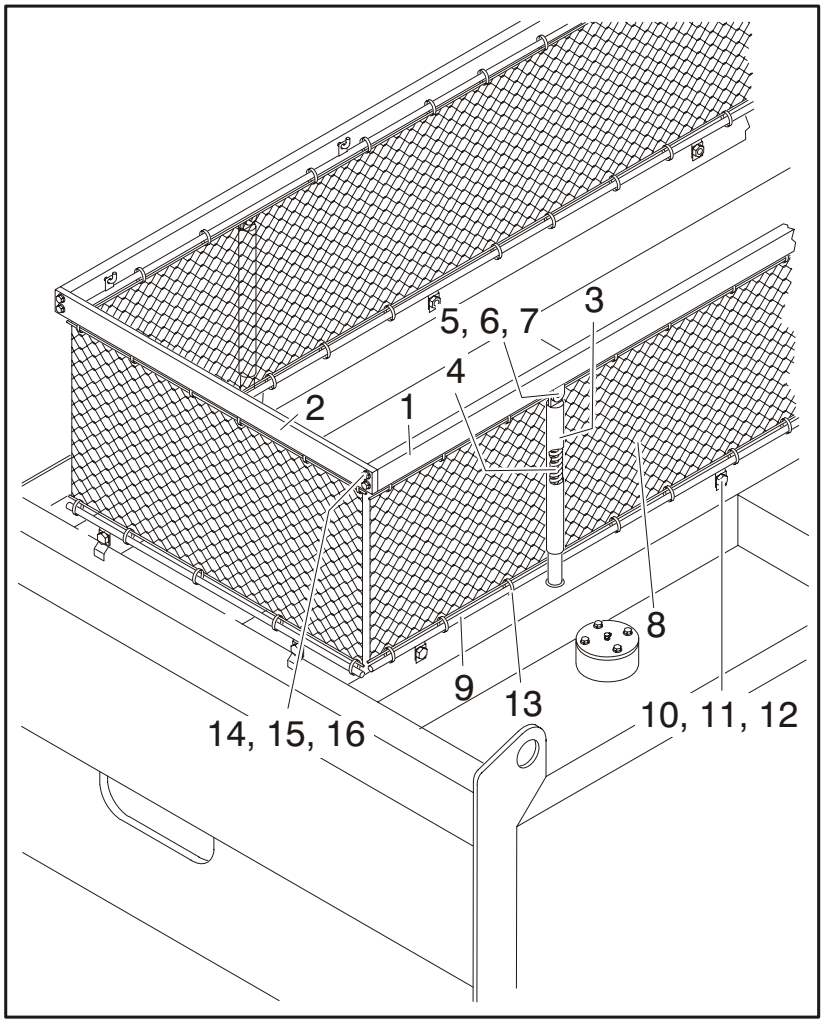
Figure 3-29. Scissor Arm Limit Switch Adjustment

Cam Adjustment:

1. Adjust Cam 1 (1) to activate Platform Stowed Limit Switch (5) when platform is completely stowed.
2. Adjust Cam 2 (2) to activate High Drive Speed Cut-out Limit Switch (6) when platform is at a height of 3 m (9.8 ft) for the 153-12 and 3.2 m (10.5 ft) for the 180-12.
3. Adjust Cam 3 (3) to activate Max Drive Height Limit Switch (7) when platform is at a height of 7 m (23 ft).
4. Adjust Cam 4 (4) to activate Max Height Limit Switch (8) when platform is at a height of 15.3 m (50 ft) for the 153-12 and 18 m (59 ft) for the 180-12.

NOTE: *The limit switch plate can be removed by removing the bolts, washers and nuts at each end of the mounting plate.*

Arm Guards



1. Long Upper Tube
2. Short Upper Tube
3. Upper Column
4. Compression Spring
5. Bolt, M10 x 34mm
6. Washer, M10
7. Nut, M10
8. Safety Screen
9. Round Tube
10. Bolt, M8 x 20mm
11. Washer, M8
12. Nut, M8
13. Tie Cable
14. Bolt, M10 x 20mm
15. Washer, M10
16. Nut, M10

Figure 3-30. Arm Guards Installation

NOTE: *The below procedures apply to the front/back and left/right sides.*

Removal:

1. Applying downward pressure on the Long Upper Tube (1) will compress the Compression Spring (4) inside the Upper Column (3) and allow the Safety Screen Assembly (8) to be removed from the hooks.
2. Remove all Bolts (10), Nuts (12), and Washers (11) to completely remove the Safety Screen from the frame.
3. Cut the Tie Cables (13) to separate the Safety Screen from the Round Tubes.
4. The Long Upper Tubes (1) can be disconnected from the Short Upper Tubes (2) by removing the Bolts (14), Nuts (16), and Washers (15).
5. Separate the Upper Column (3) from the Long Upper Tube (1) by removing the Bolts (5), Nuts (7), and Washers (6).

Installation:

1. Follow the removal instructions in reverse order.
2. The Tie Cables (13) will have to be replaced.

Scissor Arm Assembly Removal

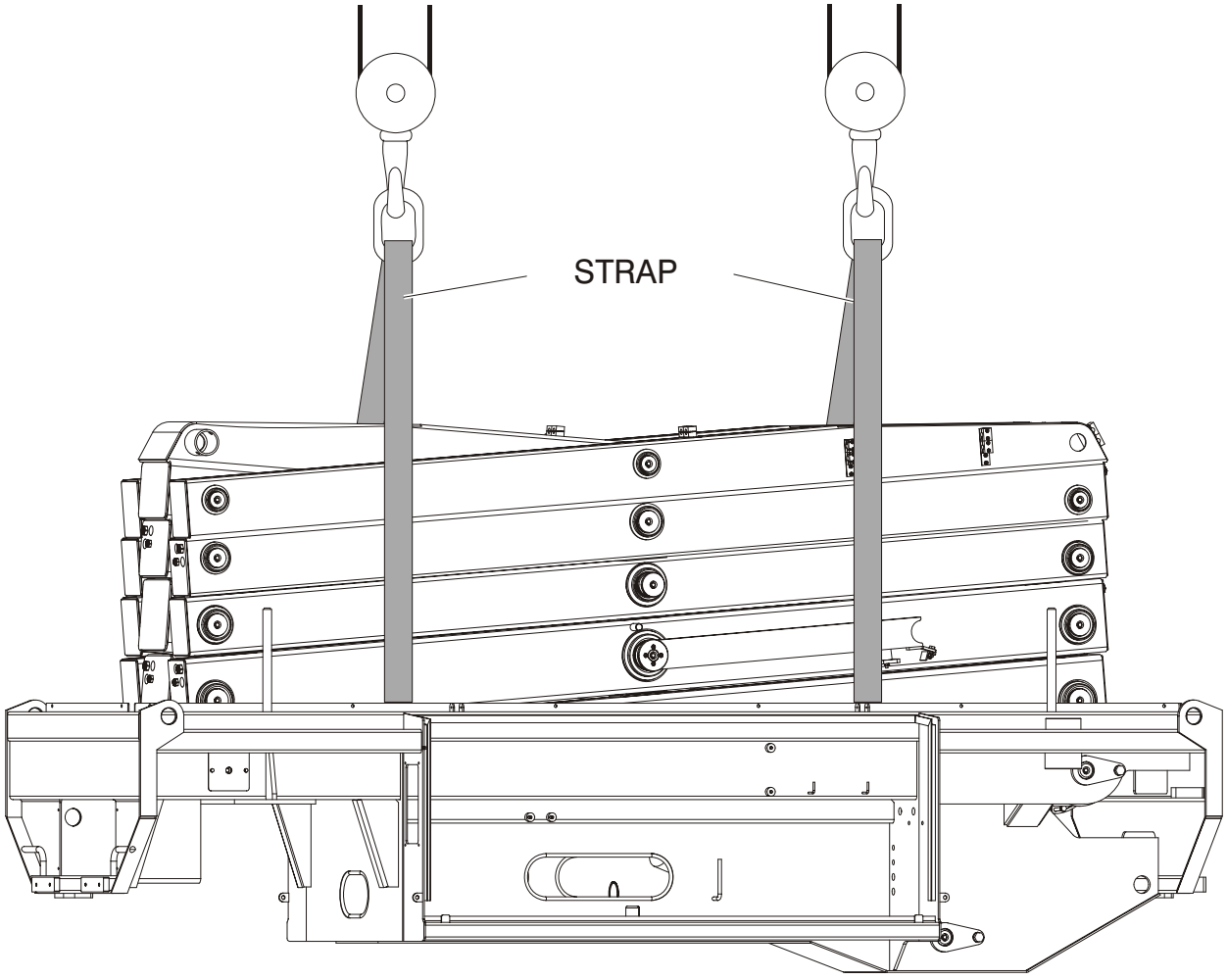
⚠ WARNING

EXTREME CAUTION MUST BE USED WHILE REMOVING ANY LARGE COMPONENTS. THESE COMPONENTS ARE EXTREMELY HEAVY AND CAN CAUSE SERIOUS INJURY OR DEATH IF NOT REMOVED CAUTIOUSLY.

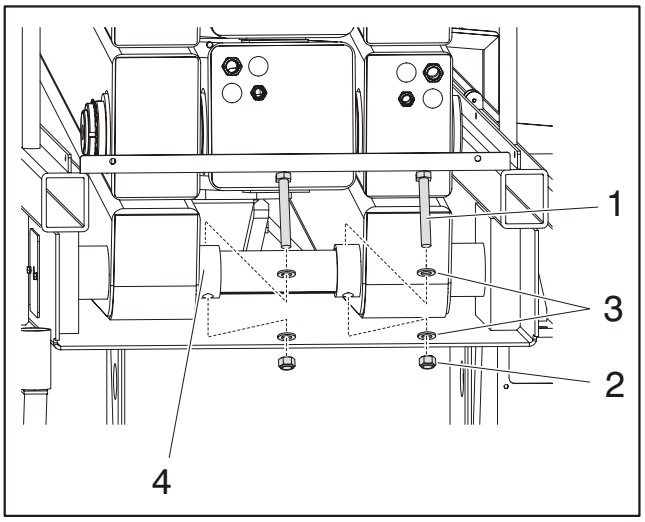
NOTE: *It is recommended to remove the scissor arm assembly as a whole unit.*

1. Disconnect all hoses and wires connecting the scissor assembly to the chassis and platform.
2. Remove the platform from the scissor arm assembly. (See Platform Removal procedures on pages 3-28 and 3-29)
3. Remove the arm guards. (See Arm Guards removal instructions on the previous page)
4. Secure scissor arm assembly with two lifting straps attached to an overhead lifting device.

NOTE: *Scissor arm assembly weighs approximately 3900 - 4100 kg (6598 - 9039 lbs). Straps and lifting device must be capable of lifting the scissor assembly.*

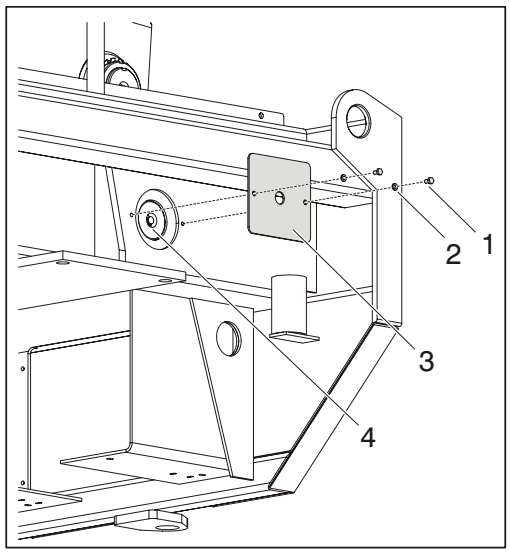


5. Remove one pin from the steering linkage to gain access to the scissor arms pin behind the wheel. (see Section 3-6., Steering Assembly).
6. Remove the cable from the ground control socket in the valve compartment. Secure the cable to the arm stack with tape. As soon as possible, brace the lift cylinder so that when it is disconnected from the arm stack it will be secured and will not fall.
7. Remove the Bolts (1),Washers (2), and Nuts (4) on the bottom arm pin at the rear of the machine.



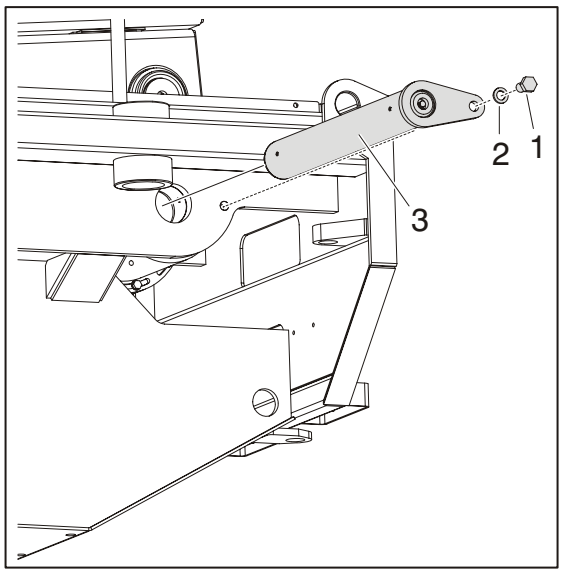
1. Bolt, M16 x 110mm
2. Washer, M16
3. Bushing
4. Nut, M16

8. Slightly lift the scissor stack up with the overhead crane so that the rear sliding blocks in the chassis are free.
9. Remove the Coverplates (3) from both sides of the machine by removing the two Bolts (1) and Lockwashers (2). Once the coverplates are removed the Pin (4) can be pushed out.



1. Bolt, M6 x 10mm
2. Lockwasher, M6
3. Coverplate
4. Pin, 70mm

10. Remove the plate with the limit switches attached. (refer to Figure 3-29., Scissor Arm Limit Switch Adjustment)
11. Remove the bottom arm Pin (3) at the front of the machine by removing the Bolt (1) and Lockwasher (2). Pull the Pin out and secure the pin to the chassis.



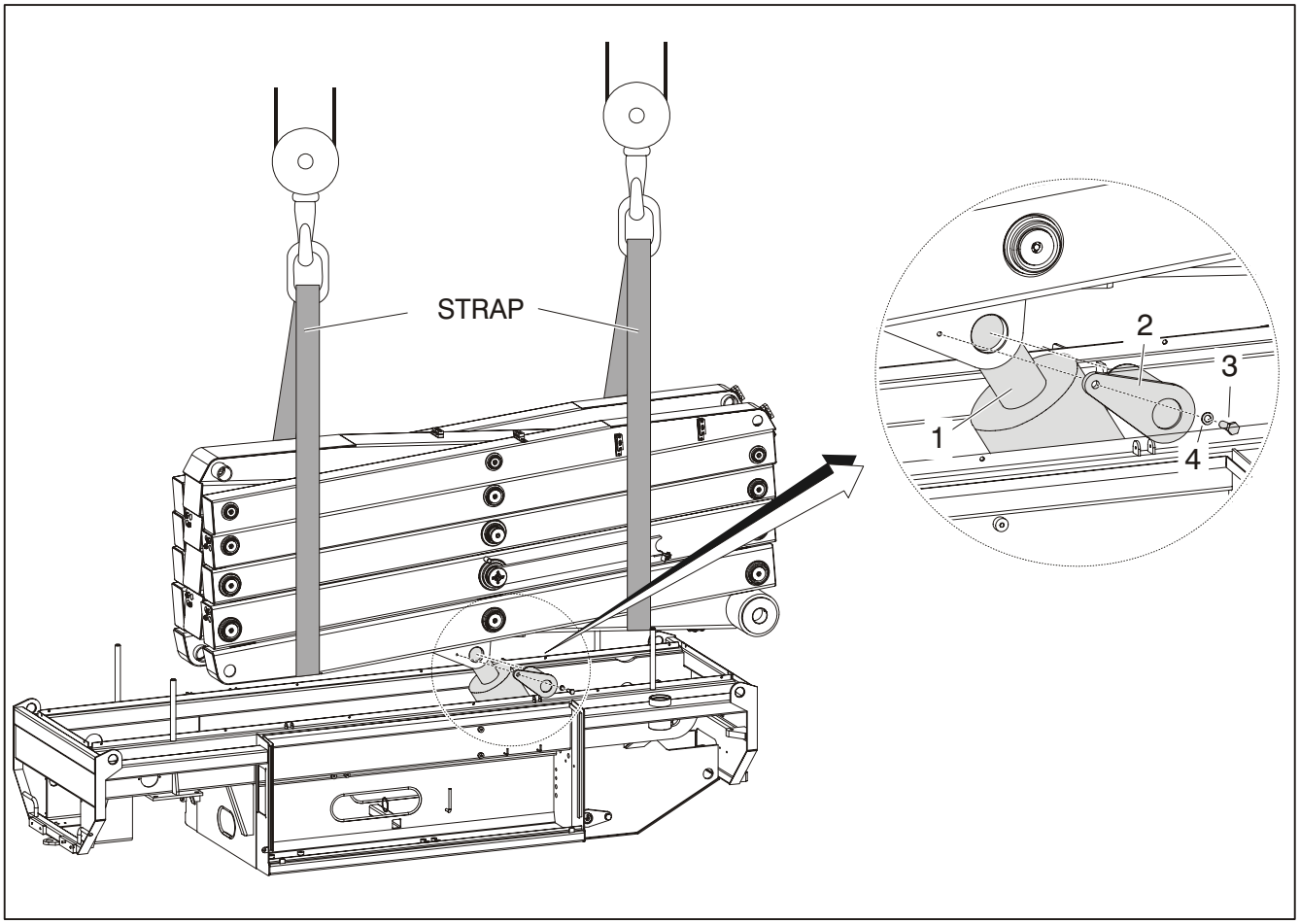
1. Bolt, M20 x 35mm
2. Lockwasher, M20
3. Pin, 85mm

12. Lift the arm stack up and to the front. The lift cylinder (1) is still attached to the chassis and the arm stack will pivot about the Pin (2). When sufficient clearance is achieved between the lift cylinder and frame, secure the cylinder.

⚠ IMPORTANT

NEVER EXTEND THE LIFT CYLINDER WHEN THERE IS NO LOAD ON THE CYLINDER. THE CYLINDER IS SINGLE ACTING AND WILL HAVE NO MEANS OF RETRACTING.

13. Disconnect the Lift Cylinder from the arm stack by removing the Bolt (3) and Lockwasher (4). Pull out the Pin (2).



1. Lift Cylinder
2. Pin, 85mm
3. Bolt, M12 x 35mm
4. Lockwasher, M12

14. The arm stack can now be moved away from the machine. Place the arm stack in a holding device or on secure blocks.

NOTE: *Follow the removal steps in reverse order when installing the arm assembly.*

Lift Cylinder Removal

⚠ WARNING

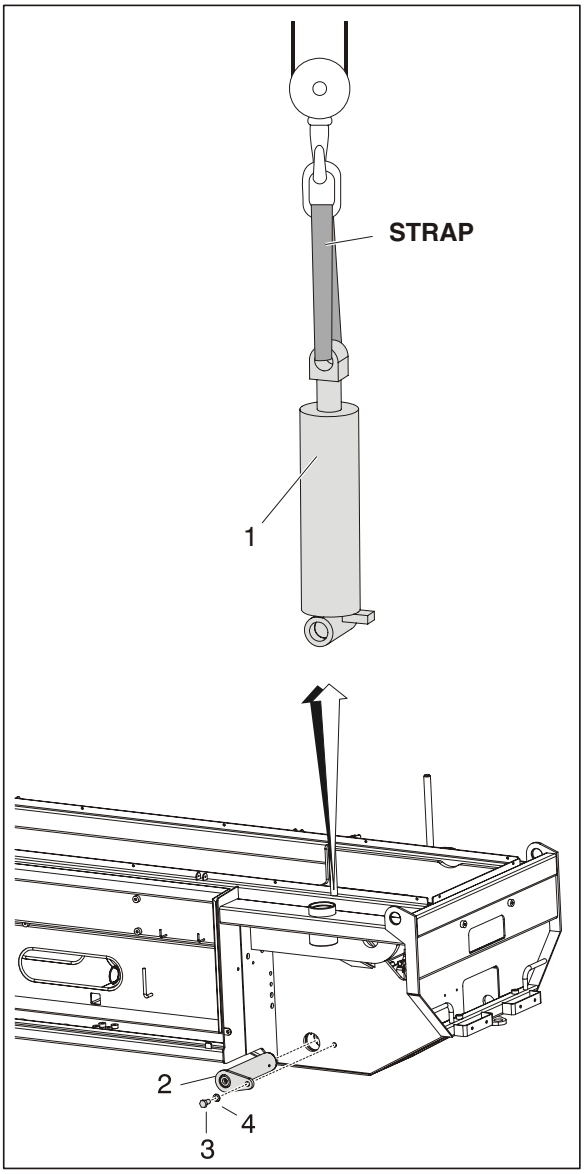
USE CAUTION WHEN REMOVING AND MOVING THE LIFT CYLINDER. THE LIFT CYLINDER ASSEMBLY WEIGHS APPROXIMATELY 270 KG (595 LBS). USE APPROPRIATE LIFTING DEVICES.

1. Follow the procedures on the previous pages to remove the platform and scissor arm assemblies.
2. Shutoff flow of hydraulic fluid by closing the shutoff levers on the hydraulic tank (see Figure 3-15.). Remove all hoses and/or wires from the Lift Cylinder (1).

⚠ IMPORTANT

MAKE SURE THE FITTING ON THE LEAK OIL LINE IS CLOSED TO PREVENT EXTENSION OF THE CYLINDER WHILE LIFTING FROM THE MACHINE.

3. Place a strap, attached to an overhead lifting device, through the top portion of the lift cylinder to secure the cylinder.
4. Put the cylinder into a vertical position with the overhead lifting device.
5. Remove the Bolt (2) and Lockwasher (3). Pull the Pin (4) out of the machine.
6. Carefully raise the Lift Cylinder (1) from the chassis using an overhead crane or other suitable lifting device.



1. Lift Cylinder
2. Pin, 85mm
3. Bolt, M20 x 35mm
4. Washer, M20

Figure 3-31. Lift Cylinder Removal

NOTE: *Follow the removal procedures in reverse order when installing the lift cylinder.*

Scissor Arms Disassembly

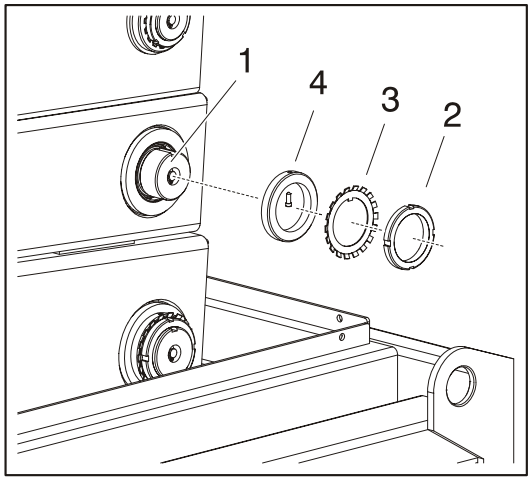
⚠ CAUTION

INDIVIDUAL SCISSOR ARMS ARE HEAVY. USE CAUTION WHEN REMOVING. USE APPROPRIATE LIFTING DEVICES.

1. Disconnect battery and shutoff flow of hydraulic fluid by closing the shutoff levers on the hydraulic tank (see Figure 3-15.).
2. Remove Platform (see Figure 3-26., Platform Removal - 1 of 2 (Front of Platform) and Figure 3-27., Platform Removal - 2 of 2 (Rear of Platform)).
3. Remove the Arm Guards (see Figure 3-30., Arm Guards Installation).
4. Hydraulic lines and electrical lines run through the insides of the scissor arms. These hoses and wires must be removed before removing the arm components.
5. Brace the Scissor Arm Assembly, as well as, the individual Scissor Arm(s) being removed.

NOTE: *The below steps apply to each scissor arm pin.*

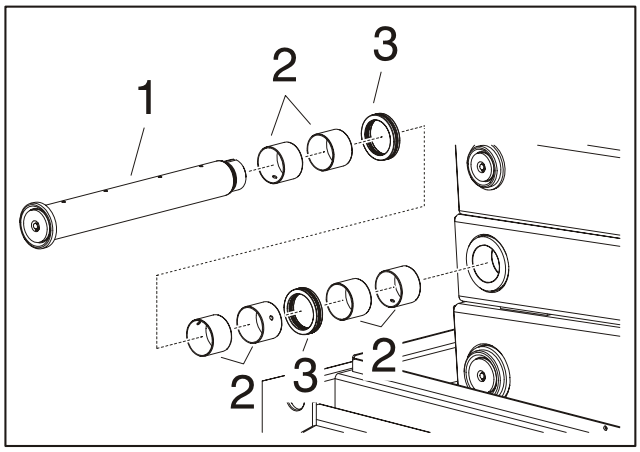
6. On the left side of the machine, remove the Nut (2) with a spanner wrench. Next remove the Retaining Washer (3) and Washer and Pin (4).



1. Arm Pin (60mm, 70mm, 80mm, 85mm, 90mm, or 110mm)
2. Nut (KM 10, KM 12, KM 14, KM 15, KM 16, or KM 20)
3. Retaining Washer (MB 10, MB 12, MB 14, MB 15, MB 16, or MB 20)
4. Washer & Pin

Figure 3-32. Scissor Arm Removal (Left Side)

7. Move to the right side of the machine. The Arm Pin (1) can now be pulled out of the scissor arm stack. Remove the six Bushings (2) and two Ball Thrust Bearings (3).



1. Arm Pin (60mm, 70mm, 80mm, or 85mm, 90mm, or 110mm)
2. Bushing
3. Ball Thrust Bearing

Figure 3-33. Scissor Arm Removal (Right Side)

8. Repeat steps 4 and 5 at each Arm Pin in order to remove the individual scissor arm.
9. Carefully lift the arm from the assembly.

NOTE: *Follow the removal steps in reverse order when installing the scissor arms.*

NOTE: *Tighten the Lock Nuts until there is zero clearance between the arms and the bearings. Back off one quarter of a revolution. Bend the lip on the corresponding Retaining Washer into the notch on the lock nuts.*

NOTES:

SECTION 4. HYDRAULICS

4.1 CYLINDERS - THEORY OF OPERATION

Lift Cylinder:

The lift cylinder is a single acting cylinder incorporating dual solenoid holding valves and a pilot operated check valve for emergency lowering. The lifting function is controlled by the 3rd section of the main control valve. Lift speed is limited by flow from section 1 in the pump.

Lowering is operated by energizing the 2 solenoid holding valves together with the 3rd section of the main control valve.

To enable lowering at full speed when the engine is stopped (i.e. there is no hydraulic power available to act as a pilot supply for the electrical actuator), a pilot line is connected to the auxiliary port "M" on the control valve via a check valve. This provides the hydraulic power necessary to shift the lower valve section.

Steer Cylinder:

Steering is controlled by a double acting cylinder connected to the 4th section of the main control valve.

4.2 VALVES - THEORY OF OPERATION

Solenoid Control Valves (Bang-Bang)

Control valves used are four-way three-position solenoid valves of the sliding spool design. When a circuit is activated and the control valve solenoid energizes, the spool is shifted and the corresponding work port opens to permit oil flow to the component in the selected circuit, with the opposite work port opening to reservoir. Once the circuit is deactivated (control returned to neutral), the valve spool returns to neutral (center) and oil flow is then directed through the valve body and returns to reservoir. A typical control valve consists of the valve body, sliding spool, and two solenoid assemblies. The spool is machine fitted in the bore of the valve body. Lands on the spool divide the bore into various chambers, which, when the spool is shifted, align with corresponding ports in the valve body open to common flow. At the same time other ports would be blocked to flow. The spool is spring-loaded to center position, therefore when the control is released, the spool automatically returns to neutral, prohibiting any flow through the circuit.

Relief Valves

Main relief valves are installed at various points within the hydraulic system to protect associated systems and components against excessive pressure. Excessive pressure can be developed when a cylinder reaches its limit of travel and the flow of pressurized fluid continues from the system control. The relief valve provides an alternate path for the continuing flow from the pump, thus preventing rupture of the cylinder, hydraulic line or fitting. Complete failure of the system pump is also avoided by relieving circuit pressure. The relief valve is installed in the circuit between the pump outlet (pressure line) and the cylinder of the circuit, generally as an integral part of the system valve bank. Relief pressures are set slightly higher than the load requirement, with the valve diverting excess pump delivery back to the reservoir when operating pressure of the component is reached.

Crossover Relief Valves

Crossover relief valves are used in circuits where the actuator requires an operating pressure lower than that supplied to the system. When the circuit is activated and the required pressure at the actuator is developed, the crossover relief diverts excess pump flow to the reservoir. Individual, integral relief's are provided for each side of the circuit.

Proportional Valve

Flow is proportional to the amount of voltage supplied to the valve coil. Voltage is gained by the machine controller and determined by the position of the joystick.

4.3 CYLINDER CHECKING PROCEDURE

NOTE: *Cylinder check must be performed anytime a system component is replaced or when improper system operation is suspected.*

1. Using all applicable safety precautions, activate engine and fully extend cylinder to be checked. Shut down engine.
2. Carefully disconnect hydraulic hoses from retract port of cylinder. There will be some initial weeping of hydraulic fluid which can be caught in a suitable container. After the initial discharge, there should be no further drainage from the retract port.
3. Activate engine and extend cylinder.
4. If cylinder retract port leakage is less than 6-8 drops per minute, carefully reconnect hose to port and retract cylinder. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repair must be made.
5. With cylinder fully retracted, shut down engine and carefully disconnect hydraulic hose from cylinder extend port.
6. Activate engine and retract cylinder. Check extend port for leakage.
7. If extend port leakage is less than 6-8 drops per minute, carefully reconnect hose to extend port, than activate cylinder through one complete cycle and check for leaks. If leakage continues at a rate of 6-8 drops per minute or more, cylinder repairs must be made.

4.4 CYLINDER REPAIR

NOTE: *The following are general procedures that apply to all of the cylinders on this machine. Procedures that apply to a specific cylinder will be so noted. Refer to Figures 4-22 thru 4-23 for specific cylinder assembly breakdowns and for specific parts references. Refer to JLG Parts Manual 3121311 for seal kits and part numbers.*

Disassembly

⚠ WARNING

BEFORE REMOVING CYLINDERS FROM THE MACHINE, BE SURE TO SUPPORT THE MACHINE AND SCISSOR ARMS/PLATFORM WITH SAFETY PROPS, FORKLIFTS, OR OVERHEAD CRANE TO PREVENT RELEVANT COMPONENTS FROM COLLAPSING AND CAUSING SERIOUS INJURY OR DEATH. (SEE FIGURE 4-25.)

1. Remove cylinder(s) from the machine by first disconnecting all hoses and/or wires and any valves. Next, unscrew bolts connecting cylinder(s) to the machine. If applicable, remove any pins connecting the cylinders to the machine.

NOTE: *Step 2 applies only to the Lift Cylinder.*

2. To prevent damage, remove the hydraulic block, load retaining valve block, and check valve block from the lift cylinder barrel by unscrewing the 8 set screws.

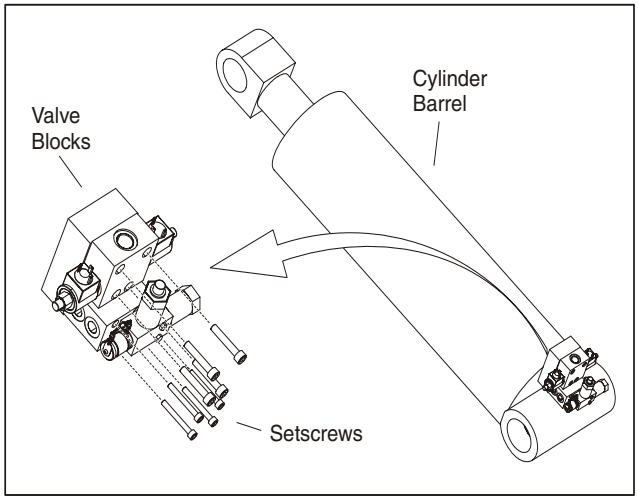


Figure 4-1. Lift Cylinder Valve Block Removal

⚠ IMPORTANT

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

3. Connect a suitable auxiliary hydraulic power source to the cylinder port block fitting.

⚠ WARNING

DO NOT FULLY EXTEND CYLINDER TO THE END OF STROKE. RETRACT CYLINDER SLIGHTLY TO AVOID TRAPPING PRESSURE.

4. Operate the hydraulic power source and extend the cylinder. Shut down and disconnect the power source.
5. Adequately support the cylinder rod, if applicable.
6. Place the cylinder barrel into a suitable holding fixture.

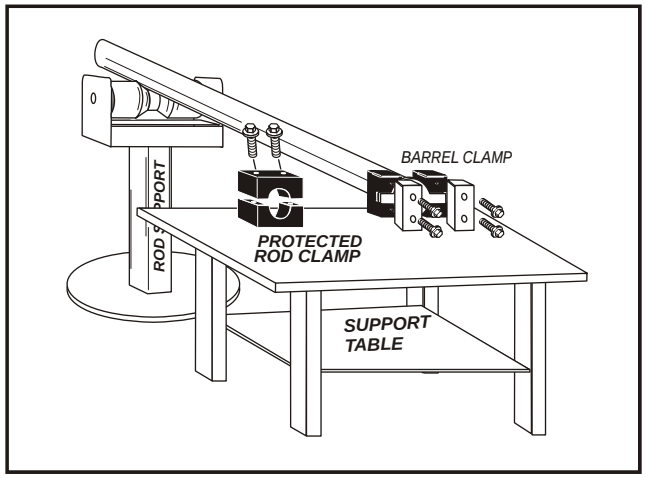


Figure 4-2. Cylinder Barrel Support

7. Using a spanner wrench, loosen and remove the cylinder head from the barrel.

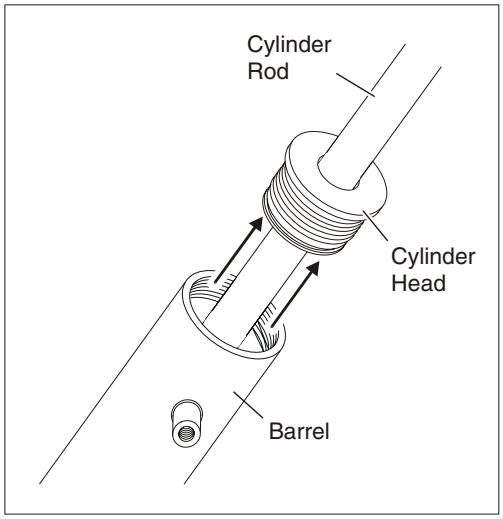


Figure 4-3. Cylinder Head Removal

⚠ IMPORTANT

EXTREME CARE SHOULD BE TAKEN WHEN REMOVING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

8. With the barrel clamped securely, apply pressure to the rod pulling device and carefully withdraw the complete rod assembly from the cylinder barrel.

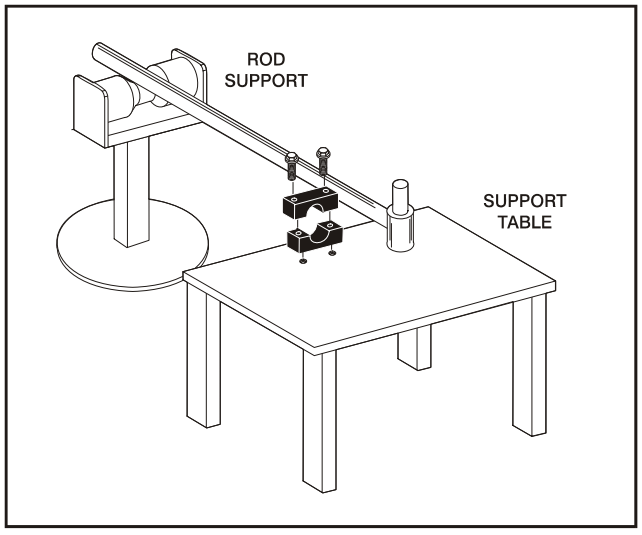


Figure 4-4. Cylinder Rod Support

9. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.
10. Loosen and remove the setscrew which attaches the piston to the rod, and remove the piston.

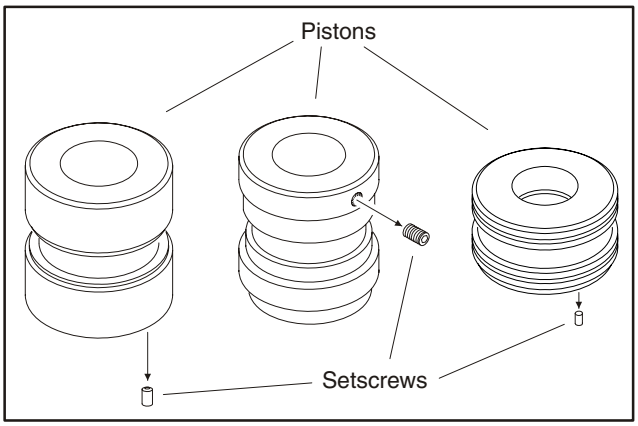


Figure 4-5. Piston Setscrew Removal

11. Unscrew the piston counter-clock-wise, by hand, and remove the piston from cylinder rod.

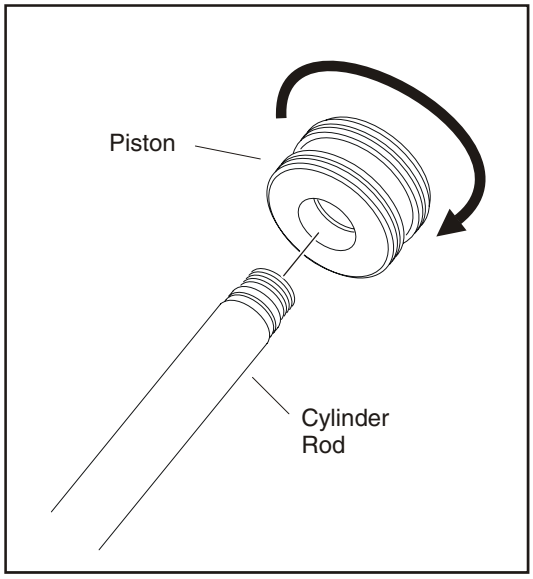


Figure 4-6. Piston Removal

12. Remove and discard the piston o-rings and seal rings.

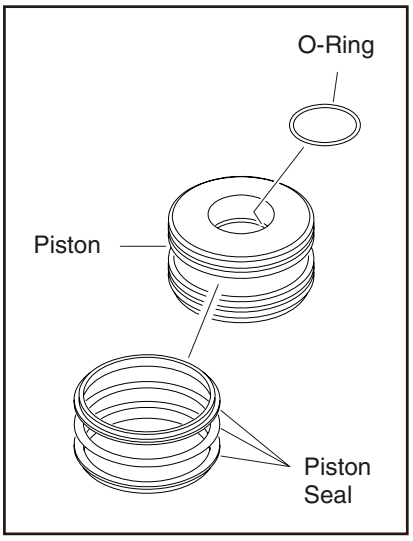


Figure 4-7. Piston Seals

13. If applicable, remove the spacer from the rod.

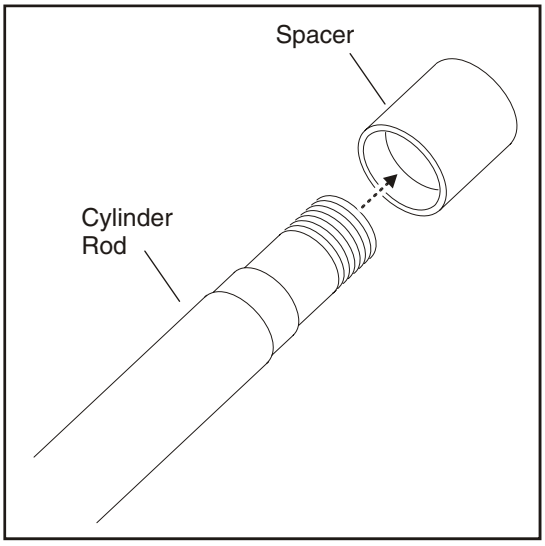


Figure 4-8. Spacer Removal

14. Remove the rod from the holding fixture.

15. Remove the cylinder head from the cylinder rod.

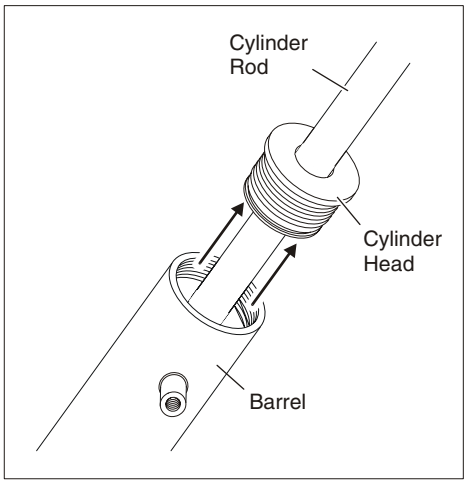


Figure 4-9. Cylinder Head Removal

16. If applicable, remove and discard the rod seal, wiper seal, and o-ring(s).

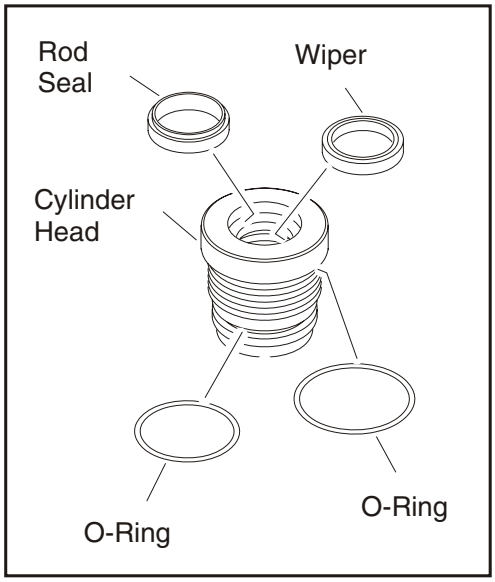


Figure 4-10. Cylinder Head Seals

Cleaning and Inspection

1. Clean all parts thoroughly in an approved cleaning solvent.
2. Inspect the cylinder rod for scoring, tapering, ovality, or other damage. If necessary, dress rod with Scotch Brite or equivalent. Replace rod if necessary.
3. Inspect threaded portion of rod for excessive damage. Dress threads as necessary.
4. Inspect inner surface of cylinder barrel tube for scoring or other damage. Check inside diameter for tapering or ovality. Replace if necessary.
5. Inspect threaded portion of barrel for damage. Dress threads as necessary.
6. Inspect piston surface for damage and scoring and for distortion. Dress piston surface or replace piston as necessary.
7. If applicable, inspect threaded portion of piston for damage. Dress threads as necessary.
8. Inspect seal and o-ring grooves in piston for burrs and sharp edges. Dress applicable surfaces as necessary.
9. Inspect cylinder head inside diameter for scoring or other damage and for ovality and tapering. Replace as necessary.
10. Inspect threaded portion of head for damage. Dress threads as necessary.
11. Inspect seal and o-ring grooves in head for burrs and sharp edges. Dress applicable surfaces as necessary.
12. Inspect cylinder head outside diameter for scoring or other damage and ovality and tapering. Replace as necessary.
13. If applicable, inspect rod and barrel bushings for signs of excessive wear or damage. Replace as necessary.
    a. Thoroughly clean bushing housing, of burrs, dirt etc. to facilitate bearing installation.
    b. Inspect bushing housing for wear or other damage. If the bushing housing is worn or damaged, rod/barrel must be replaced.
    c. Lubricate inside of bushing housing with WD40 prior to bushing installation.
    d. Using an arbor of the correct size, carefully press the bushing(s) into bushing housing on the cylinder rod and cylinder barrel, if applicable.

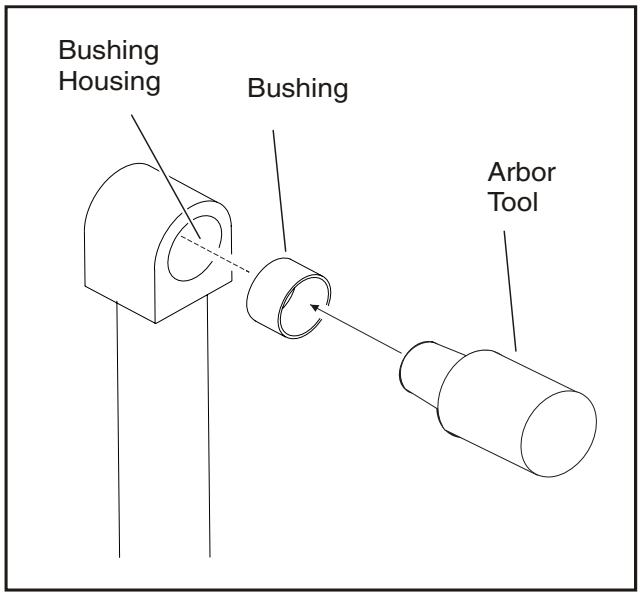


Figure 4-11. Bushing Installation

NOTE: *Step 14 applies only to the Lift Cylinder.*

14. Inspect the hydraulic block, load retaining valve block, and check valve block for any damage. Replace as necessary.
15. Inspect the oil ports for blockage or the presence of dirt or other foreign material. Repair as necessary.
16. If applicable, inspect piston rings for cracks or other damage. Replace as necessary.

Assembly

NOTE: *Prior to cylinder assembly, ensure that the proper cylinder seal kit is used. See your JLG Parts Manual 3121311. Always replace seals when servicing cylinders.*

Apply a light film of hydraulic oil to all components prior to assembly.

1. A special tool is used to install a new rod seal into the applicable cylinder head gland groove.

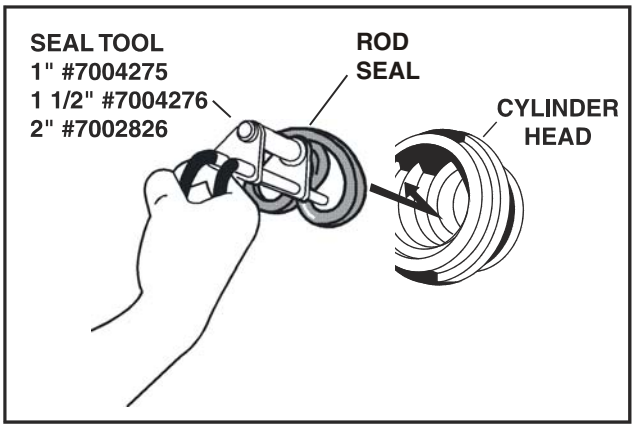


Figure 4-12. Rod Seal Installation

⚠ IMPORTANT

WHEN INSTALLING PISTON SEALS, ENSURE SEALS ARE INSTALLED PROPERLY. IMPROPER SEAL INSTALLATION COULD RESULT IN CYLINDER LEAKAGE AND IMPROPER CYLINDER OPERATION.

⚠ IMPORTANT

WHEN INSTALLING THE WIPER SEAL, APPLY LOCTITE #609 ON THE WIPER SEAL IN THREE EVENLY SPACED PLACES TO AID IN RETENTION OF THE SEAL.

2. Use a soft mallet to tap a new wiper seal into the applicable cylinder head gland groove. Install a new rod seal into the applicable cylinder head gland-groove. Install new o-rings onto the appropriate outside diameter grooves of the cylinder head.

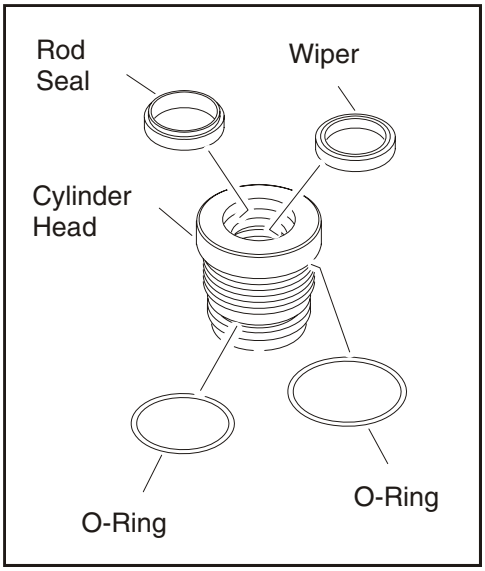


Figure 4-13. Cylinder Head Seal Installation

3. Carefully install the cylinder head on the rod, ensuring that the wiper, o-ring, and rod seals are not damaged or dislodged. Push the head along the rod to the rod end, as applicable.

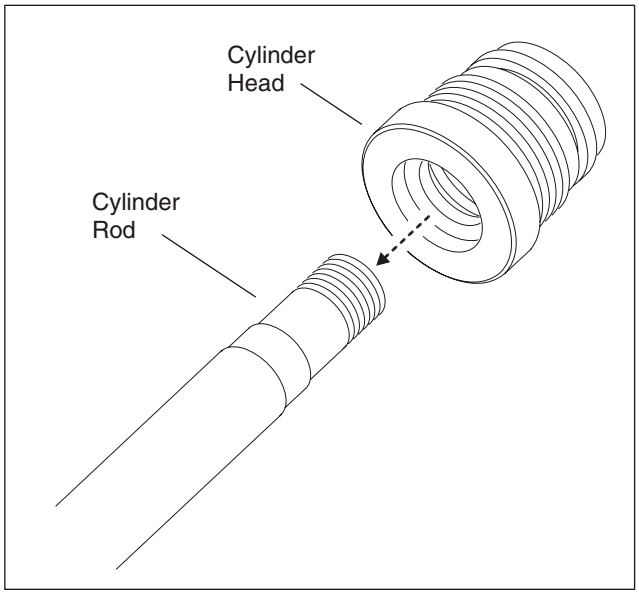


Figure 4-14. Cylinder Head Installation

4. Carefully slide the piston spacer onto the cylinder-rod.

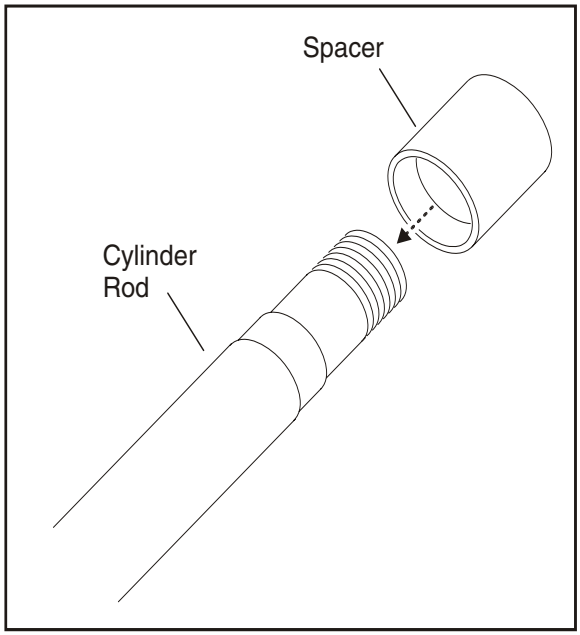


Figure 4-15. Spacer Installation

5. If applicable, correctly install new o-ring and snap ring in the inner piston diameter groove.

6. If applicable, correctly place new seals in the outer piston diameter groove(s). (A tube, with an inner diameter slightly larger than the outer diameter of the piston is recommended to install the solid seal.)

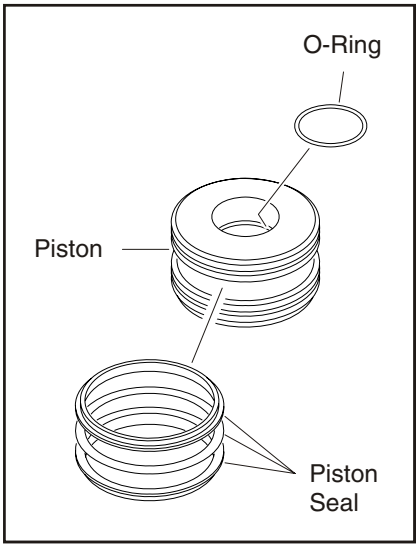


Figure 4-16. Piston Seal Installation

7. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to piston as possible.
8. Carefully thread the piston clock-wise on the cylinder rod hand tight until it abuts the spacer, ensuring that the o-ring, snap ring, and piston seals are not damaged or dislodged.

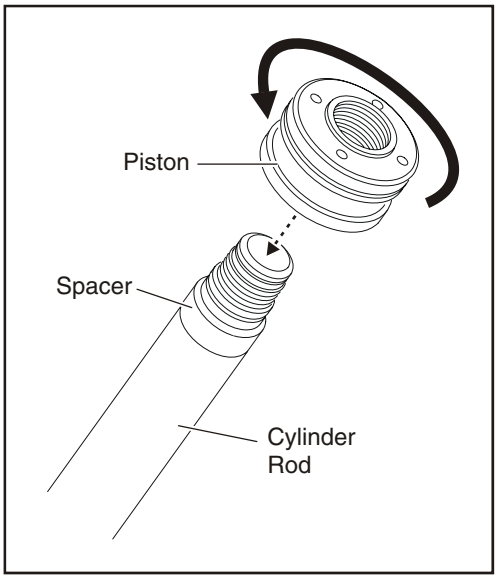


Figure 4-17. Piston Installation

9. Insert the setscrews on the piston and tighten to lock piston in place on cylinder rod.

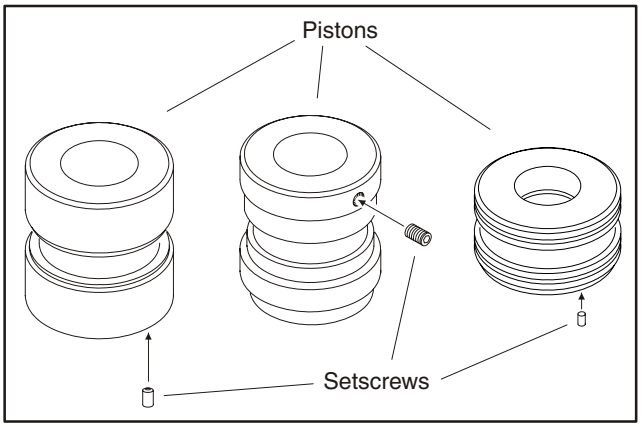


Figure 4-18. Piston Setscrew Installation

10. Remove the cylinder rod from the holding fixture.
11. Position the cylinder barrel in a suitable holding fixture.

⚠ IMPORTANT

EXTREME CARE SHOULD BE TAKEN WHEN INSTALLING THE CYLINDER ROD, HEAD, AND PISTON. AVOID PULLING THE ROD OFF-CENTER, WHICH COULD CAUSE DAMAGE TO THE PISTON AND CYLINDER BARREL SURFACES.

12. With barrel clamped securely, and while adequately supporting the rod, insert the piston end into the barrel cylinder. Ensure that the piston loading o-ring and seal ring are not damaged or dislodged.

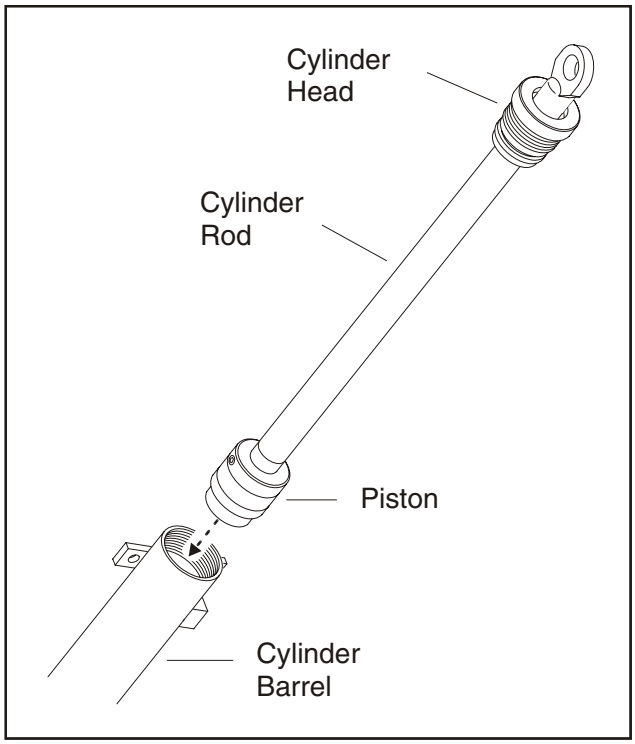


Figure 4-19. Rod Installation

13. Continue pushing the rod into the barrel until the cylinder head can be inserted into the barrel cylinder.

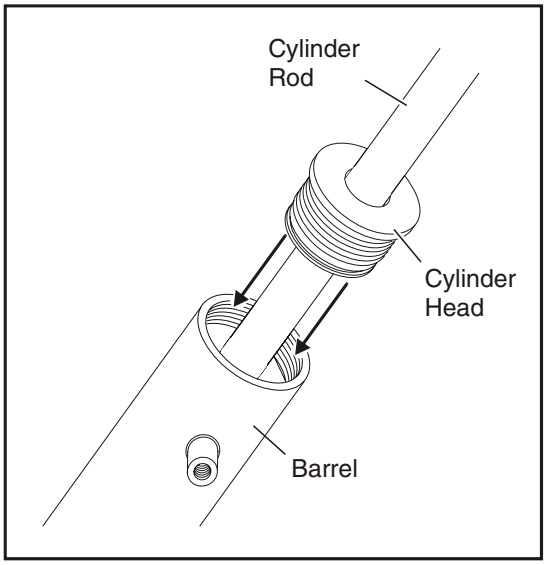
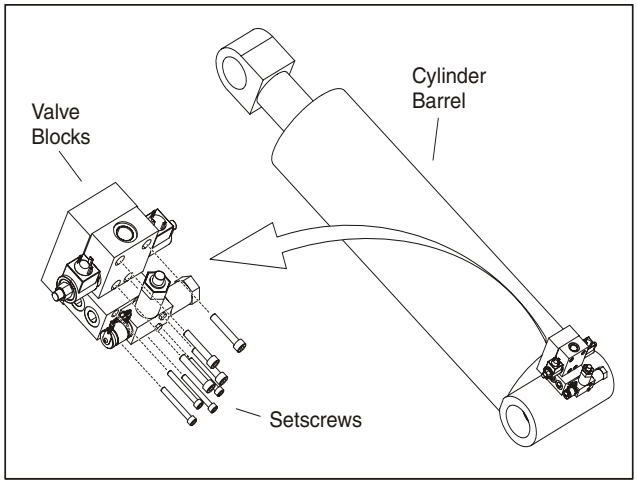


Figure 4-20. Rod Assembly Installation

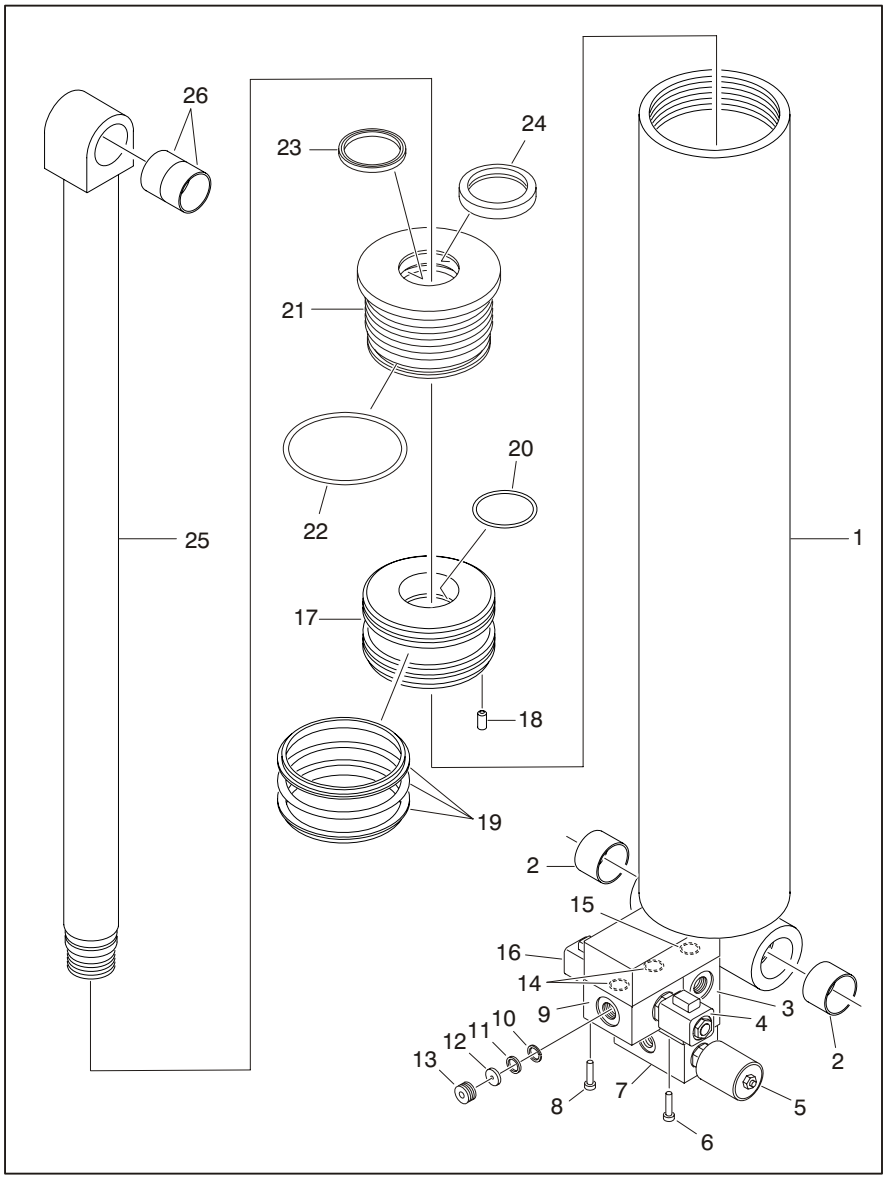
14. Use a spanner wrench to tightten the cylinder head on the barrel.

15. If applicable, after the cylinder has been reassembled, the rod should be pushed all the way in (fully retracted) prior to the reinstallation of any valve block or load check valve.



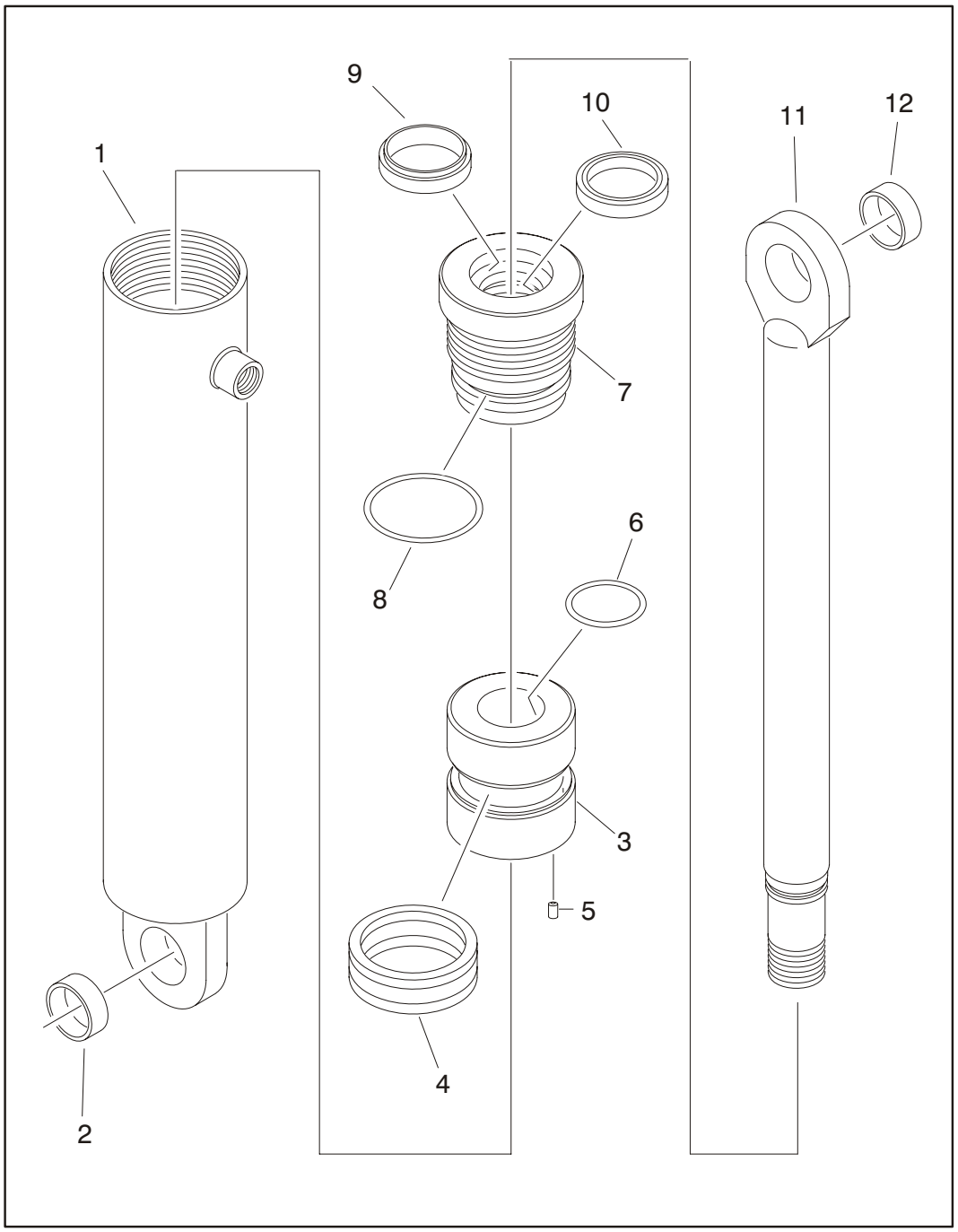
NOTE: *Lift Cylinder only.*

Figure 4-21. Valve Block Installation



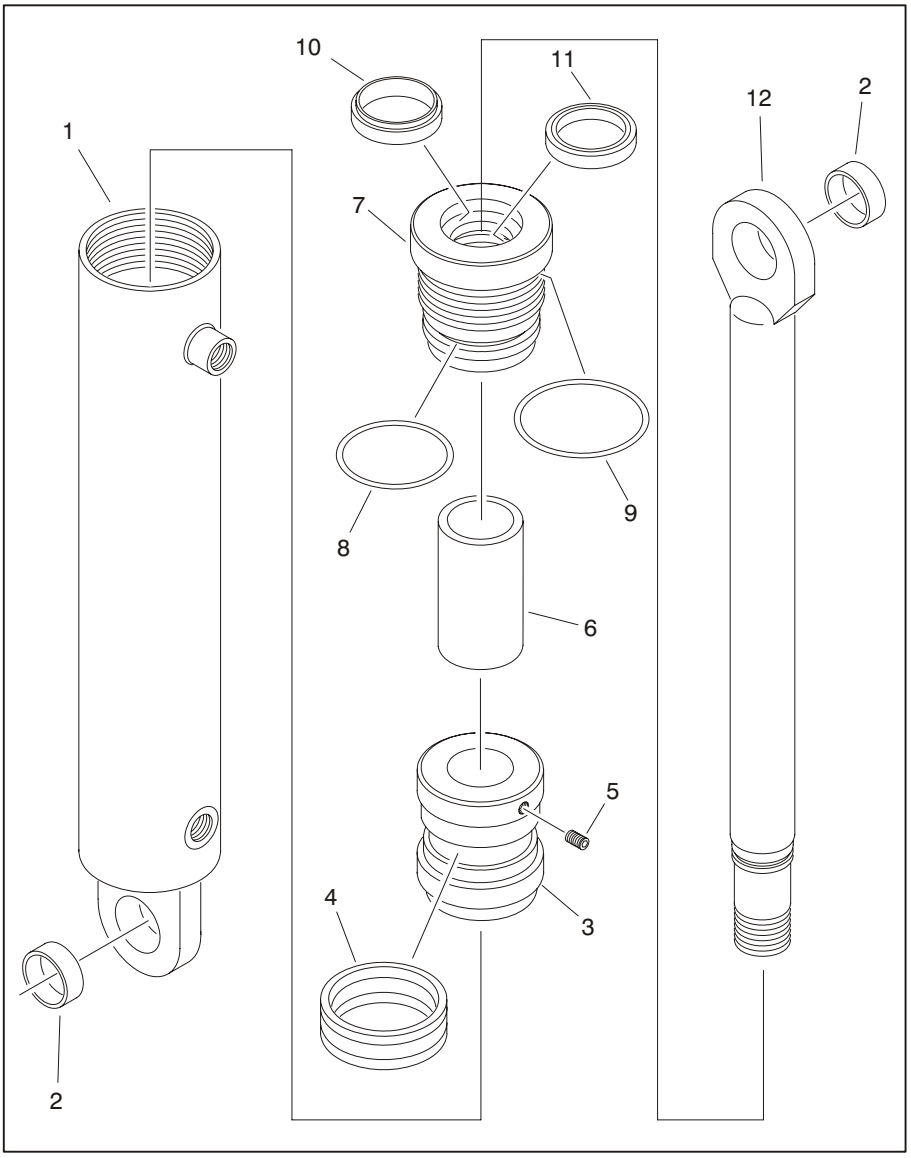
1. Cylinder Barrel Weldment
2. Bushing
3. Check Valve Block
4. Holding Valve
5. Pressure Sensor (qty. 2)
6. Screw
7. Hydraulic Block
8. Screw
9. Load Retaining Valve Block
10. Snap Ring
11. Throttle Ring
12. Throttle Collar
13. Throttle Screw
14. O-Ring
15. O-Ring
16. Holding Valve
17. Piston
18. Setscrew
19. Piston Seal Set
20. O-Ring
21. Cylinder Head
22. O-Ring
23. Rod Seal
24. Wiper
25. Piston Rod with Rod Eye
26. Bushing

Figure 4-22. Lifting Cylinder Assembly



1. Cylinder Barrel Weldment
2. Bronze Bushing
3. Piston
4. Piston Seal
5. Setscrew
6. O-Ring
7. Cylinder Head
8. O-Ring
9. Wiper
10. Rod Seal
11. Piston Rod with Rod Eye
12. Bronze Bushing

Figure 4-23. Steering Cylinder Assembly (Prior to S/N 1200009628)



1. Cylinder Barrel Weldment
2. Bushing
3. Piston
4. Piston Seal
5. Setscrew
6. Spacer
7. Cylinder Head
8. O-Ring
9. O-Ring
10. Wiper
11. Rod Seal
12. Rod Weldment

Figure 4-24. Steering Cylinder Assembly (S/N 1200009628 to Present)

Table 4-1. Steering Cylinder Specs

Maximum Working Pressure	200 bar (2900.7 psi)
Piston Head Torque	260 Nm (191.8 lb ft)
Maximum Speed	0.5 m/sec (1.6 ft/sec)
Maximum Operating Temperature	-20°C to 80°C (-4°F to 176°F

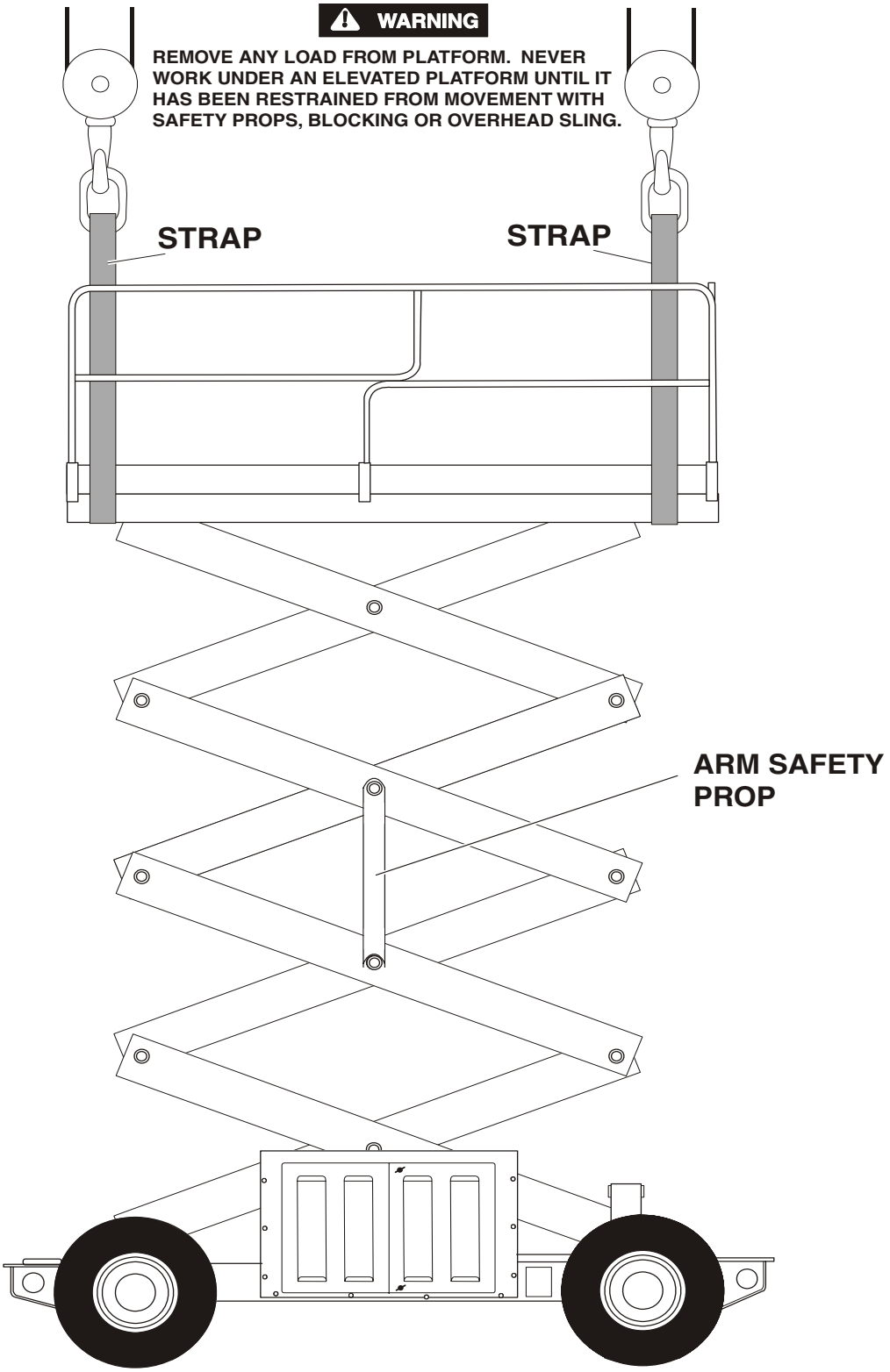
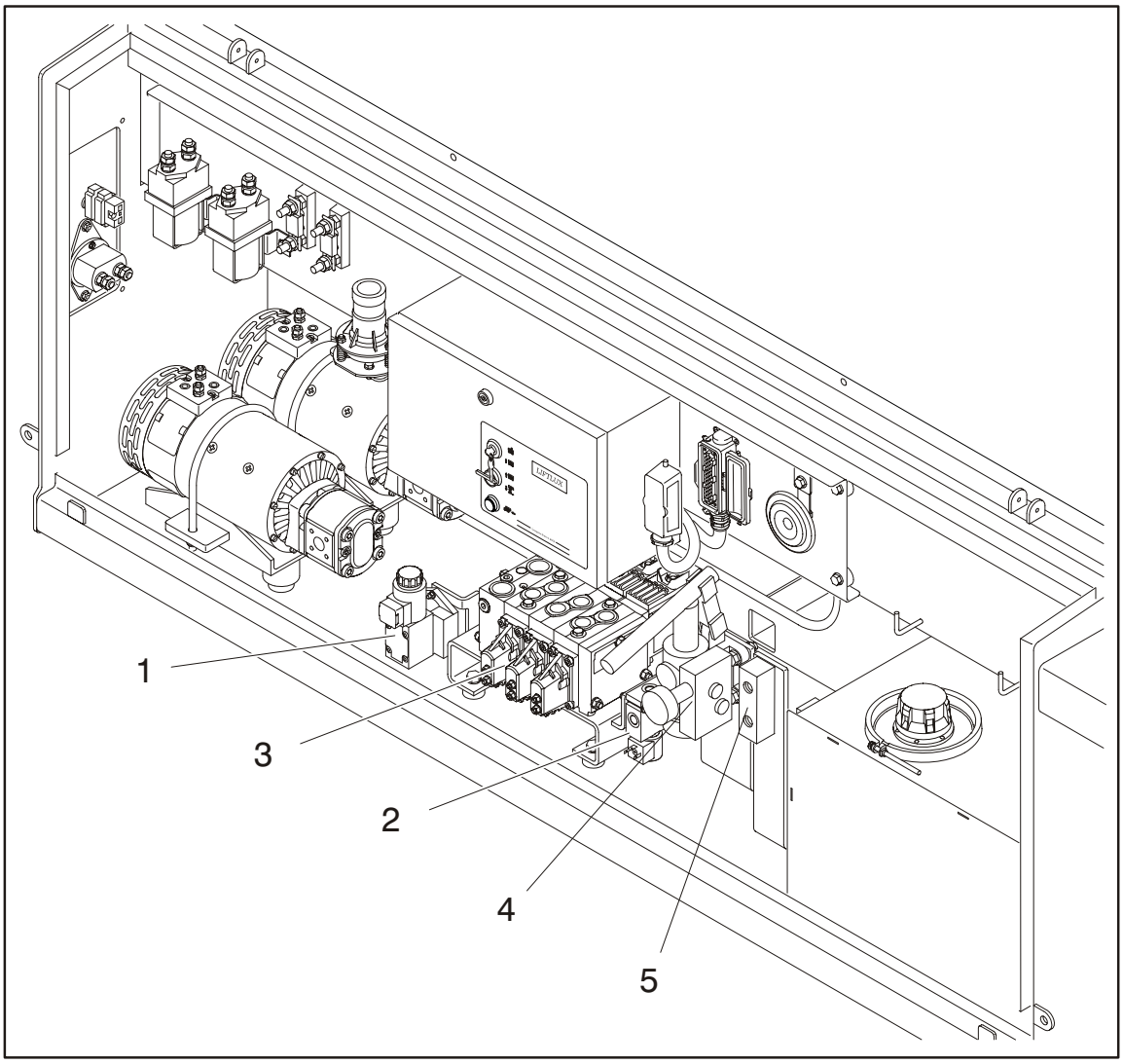


Figure 4-25. Arms and Platform Positioning and Support

4.5 VALVES

Valve Compartment



1. Directional Control Valve
2. Brake Valve
3. Proportional Valve Block
4. Hand Pump
5. Pressure Distribution Manifold

Figure 4-26. Valve Compartment

Directional Control Valve

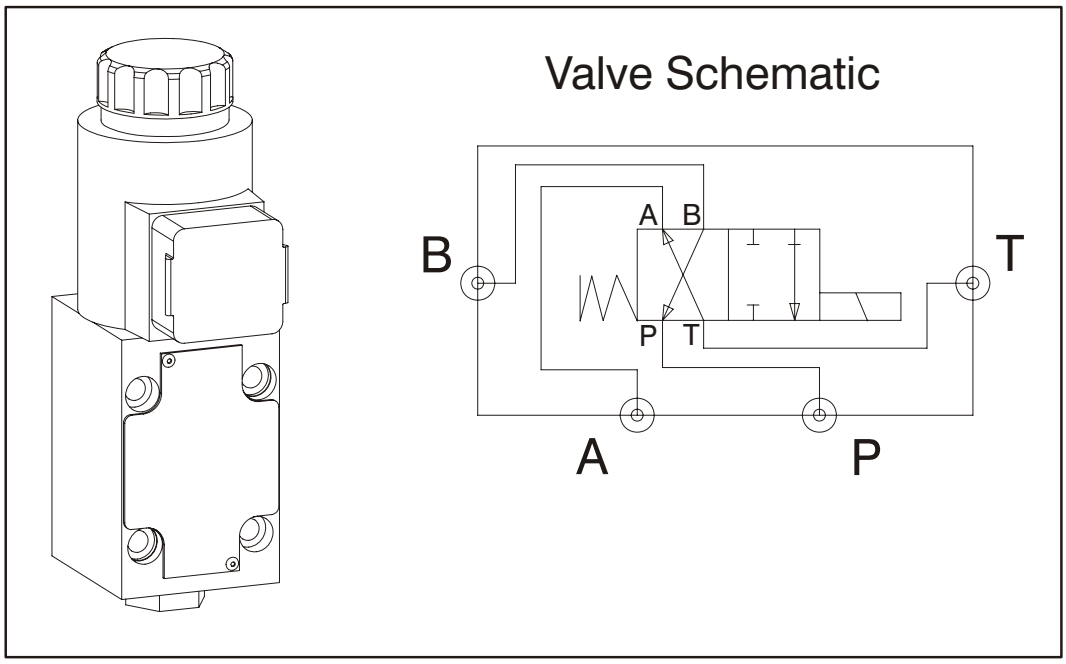
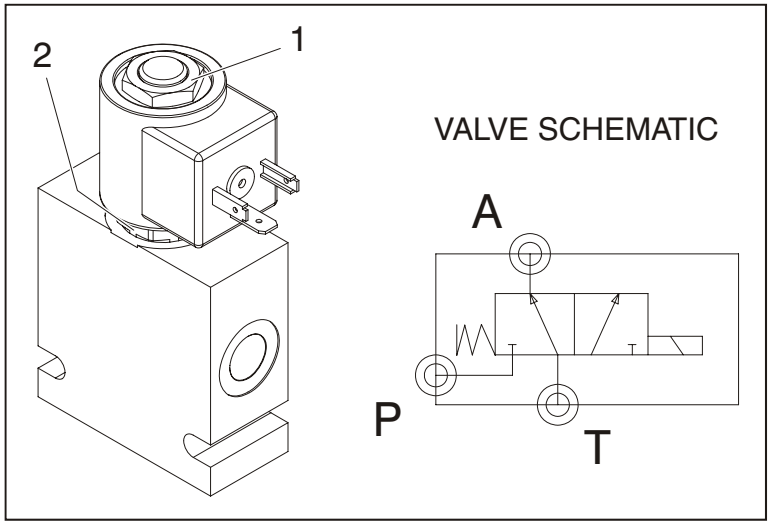


Figure 4-27. Directional Control Valve

Brake Valve

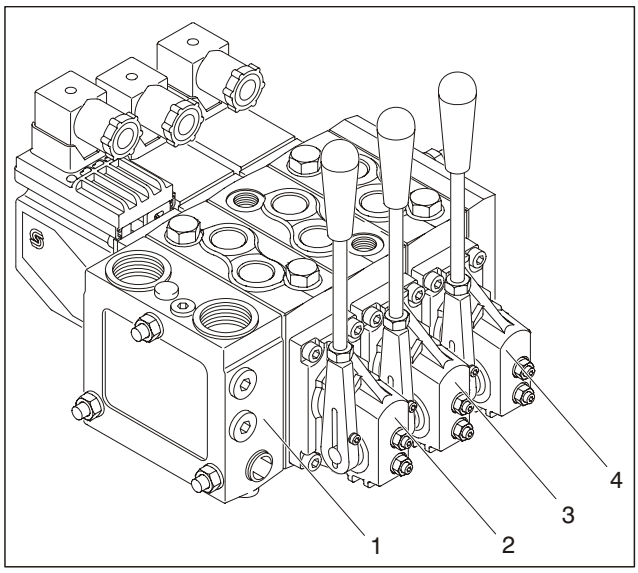


1. Torque to 6.8 Nm (5 ft lbs)
2. Torque to 27.1 Nm (20 ft lbs)

- Operating Pressure: 207 bar (3000 psi)
- Voltage: 24VDC

Figure 4-28. Brake Valve

Proportional Valve Block



1. Main Pressure Block
2. Drive
3. Lift
4. Steer

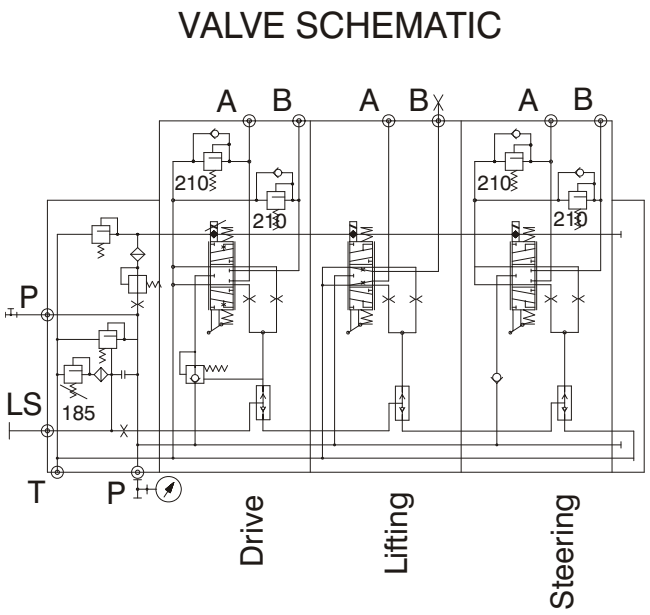


Figure 4-29. Main Valve Block

Adjust main pressure on top of the Main Pressure Block.

- Remove the rubber plug
- Adjust to 185 bar (2683.1 psi) (153-12)
- Adjust to 195 bar (2828 psi) (180-12)
- see illustration to the right

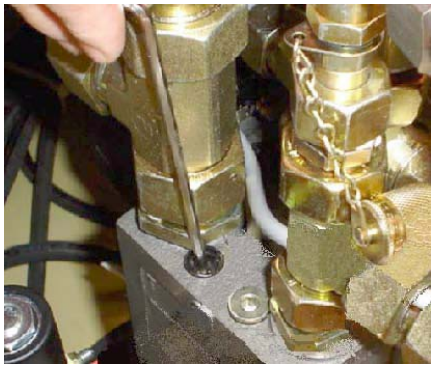
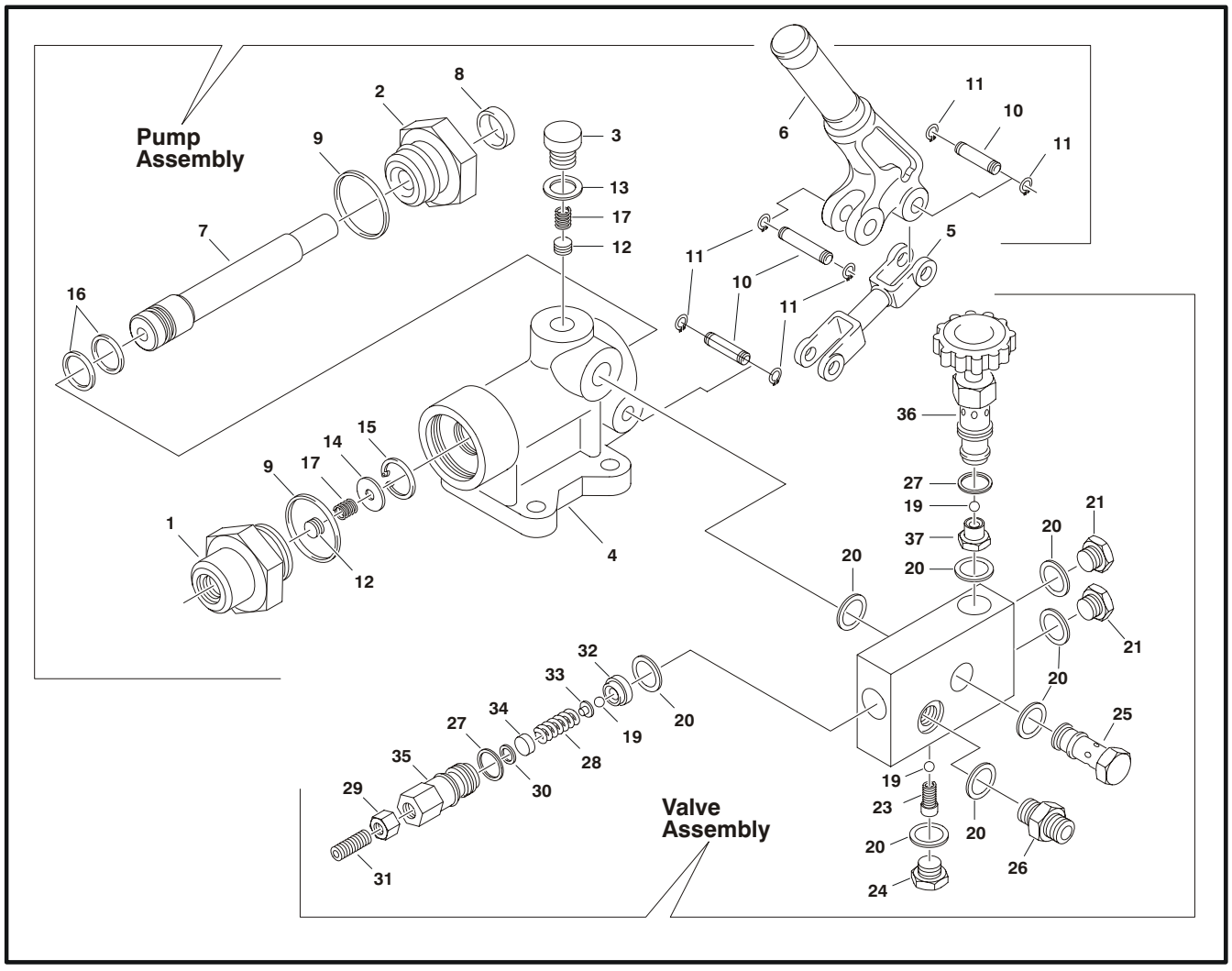


Figure 4-30. Proportional Valve Pressure Adjustment

Hand Pump



Pump Assembly

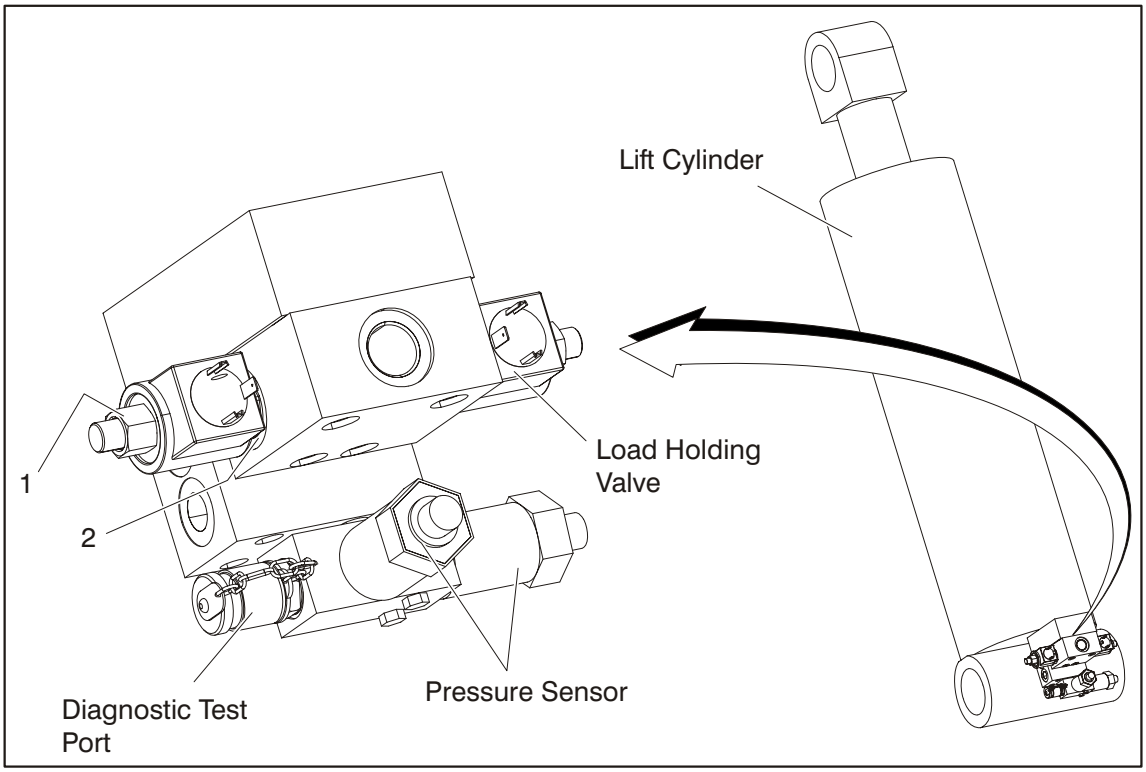
1. Valve, Suction
2. Plug
3. Plug
4. Body
5. Rod, Connecting
6. Lever
7. Piston
8. Seal
9. Seal
10. Pin
11. Ring, Retaining
12. Ball
13. Ring
14. Washer
15. RIng, Internal Retaining
16. Seal
17. Spring

Valve Assembly

18. Body
19. Ball
20. Ring
21. Bolt M8 x 8mm
22. Spinner (Not Shown)
23. Spring
24. Plug
25. Screw
26. Fitting, Straight
27. Seal
28. Spring
29. Nut M10
30. Seal
31. Setscrew
32. Relief, Valve
33. Pin, Ball Driving
34. Plate, Seal
35. Valve Body
36. Knob Assembly
37. Valve Body

Figure 4-31. Hand Pump Assembly

Lift Cylinder Valves



Load Holding Valves (Qty. 2)

1. Torque to 6.8 Nm (5 ft lbs)
2. Torque to 27.1 Nm (20 ft lbs)

- Operating Pressure: 345 bar (5000 psi)

Pressure Sensors (Qty. 2)

- Torque to 25 Nm (18.4 ft lbs)

Diagnostic Test Port

- Pressure Rating: 630 bar (9137 psi)

Figure 4-32. Lift Cylinder Valve Block

SECTION 5. JLG CONTROL SYSTEM

5.1 OPERATION AND TECHNICAL DATA ON CONTROL CARD COMPLEX 2

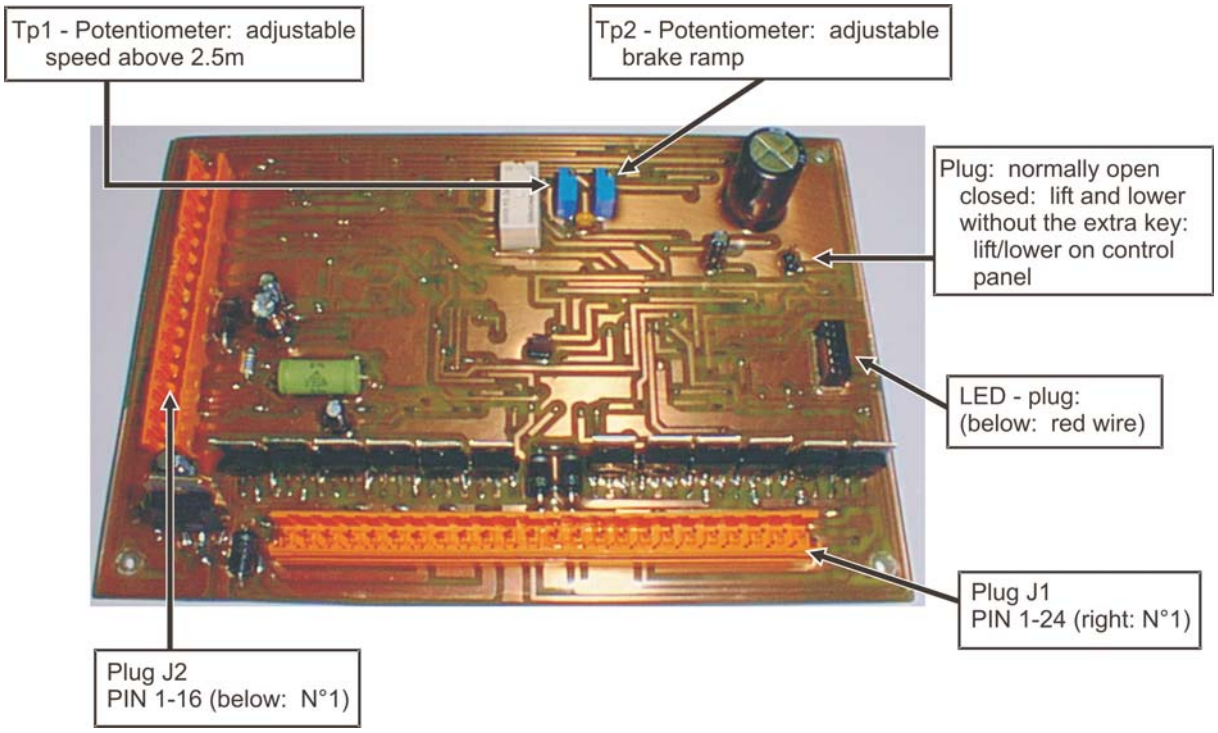


Figure 5-1. Control Card Complex 2 Board

General Description of Components and Functions

- The system is designed solely for the use and control of Scissor Lifts with electrically powered multiple hydraulic pumps, as well as for the following functions without limits to the working height.
- The control system is based on the control card "Complex 2", which is fitted in the main terminal box in the side compartment. The safest location for operating the machine is on the platform. However, the control panel can also be plugged into the lower control station in the hydraulic compartment in case of an emergency.
- An **emergency stop** is positioned on the platform control console (**red button**). At ground level, an emergency stop switch is located on the ground control panel. When activated, the signals of the control board will be cut off instantly and all functions will be stopped, except the functions; emergency descent and emergency lifting (at ground level). The **Battery Isolator Switch** on the ground control panel acts as an isolator switch for the batteries and cuts off the power supply.
- The machine is equipped with a powerful horn to attract attention. The horn can be activated from the control panel. While driving, a constant acoustic signal - digisound - is activated as an additional motion alarm.
- The safe use of the Elevating Work Platform (EWP) is influenced by certain limits. To guarantee adherance to these limits various limits, limit switches are fitted to the machine which will cut off the functions when reaching the critical marks:
    a. **Tilt Switch** - cuts off lifting, driving, and steering once the platform is raised above 2.5 m (8 ft) and the critical mark (3° inclination for the 153-12 and 2° for the 180-12) is reached. Only lowering will then be possible. When the platform is completely lowered, the machine can perfom at any incline level in order to make the loading/unloading and drive of the machine possible. (**S 2.5 m limit switch**).

b. **Drive Cutout Switch** - the drive function will be cut off completely once the platform reaches 7 m in height. (**S 8 m limit switch**).

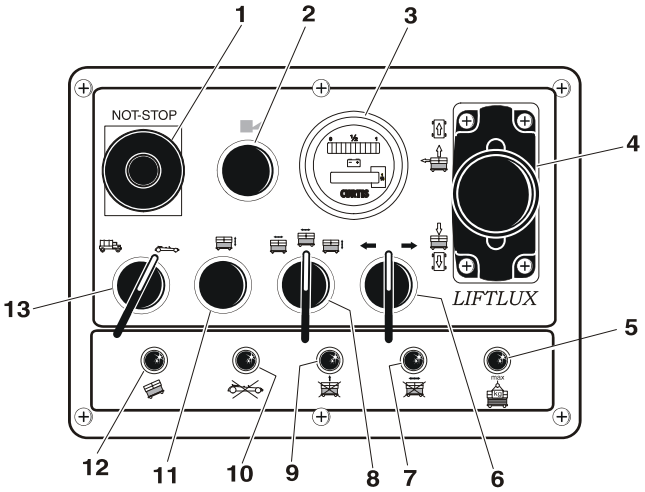
c. When the platform is in a raised position, the travel speed the machine would normally reach would be too high. For that reason the **serial/parallel-valve**, which usually controls the drive engines speed (fast vs. slow drive), will be cut off once the platform is elevated above 3 m (153-12) and 3.2 m (180-12). (**S 2.5 m limit switch**). The electronic circuit lowers the output signal of the drive control (joystick) to a certain value, which can be adjusted on the "Complex 2 Card." When the platform has lowered, the serial/parallel-valve and pump 2 can be activated by the **fast/slow switch** (truck, racing car symbols) located on the control panel. In this situation, the output signal of the joystick is not lowered and thus, the speed limit is for slow drive. Switching on the differential lock has the same application as slow drive. Additionally, the four solenoids of the differential block are energized.

d. **Height Limit Switch** - the lifting function of the machine will be cut off completely once the platform reaches its maximum height. (**S Max. Height limit switch**).

Model	Maximum Height
153-12	15.3 m (50 ft)
180-12	18 m (59 ft)

⚠ IMPORTANT

THE PROPER FUNCTIONING OF EACH OF THE LIMIT SWITCHES IS VERY IMPORTANT FOR THE SAFE USE OF THE EWP. THEREFORE, THE LIMIT SWITCHES MUST BE CHECKED BEFORE OPERATING THE MACHINE EACH DAY. TO MAKE THIS TASK EASY, CONTROL LED'S FOR EACH IMPORTANT FUNCTION (SWITCH) ARE FITTED ON THE CONTROL PANEL (SEE FIGURE 5-2).



1.Emergency Stop Switch
2.Horn
3.Battery Discharge Indicator
4. Lift/Drive Controller/Joystick
5.Overload LED
6.Steer Switch
7.Drive Cutout LED
8.Lift/Drive Selector
9.Lift Cutout LED
10.Slow Drive LED
11.Lift/Lower Enable
12.Tilt (slope) LED
13.Speed Switch

Figure 5-2. Platform Control Station

The electrical signals for the limit switch LED's are taken directly from the appropriate input/output terminals of the control board. This guarantees the actual status of the limit switch can be monitored by the control LED. This also makes changing any of the LED's easy because there is no danger of mixing up or reversing polarities. All limit switches are equipped with only one opener and therefore connected by two core leads. The LED's remain illuminated when the limit switches are not actuated. Once one of the previously mentioned limits is exceeded, the associated LED will go out.

Joystick Controller and Drive Mode

- Located on the control panel is the **Lift/Drive Switch** (#8 in fig. 5-2), which switches between the lift-lower mode and the drive-steer mode. The lift/lower and drive functions are controlled by the same controller (joystick)(#4) depending on the position of the selector (#8). The lift/lower function also requires the pressing of **Lift/Lower Enable Button** (#11). Steering left/right is controlled by the **Steer Switch** (#6). Steering is prohibited when the machine is in the lift/lower mode.

- When the lift/drive/pltf.ext.-switch is in the drive position, the Input terminals **J2**/**2** and **J2**/**13** on the control card are carrying no voltage - therefore the lift/lower function is cut off. The emergency lifting/lowering at the lower control station of the chassis, however, will remain active.
- When the selector switch (#8) is positioned on the drive function, the controller (joystick) will control the forward and reverse movement of the EWP. Move the controller forward for forward-drive and back for reverse-drive. The controller has a "neutral zone" of about ±7% of the total possible moving distance. After reaching the end of the "neutral zone", the valve "**drive, break and digisound**" will be activated. The required voltage can be measured at **lead number 1** of the control-cable and can be measured as well at **terminal number 1**.
- When the EWP is in the lowered position (below 2.5 m) and the Speed Switch (#13) is in "fast" position, a positive signal will be measured at **Output J1**/**1** and **Serial**/**Parallel Valve** will be activated (**Control-lead number 12**).
- Input **J 2**/**9** on the "Complex 2 Card" is used to open the bypass valve on the hydraulic pump, which provides the required operating hydraulic pressure. Once the joystick and battery control breach the "neutral zone", input J 2/9 provides the hydraulic pressure and activates the electric motor by delivering a positive signal.
- When the controller is in the "neutral position", the output signal - measured at **J2**/**16** - is about 50% of the voltage-supply (12V). The voltage will be interpreted as "neutral" by the **drive-block-valve**. When the controller is moved completely forward (forward drive) the signal will increase to about 75% of the voltage-supply. The drive-block-valve will then open completely. Moving the controller completely back (reverse drive) will decrease the signal to about 25% of the voltage-supply. The drive-block-valve will interpret this as the reverse drive and open in the opposite direction.

Joystick Controller and Drive/Lift/Lower

- The working range of the controller is between **25% to 75%** of the voltage-supply. An increase or decrease in these values will cause the drive-block-valve to shut down and will be shown by the red LED light at the drive-block-spooler. In normal function, the LED is green.
- **Lead number 13** of the control-cable carries the information for the "Complex 2" based on what position the **S 2.5m-switch** is on. When the platform is elevated, this input has no signal. In this case, the output-signal of the controller will be regulated by the potentiometer **TP1** to a lower value. The drive-speed will decrease, in addition to the cut-off of the **serial**/**parallel-valve**. The required value can be adjusted at **TP1**, but must be **below 60 cm**/**sec**. The drive-speed in the elevated position is the same as the speed in the "slow" position. In this position the 4WD will be blocked.
- The machine is equipped with a high performance brake-system which led to the development of a system which would guarantee a constant comfortable and safe activation of the breaking procedure. The **ramp generator** guarantees this. The actual signal at the drive-block-valve does not exactly follow the output-signal of the controller, it is in fact slightly time delayed (approx. 2 second delay). Therefore the drive-block-valve and the brakes will not be cut off instantly after the controller has been returned to its "neutral" position. A smooth start/stop of the machine is therefore guaranteed even if the controller is accidentally quickly moved forward/backward or released.

NOTE: *The ramp generator does not interfere with the hydraulic pump drive, but it is also activated when steering left and right. The intensity of the ramp generator function can be adjusted with potentiometer **TP2** on the "**Complex 2**" control card.*

- When the **Lift**/**Drive-Switch** is on the "Lift" function, the movement of the controller, in conjunction with, pressing the Lift/Lower Enable Button (#11) will result in the raising or lowering of the platform. The max lifting speed will be reached instantly after the controller leaves the "neutral" zone. The control board analyzes the output signal of the controller - via lead **number 5** - and activates the pump 1 or 2 via **lead number 7 and number 16**. The signal for lowering is carried on **lead number 3**, which activates the appropriate valve for lowering as well as the seat-valve.
- When the platform has reached its maximum height, which is signaled by the Lift Cutout LED (#9), the lifting valve and bypass valve will be cut off.
- The emergency lifting at the control box on the chassis is also influenced by the previously stated cut-off. All other parameters such as; Tilt Switch, Lift/Lower Switch, and Drive/Lift Switch have no influence on the emergency lifting function.

⚠ WARNING

IF THE MACHINE IS IN AN UNSTABLE POSITION DUE TO DANGEROUS INCLINE, DO NOT ATTEMPT TO LIFT THE PLATFORM WITH THE EMERGENCY LIFT FUNCTION. SERIOUS INJURY OR DEATH COULD RESULT.

5.2 LOAD SENSING SYSTEM (LSS)

LSS Re-Calibration Procedure

Required Tools & Equipment

1. Calibrated Weights (refer to Table 5-1, LSS Load Height Chart)
2. Pressure Gauge, capable of reading 150 bar (2176 psi) (digital gauge recommended)
3. Measuring tape, up to 6 meters (20 ft) in length
4. Standard Mechanics Tools

⚠ WARNING

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

STAGE 1

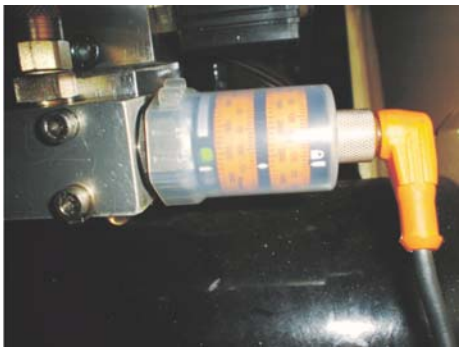
1. Ensure all scissor pins and wear pads are sufficiently greased before any calibration is carried out. Any tight pins or wear pads will affect the accuracy of the set-up procedure.
2. Load the scissor deck evenly with the maximum rated load, plus an additional 15% (refer to Table 5-1).

Table 5-1. LSS Load Height Chart

Model	153-12	180-12
Max Load	500 kg (1102.3 lbs)	
Max Load plus 15%	575 kg (1268 lbs)	
Height	3.2 m (10.5 ft)	3.8 m (12.5 ft)
Both Reset Rings	100 bar (1450.3 psi)	125 bar (1812.9 psi)

3. Locate the test port on the valve block fitted to the base of the lift cylinder and attach a digital pressure gauge.
4. Secure a tape measure to the side of the platform deck at the platform floor capable of measuring lift height (refer to Table 5-1, LSS Load Height Chart).

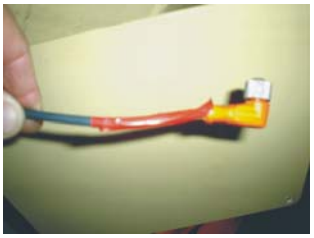
Stage 2



Pressure Sensor

1. Remove the plastic cover from both Pressure Sensors, located on the hydraulic block at the base of the lift cylinder, by first unscrewing the plug connector. Then reconnect the plugs.

Plastic Cover



Plug

2. Unlock the locking ring by turning the Top Black ring 90° to the Unlocked Symbol. Do the same to both Pressure Sensors.

3. Turn the Orange Set Ring to 250 bar (3626 psi) and the Reset Ring to 125 bar (1813 psi) on both Pressure Sensors.

4. With the machine positioned on a firm level surface in an area free of obstuctions, connect the control box at the lower station and, lift the loaded platform while monitoring the digital pressure gauge attached to the lift cylinder. Record the maximum pressure (this will be at its maximum pressure around the height specified in Table 5-1). Max Pressure = xxx bar @ Height yyy meters.

⚠ WARNING

LIFT ONLY USING LOW SPEED THROUGHOUT THE CALIBRATION PROCEDURE.

STAGE 3

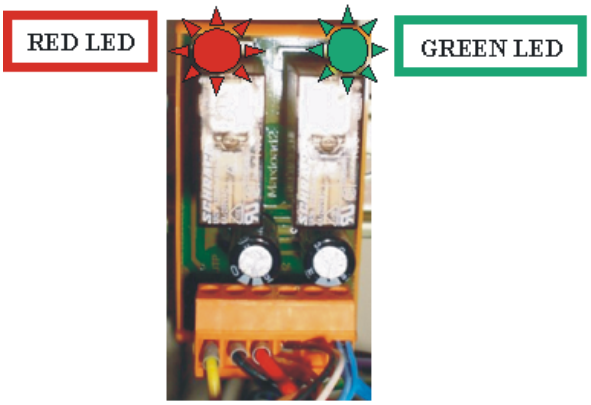
1. Identify Pressure Sensor No/1 (this will have a piece of tape wound around the cable close to the Plug Connector).
2. Turn the Top Orange Set Ring on Sensor No/1 to the Max Pressure reading xxx bar recorded earlier in stage 2 section 4.
3. Position the control box so that you are able to lift the platform and observe the Green LED on Sensor No/1. This should turn to a Green and Yellow LED and Stop the lift function at the previously recorded height.
4. Once the platform has cut-out the lift function and the Green and Yellow LED's are lit, the manual descent taps and hand pump must be used each time to return the platform back down to the stowed position. Continue to adjust Max Pressure xxx to match Max Height yyy.

NOTE: *To achieve the correct setting, make ± 2 bar changes to the Set Ring scale.*

NOTE: *At this stage you are trying to set the pressure on sensor No/1 to stop the lift function at the height at which the pressure peaked. If the platform goes passed the recorded height yyy, the pressure on the Orange Set Ring is* ***TOO HIGH****. If the lift function stops before the recorded height yyy, the pressure is* ***TOO LOW****.*

STAGE 4

1. Inside the ground control box you should see that only the Green LED is lit on the LSS Relay. When Pressure Sensor No/1 has been set to the correct pressure and the platform stops at the correct height, move to the next stage.



2. If satisfied with the adjustment to Sensor No/1, turn the locking ring on the Pressure Sensor to the locked position. Make sure NOT to upset the adjustment.
3. Locate Pressure Sensor No/2 on the Valve. Lower the pressure on the Set Ring from the 250 bar, so that it is +2 bar higher than the locked Set Pressure now on Sensor No/1.
4. Lift the platform until it cuts lift up function.

NOTE: *Sensor No/2* ***MUST*** *trip Green/Yellow LED's* ***ON*** *within* ***ONE SECOND AFTER*** *Pressure Sensor No/1 has tripped bringing on the Overload Alarm and Red Warning LED on the Control Box.*

NOTE: *When the System is set CORRECTLY, only the RED LED will be lit on the Relay Inside the Ground Control Box and Alarm will sound. Functions are cut and the Overload Lamp is lit.*

Relay Inside Ground Control Box

NOTE: *If the **RED LED** and **GREEN LED** are lit, Pressure Sensor No/2 is cutting **BEFORE** Sensor No/1. The Lift function will stop. The Engine will stop. No Alarm or Warning will be seen on the Control Box.*

Relay Inside Ground Control Box

NOTE: *If **ONLY** the **GREEN LED** is lit on the LSS Relay, Pressure Sensor No/1 is cutting first and Pressure Sensor No/2 is NOT cutting out within the ONE SECOND time permitted. Lift will stop. No Alarm or Overload Warning Lamp is lit.*

Relay Inside Ground Control Box

5. Turn the Locking Ring on Pressure Sensor No/2 to the locked position. Replace plastic covers over both sensors. Remove the 15% additional load on the platform and test the lift function. The platform must lift the rated load without activating the LSS Overload System. Add the 15% additional load back to the platform and test that the LSS activates the LSS Overload System. Test several times for correct operation.

SECTION 6. GENERAL ELECTRICAL INFORMATION & SCHEMATICS

6.1 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.

6.2 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

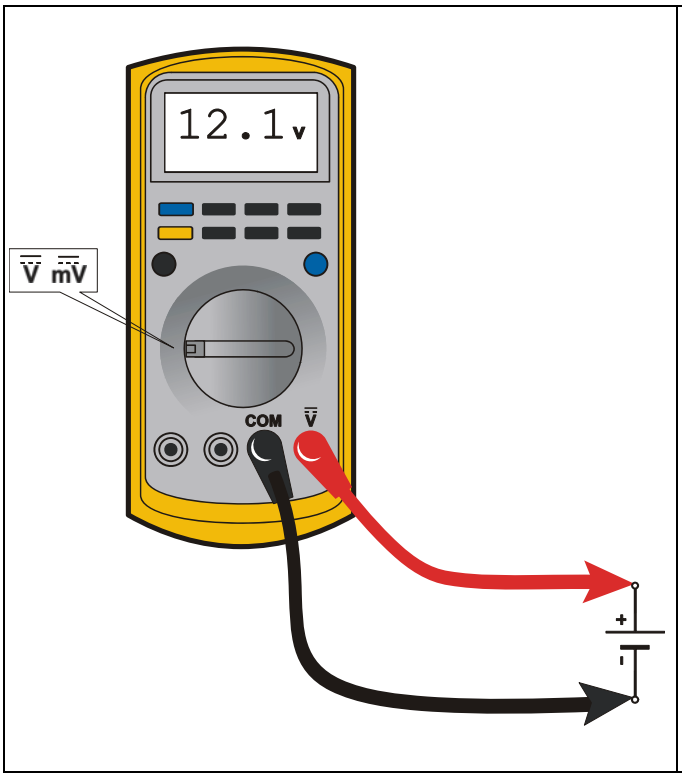


Figure 6-1. Voltage Measurement (DC)

- 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

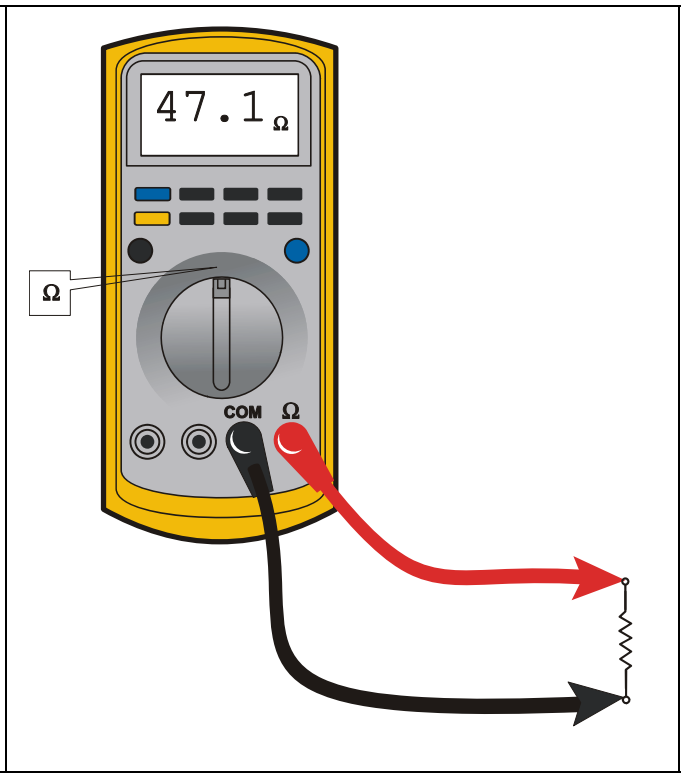


Figure 6-2. Resistance Measurement

- 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

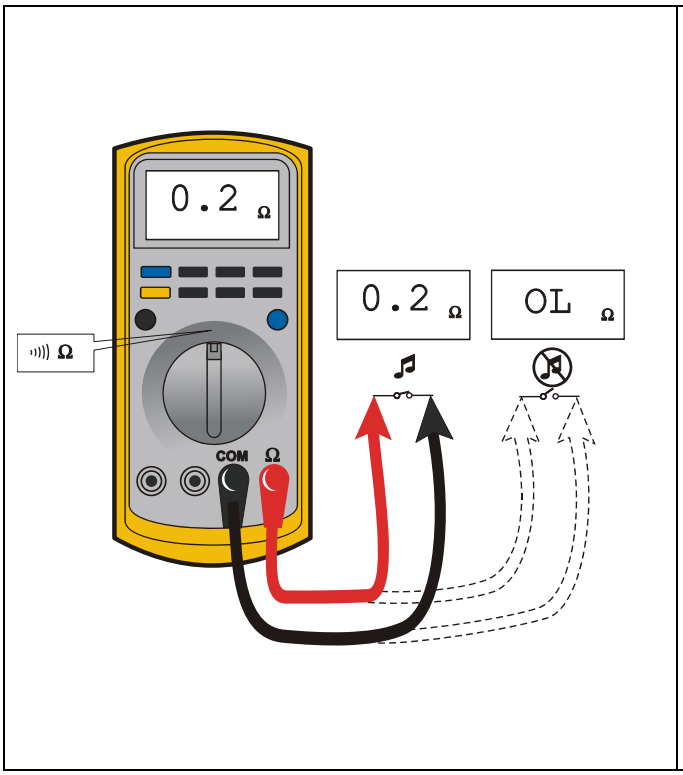


Figure 6-3. Continuity Measurement

- 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

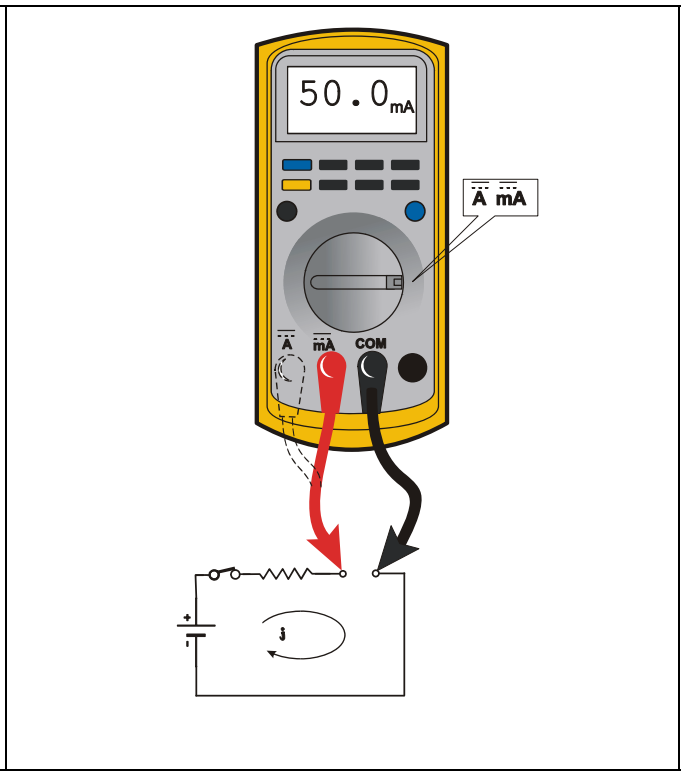


Figure 6-4. Current Measurement (DC)

- 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.

6.3 APPLYING SILICONE DIELECTRIC COMPOUND TO AMP CONNECTORS

Silicone Dielectric Compound must be used on the AMP connections for the following reasons:

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

Use the following procedure to apply Silicone Dielectric Compound to the electrical connectors.

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

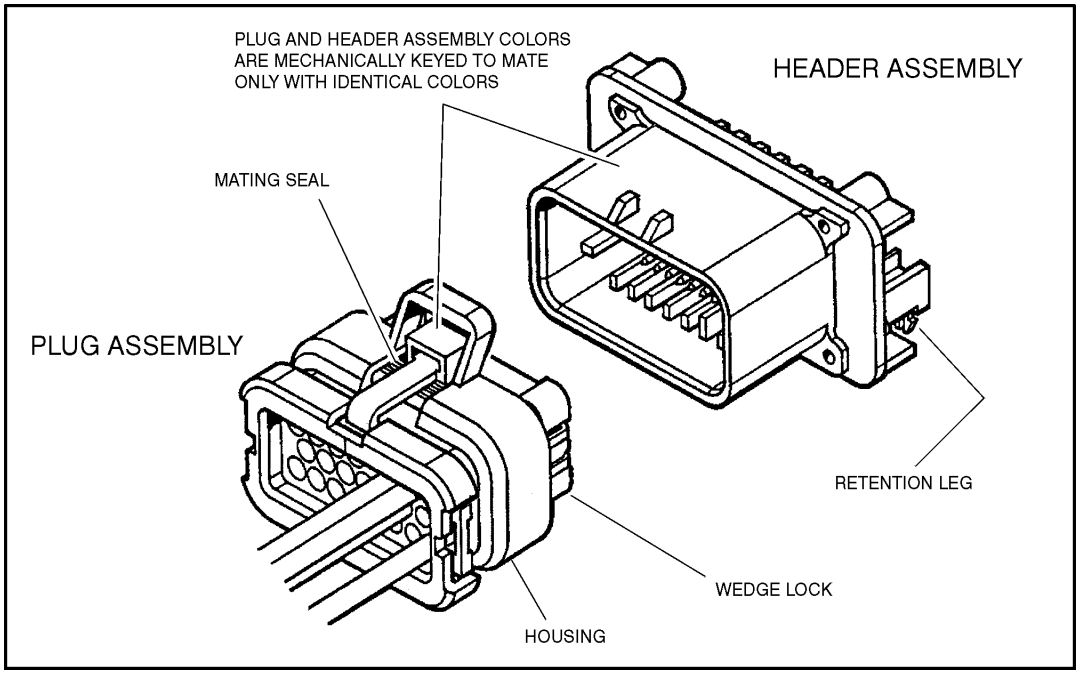


Figure 6-5. AMP Connector

Assembly

Check to be sure the wedge lock is in the open, or as-shipped, position (See Figure 6-6. Connector Assembly (1 of 4)). Proceed as follows:

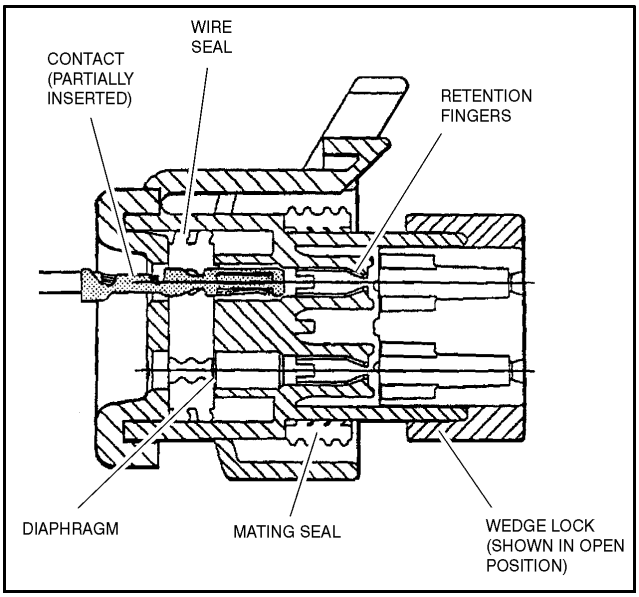


Figure 6-6. Connector Assembly (1 of 4)

1. To insert a contact, push it straight into the appropriate circuit cavity as far as it will go (See Figure 6-7. Connector Assembly (2 of 4)).
2. Pull back on the contact wire with a force of 1 or 2 lbs. to be sure the retention fingers are holding the contact (See Figure 6-7. Connector Assembly (2 of 4)).
3. After all required contacts have been inserted, the wedge lock must be closed to its locked position. Release the locking latches by squeezing them inward (See Figure 6-8. Connector Assembly (3 of 4)).
4. Slide the wedge lock into the housing until it is flush with the housing (See Figure 6-9. Connector Assembly (4 of 4)).

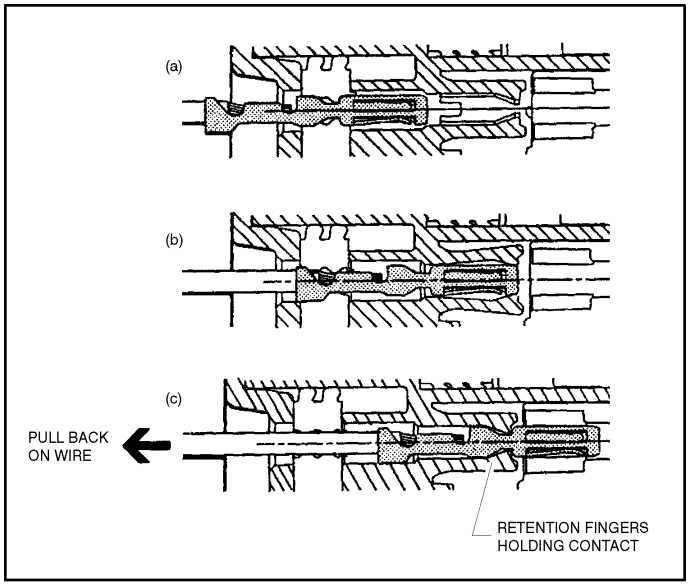


Figure 6-7. Connector Assembly (2 of 4)

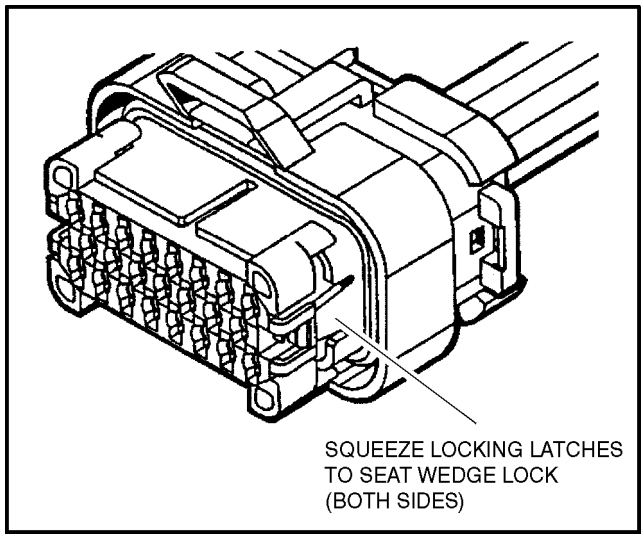


Figure 6-8. Connector Assembly (3 of 4)

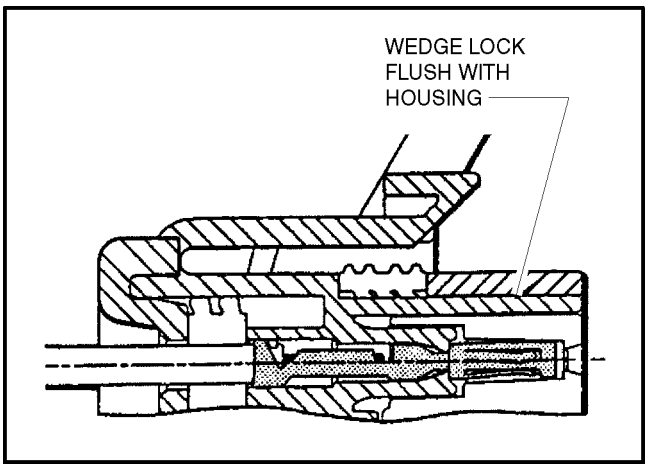


Figure 6-9. Connector Assembly (4 of 4)

Disassembly

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

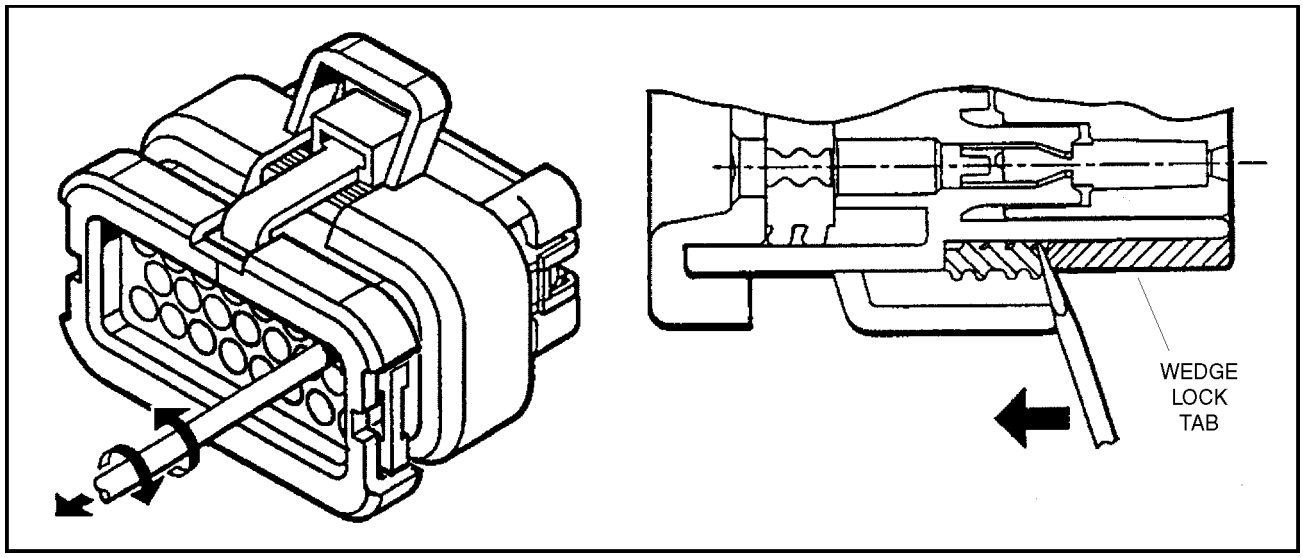


Figure 6-10. Connector Disassembly

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

Wedge Lock

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

Service - Voltage Reading

⚠ CAUTION

DO NOT PIERCE WIRE INSULATION TO TAKE VOLTAGE READINGS.

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

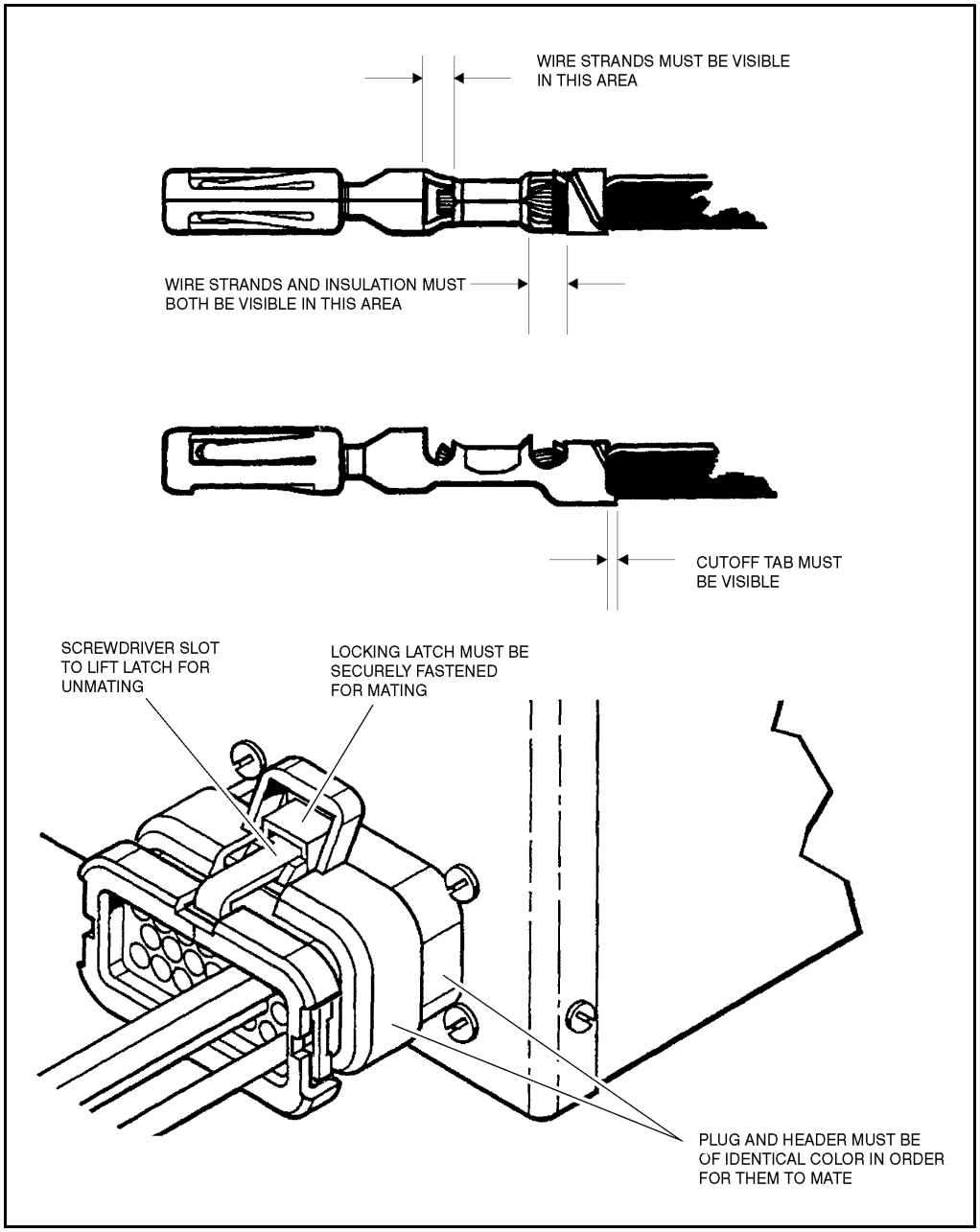


Figure 6-11. Connector Installation

6.4 WORKING WITH DEUTSCH CONNECTORS

DT/DTP Series Assembly

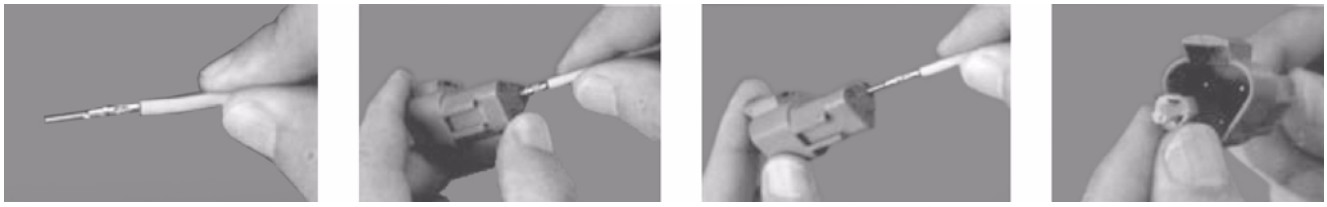


Figure 6-12. DT/DTP Contact Installation

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

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

DT/DTP Series Disassembly

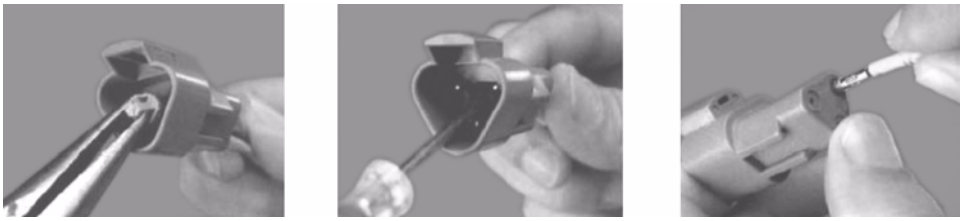


Figure 6-13. DT/DTP Contact Removal

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

HD30/HDP20 Series Assembly

Figure 6-14. HD/HDP Contact Installation

8. Grasp contact about 25mm behind the contact crimp barrel.
9. Hold connector with rear grommet facing you.

10. Push contact straight into connector grommet until a positive stop is felt. A slight tug will confirm that it is properly locked in place.

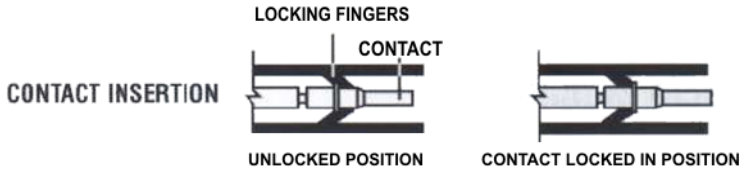


Figure 6-15. HD/HDP Locking Contacts Into Position

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

HD30/HDP20 Series Disassembly

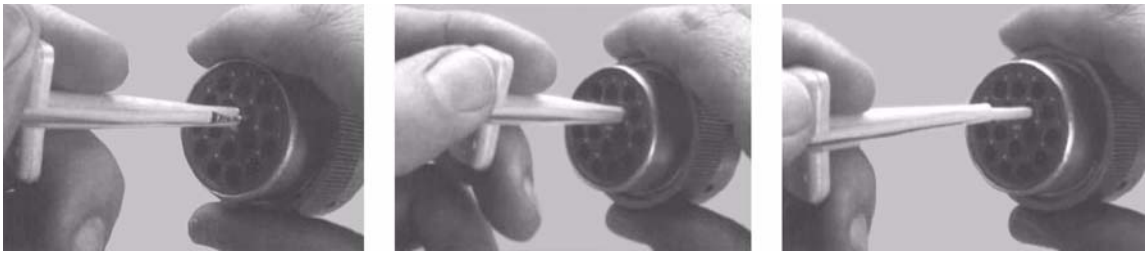


Figure 6-16. HD/HDP Contact Removal

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

Figure 6-17. HD/HDP Unlocking Contacts

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

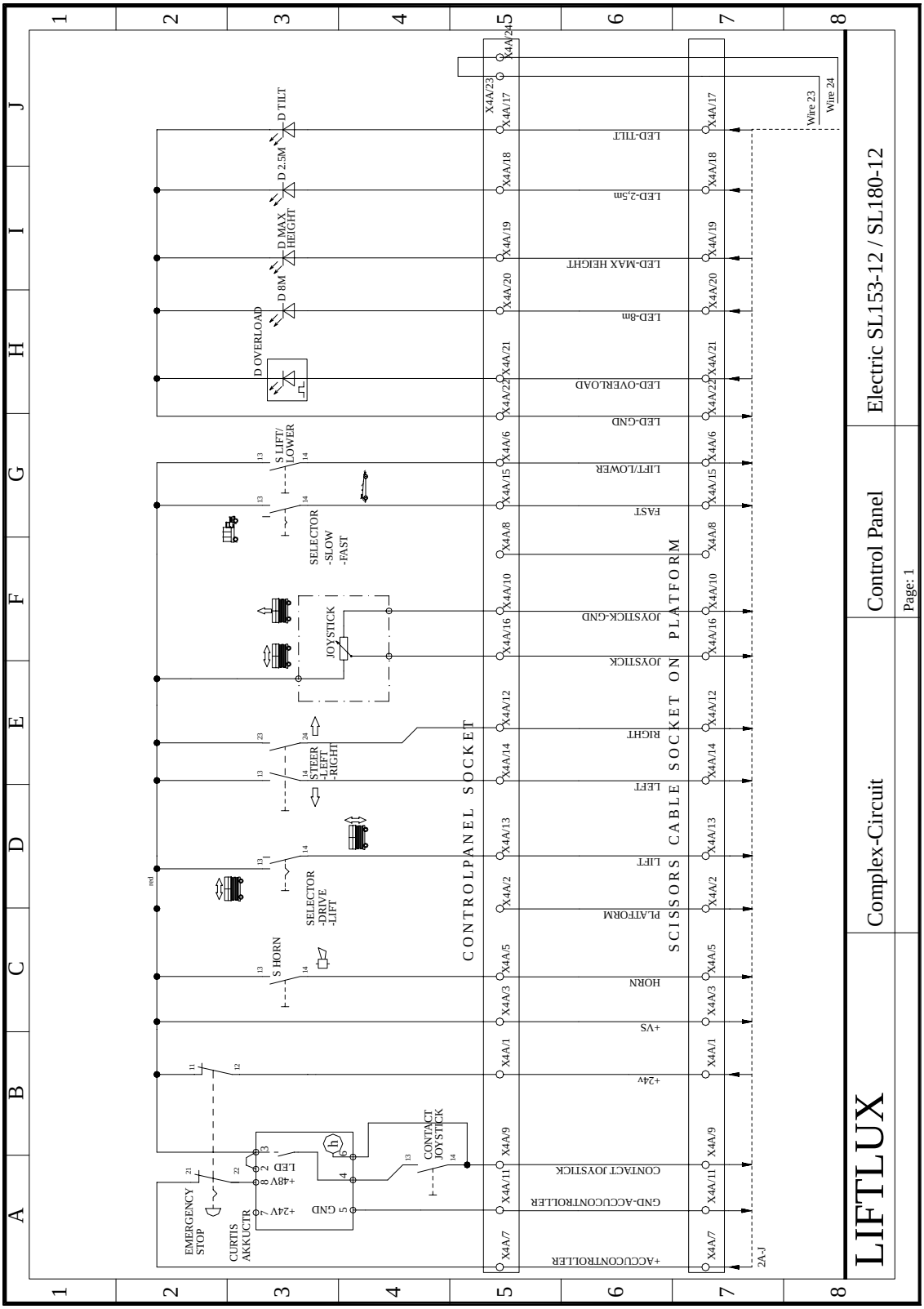


Figure 6-18. Electrical Schematic - Sheet 1 of 10

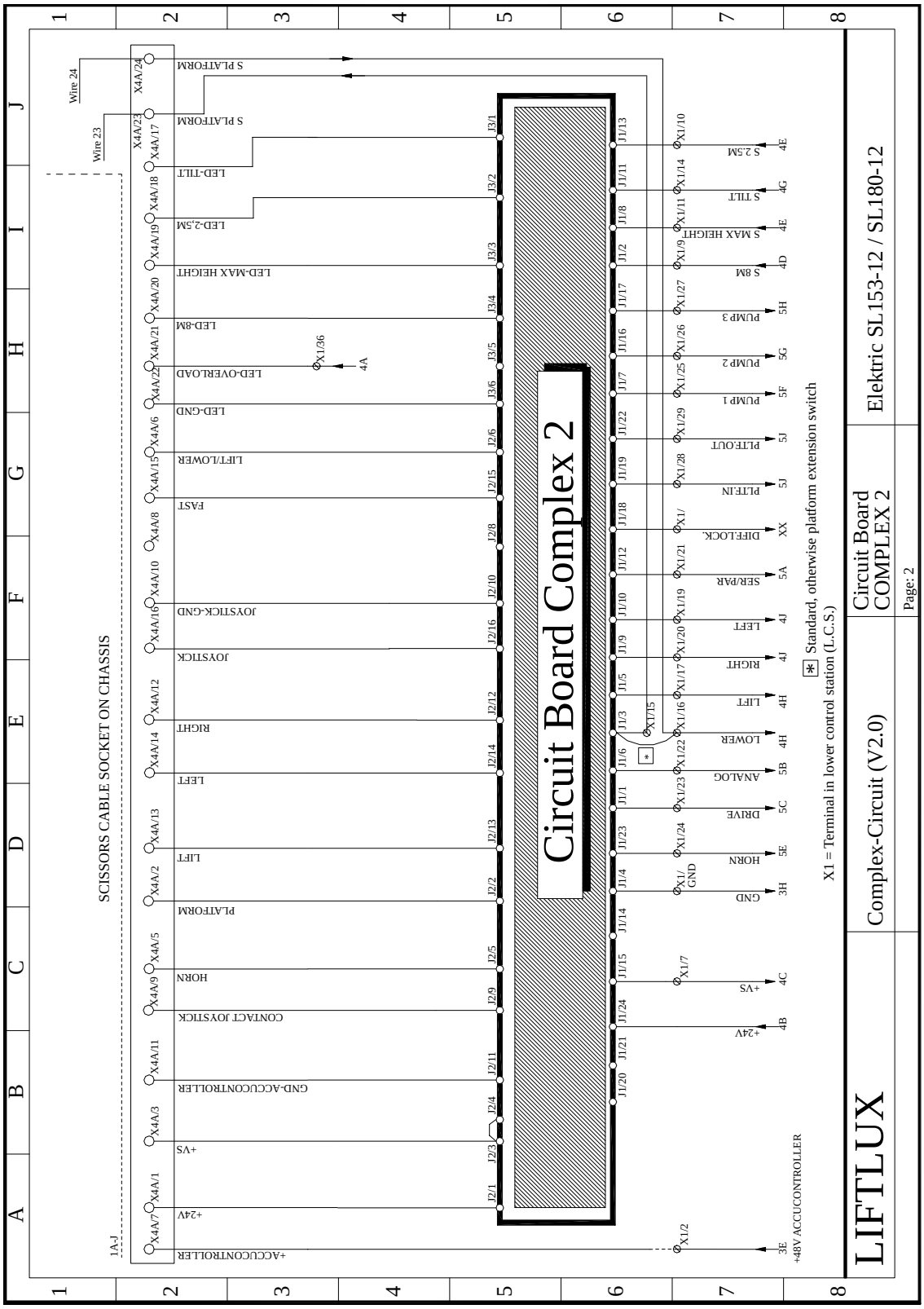


Figure 6-19. Electrical Schematic - Sheet 2 of 10

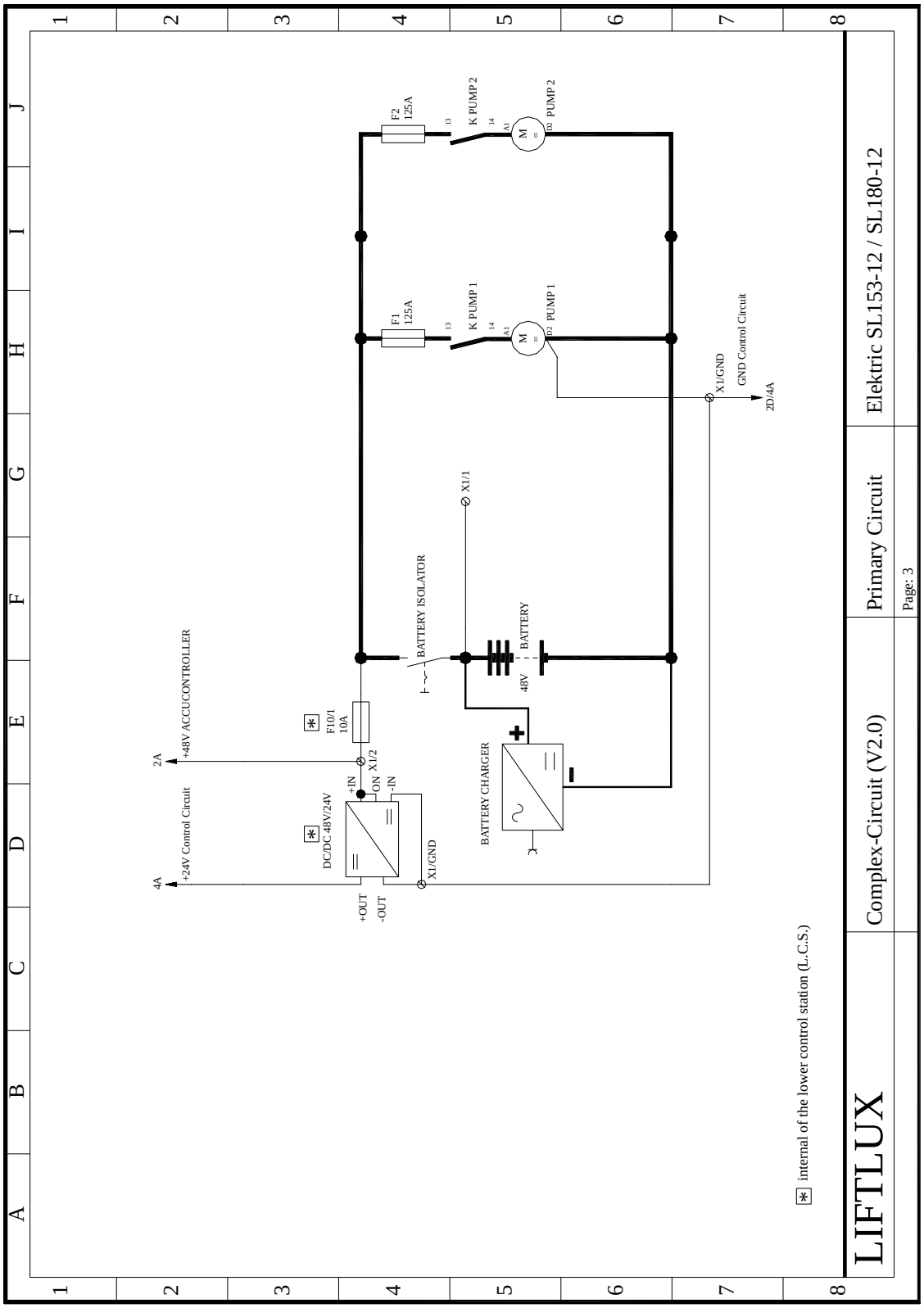


Figure 6-20. Electrical Schematic - Sheet 3 of 10

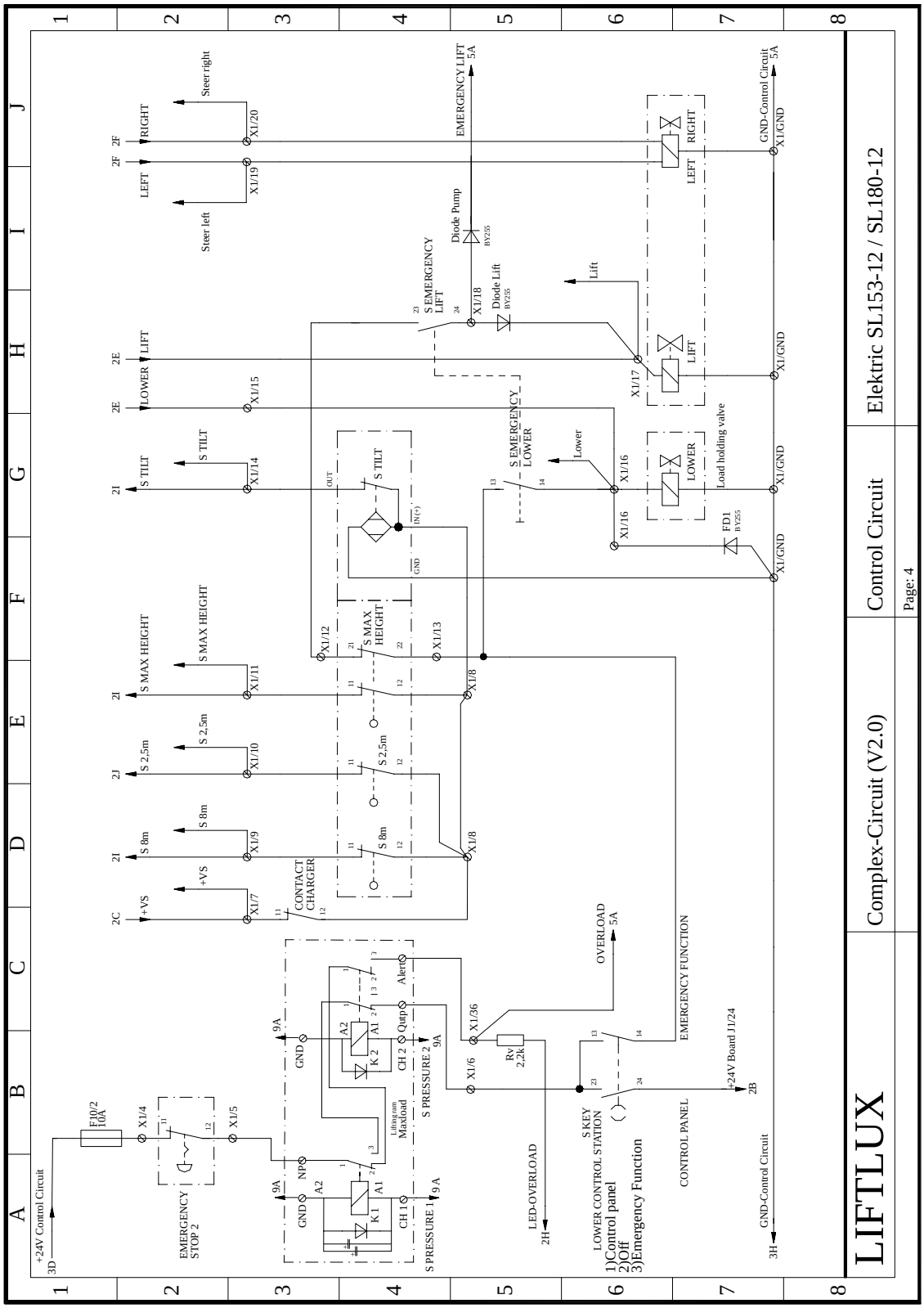


Figure 6-21. Electrical Schematic - Sheet 4 of 10

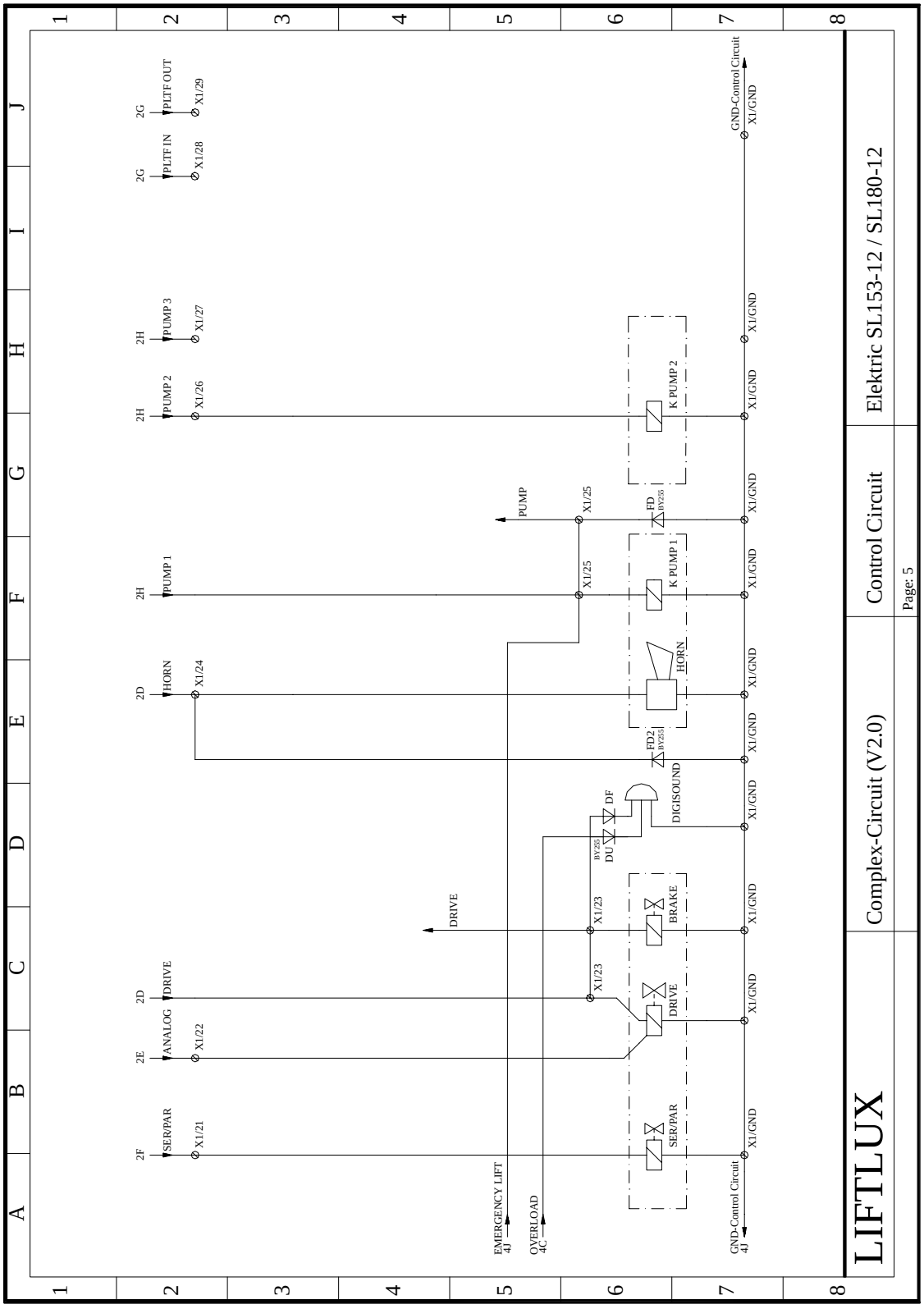


Figure 6-22. Electrical Schematic - Sheet 5 of 10

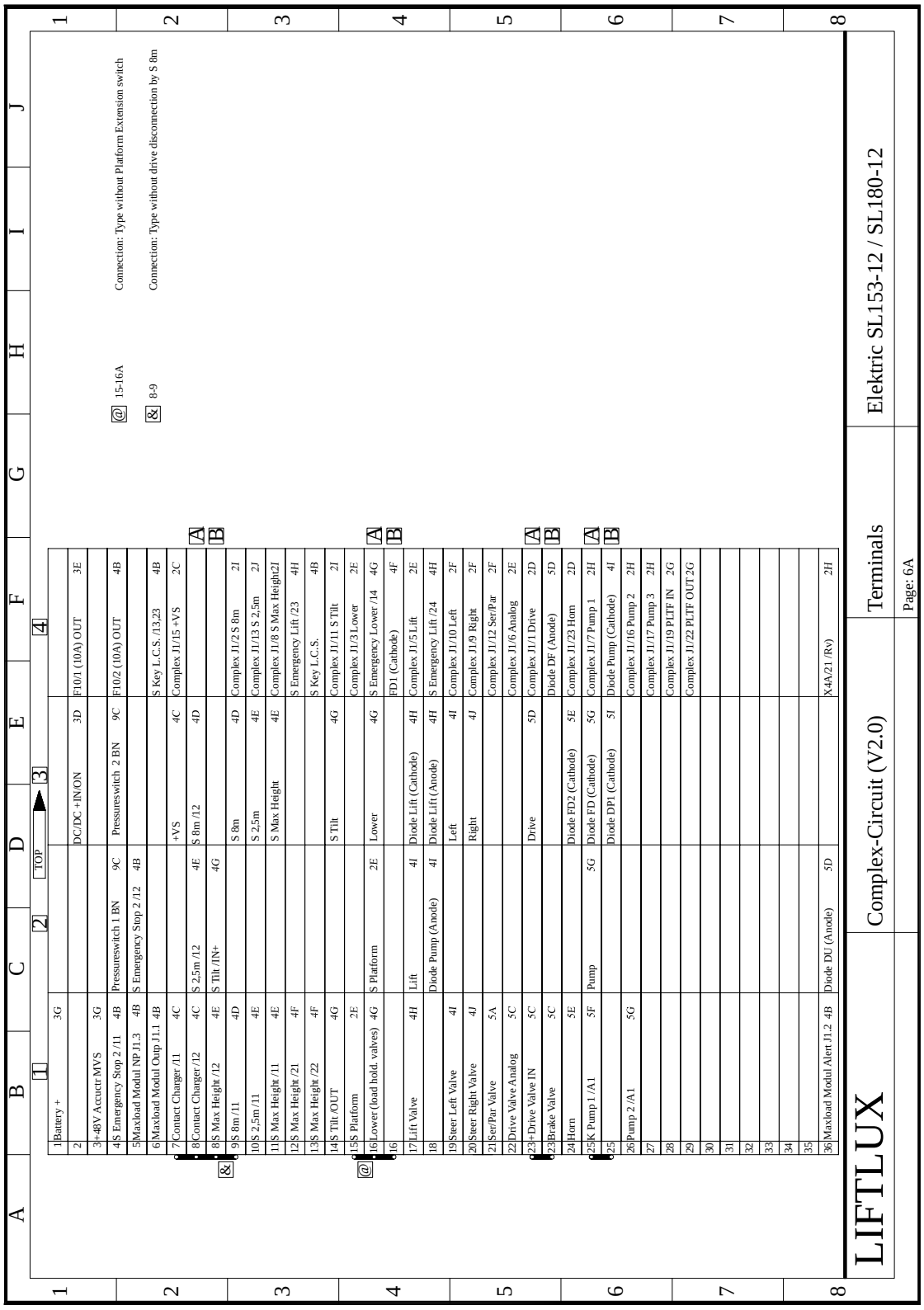


Figure 6-23. Electrical Schematic - Sheet 6 of 10

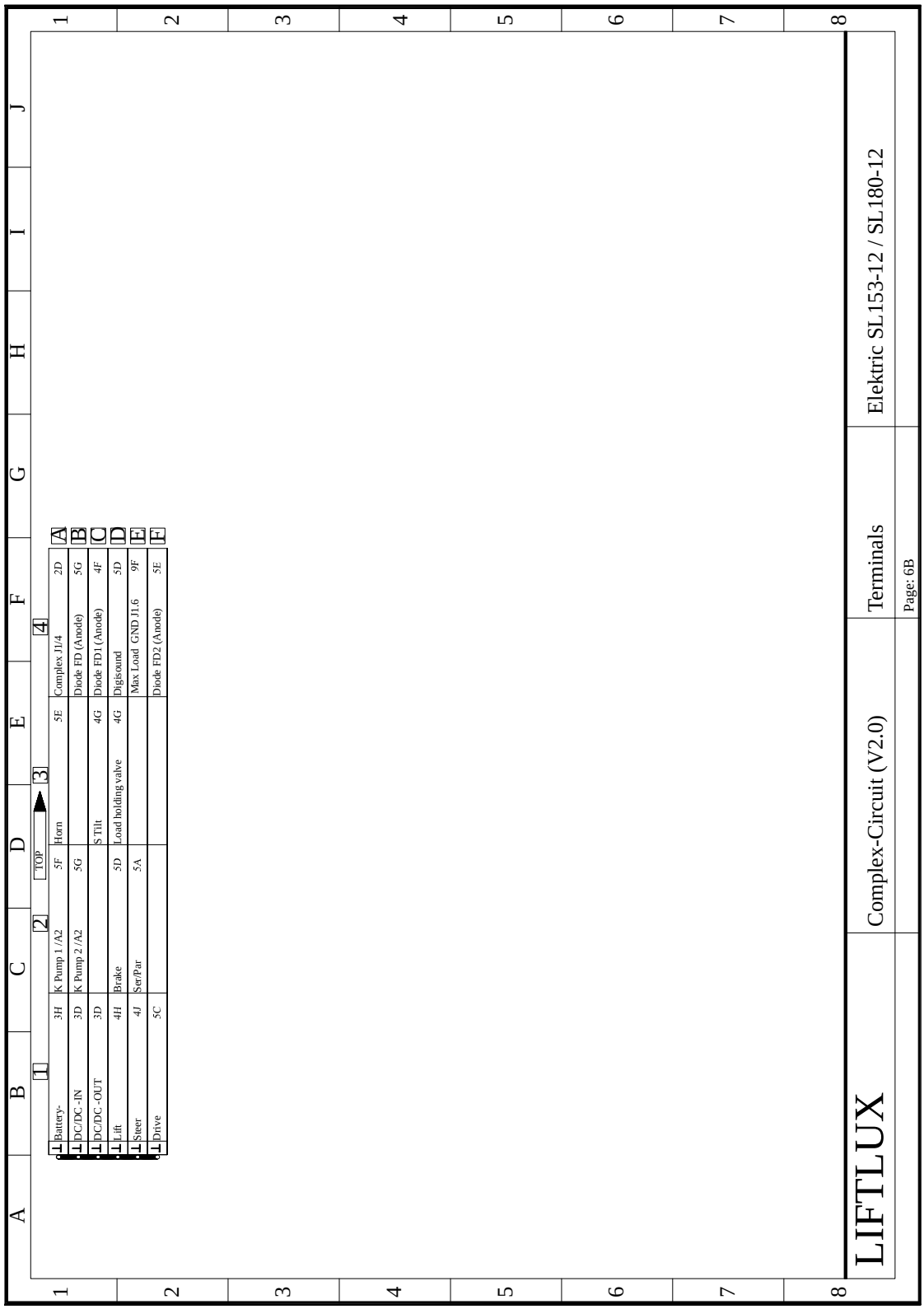


Figure 6-24. Electrical Schematic - Sheet 7 of 10

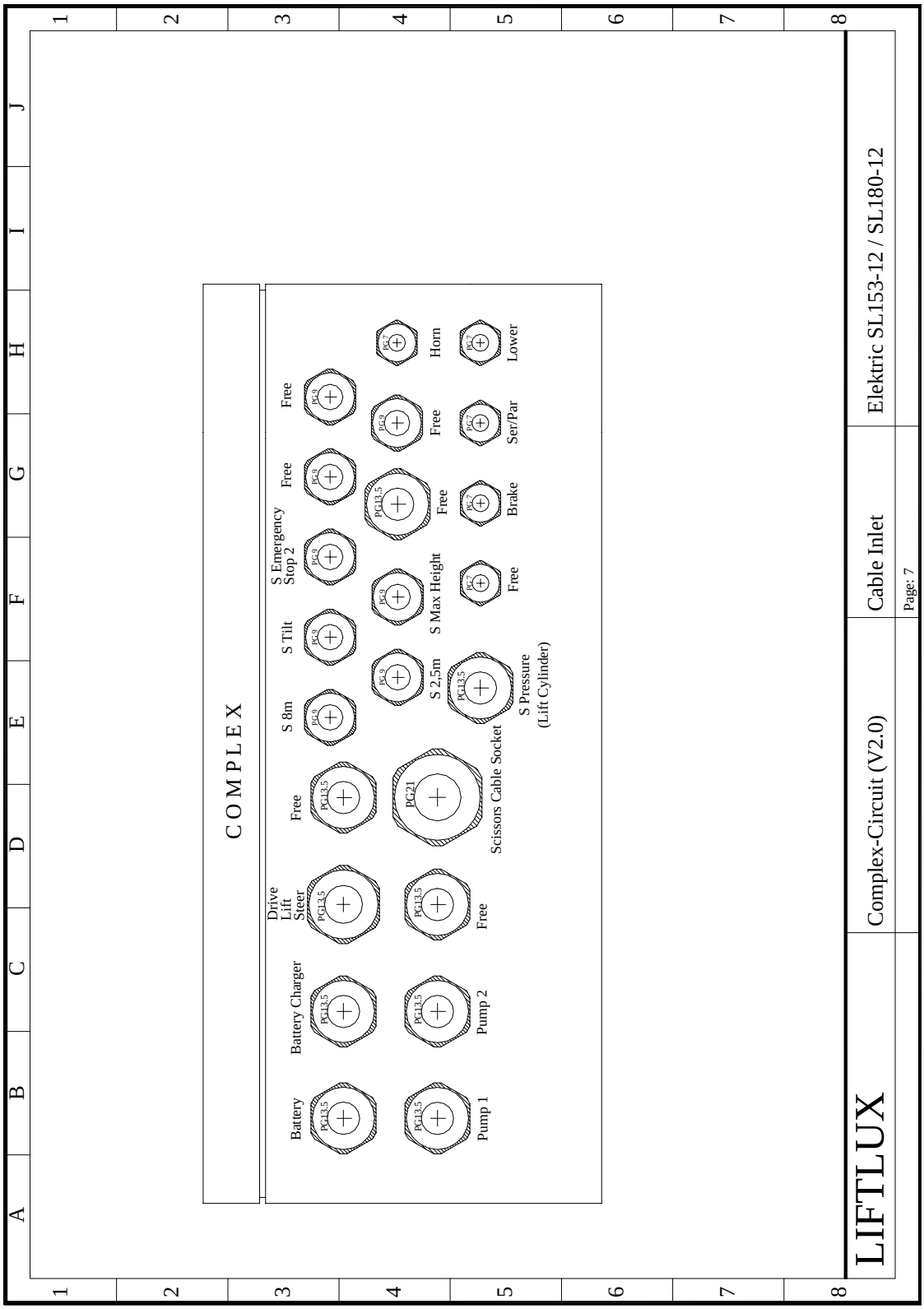


Figure 6-25. Electrical Schematic - Sheet 8 of 10

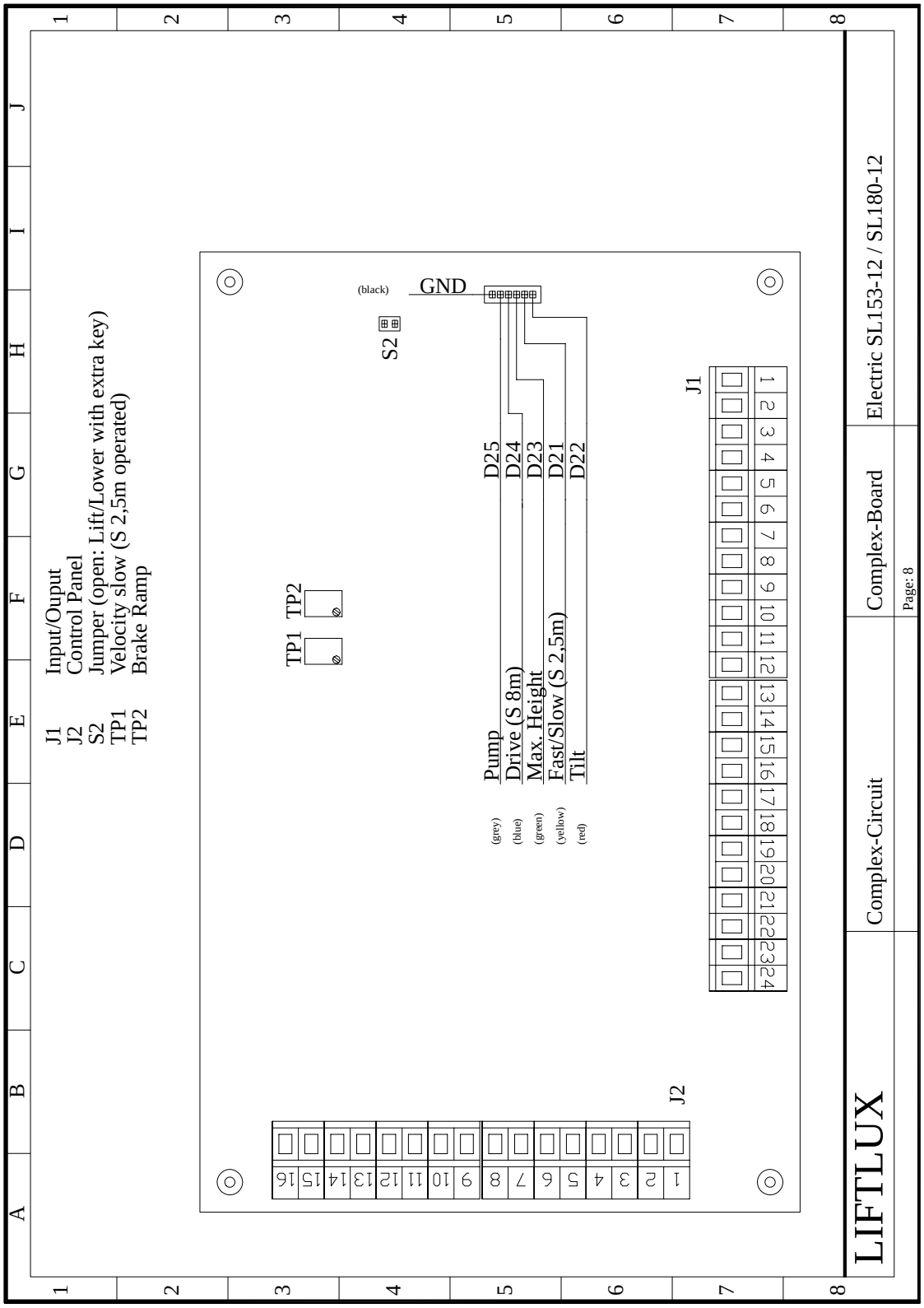


Figure 6-26. Electrical Schematic - Sheet 9 of 10

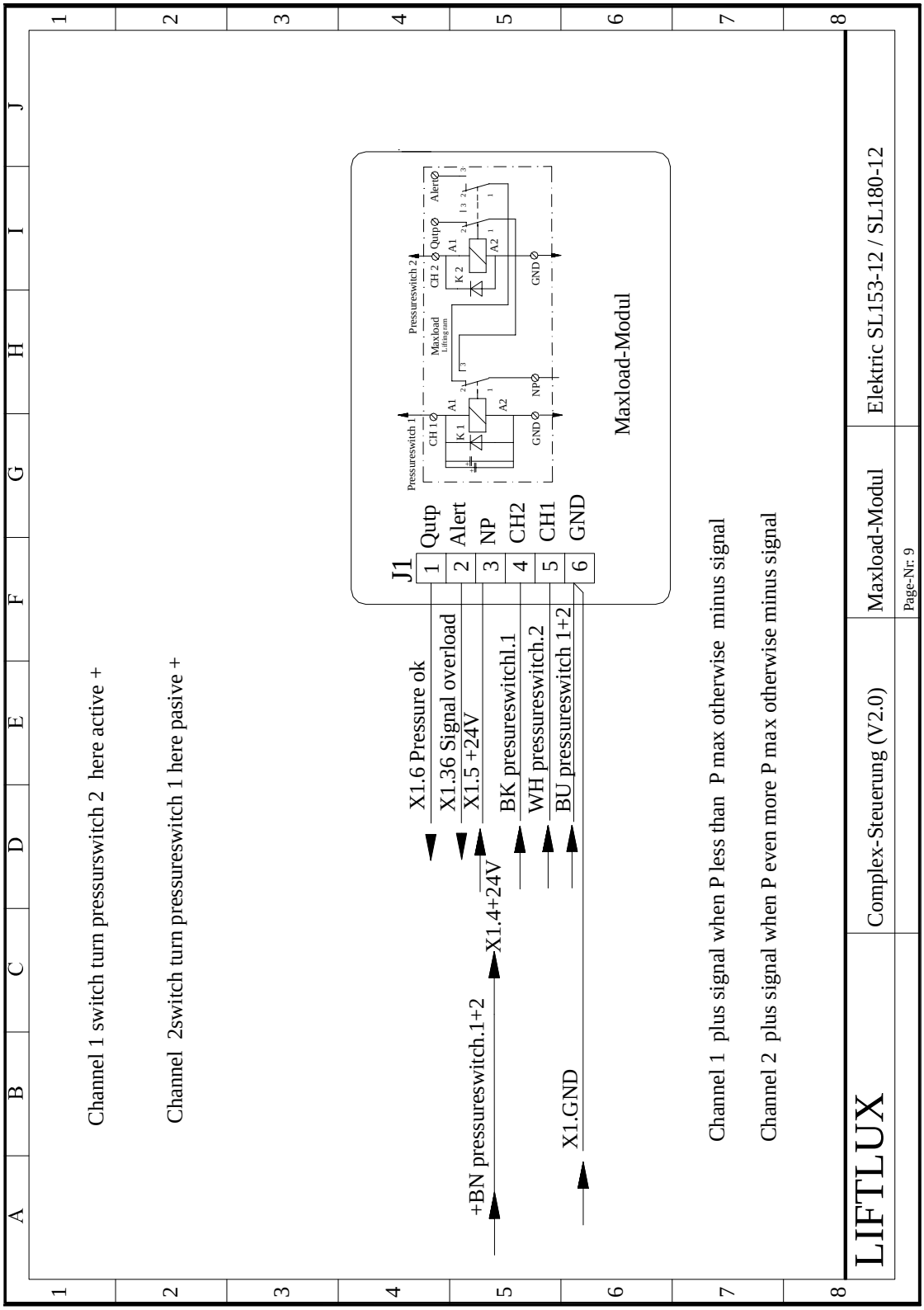


Figure 6-27. Electrical Schematic - Sheet 10 of 10

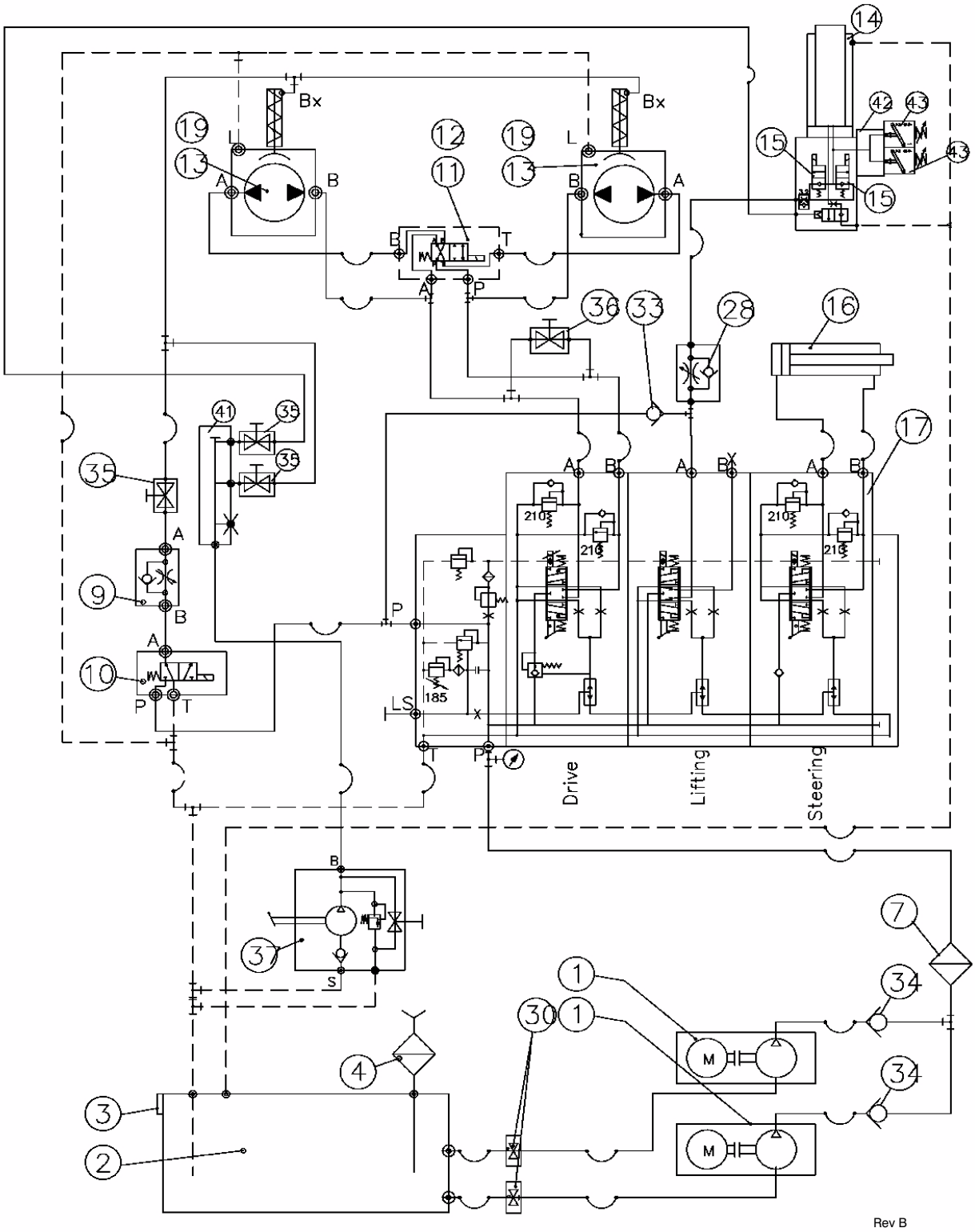


Figure 6-28. Hydraulic Schematic - 153-12

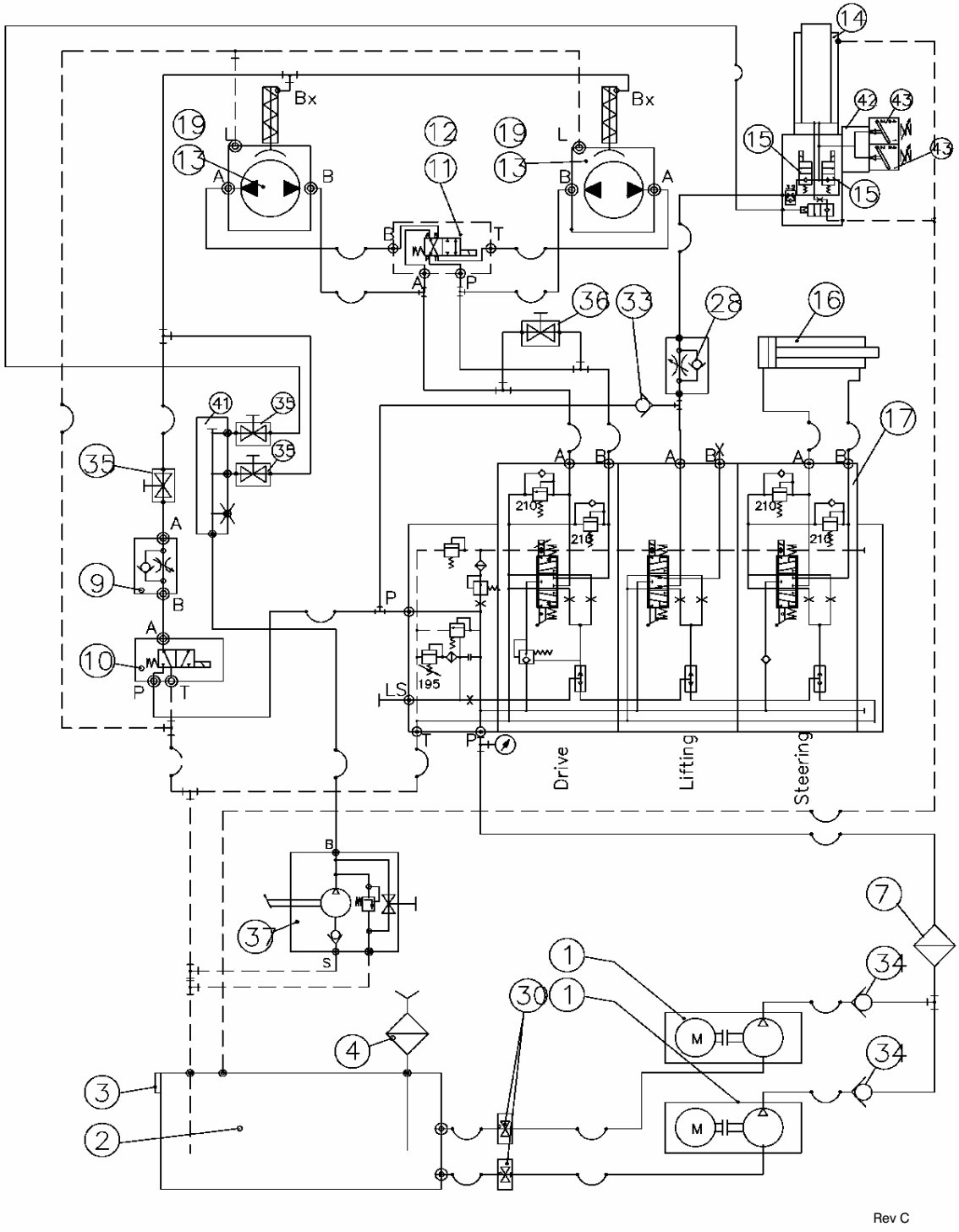


Figure 6-29. Hydraulic Schematic - 180-12

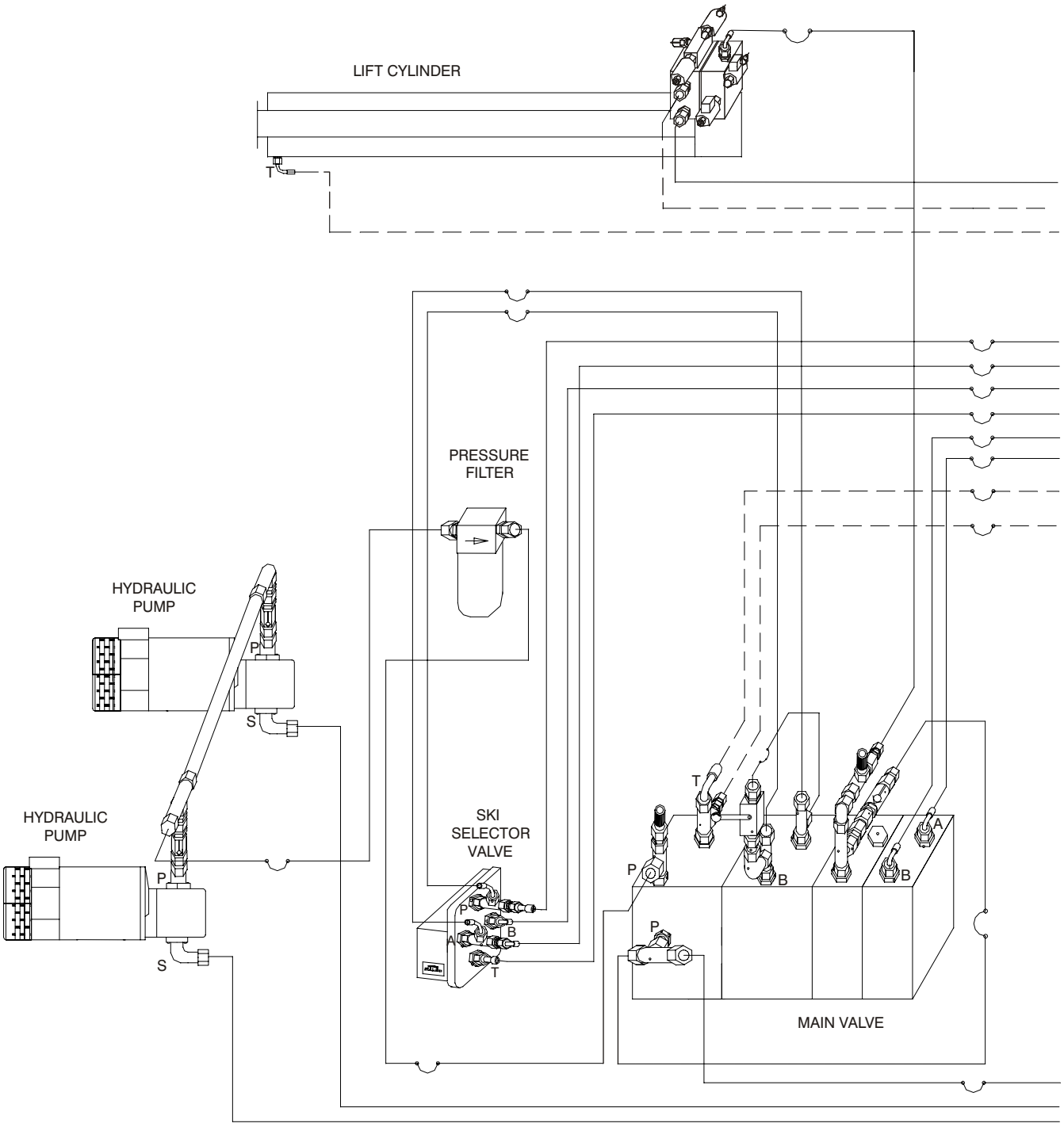


Figure 6-30. Hydraulic Diagram - Sheet 1 of 2

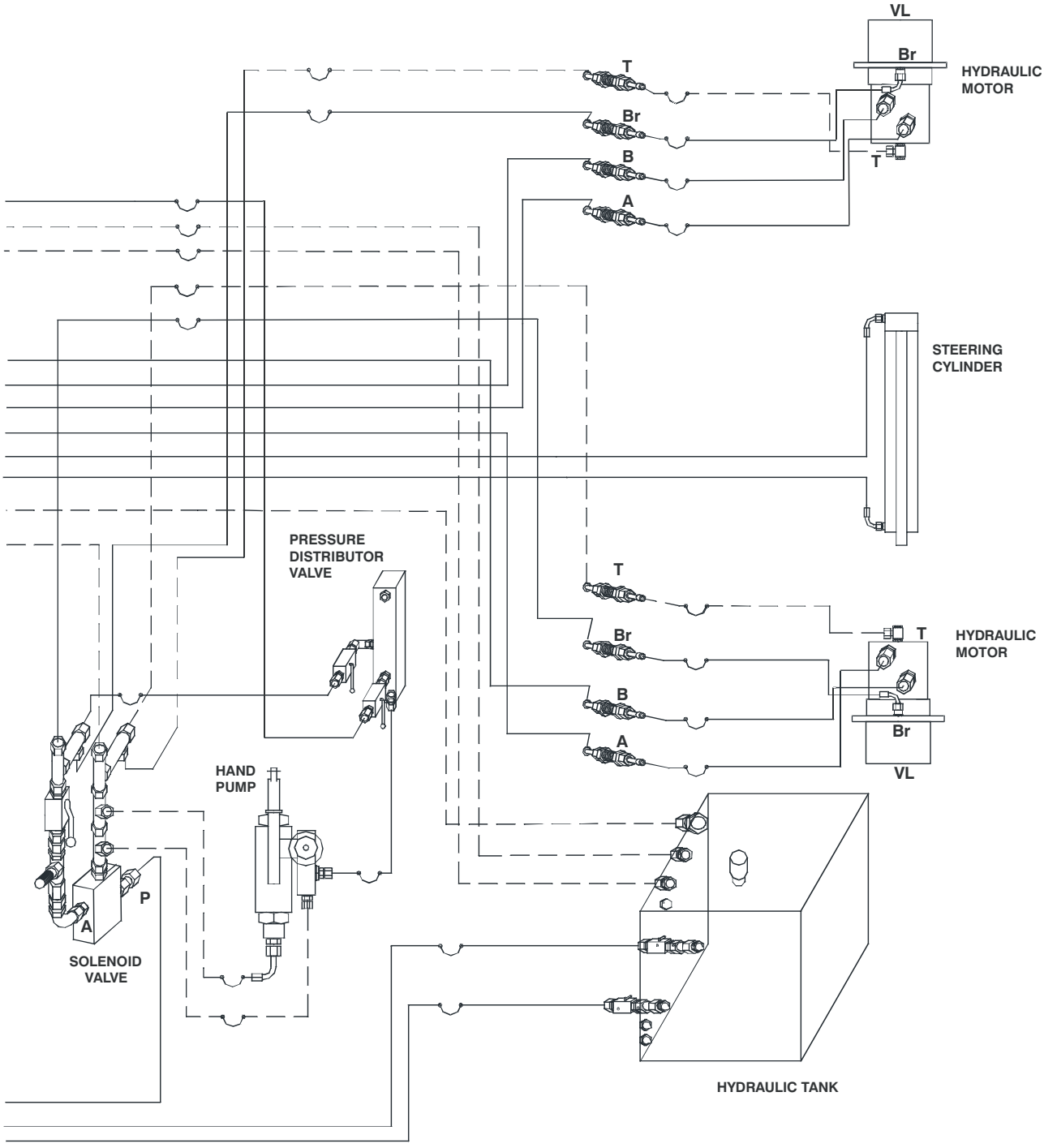


Figure 6-31. Hydraulic Diagram - Sheet 2 of 2

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