An Oshkosh Truck Corporation Company

Service & Maintenance Manual

Liftlux

Model 203-24

S/N 12378 & 14130
S/N 15548 to Present

3121334

November 29, 2007

CE

NQA ISO9001 REGISTERED COMPANY UKAS QUALITY MANAGEMENT 015

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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SECTION 1. SPECIFICATIONS

1.1 OPERATING SPECIFICATIONS

Table 1-1. Operating Specifications

Maximum Working Height	22.3 m (73.2 ft)
Maximum Platform Height	20.3 m (66.7 ft)
Turning Radius : Inside Outside	 1.2m (3.9 ft) 5.2 m (17.1 ft)
Maximum Work Load (Capacity): Main Platform Platform Extension	 750 kg (1650 lbs) 500 kg (1100 lbs)
Maximum Platform Occupants	4
Tools and Equipment: Main Platform Platform Extension	 430 kg (1300 lbs) 180 kg (397 lbs)
Maximum Horizontal Manual Side Force	400N (90 Lb force)
Tilt Sensor Setting	3°
Maximum Operating Wind Speed	12.5 m/s (28 mph)
Gross Machine Weight (Approximate)	11,400 kg (25,132 lbs)
Drive Speed: Slow Fast	 0.2 m/s (0.6 ft/sec) 1 m/s (3.2 ft/sec)
Sideslope (Machine Stowed)	5°
Gradeability (MachineStowed)	25%
Lift Speed (Platform Empty)	60 sec
Lowering Speed	60 sec
Maximum Operating Hydraulic Pressure	210 bar (3046 psi)
Power Supply	Diesel Engine
Maximum Ground Bearing Pressure: Outrigger Pads Tires	 9 kg/cm^2 (128 psi) 5 kg/cm^2 (71 psi)
Maximum Tire Load	4400 kg (9700 lbs)
Maximum Outrigger Pad Load	4290 kg (9548 lbs)
Electrical System Voltage	24 V
Ground Clearance	0.27 m (0.9 ft)

1.2 DIMENSIONAL DATA

Table 1-2. Dimensional Data

Machine Height: rails up rails down	 3.8 m (12.5 ft) 3 m (9.9 ft)
Platform dimensions: extension retracted (L x W) extension extended (L x W)	 4.6 x 2.4 m (15 x 7.9 ft) 7.4 x 2.4 m (24.3 x 7.9 ft)
Transport Dimensions (L x W x H): rails up rails down	 4.6 x 2.4 x 3.8 m (15 x 7.9 x 12.5 ft) 4.6 x 2.4 x 3 m (15 x 7.9 x 9.9 ft)

1.3 CAPACITIES

Table 1-3. Capacities

Fuel Tank	90 L (23.8 gal)
Hydraulic Tank	135 L (35.7 gal)
Engine Crankcase: with Filter without Filter	 10.5 L (11 qt) 10 L (10.6 qt)

1.4 ENGINE

Table 1-4. Engine Specifications

Type	Deutz F3L 2011; or Deutz D2011 L03 i
Number of Cylinders	3
Displacement	2.3L (140.4 in^3)
Bore	94 mm (3.7 in)
Stroke	112 mm (4.4 in)
Fuel Type	Diesel

Battery

Table 1-5. Engine Battery Specifications

Voltage	12V
Cranking Performance	100Ah
Reserve Capacity	880A

1.5 TIRES

Table 1-6. Tire Specifications

Size	IN355/55D625
Load Range	G (14 Ply Rating)
Tire Pressure (foam fill)	6.2 bar (90 psi)
Max Tire Load	4400 kg (9700 lbs)
Wheel Lug Nut Torque: Front Axle: Rear Axle:	 480 Nm (354 ft lbs) 480 Nm (354 ft lbs)
Bolt Size	M18 x 1.5

1.6 TORQUE REQUIREMENTS

NOTE: *JLG recommends that once any locknut is removed from the machine it is discarded and replaced with a new one. When maintenance becomes necessary or a fastener has loosened, refer to Figure 1-3., Torque Chart - (In/Lb - Ft/Lb). (For ASTM Fasteners) to Figure 1-5., Torque Chart - (Nm) - (For Metric Class Fasteners). to determine proper torque value.*

1.7 LIMIT SWITCHES

Platform Stowed/Jacks Retract Limit Switch

Switch that senses when the platform is lowered to 3.5 m (11.5 ft). Cuts out lowering function, enables drive function when tilted, and enables outriggers retract when outriggers are deployed.

High Drive Speed Cutout Limit Switch

When the platform reaches and exceeds a height of 3.5 m (11.5 ft), the fast drive speed will be cut back to the slow drive speed. Once the platform is completely lowered, the high drive speed is possible. The High Drive Cutout LED on the platform control console will be out when the platform exceeds the limit.

Maximum Drive Height Limit Switch

The drive function will be disabled once the platform reaches a height of 15.2 m (50 ft). The platform must be lowered below the limit to enable the drive function.

Maximum Height Limit Switch

Once the plaform has reached its maximum height of 20.3 m (66.6 ft), the lifting function will be cut off by the maximum height limit switch. This maximum height can only be achieved when the outriggers are selected and deployed. When maximum height is reached, the Lift Cutout Indicator LED on the platform control console will no longer be iluminated.

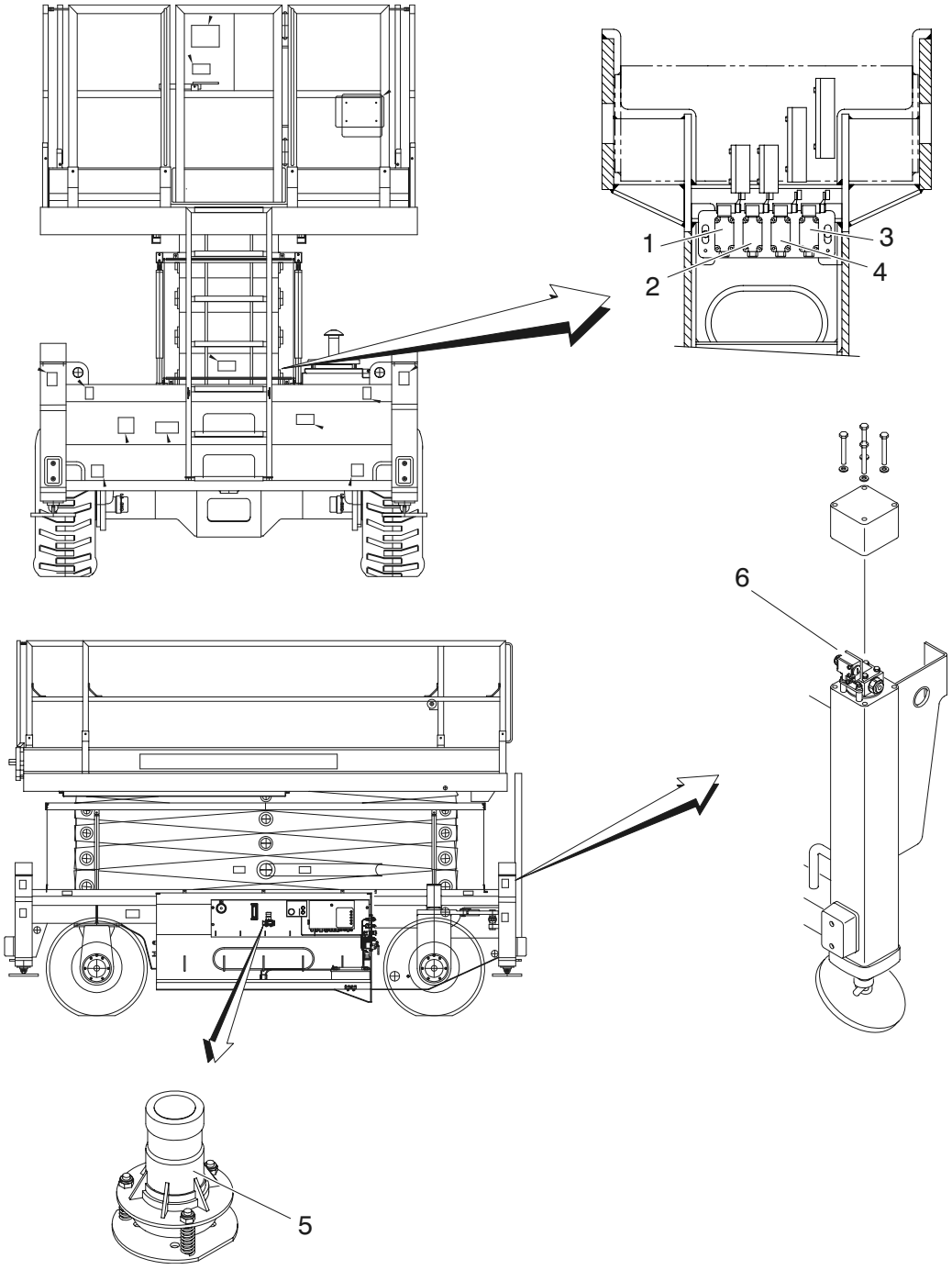
Tilt Sensor

The tilt switch cuts out lifting, driving, and steering once the platform reaches a tilt angle (slope) beyond 3° and the platform reaches 3.5 m (11.5 ft). At this point, the warning LED on the platform control console will be illuminate. Lowering is the only function possible.

Outrigger Interlock Sensors

Outriggers Selected - Limit switch senses ground contact for all outriggers to enable platform to be raised.

Outriggers Not Selected - Limit switch senses when all outriggers are retracted to enable platform to be raised and machine to be driven.



1. Platform Stowed/Jacks Retract Limit Switch
2. High Drive Speed Cutout Limit Switch
3. Maximum Drive Height Limit Switch
4. Maximum Height Limit Switch
5. Tilt Sensor
6. Outrigger Sensor (all 4 outriggers)

Figure 1-1. Limit Switch Locations

1.8 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 1-7. Pressure Setting

Main Relief	Steer Relief
210 bar (3046 psi)	175 bar (2538 psi)

1.9 MAJOR COMPONENT WEIGHTS

Table 1-8. Major Component Weights

Component	Unit of Measure
Platform Assembly (including extension)	890 kg (1962 lbs)
Platform Extension	390 kg (860 lbs)
Chassis	3800 kg (8377 lbs)
Arm Assembly	5100 kg (11,243 lbs)
Lift Cylinder	450 kg (992 lbs)

1.10 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 1-9. Critical Stability Weights

Component	Unit of Measure
Engine	217 kg (478 lbs)
Wheel and Tire Assembly (each)	200 kg (441 lbs)
Wheel/Tire and Drive Assembly (each)	246 kg (542 lbs)
Batteries - Standard (each)	24.6 kg (54 lbs)

1.11 LUBRICATION

Hydraulic Oil

Table 1-10. 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.*

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 is desired, contact JLG Industries for proper recommendations.

When temperatures remain below -7°C (20°F), JLG Industries recommends the use of Mobil DTE 13M.

Table 1-11. Mobil Hydraulic Fluid Specs

Description	Mobil 424	Mobil DTE 13M
ISO Viscosity Grade	10W-30	#32
Specific Gravity	29.0	0.877
Pour Point, Max	-46°C (-43°F)	-40°C (-40°F)
Flash Point, Min.	228°C (442°F)	166°C (330°F)
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

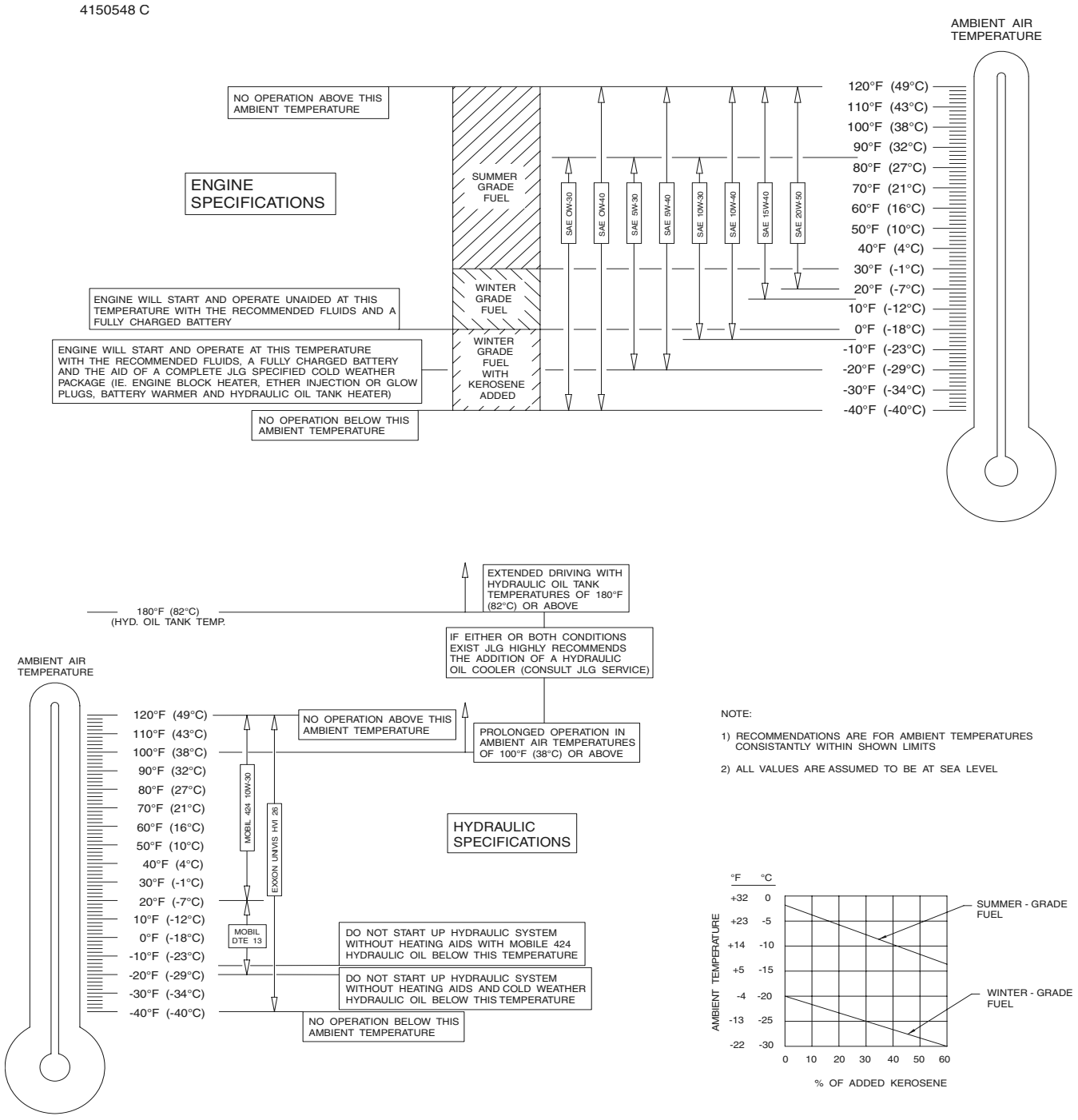


Figure 1-2. Engine Operating Temperature Specifications

SIZE	THDS. PER INCH	BOLT DIA.	TENSILE STRESS AREA	VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY — SAE GRADE 5 BOLTS & GRADE 2 NUTS — CLAMP LOAD	TORQUE DRY OR LOCTITE 263	TORQUE LUB	TORQUE LOCTITE 262	TORQUE LOCTITE 242 OR 271	SAE GRADE 8 BOLTS & GRADE 8 NUTS & SOCKET HEAD CAP SCREWS — CLAMP LOAD	TORQUE DRY OR LOCTITE 263	TORQUE LUB	TORQUE LOCTITE 262	TORQUE LOCTITE 242 OR 271	UNPLATED CAP SCREWS — UNBRAKO 1960 SERIES SOCKET HEAD — CLAMP LOAD	TORQUE WITHOUT LOC-WEL PATCH	TORQUE WITH LOC-WEL PATCH
		IN	SQ. IN.	LB.	IN-LB	IN-LB	IN-LB	IN-LB	LB.	IN-LB.	IN-LB	IN-LB	IN-LB	LB.	IN-LB	IN-LB
4	40	0.1120	0.00604	380	8	6	—	—	540	12	9	—	—	—	—	—
	48		0.00661	420	9	7	—	—	600	13	10	—	—	—	—	—
6	32	0.1380	0.00909	580	16	12	—	—	820	23	17	—	—	—	—	—
	40		0.01015	610	18	13	—	—	920	25	19	—	—	—	—	—
8	32	0.1640	0.01400	900	30	22	—	—	1260	41	31	—	—	—	—	—
	36		0.01474	940	31	23	—	—	1320	43	32	—	—	—	—	—
10	24	0.1900	0.01750	1120	43	32	—	—	1580	60	45	—	—	—	—	—
	32		0.02000	1285	49	36	—	—	1800	68	51	—	—	—	—	—
1/4	20	0.2500	0.0318	2020	96	75	—	105	2860	144	108	—	160	3180	160	168
	28		0.0364	2320	120	86	—	135	3280	168	120	—	185	3640	168	178
		IN	SQ. IN.	LB.	FT-LB	FT-LB	FT-LB	FT-LB	LB.	FT-LB	FT-LB	FT-LB	FT-LB	LB.	FT-LB	FT-LB
5/16	18	0.3125	0.0524	3340	17	13	16	19	4720	25	18	22	30	5240	25	28
	24		0.0580	3700	19	14	17	21	5220	25	20	25	30	5800	27	30
3/8	16	0.3750	0.0775	4940	30	23	28	35	7000	45	35	40	50	7750	45	50
	24		0.0878	5600	35	25	32	40	7900	50	35	45	55	8780	50	55
7/16	14	0.4375	0.1063	6800	50	35	45	55	9550	70	55	63	80	10630	70	77
	20		0.1187	7550	55	40	50	60	10700	80	60	70	90	11870	75	82
1/2	13	0.5000	0.1419	9050	75	55	68	85	12750	110	80	96	120	14190	110	120
	20		0.1599	10700	90	65	80	100	14400	120	90	108	130	15990	115	127
9/16	12	0.5625	0.1820	11600	110	80	98	120	16400	150	110	139	165	18200	155	170
	18		0.2030	12950	120	90	109	135	18250	170	130	154	190	20300	165	182
5/8	11	0.6250	0.2260	14400	150	110	135	165	20350	220	170	180	240	22600	210	231
	18		0.2560	16300	170	130	153	190	23000	240	180	204	265	25600	220	242
3/4	10	0.7500	0.3340	21300	260	200	240	285	30100	380	280	301	420	33400	365	400
	16		0.3730	23800	300	220	268	330	33600	420	320	336	465	37300	400	440
7/8	9	0.8750	0.4620	29400	430	320	386	475	41600	600	460	485	660	46200	585	645
	14		0.5090	32400	470	350	425	520	45800	660	500	534	725	50900	635	700
1	8	1.0000	0.6060	38600	640	480	579	675	51500	900	680	687	990	60600	865	950
	12		0.6630	42200	700	530	633	735	59700	1000	740	796	1100	66300	915	1000
1-1/8	7	1.1250	0.7630	42300	800	600	714	840	68700	1280	960	1030	1400	76300	1240	1365
	12		0.8560	47500	880	660	802	925	77000	1440	1080	1155	1575	85600	1380	1520
1-1/4	7	1.2500	0.9690	53800	1120	840	1009	1175	87200	1820	1360	1453	2000	96900	1750	1925
	12		1.0730	59600	1240	920	1118	1300	96600	2000	1500	1610	2200	107300	1880	2070
1-3/8	6	1.3750	1.1550	64100	1460	1100	1322	1525	104000	2380	1780	1907	2625	115500	2320	2550
	12		1.3150	73000	1680	1260	1506	1750	118100	2720	2040	2165	3000	131500	2440	2685
1-1/2	6	1.5000	1.4050	78000	1940	1460	1755	2025	126500	3160	2360	2530	3475	140500	3040	3345
	12		1.5800	87700	2200	1640	1974	2300	142200	3560	2660	2844	3925	158000	3270	3600

Note: These torque values do not apply to cadmium plated fasteners.

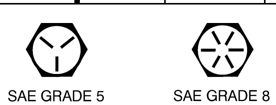
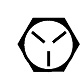


Figure 1-3. Torque Chart - (In/Lb - Ft/Lb). (For ASTM Fasteners)

SIZE	THDS. PER INCH	BOLT DIA.	TENSILE STRESS AREA	VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY — SAE GRADE 5 BOLTS & GRADE 2 NUTS: CLAMP LOAD	TORQUE: DRY OR LOCTITE 263	TORQUE: LUB	TORQUE: LOCTITE 262	TORQUE: LOCTITE 242 OR 271	SAE GRADE 8 BOLTS & GRADE 8 NUTS & SOCKET HEAD CAP SCREWS: CLAMP LOAD	TORQUE: DRY OR LOCTITE 263	TORQUE: LUB	TORQUE: LOCTITE 262	TORQUE: LOCTITE 242 OR 271	UNPLATED CAP SCREWS — UNBRAKO 1960 SERIES SOCKET HEAD: CLAMP LOAD	TORQUE: WITHOUT LOC-WEL PATCH	TORQUE: WITH LOC-WEL PATCH
		IN	SQ. IN.	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m
4	40	0.1120	0.00604	380	.8	.8	—	—	540	1.4	1.0	—	—	—	—	—
	48		0.00661	420	1.0	.8	—	—	600	1.5	1.0	—	—	—	—	—
6	32	0.1380	0.00909	580	1.8	1.4	—	—	820	2.6	2.0	—	—	—	—	—
	40		0.01015	610	2.0	1.6	—	—	920	2.8	2.2	—	—	—	—	—
8	32	0.1640	0.01400	900	3.4	2.4	—	—	1260	4.6	3.4	—	—	—	—	—
	36		0.01474	940	3.4	2.6	—	—	1320	5	3.6	—	—	—	—	—
10	24	0.1900	0.01750	1120	5	3.6	—	—	1580	7	5	—	—	—	—	—
	32		0.02000	1285	6	4	—	—	1800	8	6	—	—	—	—	—
1/4	20	0.2500	0.0318	2020	11	8	—	12	2860	16	12	—	18	3180	18	19
	28		0.0364	2320	14	10	—	15	3280	19	14	—	21	3640	19	20
		IN	SQ. IN.	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m	N, m	N, m	LB.	N, m	N, m
5/16	18	0.3125	0.0524	3340	23	18	22	26	4720	34	24	30	41	5240	34	38
	24		0.0580	3700	26	19	23	28	5220	34	27	34	41	5800	37	41
3/8	16	0.3750	0.0775	4940	41	31	38	47	7000	61	47	54	68	7750	61	68
	24		0.0878	5600	47	34	43	54	7900	68	47	61	75	8780	68	75
7/16	14	0.4375	0.1063	6800	68	47	61	75	9550	95	75	85	108	10630	95	104
	20		0.1187	7550	75	54	68	81	10700	108	81	95	122	11870	102	111
1/2	13	0.5000	0.1419	9050	102	75	92	115	12750	149	108	130	163	14190	149	163
	20		0.1599	10700	122	88	108	136	14400	163	122	146	183	15990	156	172
9/16	12	0.5625	0.1820	11600	149	108	133	163	16400	203	149	188	224	18200	210	230
	18		0.2030	12950	163	122	148	183	18250	230	176	209	258	20300	224	247
5/8	11	0.6250	0.2260	14400	203	149	183	224	20350	298	230	244	325	22600	285	313
	18		0.2560	16300	230	176	207	258	23000	325	244	277	359	25600	298	328
3/4	10	0.7500	0.3340	21300	353	271	325	386	30100	515	380	408	569	33400	495	542
	16		0.3730	23800	407	298	363	447	33600	569	434	456	630	37300	542	597
7/8	9	0.8750	0.4620	29400	583	434	523	644	41600	813	624	658	895	46200	793	874
	14		0.5090	32400	637	475	576	705	45800	895	678	724	983	50900	861	949
1	8	1.0000	0.6060	38600	868	651	785	915	51500	1220	922	931	1342	60600	1173	1288
	12		0.6630	42200	949	719	858	997	59700	1356	1003	1079	1491	66300	1241	1356
1-1/8	7	1.1250	0.7630	42300	1085	813	968	1139	68700	1735	1302	1396	1898	76300	1681	1851
	12		0.8560	47500	1193	895	1087	1254	77000	1952	1464	1566	2135	85600	1871	2061
1-1/4	7	1.2500	0.9690	53800	1518	1139	1368	1593	87200	2468	1844	1970	2712	96900	2373	2610
	12		1.0730	59600	1681	1247	1516	1763	96600	2712	2034	2183	2983	107300	2549	2807
1-3/8	6	1.3750	1.1550	64100	1979	1491	1792	2068	104000	3227	2413	2586	3559	115500	3145	3457
	12		1.3150	73000	2278	1708	2042	2373	118100	3688	2766	2935	4067	131500	3308	3640
1-1/2	6	1.5000	1.4050	78000	2630	1979	2379	2745	126500	4284	3200	3430	4711	140500	4122	4535
	12		1.5800	87700	2983	2224	2676	3118	142200	4827	3606	3856	5322	158000	4433	4881

Note: These torque values do not apply to cadmium plated fasteners.


SAE GRADE 5

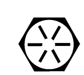

SAE GRADE 8

Figure 1-4. Torque Chart (Metric Conversion) - (For ASTM Fasteners)

			VALUES FOR ZINC PLATED / YELLOW CHROMATE FASTENERS ONLY									
			CLASS 8.8 METRIC BOLTS & CLASS 8 METRIC NUTS					CLASS 10.9 METRIC BOLTS & CLASS 10 METRIC NUTS				
SIZE	PITCH	TENSILE STRESS AREA	CLAMP LOAD	TORQUE				CLAMP LOAD	TORQUE			
				DRY OR LOCTITE 263	LUB	LOCTITE 262	LOCTITE 242 OR 271		DRY OR LOCTITE 263	LUB	LOCTITE 262	LOCTITE 242 OR 271
		sq. mm	KN	N, m	N, m	N, m	N, m	KN	N, m	N, m	N, m	N, m
3	.5	5.03	2.19	1.3	1.0	1.2	1.4	3.13	1.9	1.4	1.5	2.1
3.5	.6	6.78	2.95	2.1	1.6	1.9	2.3	4.22	3.0	2.2	2.4	3.3
4	.7	8.78	3.82	3.1	2.3	2.8	3.4	5.47	4.4	3.3	3.5	4.8
5	.8	14.2	6.18	6.2	4.6	5.6	6.8	8.85	8.9	6.6	7.1	9.7
6	1	20.1	8.74	11	7.9	9.4	12	12.5	15	11	12	17
7	1	28.9	12.6	18	13	16	19	18	25	19	20	28
8	1.25	36.6	15.9	25	19	23	28	22.8	37	27	29	40
10	1.5	58.0	25.2	50	38	45	55	36.1	72	54	58	79
12	1.75	84.3	36.7	88	66	79	97	52.5	126	95	101	139
14	2	115	50.0	140	105	126	154	71.6	200	150	160	220
16	2	157	68.3	219	164	197	241	97.8	313	235	250	344
18	2.5	192	83.5	301	226	271	331	119.5	430	323	344	473
20	2.5	245	106.5	426	320	383	469	152.5	610	458	488	671
22	2.5	303	132.0	581	436	523	639	189.0	832	624	665	915
24	3	353	153.5	737	553	663	811	220.0	1060	792	845	1170
27	3	459	199.5	1080	810	970	1130	286.0	1540	1160	1240	1690
30	3.5	561	244.0	1460	1100	1320	1530	349.5	2100	1570	1680	2310
33	3.5	694	302.0	1990	1490	1790	2090	432.5	2600	2140	2280	2860
36	4	817	355.0	2560	1920	2300	2690	509.0	3660	2750	2930	4020
42	4.5	1120	487.0	4090	3070	3680	4290	698.0	5860	4400	4690	6440

Note: These torque values do not apply to cadmium plated fasteners.

METRIC CLASS 8.8

METRIC CLASS 10.9

Figure 1-5. Torque Chart - (Nm) - (For Metric Class Fasteners).

SECTION 2. GENERAL

2.1 MACHINE PREPARATION, INSPECTION, AND MAINTENANCE

General

This section provides the necessary information needed by those personnel that are responsible to place the machine in operation readiness and maintain its safe operating condition. For maximum service life and safe operation, ensure that all the necessary inspections and maintenance have been completed before placing the machine into service.

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.

Preventative Maintenance

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

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

Table 2-1. Inspection and Maintenance

Type	Frequency	Primary Responsibility	Service Qualification	Reference
Pre-Start Inspection	Prior to use each day; or At each Operator change.	User or Operator	User or Operator	Operator and Safety Manual
Pre-Delivery Inspection	Prior to each sale, lease, or rental delivery.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
Frequent Inspection	In service for 3 months or 150 hours, whichever comes first; or Out of service for a period of more than 3 months; or Purchased used.	Owner, Dealer, or User	Qualified JLG Mechanic	Service and Maintenance Manual and applicable JLG inspection form.
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.
EO	Engine (crankcase) Oil. Gas - API SF/SG class, MIL-L-2104. Diesel - API CC/CD class, MIL-L-2104B/ MIL-L-2104C.
HO	Hydraulic Oil. API service classification GL-3, e.g. Mobil 424.

2.4 OPERATOR MAINTENANCE

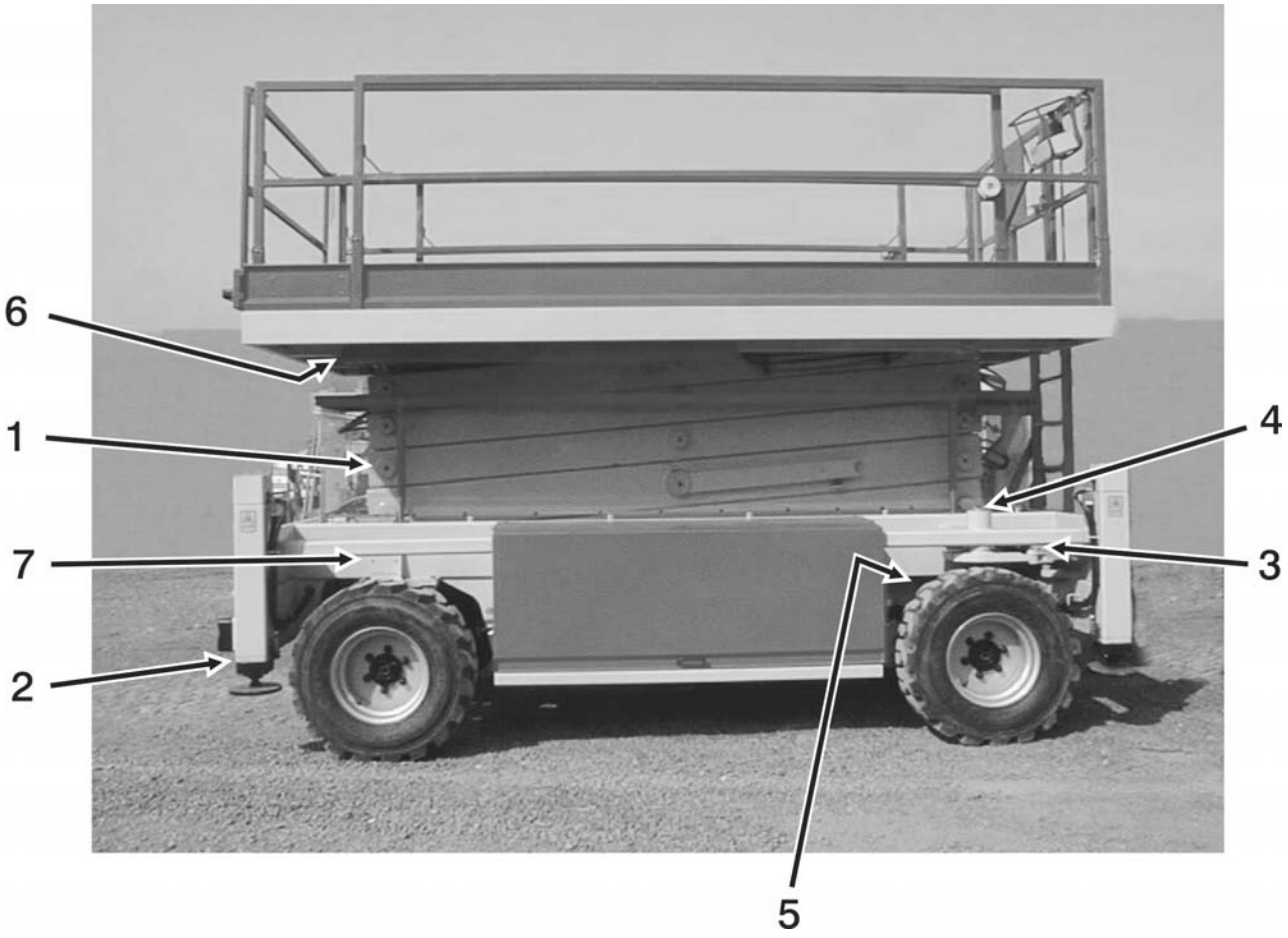
⚠ WARNING

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

NOTE: *Be sure to lubricate like items 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.

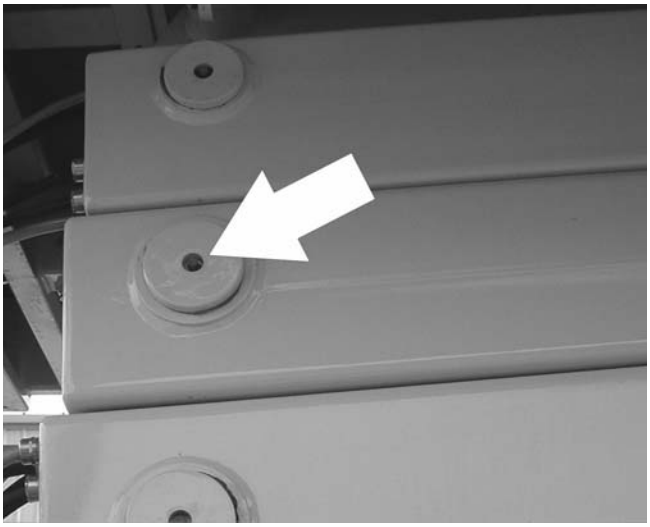


1. Arm Pins
2. Outrigger Cylinders
3. Tie Rod Ends
4. Spindles
5. Lift Cylinder
6. Upper Slide Pads
7. Lower Slide Pads
8. Engine Compartment (opposite side not shown)
9. Fuel Tank (opposite side not shown)

Figure 2-1. Lubrication Diagram

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

1. Arm Pins

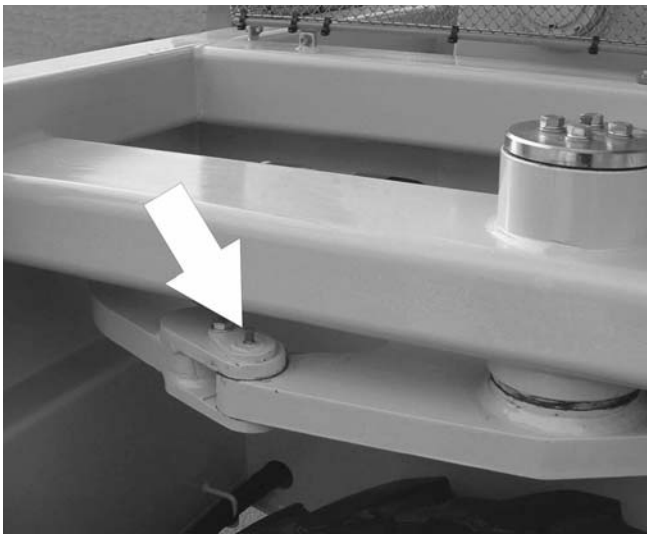


- Lube Points - 39 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

2. Outrigger Cylinders

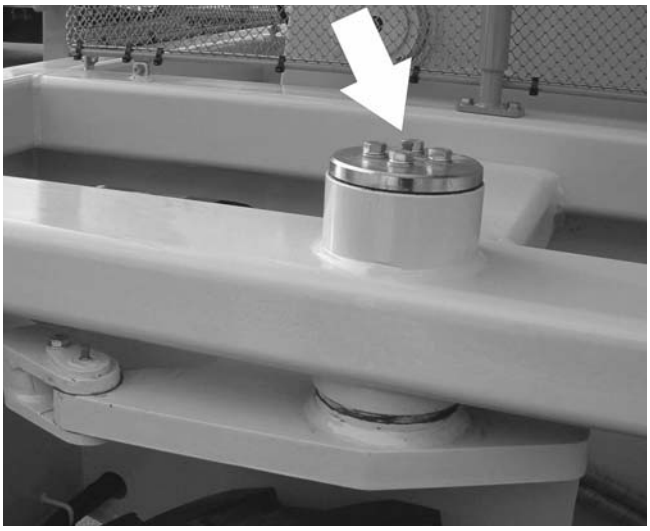
- Lube Points - 4 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

3. Tie Rod Ends



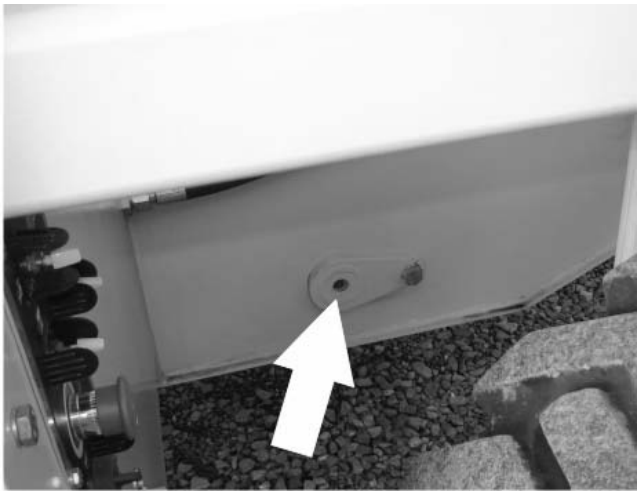
- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube -MPG
- Interval - As Required

4. Spindles



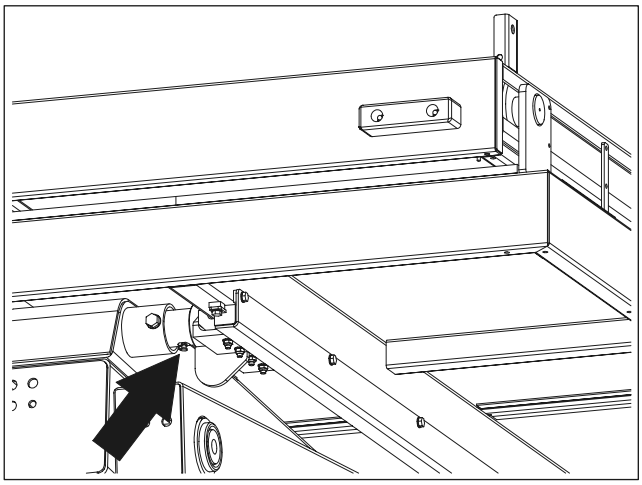
- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

5. Lift Cylinder



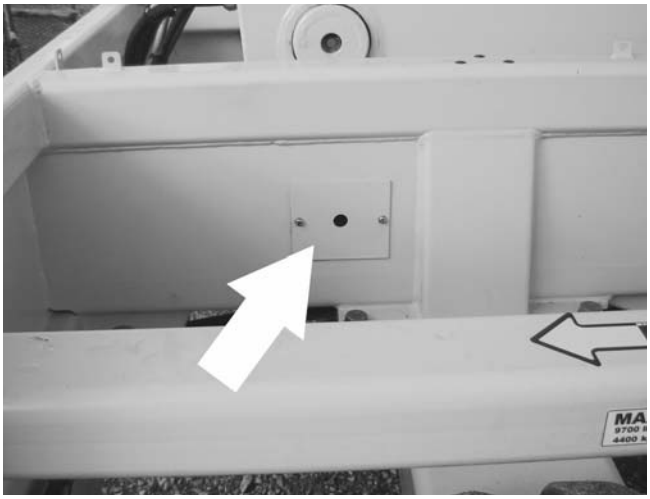
- Lube Points - 2 Grease Fittings
- Capacity - As Required
- Lube - MPG
- Interval - As Required

6. Upper Slide Pads



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

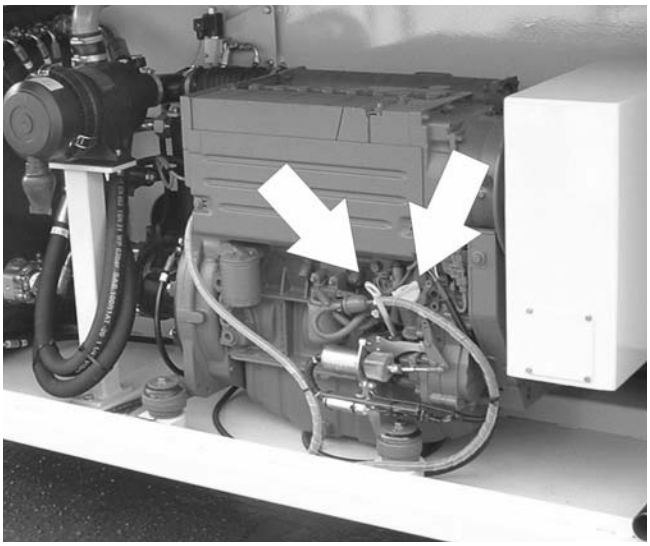
7. Lower Slide Pads



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

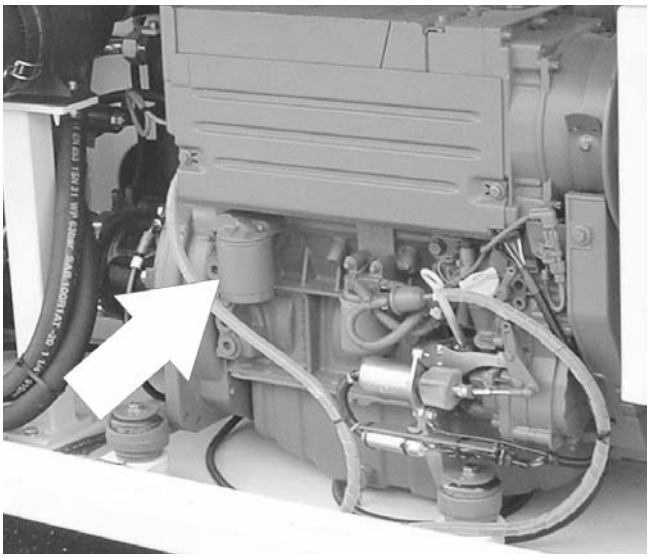
8. Engine Compartment

   a. Engine Oil Check/Fill



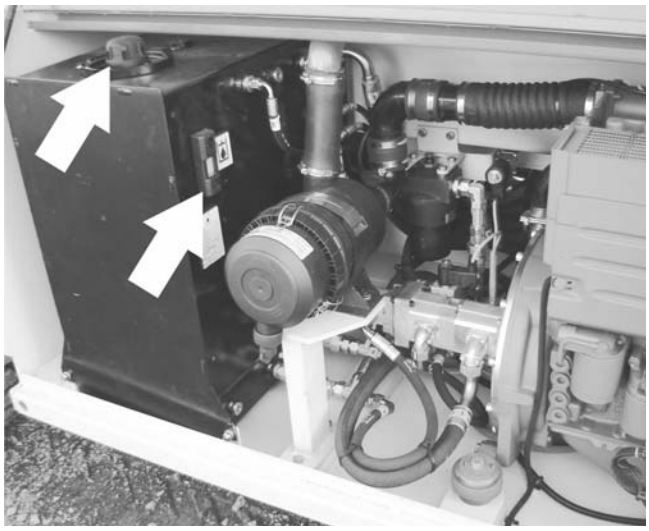
- Lube Points - Fill Cap & Dip Stick
- Capacity - See Engine Manual
- Lube - EO SAE 20W20
- Interval - Every 3 months or 150 hours of operation

b. Oil Filter



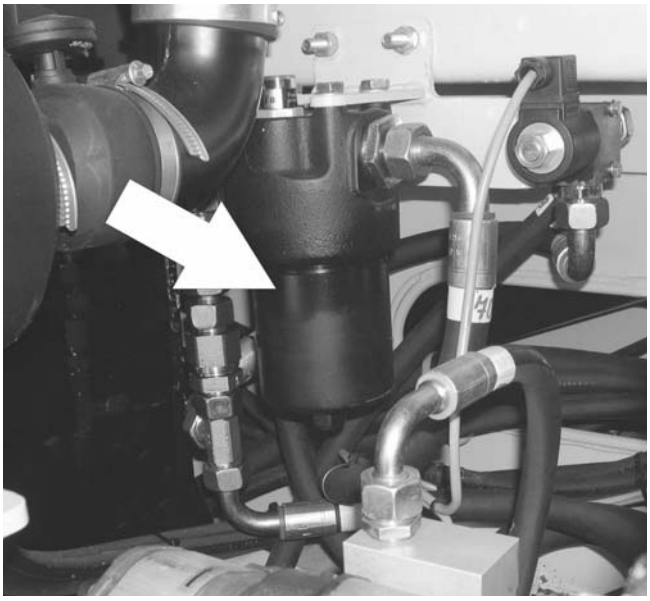
- Maintenance - Replaceable Element (JLG P/N 7016331)
- Interval - Change every 500 hours or 6 months, whichever comes first. Change filter every time engine oil is changed.

c. Hydraulic Oil Check/Fill



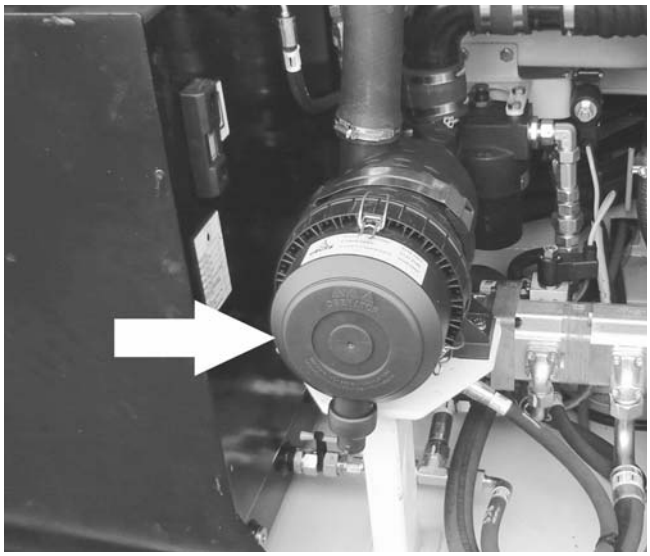
- Lube Points - Fill Cap & Site Gauge
- Capacity - 135 L (35.7 gal)
- Lube - HO
- Interval - Check oil daily, change every 1200 hours of operation

d. Hydraulic Oil Filter



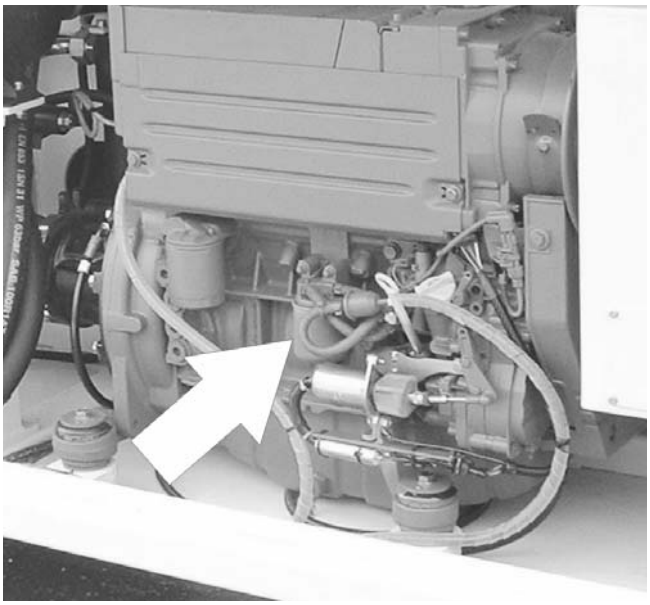
- Interval - 250 hours
- Comments - Change after first 50 hours, then every 250 hours of operation thereafter

e. Air Filter



- Maintenance - Replaceable Element
- Interval - Every 6 months or 300 hours of operation

f. Fuel Filter



- Maintenance - Replaceable Element (JLG P/N 7020023)
- Interval - Change every year or 600 hours of operation, whichever comes first.

9. Fuel Tank

- Capacity - 90 L (23.8 gal)
- Type - Diesel Fuel
- Interval - Check fuel periodically during each use

2.5 CYLINDER DRIFT TEST

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

Lift Cylinder 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 4-41., Lift/Lower 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.

NOTICE

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 OPERATING CHARACTERISTICS

NOTICE

ANYTIME SERVICING OF ELECTRICAL OR HYDRAULIC COMPONENTS IS REQUIRED, DISCONNECT BATTERY VIA THE DISCONNECT SWITCH ON THE GROUND CONTROL PANEL AND SHUT VALVE LEVERS AT THE BASE OF THE HYDRAULIC TANK TO STOP FLOW OF HYDRAULIC FLUID.

Leveling Jacks

The machine is equipped with auto leveling jacks. The automatic self leveling system is controlled by 4 double acting cylinders mounted at each corner of the machine chassis. These cylinders incorporate pilot operated holding valves on the piston side. The cracking pressure of these valves is 1 bar (15 psi) for the rear and 8 bar (116 psi) for the front.

1. Activate the leveling jack switch located on the ground control console.
2. Extend the jacks by moving the joystick on the platform control box forward.

NOTE: *The jacks deploy at idle engine speed. Once all four jacks make contact with the ground the system will go from set mode into level mode. Once level, engine rpm's will increase and lift is allowed.*

3. The tilt indicator LED's on the Main Terminal Box will go out once the machine is level.

NOTE: *There are limit switches mounted at each jack cylinder. These sense when the jack makes ground contract and enable the lift function. All four switches must have contact (lift indicator LED on the platform will light) to enable lift. When elevated, if a contact signal is lost (jack loses ground contact, wire cut, etc.), the lift function is stopped and only lowering is permitted.*

The jacks are operational (extend or retract) if the machine is in the stowed position. The minimum height limit switch must sense the machine is stowed. A failure of the limit switch will prevent the jacks from being activated.

NOTE: *Refer to Section 5.3, NIVOLUX - Automatic Self-Leveling System for detailed information regarding the automatic leveling system.*

3.2 WHEEL ASSEMBLY

Drive System

Wheel drive is achieved by orbital type (100cc/rev) hydraulic motors driving a wheel type gearbox (29.8:1 reduction) through a spring-applied brake.

The brake is released by actuating a 3 way solenoid valve. This valve provides hydraulic power from the pump directly to the brakes. The brake can be reset by deactivating the valve and restricting flow to the tank through an orifice to smooth out hard stops. Drive is controlled by a proportional solenoid valve section within the main control valve (see Figure 4-33.).

Flow to the drive motors passes through a series /parallel solenoid. When all 3 solenoids are in the passive (non-energised) mode, flow is split by 3 flow dividers:

- Front/Rear
- Rear - Left/Right
- Front - Left/Right

When the solenoids are activated, all ports on the rear hydraulic motors are connnected so that they free the wheel. The front motors are connected in series (output of one motor to the input of the other) to enable fast drive low torque mode.

Drive Hub

NOTICE

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

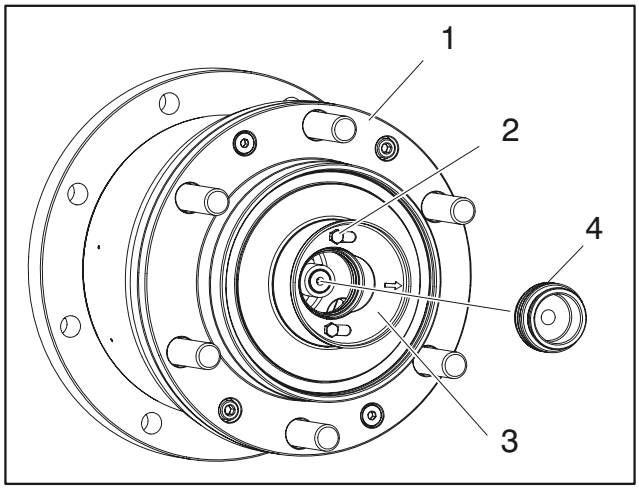
The purpose of a leak test is to make sure the unit is air tight. You can tell if your unit has a leak if the pressure gauge reading on your leak checking fitting starts to fall after the unit has been pressurized and allowed to equalize. Leaks will most likely occur at the pipe plugs, the main seal 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 0.7 bar (10 psi) for 20 minutes.

NOTE: *Due to the small air volume inside this Torque-Hub, it will pressurize 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.



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.

Unless specifically approved by JLG Industries, Inc. do not replace a foam filled tire assembly with a pneumatic tire. When selecting and installing a replacement tire, ensure that all tires are inflated to the pressure recommended by JLG. Due to size variations between tire brands, both tires on the same axle should be the same.

NOTE: *Tires are foam filled to 6.2 bar (90 psi).*

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.

NOTICE

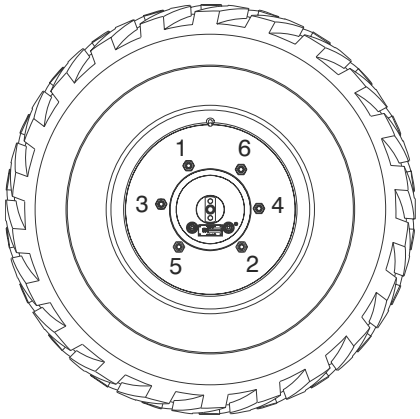
IT IS EXTREMELY IMPORTANT TO APPLY AND MAINTAIN PROPER WHEEL MOUNTING TORQUE.

⚠ WARNING

WHEEL NUTS MUST BE INSTALLED AND MAINTAINED AT THE PROPER TORQUE TO PREVENT LOOSE WHEELS, BROKEN STUDS, AND POSSIBLE DANGEROUS 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:

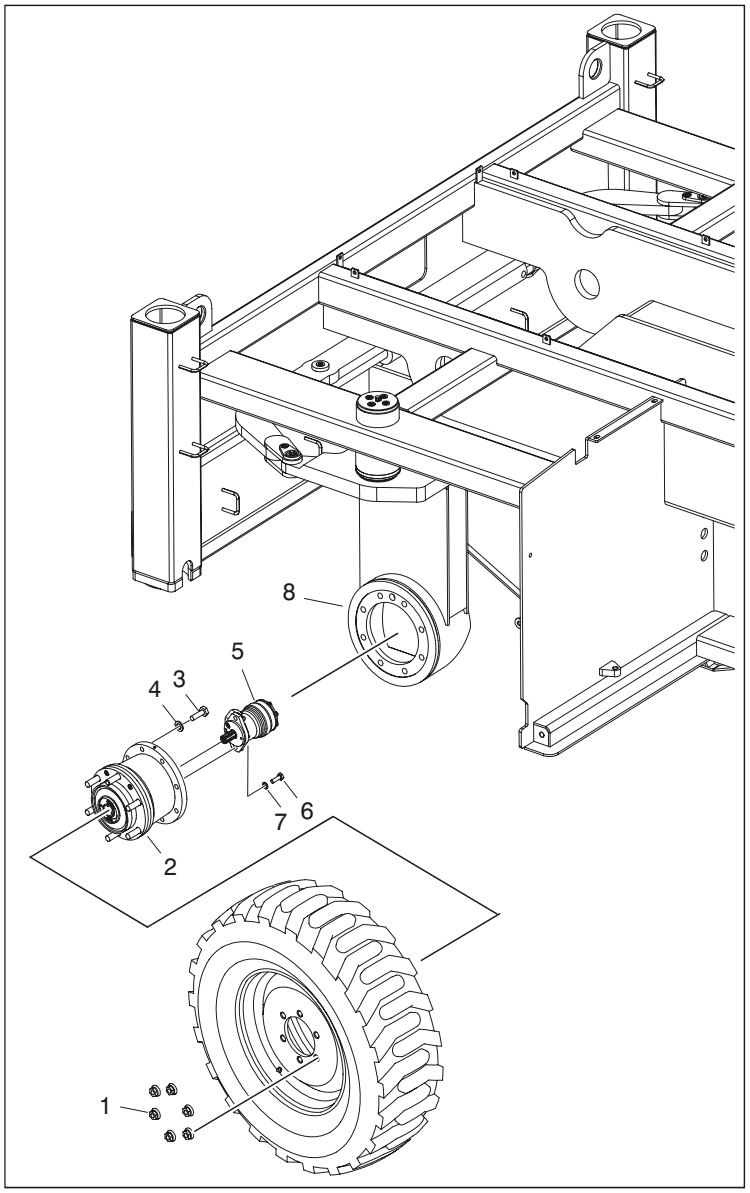


Wheelnut Tightening Pattern

3. The tightening of the nuts should be done in stages. Following the recommended sequence, tighten the nuts per 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. Drive Hub
3. Bolt, M16 x 55mm (8 per wheel)
4. Hardened Washer (8 per wheel)
5. Drive Motor
6. Bolt, M12 x 35mm (2 per wheel)
7. Lockwasher, M12 (2 per wheel)
8. Spindle

Figure 3-2. Wheel Assembly Removal

⚠ WARNING

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

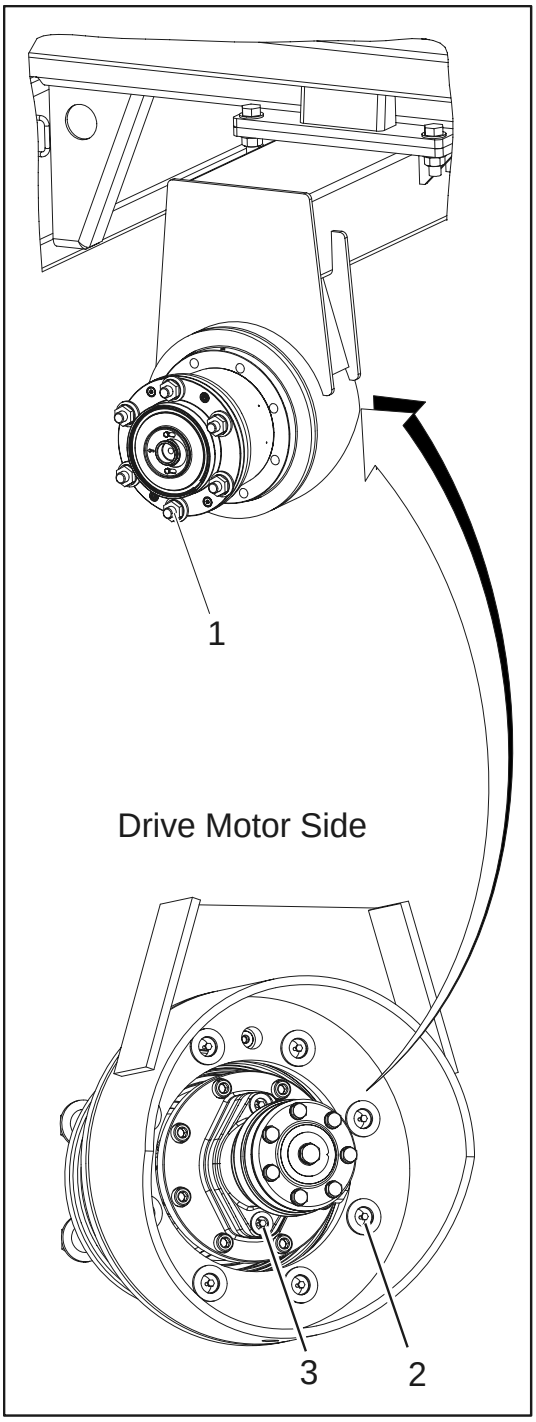
NOTE: *Follow the below steps when servicing/replacing the wheel/tire assembly. Shutoff flow of hydraulic fluid, remove and cap the hydraulic hoses on the motor.*

Removal:

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

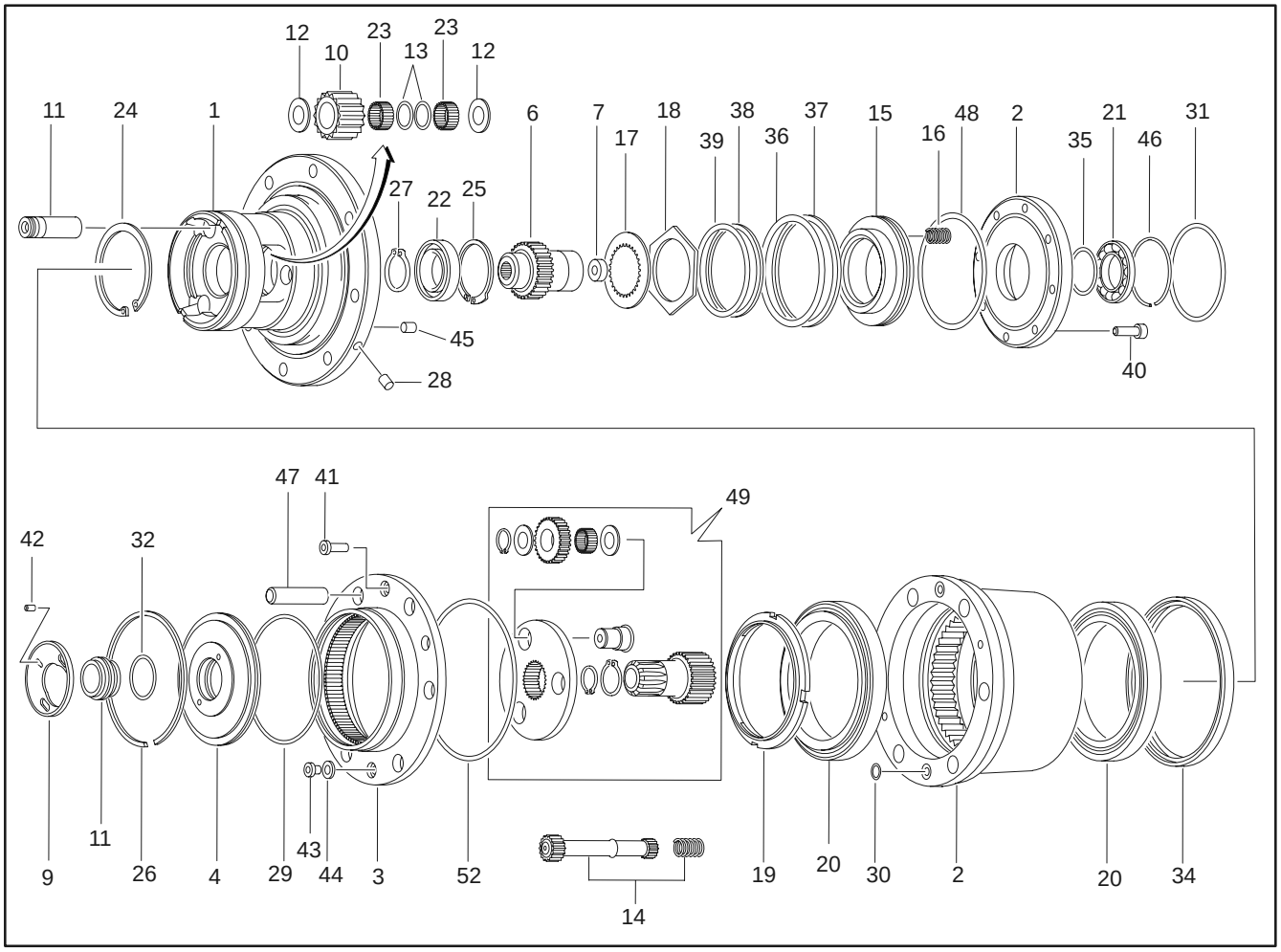
Installation:

- 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)

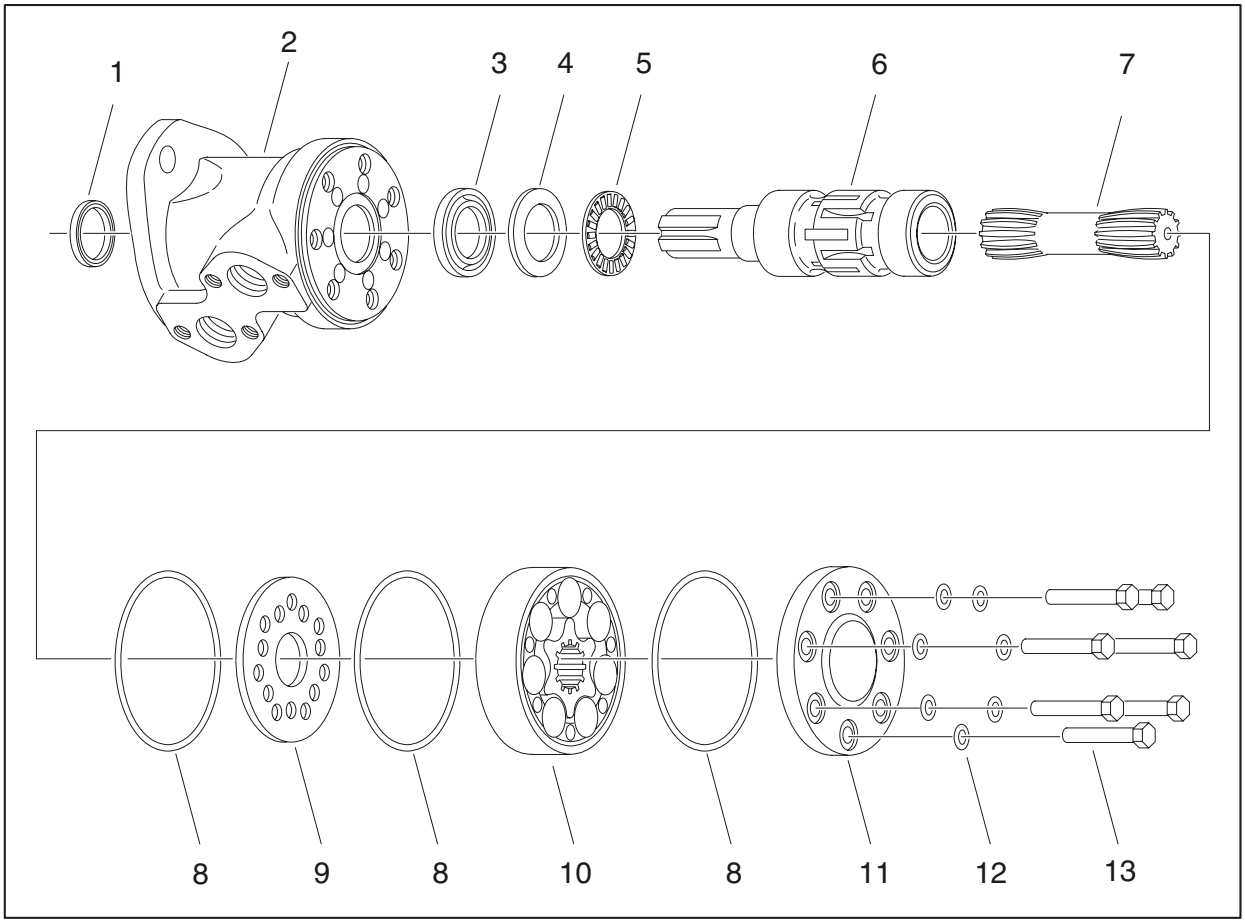
Figure 3-3. Hub Torque Values



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

Drive Motor



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

Figure 3-5. Drive Motor

Table 3-2. Drive Motor Specs

Displacement	99.8 cm^3
Max Speed	600 rpm
Max Torque	240 Nm (177 lb ft)
Max Power	13 kw
Max Oil Flow	60 L/min (15.9 gal/min)

Motor Disassembly

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

1. Place the Motor Housing (2) in a holding tool with the flange upwards.
2. Use a 13mm spanner socket to remove the screws (13) and washers (12).
3. Remove the End Cover (11) sideways.
4. When removing the Gear Wheel Set (10) and two O-Rings (8), keep fingers under the the gear wheel set to prevent the parts from falling out.
5. Remove the Cardan Shaft (7).
6. Remove the Distributor Plate (9) and O-Ring (8).
7. To remove the Output Shaft (6), place the motor housing (2) on a work bench and press the shaft out of the motor housing.
8. Remove the Bearing Race (4) from the motor housing (2).
9. Remove the Axel Needle Bearing (5).
10. 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.*

Check all parts carefully and replace if necessary.

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

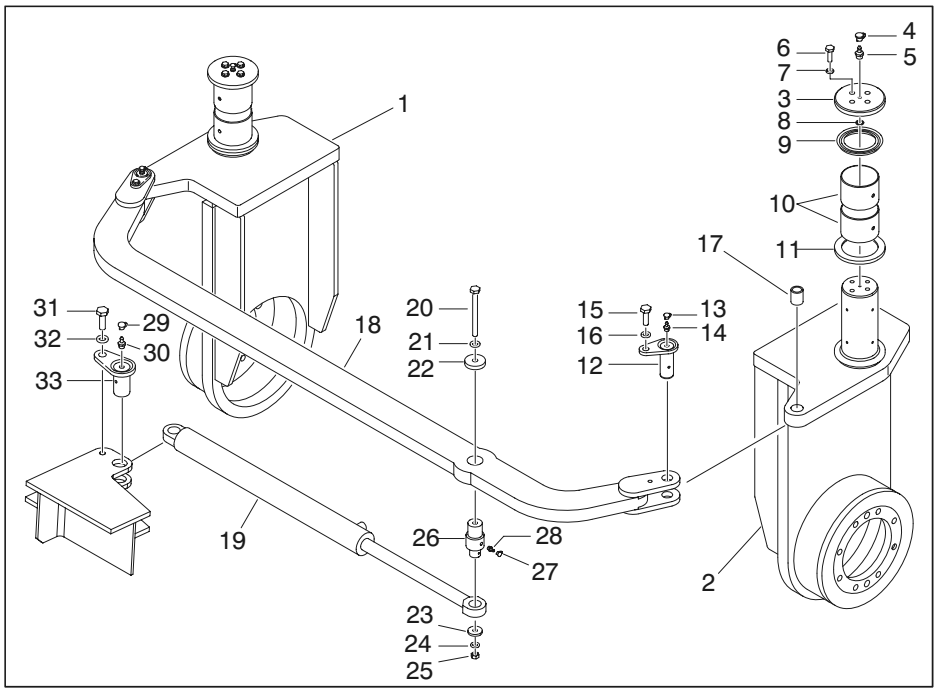
Motor Assembly

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 Axel 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 Gear Wheel Set (10) on the cardan shaft so that the top of a 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 3-3. Torques Specs

Item	Torque
Screws (item 13 in Figure 3-5.)	3.0 - 3.5 daNm (270 - 315 lbf in)

3.3 STEERING ASSEMBLY



1. Right Spindle
2. Left Spindle
3. Cap
4. Grease Fitting Cap
5. Grease Fitting
6. Bolt, M12 x 30mm
7. Lockwasher, M12
8. O-Ring
9. Ring
10. Bushing*
11. Ring
12. Pin
13. Grease Fitting Cap
14. Grease Fitting
15. Bolt, M12 x 20mm
16. Lockwasher, M12
17. Bushing
18. Tie Bar
19. Steer Cylinder
20. Bolt, M12 x 150mm
21. Flatwasher, M12
22. Washer
23. Washer
24. Flatwasher, M12
25. Nut, M12
26. Pin
27. Grease Fitting Cap
28. Grease Fitting
29. Grease Fitting Cap
30. Grease Fitting
31. Bolt, M12 x 20mm
32. Lockwasher, M12
33. Pin

Figure 3-6. Steering Assembly

NOTE: ** = not used on later machines.*

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.

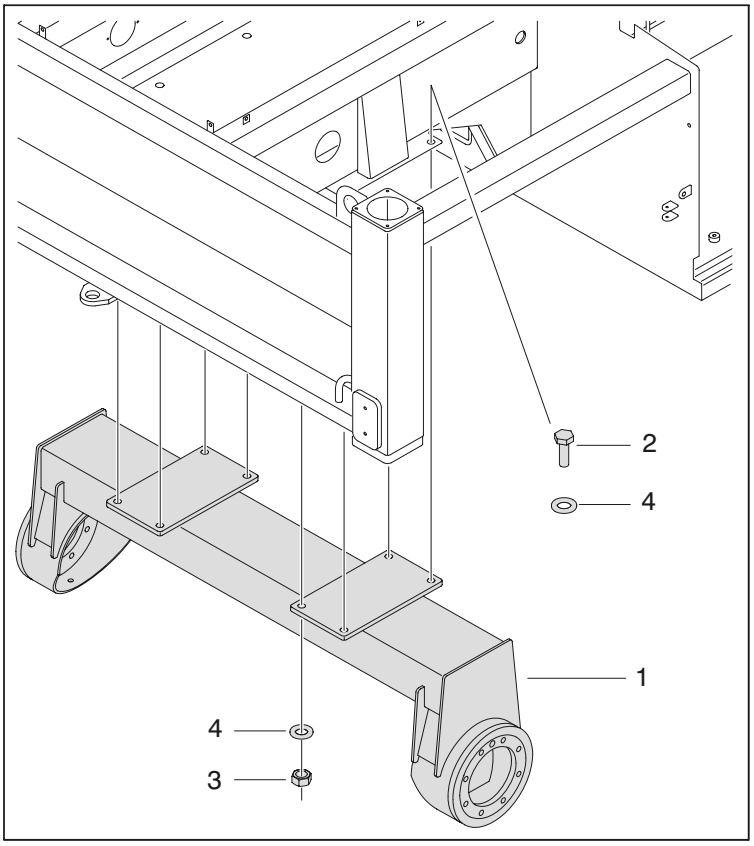
Removal:

1. Remove Steer Cylinder (19) by removing Bolts (20, 31), Washers (21, 22, 23, 32), Nuts (25) and Pins (26, 33).
2. Disconnect Tie Bar (18) from both Spindles (1, 2) by removing Bolts (15), Lockwashers (16), Pins (12), and Bushings (17). 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), Cap (3), O-Ring (8), Ring (9), and Bushings* (10). The Spindle can now be removed for repair/replacement.

Installation:

1. Follow the Removal Steps in reverse order when assembling the steering system.

3.4 REAR AXLE ASSEMBLY



1. Rear Axle Weldment
2. Bolt, M20 x 65mm
3. Nut, M20
4. Hardened Washer

Figure 3-7. Rear Axle Removal

NOTICE

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).*

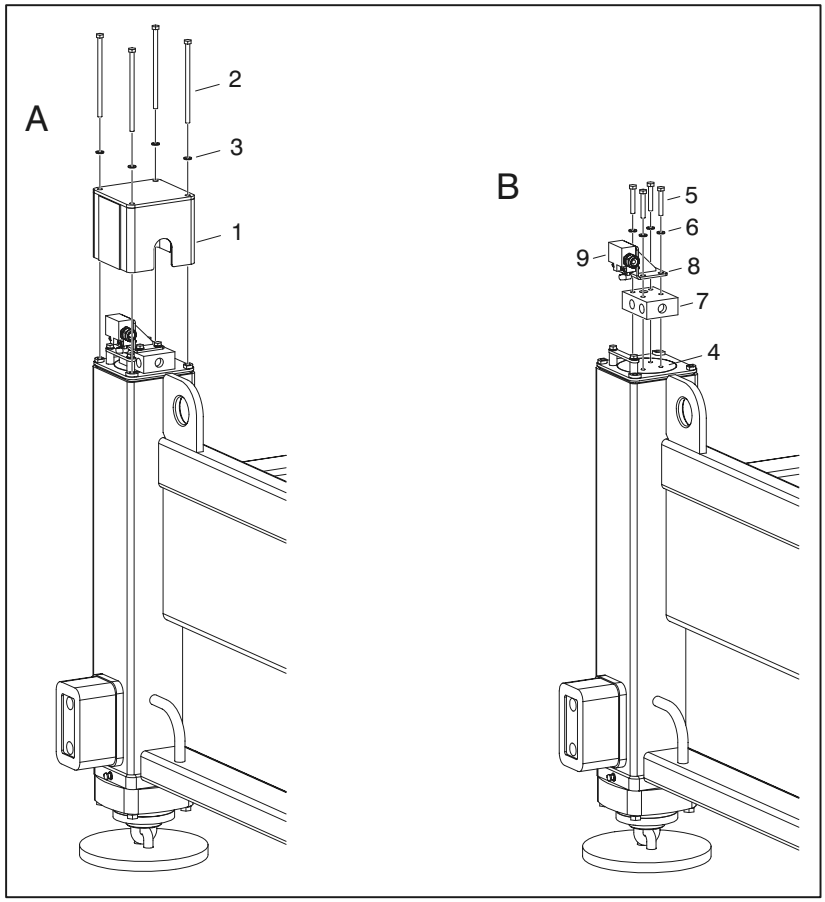
Removal:

1. Remove the eight Bolts (2), Nuts (3), and sixteen Hardened 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.

3.5 OUTRIGGER CYLINDER REMOVAL



1. Cover
2. Bolt, M8 x 160mm
3. Lockwasher, M8
4. Outrigger Cylinder
5. Bolt, M8 x 50mm
6. Lockwasher, M8
7. Valve Assembly
8. Limit Switch Bracket
9. Limit Switch

Figure 3-8. Outrigger Cylinder Removal - (Sheet 1 of 2)

NOTE: *Refer to Figure 3-8., Outrigger Cylinder Removal - (Sheet 1 of 2) and Figure 3-9., Outrigger Cylinder Removal - (Sheet 2 of 2).*

Shut off flow of hydraulic oil before attempting to remove any outrigger cylinder.

Removal:

A)

1. Remove the Cover (1) by removing the four Bolts (2) and Lockwashers (3).

B)

2. Disconnect all hydraulic hoses and wires attached to the Valve Assembly (7) and Limit Switch (9).
3. Remove the Valve Assembly, Limit Switch Bracket (8) and Limit Switch from the top of Outrigger Cylinder (4)by removing the four Bolts (5) and Lockwashers (6)

NOTE: *Support cylinder rod to prevent rod extension and consequential oil spillage.*

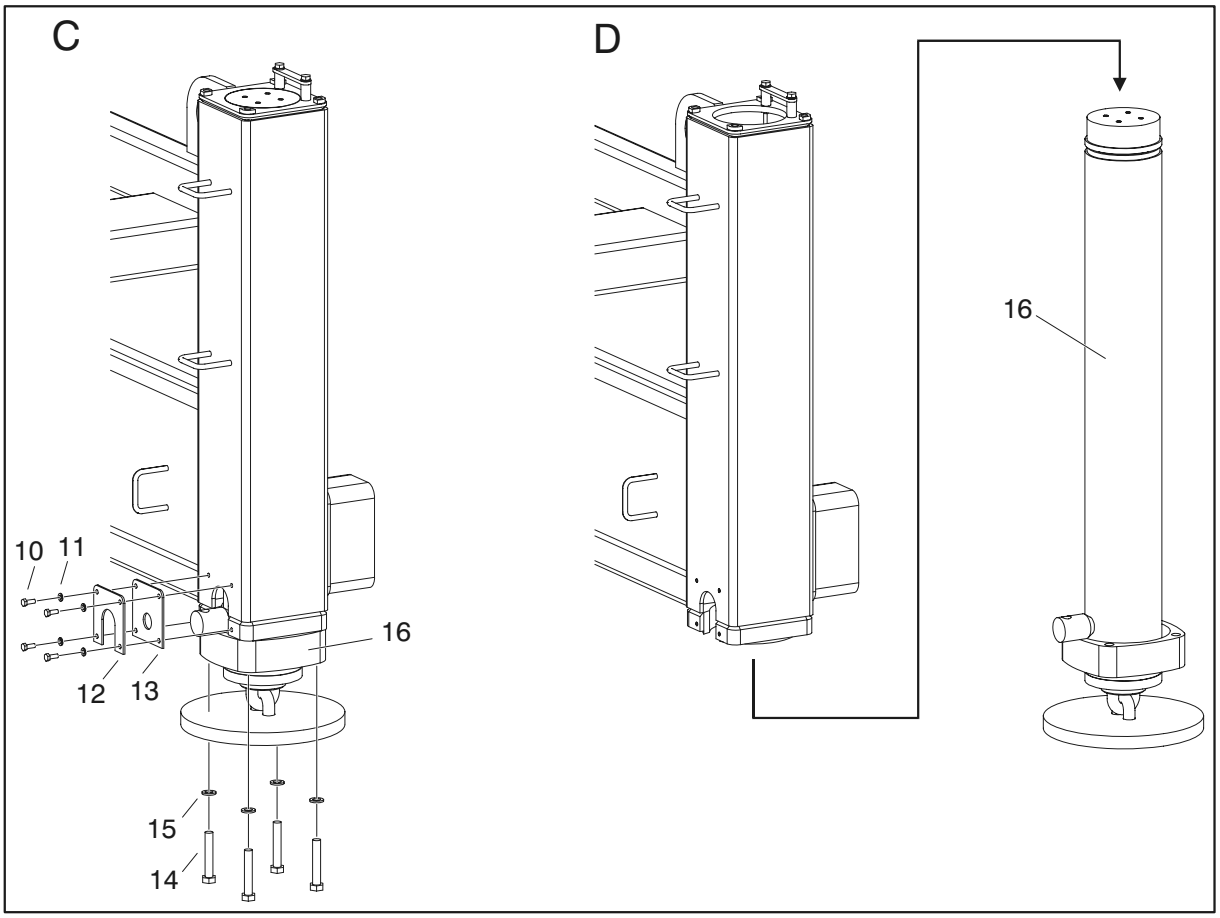
After "Removal Step #3," the frame must be elevated greater than the length of the stowed outrigger cylinder to remove the cylinder.

C)

4. Remove the Plate (12) and Gasket (13) by removing the four Bolts (10) and Lockwashers (11).
5. Secure the Outrigger Cylinder (16). Remove the four Bolts (14) and Lockwashers (15) attaching the cylinder to the frame.

D)

6. Carefully lower the Cylinder out of the frame.



10. Bolt, M6 x 16mm
11. Lockwasher, M6
12. Plate
13. Gasket
14. Bolt, M12 x 70mm
15. Lockwasher, M12
16. Outrigger Cylinder

Figure 3-9. Outrigger Cylinder Removal - (Sheet 2 of 2)

Installation:

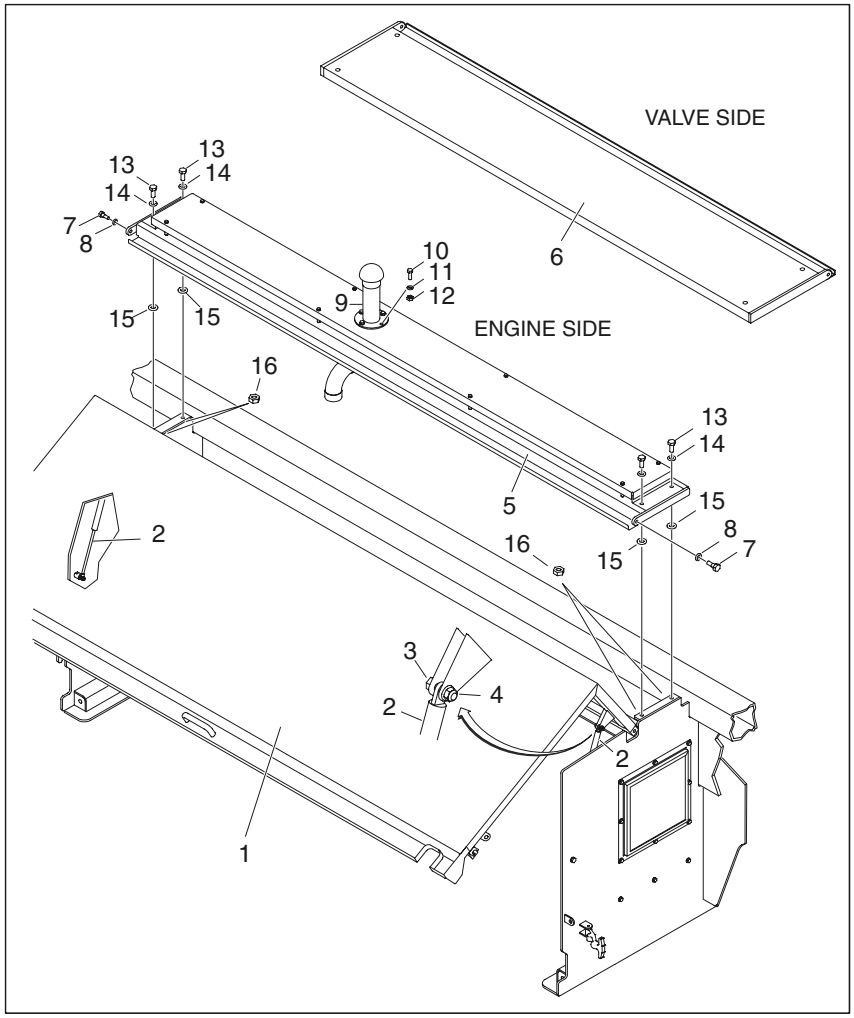
1. Carefully insert the Outrigger Cylinder (16) back into the frame and secure with the four Bolts (14) and Lockwashers (15).
2. Replace Gasket (13) and Plate (12). Secure with four Bolts (10) and Lockwashers (11).

NOTE: *At this point the frame may be lowered.*

3. Place Valve Assembly (7), Limit Switch Bracket (8), and Limit Switch (9) back onto the top of the cylinder and secure with the four Bolts (5) and Lockwashers (6).
4. Reconnect all hydraulic lines and electrical wires.
5. Return flow of hydraulic oil and ensure there is no leakage. Operate cylinder to ensure it works properly.
6. Replace Cover (1) and secure with four Bolts (2) and Lockwashers (3).

3.6 ENGINE COMPARTMENT

Hood Assembly



1. Hood
2. Gas Spring
3. Bolt M8 x 30mm
4. Nut M8
5. Cabinet Top Panel (Left)
6. Cabinet Panel (Right)
7. Special Bolt
8. Flatwasher M12
9. Air Intake Pipe
10. Bolt M8 x 25mm
11. Flatwasher M8
12. Locknut M8
13. Bolt M10 x 25mm
14. Nut M10
15. Flatwasher M10
16. Nut M10

Figure 3-10. Hood Assembly

NOTE: *Removing the hoods will allow for easier access to the components inside the engine compartment and valve compartment.*

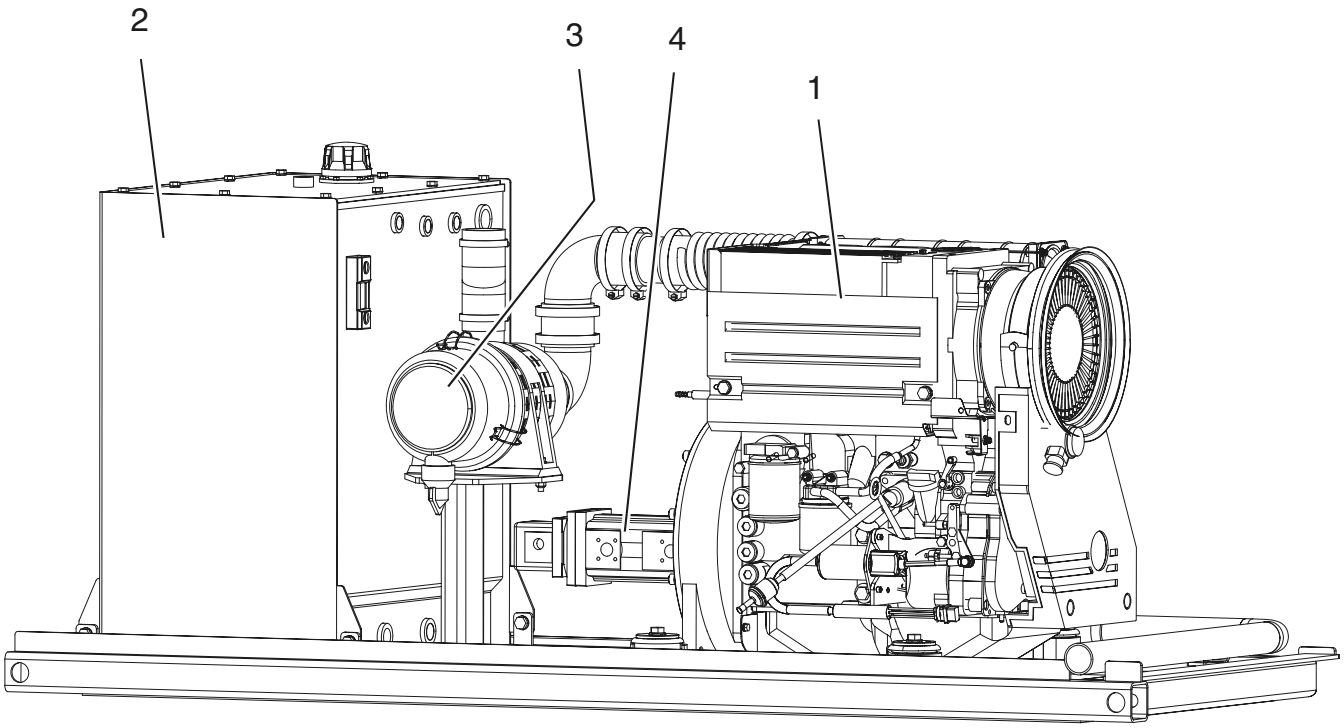
1. Open and secure Hood (1).
2. Remove Bolt (3) and Nut (4) on both Gas Springs (2). Return Hood to closed position.
3. Remove both Bolts (7) and Flatwashers (8) connecting hoods to the Cabinet Top Panel (5 & 6).

NOTE: *Step 4 applies only to the Engine Side Compartment.*

4. Remove the Air Intake Pipe (9) by removing the four Bolts (10), Flatwashers (11), and Locknuts (12).
5. Remove the Cabinet Top Panel (5 & 6) by removing the 4 Bolts (13), eight Flatwashers (14), and four Nuts (16).

NOTE: *Follow the steps in reverse order to re-attach the hood and top panel.*

Deutz Engine



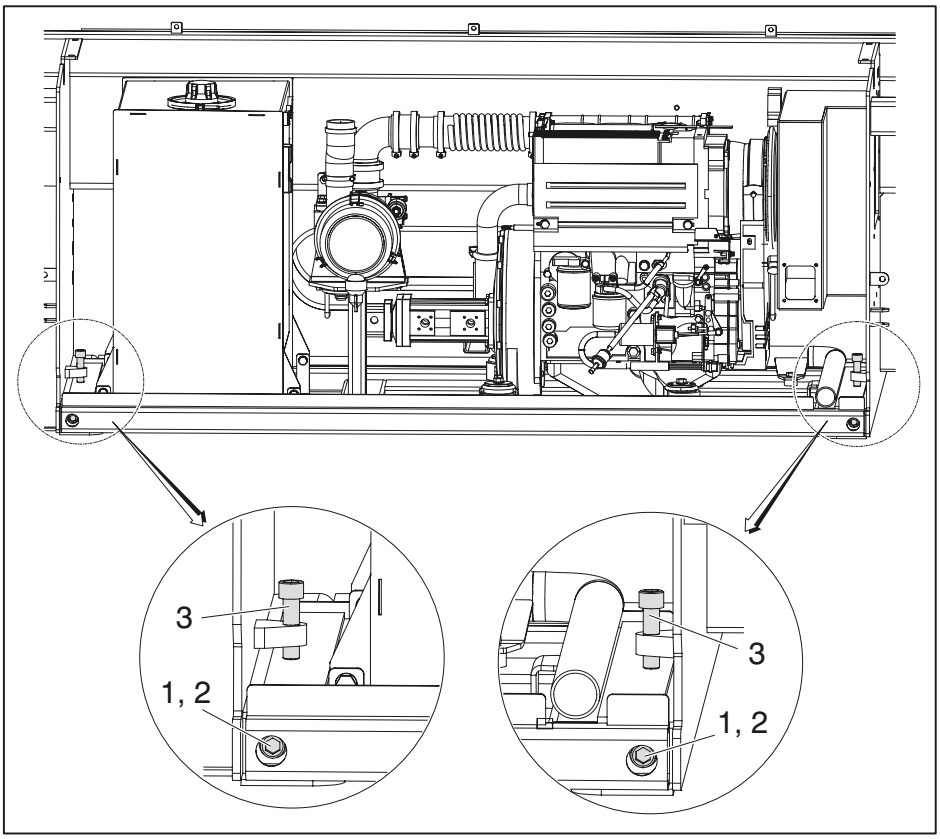
1. Deutz F3L2011
2. Hydraulic Tank
3. Air Filter
4. Hydraulic Pump

Figure 3-11. Deutz Engine

Table 3-4. Engine Technical Data

Type	F3L 2011F	D 2011 L03 i
Fuel	Diesel	
Number of Cylinders	3	
Cylinder Arrangement	Vertical In Line	
Bore	94 mm (3.7 in)	
Stroke	112 mm (4.4 in)	
Total Displacement	2.3L (140.4 in^3)	
Engine Speed	2300 rpm	
Swept Volume	2331 cm^3	
Voltage	24 Volts	

Engine Tray Slide



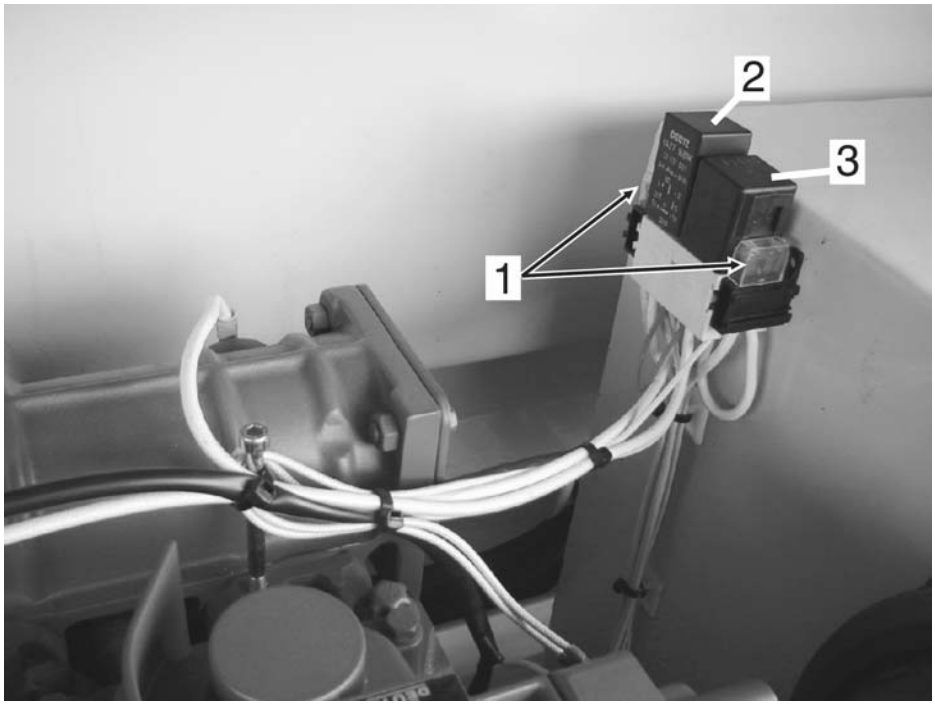
1. Bolt, M16 x 30mm
2. Lockwasher, M16
3. Bolt, M16 x 60mm

Figure 3-12. Engine Tray Slide

The engine tray can be slid outward approximately 15 cm (5.9 in.) when servicing components inside the engine compartment.

1. Remove the two Bolts (1) and Lockwashers (2) on the front of the engine tray.
2. Loosen the two top Bolts (3) at both ends of the engine compartment. Slide engine tray outward.
3. Be sure to return engine tray to stowed position when finished servicing. Secure engine tray with the two front Bolts (1) and Lockwashers (2) and two top Bolts (3).

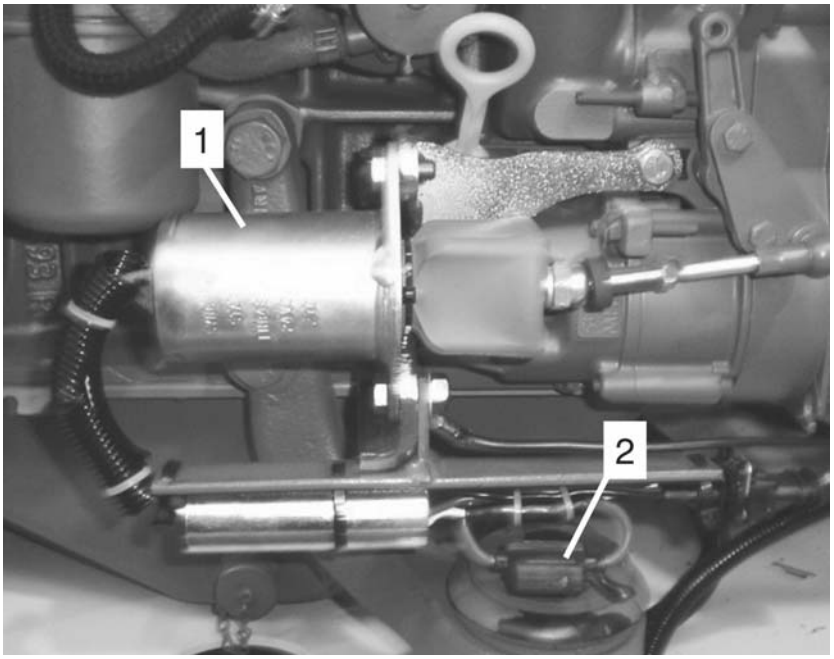
Glow Plugs



1. 30 amp Fuses
2. Timer Relay N6
3. Relay K3

Figure 3-13. Glow Plugs

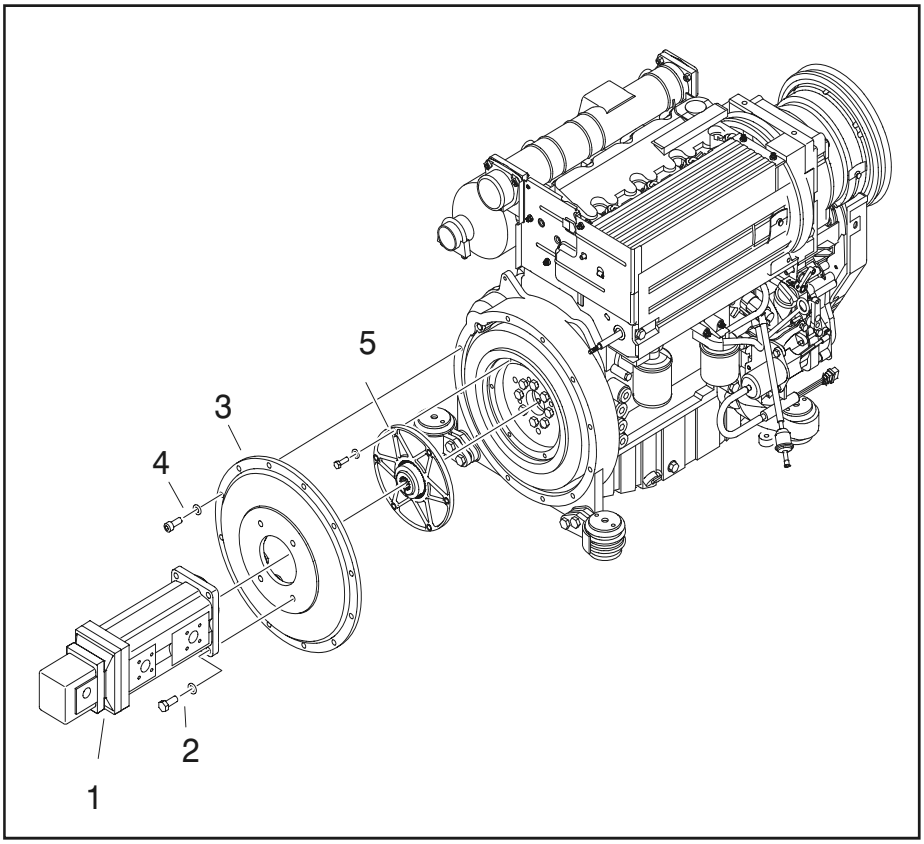
Engine Solenoid



1. Solenoid
2. 30 amp Fuse

Figure 3-14. Engine Solenoid

Gear Pump Assembly



1. Hydraulic Pump
2. Bolt (M8 x 25mm) and Lockwasher (M8)
3. Pump Mounting Flange
4. Capscrew (M8 x 25mm) and Lockwasher (M10)
5. Coupling

Figure 3-15. Gear Pump Assembly

Removal:

1. Shut off flow of hydraulic fluid to the Pump (1).
2. Disconnect any hoses and/or wires attached to the pump.
3. Remove the 4 Bolts and Lockwashers (2) connecting the pump to the Pump Mountng Flange (3). Carefully remove the pump.
4. To remove the pump mounting flange, unscrew the 12 Capscrews and Lockwashers (4).
5. The Coupling (5) can be removed by unscrewing the 6 Screws and Lockwashers (6).

Installation:

1. Follow the Removal steps in reverse order, installaing components as opposed to removing them.

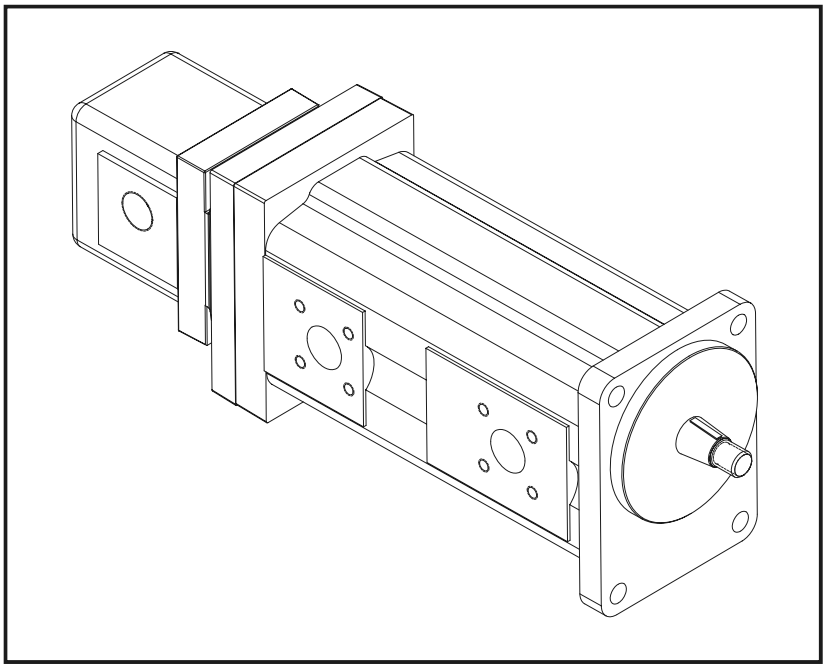


Figure 3-16. Gear Pump

Table 3-5. Gear Pump Specs.

FIRST STAGE	
Displacement	22,8 cc/rev
Rated Pressure	180 bar (2611 psi)
Peak Pressure	200 bar (2901 psi)
Maximum Speed	3000 rpm
Minimum Speed at Rated Pressure	1000 rpm
SECOND STAGE	
Displacement	8,4 cc/rev
Rated Pressure	250 bar (3626 ps)
Peak Pressure	280 bar (4061 psi)
Maximum Speed	4000 rpm
Minimum Speed at Rated Pressure	1000 rpm
THIRD STAGE	
Displacement	2 ,09 cc/rev
Rated Pressure	250 bar (3626 psi)
Peak Pressure	270 bar (3916 psi)
Maximum Speed	4000 rpm
Minimum Speed at Rated Pressure	1000 rpm

Operation:

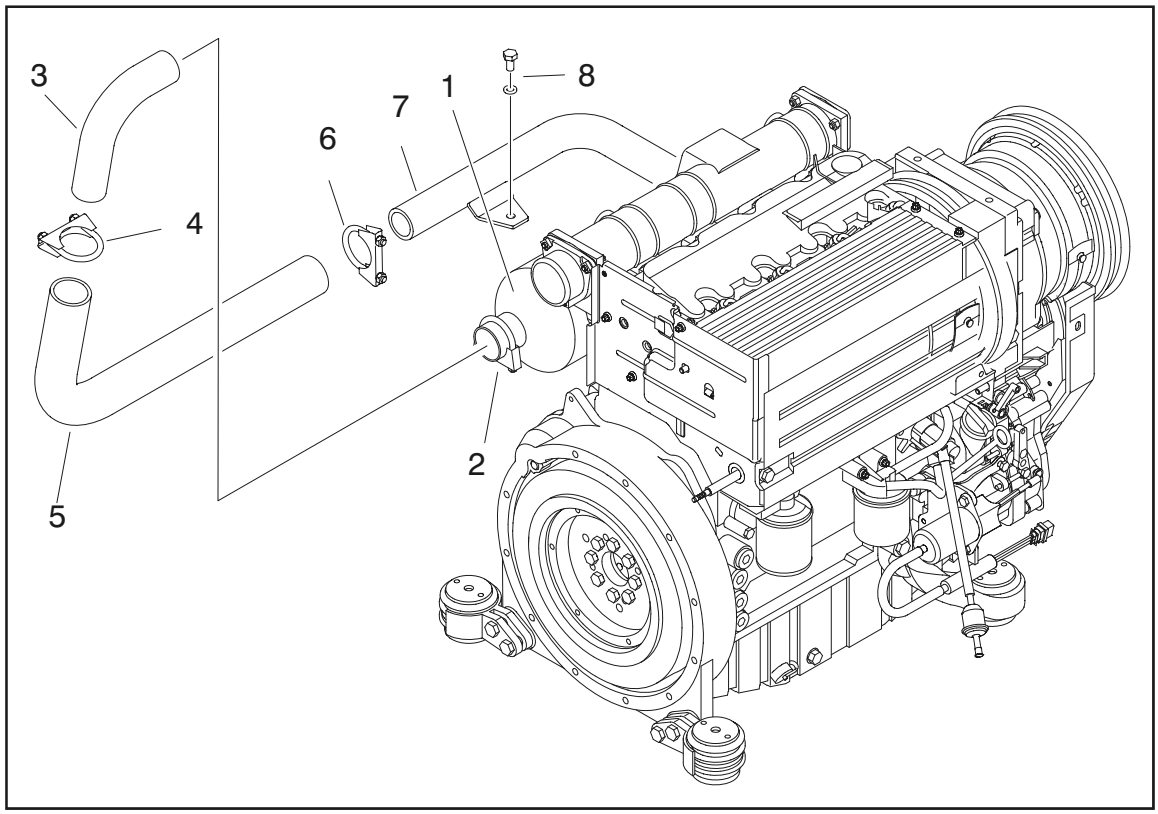
3 Sections to the pump:

- Section 1 (22.5cc/rev - 51 L/m) Main flow to control valve.
- Section 2 (8cc/rev - 18 L/m) Secondary flow to control valve
- Section 3 (2cc/rev - 4.5 L/m) Flow to steering valve

Pump Flow

- Flow from the first 2 pump sections to the control valve is protected by dump valves which normally open to tank ports. To generate hydraulic power to the control valve, the dump valves need to be activated. Section 1 valve for main flow and section 2 valve to enable high drive speed.

Exhaust Pipe Assembly



1. Muffler
2. Exhaust Clamp
3. Exhaust Elbow
4. Exhaust Clamp
5. Exhaust Flex Pipe
6. Exhaust Clamp
7. Tailpipe
8. Bolt (M10 x 20mm) and Lockwasher (M10)

Figure 3-17. Exhaust Pipe Assembly

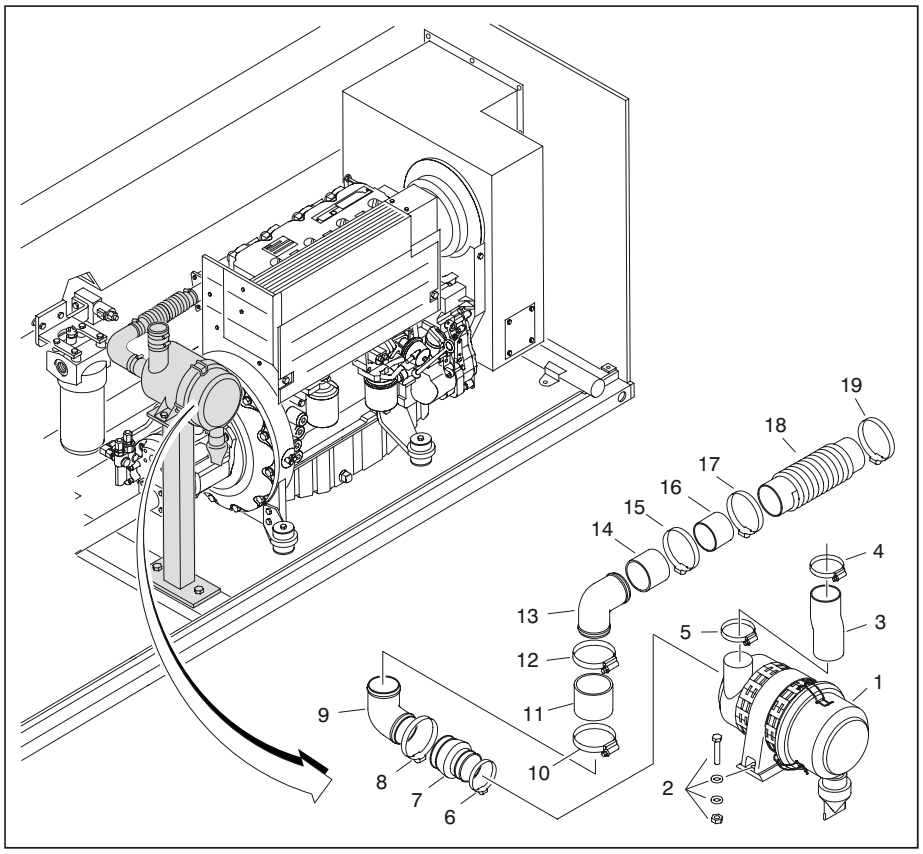
NOTE: *In the event any or all exhaust piping needs repaired or replaced follow the below steps. Refer to Figure 3-17., Exhaust Pipe Assembly.*

1. Loosen the Exhaust Clamp (2) located on the muffler (2).
2. Slide the Exhaust Elbow (3) out of the muffler.
3. Loosen the Exhaust Clamp (4).
4. The exhaust elbow can now be removed.
5. Remove the Exhaust Flex Pipe (5) by loosening the Exhaust Clamp (6). Slide the pipe out of the Tailpipe (7).
6. The tail pipe can be removed by unscrewing the Bolt (8) connecting it to the engine tray.

Installation:

1. Follow the steps in reverse order to assemble the exhaust system. Take care to securely tighten the exhaust clamps.

Air Filter Assembly



1. Air Filter
2. Bolt, Nut, Flatwasher
3. Intake Hose
4. Hose Clamp
5. Hose Clamp
6. Hose Clamp
7. Reducing Sleeve
8. Hose Clamp
9. Air Intake Elbow
10. Hose Clamp
11. Air Intake Tube
12. Hose Clamp
13. Air Intake Elbow
14. Air Intake Tube
15. Hose Clamp
16. Intake Pipe
17. Hose Clamp
18. Rubber Intake Tube
19. Hose Clamp

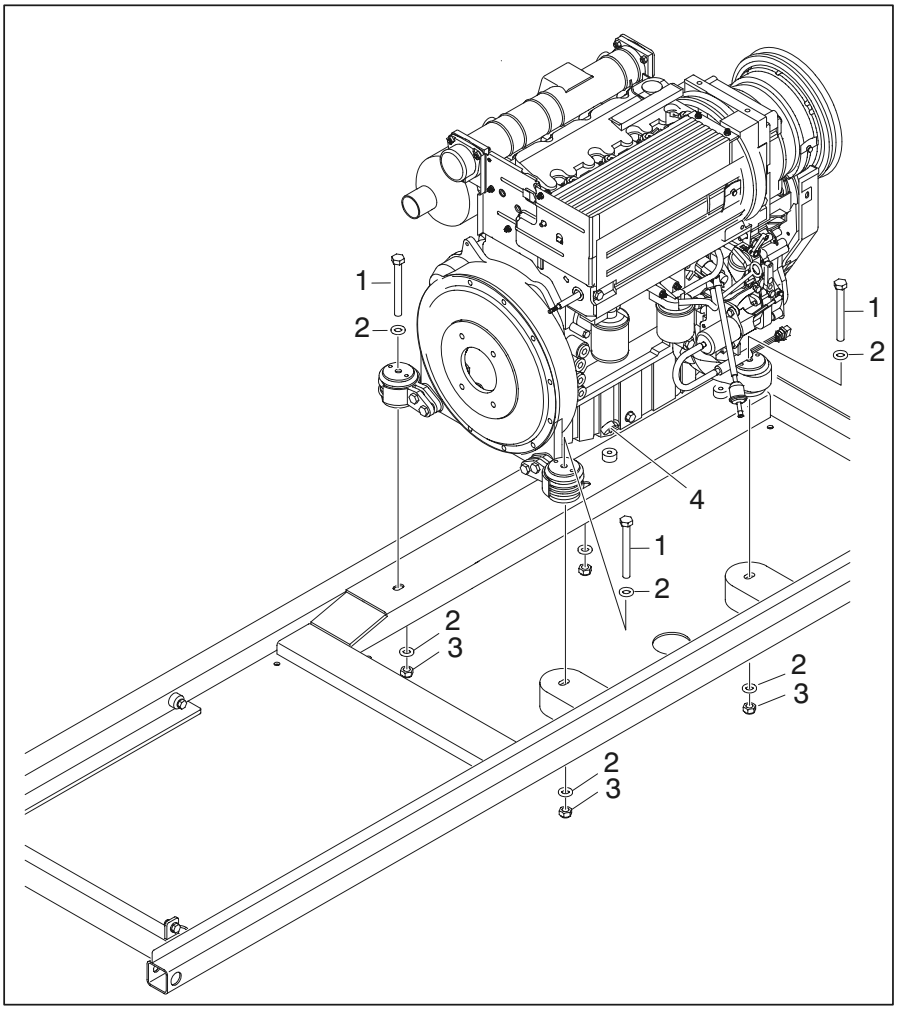
Figure 3-18. Air Filter Assembly

NOTE: *Refer to Figure 3-18. when dismantling the Air Filter for service and/or replacements.*

1. Removing the pipes and tubes requires loosening the hose clamps. Once the hose clamps are loosened, the tubes and pipes can be removed for maintenance or replacement.
2. To remove the Air Filter (1), unscrew the 2 Bolts (2). Remove the air cleaner from the bracket.
3. Lift the latches on the end of the Air Filter to access the safety element (not shown).

NOTE: *When assembling the air filter system, take care to securely fit all tubing and piping together and to securely tighten all hose clamps.*

Engine Removal



1. Bolt, M12 x 110 mm
2. Flatwasher, M12
3. Nut, M12
4. Oil Drain Port

Figure 3-19. Engine Removal

NOTE: *Refer to Figure 3-19. when removing engine from engine compartment.*

⚠ WARNING

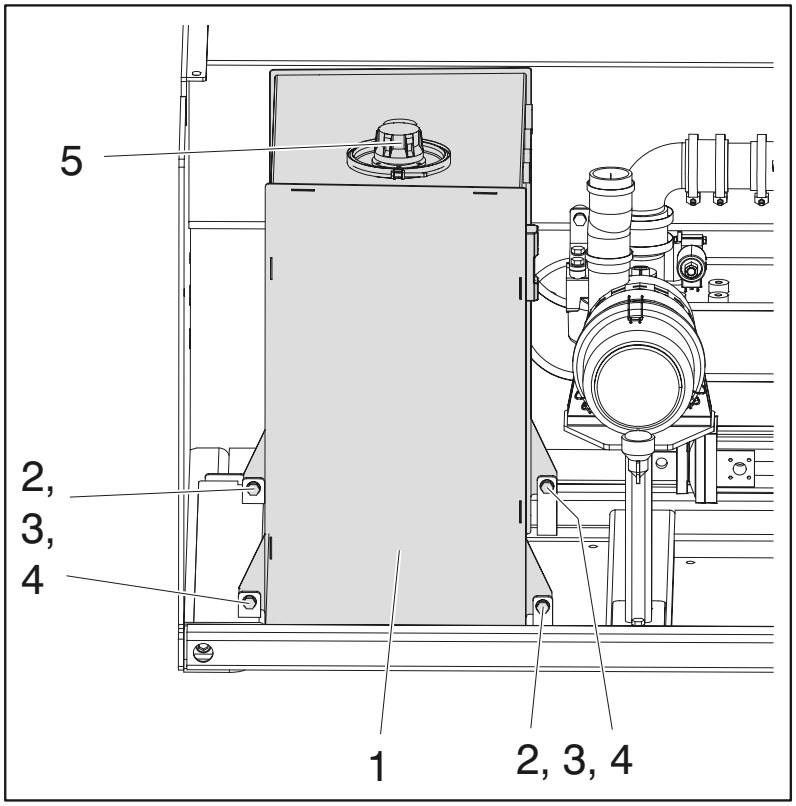
ENGINE REMOVAL REQUIRES HEAVY LIFTING DEVICES. USE EXTREME CAUTION WHEN REMOVING THE ENGINE.

1. Disconnect all electrical wires, hoses, pipes, etc.
2. Secure engine with appropriate lifting device. (Refer to Deutz Operation Manual included with the machine)
3. Remove 4 Nuts (3) and Flatwashers (2) from the underside of the engine tray.
4. Remove all 4 Bolts (1) and second set of Flatwashers.
5. Carefully lift engine from engine compartment with appropriate lifting device.

NOTE: *When installing the engine, follow the steps in reverse order.*

The machine comes with an engine oil drain hose (located in the plastic bag in the valve compartment) to use when draining the oil from the engine. Remove the cover on the Oil Drain Port (4). Attach the drain hose to the Port . The valve on the hose releases the valve on the Port to drain the oil. Run the hose through the opening on the bottom of the engine tray.

Hydraulic Tank



1. Hydraulic Tank
2. Capscrew, M10 x 25mm
3. Flatwasher, M10 (2 per capscrew)
4. Nut, M10
5. Filler
6. Shutoff Valve Levers

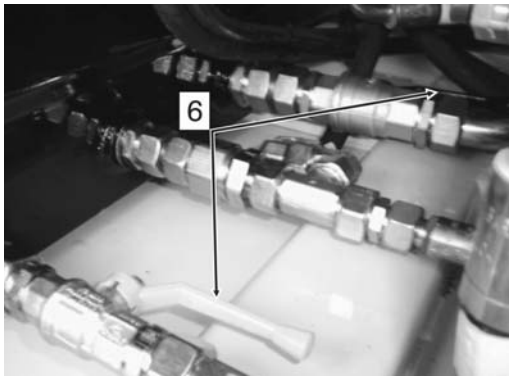


Figure 3-20. Hydraulic Tank Removal

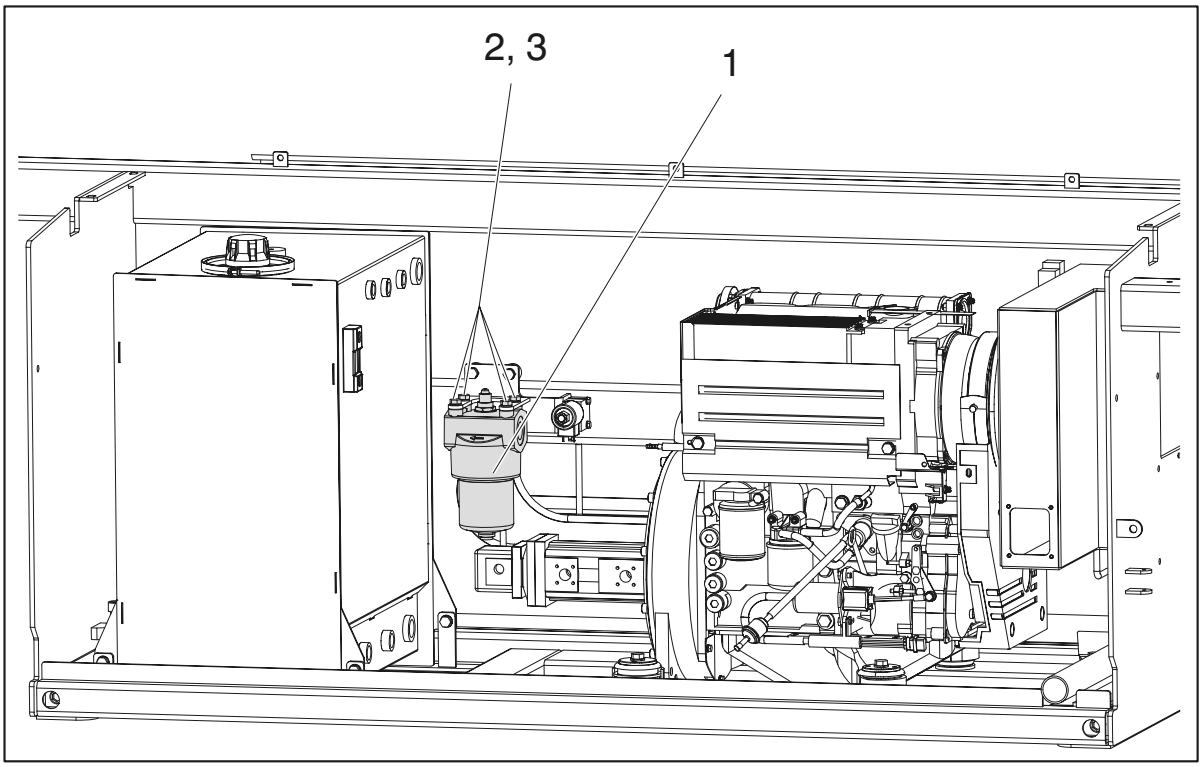
Removal:

1. Shut the two valve levers (6) at the base of the tank to turn off flow of hydraulic fluld. Drain hydraulic fluid by opening the drain port on underside of the Hydraulic Tank (1). Store fluid in appropriate receptacle. Disconnect all hoses.
2. Remove hydraulic tank by removing the four Capscrews (2), Nuts (4) and eight Flatwashers (3).
3. Carefully remove the tank from the engine compartment.

Installation:

1. Place tank into engine compartment lining up the bolt holes.
2. Replace Capscrews, Flatwashers and Nuts into their respectable holes. Tighten.
3. Replace all hydraulic hoses.
4. Ensure the drain port is closed.
5. If required, replace Filter.
6. Remove Filler cap (5) and fill tank with hydraulic fluid to its designated capacity, 135 L (37 gal).
7. Open valve lever to turn on flow of hydraulic fluid.

Pressure Filter



1. Pressure Filter
2. Capscrew, M10 x 20mm
3. Lockwasher, M10

Figure 3-21. Pressure Filter Removal

Removal:

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

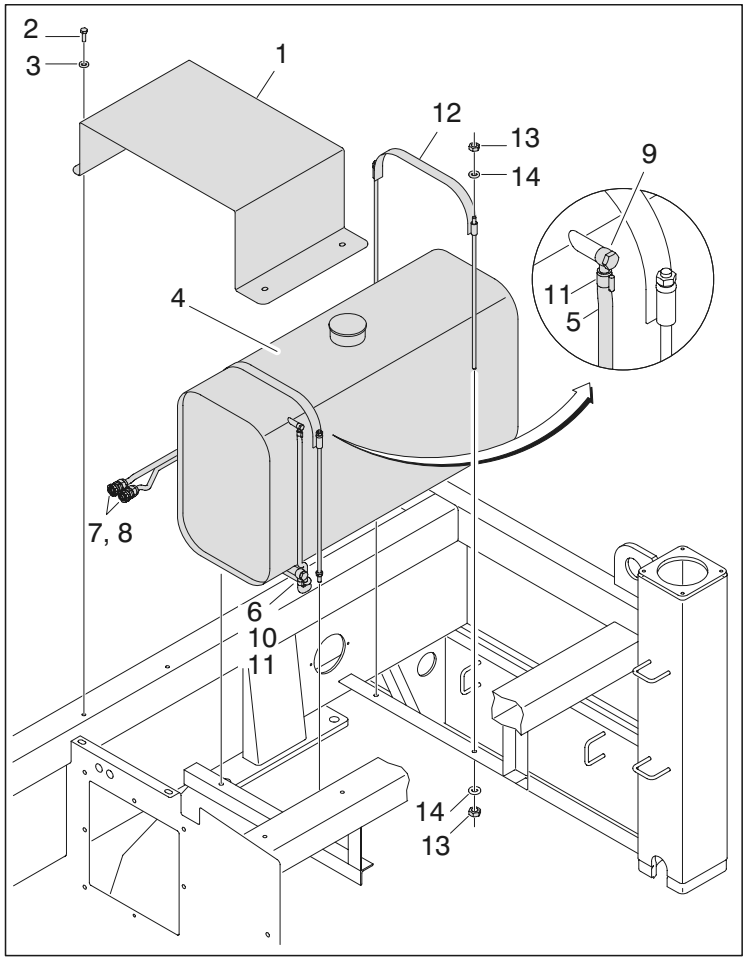
Installation:

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

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

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

3.7 FUEL TANK



1. Fuel Tank Shield
2. Bolt, M10 x 12mm
3. Lockwasher, M10
4. Fuel Tank
5. Fuel Line Hose, 5.5mm
6. Fuel Line Hose, 7.5mm
7. Strain Relief Connector
8. Strain Relief Nut
9. Hose Fitting
10. Hose Fitting
11. Clamp
12. Fuel Tank Strap
13. Nut, M8
14. Lockwasher, M8

Figure 3-22. Fuel Tank Removal

Removal:

NOTE: *Drain Fuel Tank (4) before removing. Store diesel fuel in approved receptacle.*

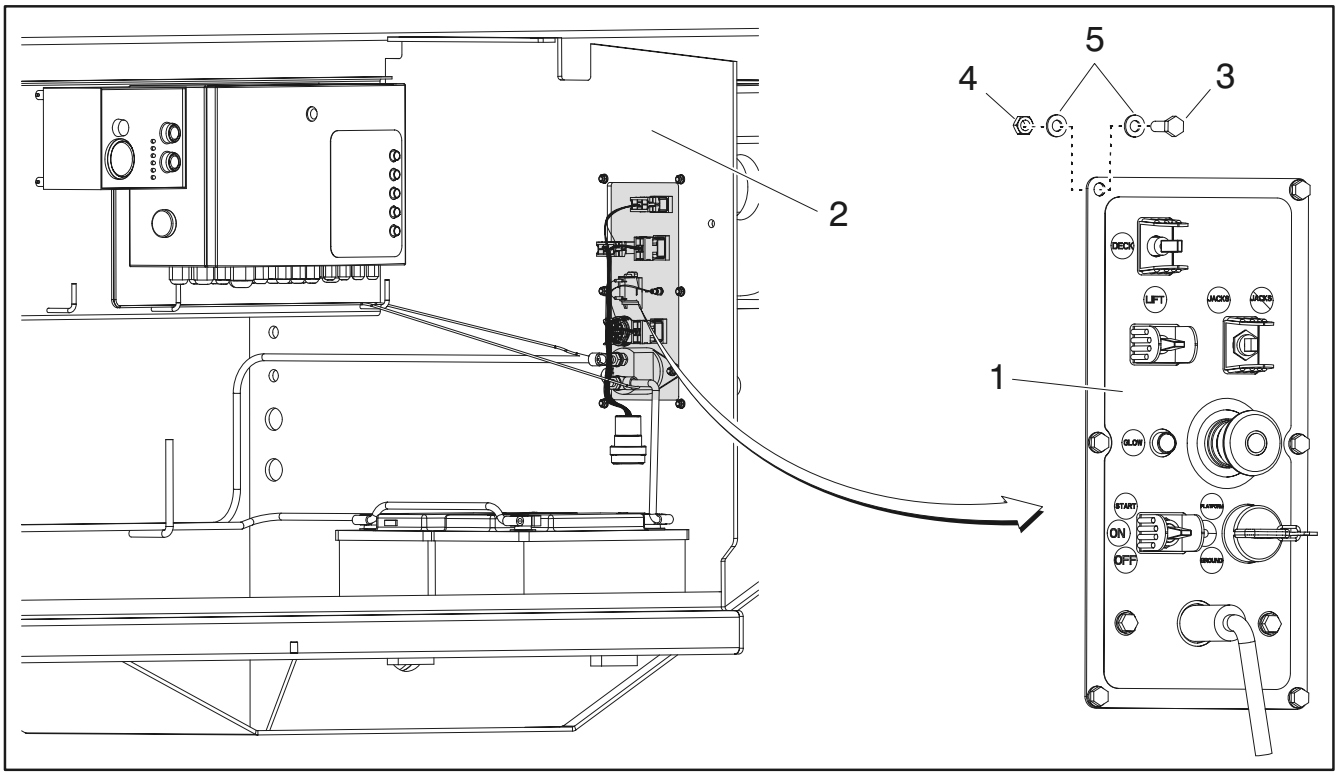
1. Remove Fuel Tank Shield (1) by removing the four Bolts (2) and Lockwashers (3).
2. Disconnect the Fuel Line Hoses (5, 6) from the engine compartment by unscrewing and removing the Strain Relief Nut (8) from the inside of the compartment.
3. The fuel line hoses can be removed from the fuel tank by removing the Hose Fittings (9, 10). The hoses can be removed from the Hose Fittings by removing the Clamps (11).
4. Remove the Fuel Tank (4) by removing the four Nuts (13) and Lockwashers (14) on the two fuel Tank Straps (12).

Installation:

1. Place Fuel Tank onto the chassis. Secure tank with Fuel Tank Strap. Fasten with Bolts and Lockwashers.
2. If applicable, secure Hose Fittings to Hoses with Clamps. Connect Fuel Line Hoses to Tank.
3. Reconnect the Fuel Line Hoses to the engine compartment by screwing the Strain Relief Nut on the inside of the compartment.
4. Install the Fuel Tank Shield by replacing the four Bolts and Lockwashers.
5. Refuel Tank with diesel fuel.

NOTE: *Empty fuel tank weighs approximately 16.6 kg (36.6 lbs).*

3.8 GROUND CONTROL PANEL



1. Ground Control Panel
2. Electrical Compartment
3. Bolt, M6 x 20mm
4. Nut, M6
5. Flatwashers, M6

Figure 3-23. Ground Control Panel Removal

Removal:

NOTICE

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

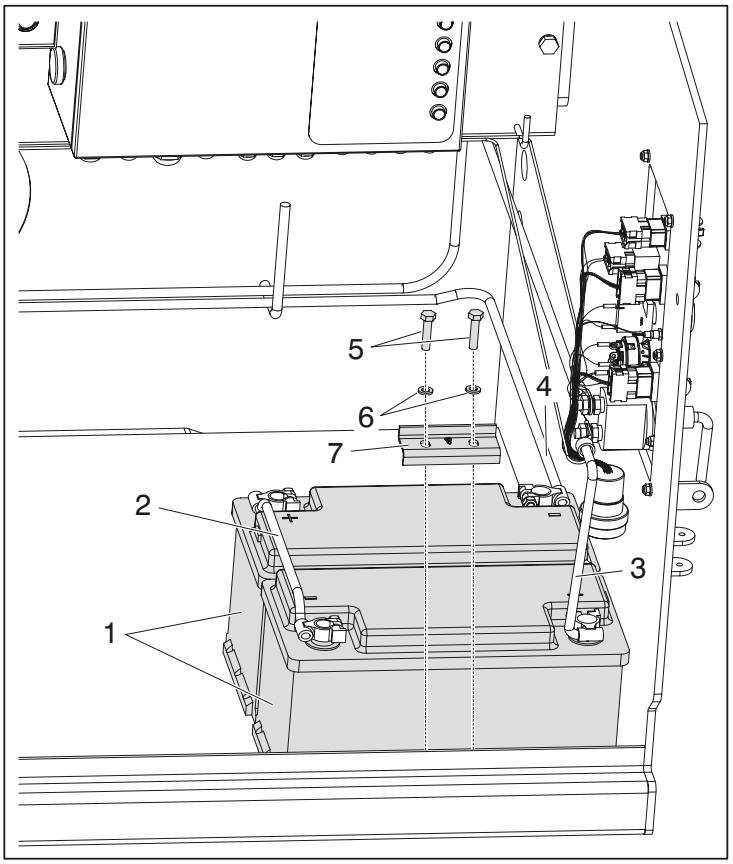
1. Disconnect all plugs and wires from the back of the control panel.
2. Remove the panel from the the Electrical Compartment (2) by removing the six Bolts (3), Nuts (4), and twelve Flatwashers (5).

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 LED's and switches work properly.

3.9 BATTERY REMOVAL



1. Batteries
2. Battery Cable (Battery - to Battery +)
3. Battery Cable (Battery + to Battery Disconnector)
4. Battery Cable (Battery - to Engine)
5. Bolts, M8 x 35mm
6. Lockwashers, M8
7. Battery Hold Clamp

NOTE: *Items 5, 6, and 7 are also located on the back side of the battery (not shown)*

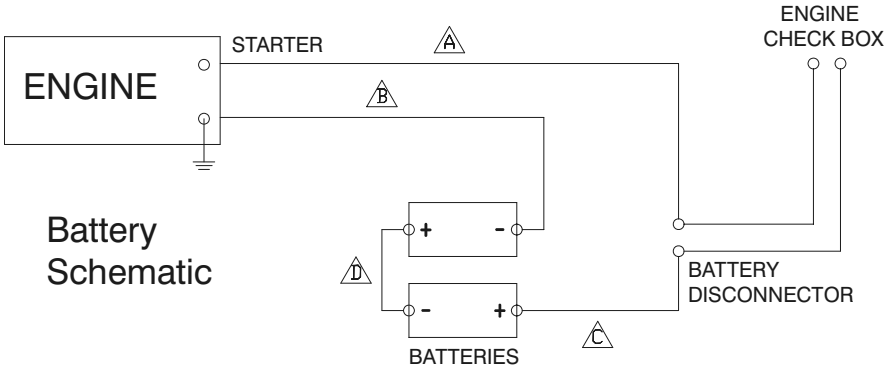


Figure 3-24. Battery Removal

Removal:

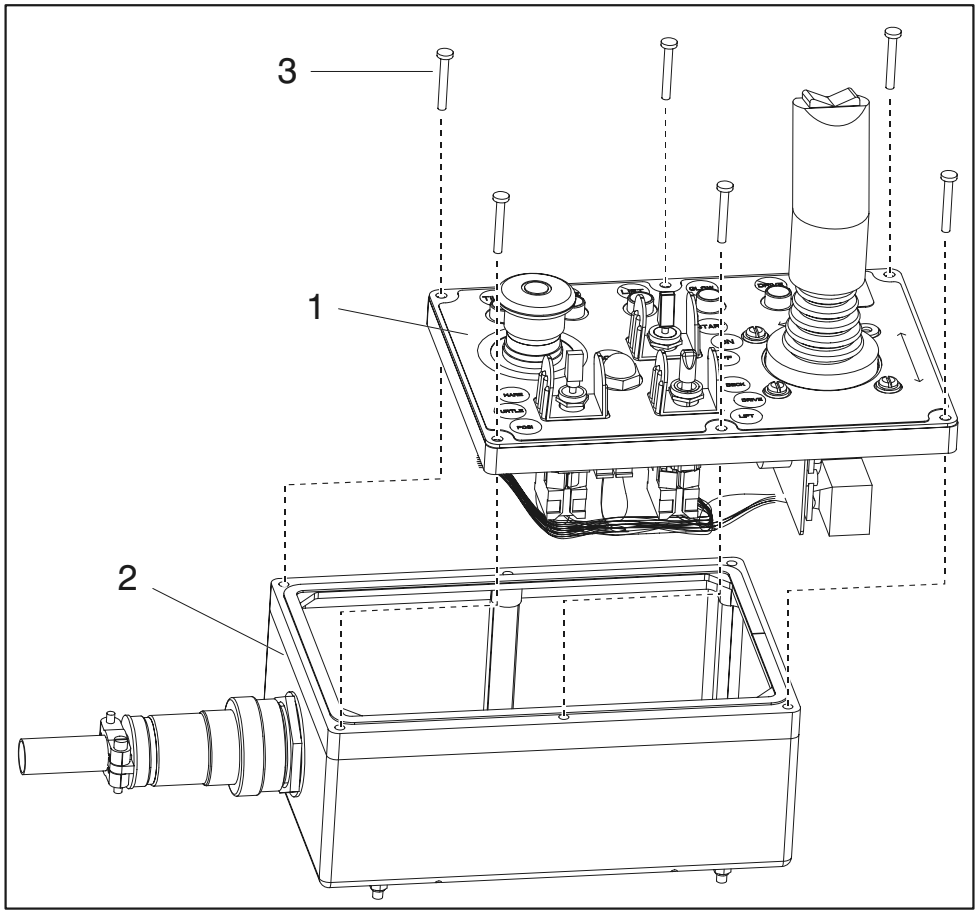
1. Disconnect and remove the Battery Cables (2, 3, 4) from the battery terminals. Loosen the bolt on the terminal clamps to remove the cables.
2. Remove the Bolts (5), Flatwashers (6) securing both the front (shown) and rear (not shown) Battery Hold Clamp (7) to the electrical compartment.
3. Remove the Battery Hold Clamp.
4. Remove Batteries(1).

Installation:

1. Place Batteries into electrical compartment.
2. Align Battery Hold Clamps with bolt holes on floor.
3. Secure Clamps with Bolts and Lockwashers.
4. Reconnect Battery Cables to the battery terminals. Tighten bolt on the terminal clamps.

3.10 PLATFORM

Platform Control Box



1. Control Box Lid
2. Control Box
3. Screw, M4 x 30mm

Figure 3-25. 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.*

Joystick Controller

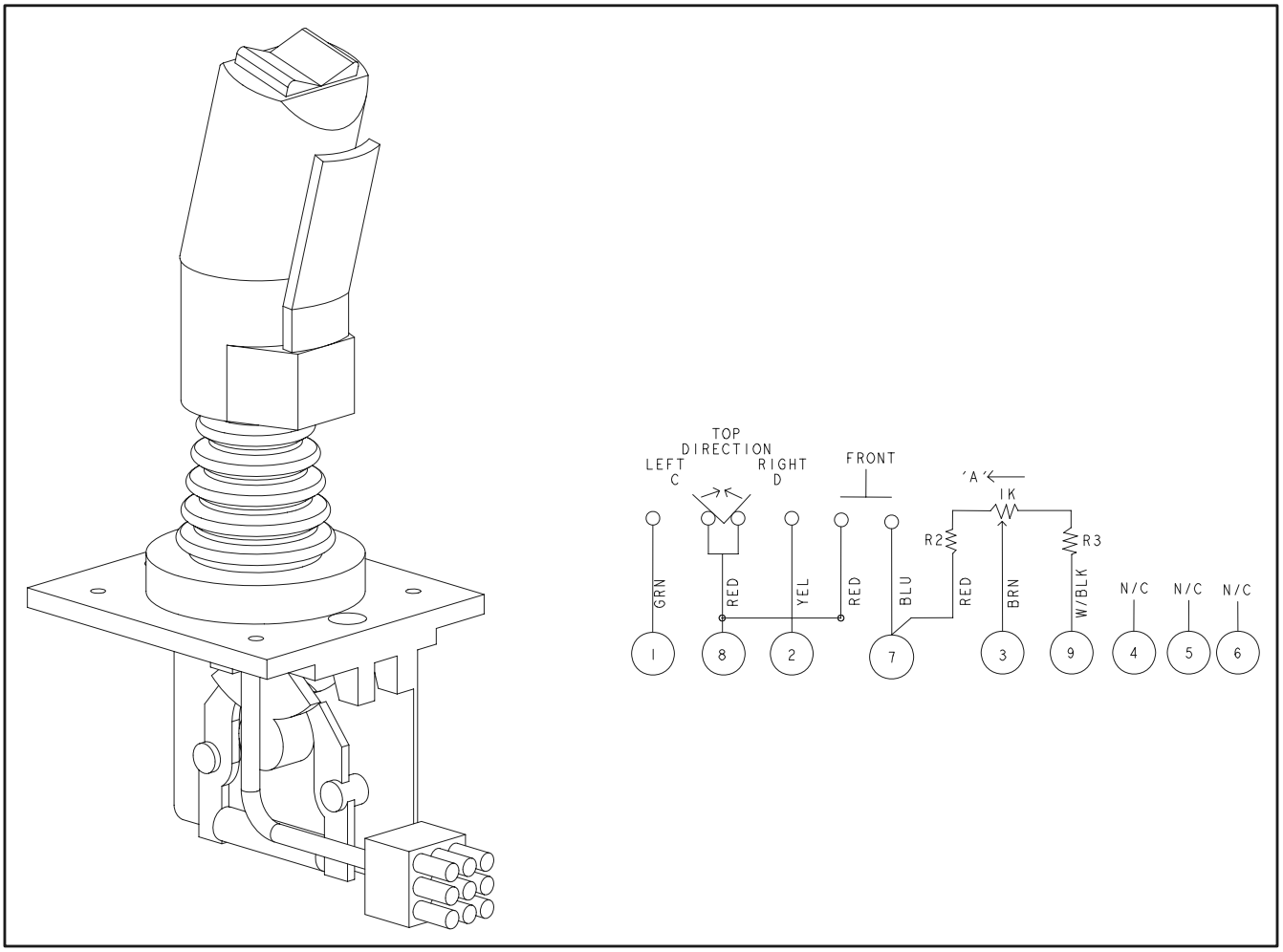


Figure 3-26. Joystick

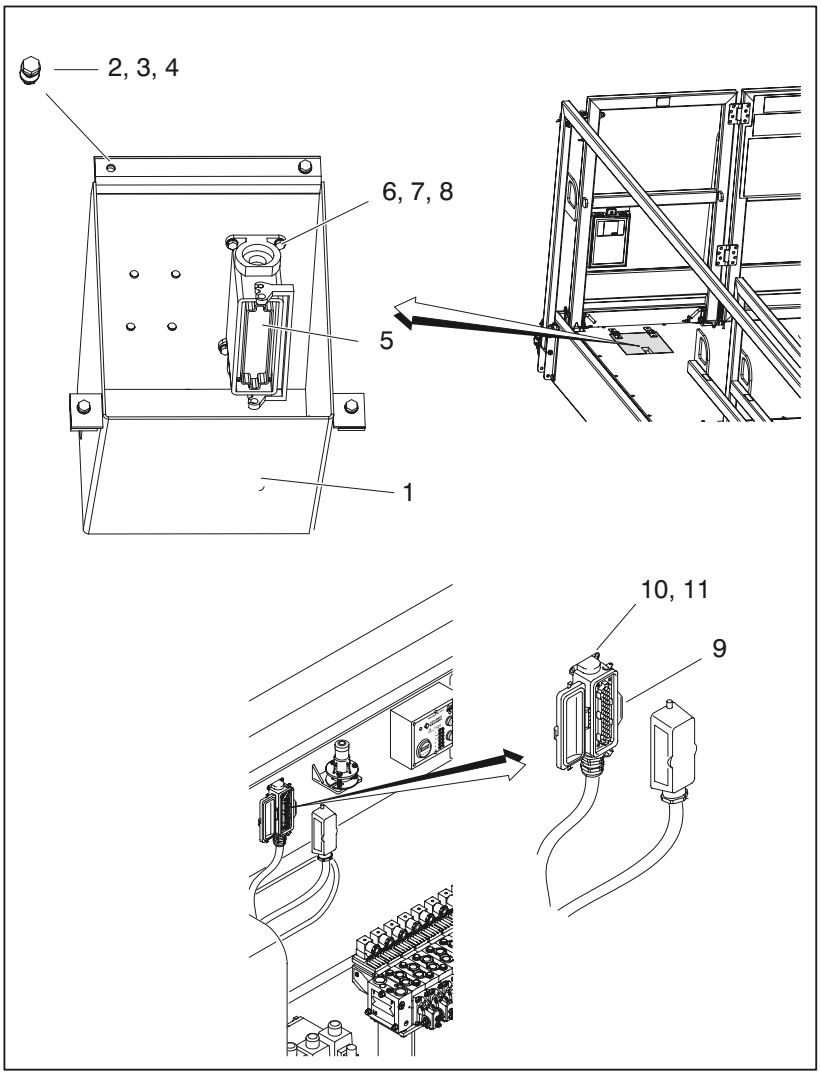
Table 3-6. Joystick Specifications

Input Voltage	24V (±0.05V)
Centered Output Voltage	12V (±0.25V)
Reverse Voltage	5.5 - 6.5V
Forward Voltage	17.5 - 18.5V

Table 3-7. Plug Loading Chart

Terminal	Color	Function
1	Green	Steer Left
2	Yellow	Steer Right
3	Brown	Pot Out
4	N/C	
5	N/C	
6	N/C	
7	Blue	24V In
8	Red	Enable / 24V Out
9	White / Black	Ground

Receptacles



1. Receptacle Box
2. Bolt, M6 x 20mm
3. Flatwasher, M6 (qty 2)
4. Nut, M6
5. Platform Control Box Outlet
6. Bolt, M5 x 16
7. Flatwasher, M5 (qty 2)
8. Nut, M5
9. Ground Receptacle
10. Bolt, M5 x 10mm
11. Lockwasher, M5

Figure 3-27. Platform Receptacle Box Removal

⚠ WARNING

DISCONNECT BATTERY SUPPLY ON GROUND CONTROL PANEL BEFORE REMOVING RECEPTACLE BOX.

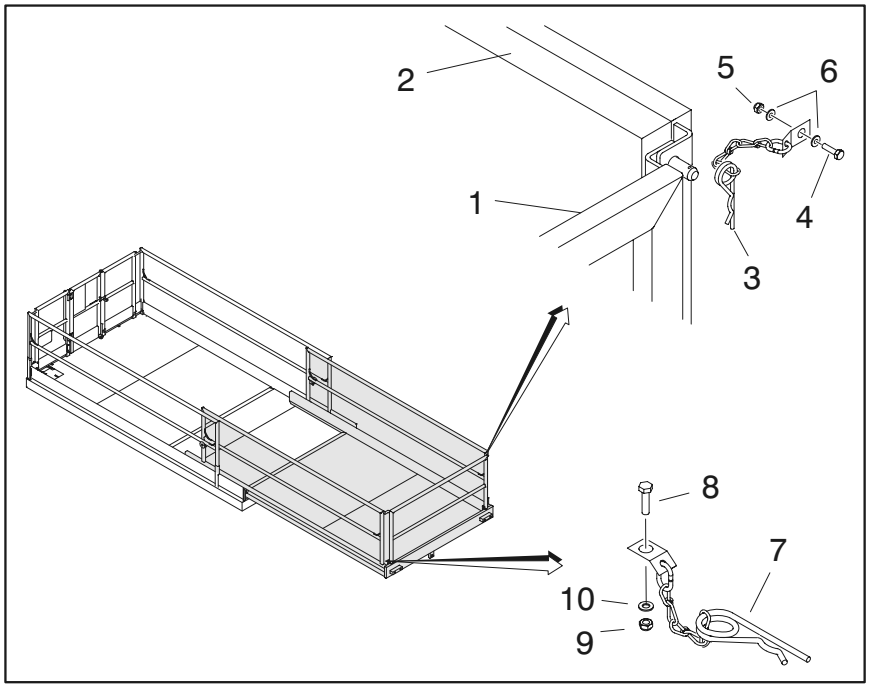
Removal:

1. Remove front platform floor panel to expose the bolts connecting the Receptacle Box (1) to the platform.
2. Disconnect all wires connected to the Receptacle (5) and Platform Control Box Outlet (6).
3. Remove the four Bolts (2), eight Flatwashers (3), and four Nuts (4).
4. Lift box from platform.
5. The Receptacle (5) can be removed from the box by removing the four screws on the backside.
6. The Platform Control Box Outlet (6) can be removed by removing the four Bolts (7), eight Flatwashers (8), and four Nuts (9).
7. The Ground Receptacle (9) can be removed by removing the four Bolts (10) and Lockwashers (11).

Installation:

1. Follow Removal steps in reverse order.

Extension End Rails



1. Extension End Rail
2. Extension Side Rail
3. Spring Cotter
4. Bolt, M8 x 20mm
5. Nut, M8
6. Flatwasher, M8
7. Spring Cotter
8. Capscrew, M10 x 80mm
9. Locknut, M10
10. Washer, 10mm

Figure 3-28. Extension End Rail Removal

NOTE: *Before rails can be lowered, loosen the bolt on the plastic rail-guide rollers and lower the roller so that it is not hindering the lowering of the rails.*

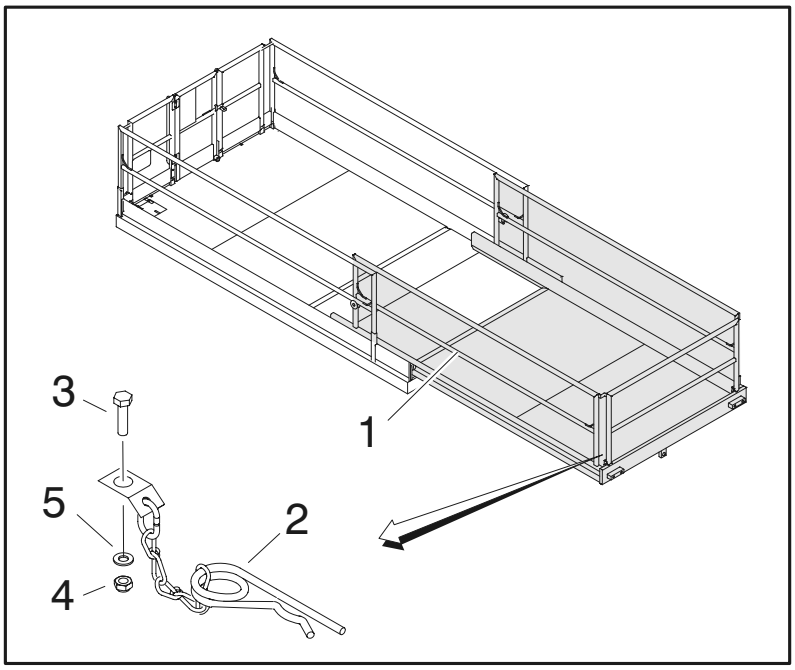
Removal:

1. Disconnect End Rail (1) from Side Rail (2) by removing the two Spring Cotters (3).
2. The Chain Assembly can be removed from the End Rail by removing the Bolts (4), Nuts (5), and Flatwashers (6).
3. Remove the Spring Cotter (7) on each leg of the End Rail. Carefully fold the end rail inward to its stowed postion.
4. The End Rail can be removed by removing the Capscrews (8), Locknuts (9), and Washers (10) on each leg of the End Rail.

Installation:

1. Lay end rail on the platform deck in the rails stowed position, lining up the bolt holes with the appropriate connection points on the platform.
2. Follow the removal instructions in reverse order.

Extension Side Rails



1. Extension Side Rail
2. Spring Cotter
3. Capscrew, M10 x 80mm
4. Locknut, M10
5. Washer, 10mm

Figure 3-29. Extension Side Rail Removal

NOTE: *Stow or remove the Extension End Rail before removing the Extension Side Rails. (See the procedures on the previous page).*

Removal:

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

1. Remove the Spring Cotters (2) on each leg of the Side Rail (1).
2. Carefully fold the rails inward to the stowed position.
3. Remove the rail by removing the Capscrews (3), Locknuts (4), and Washers (5) from each leg of the rail.

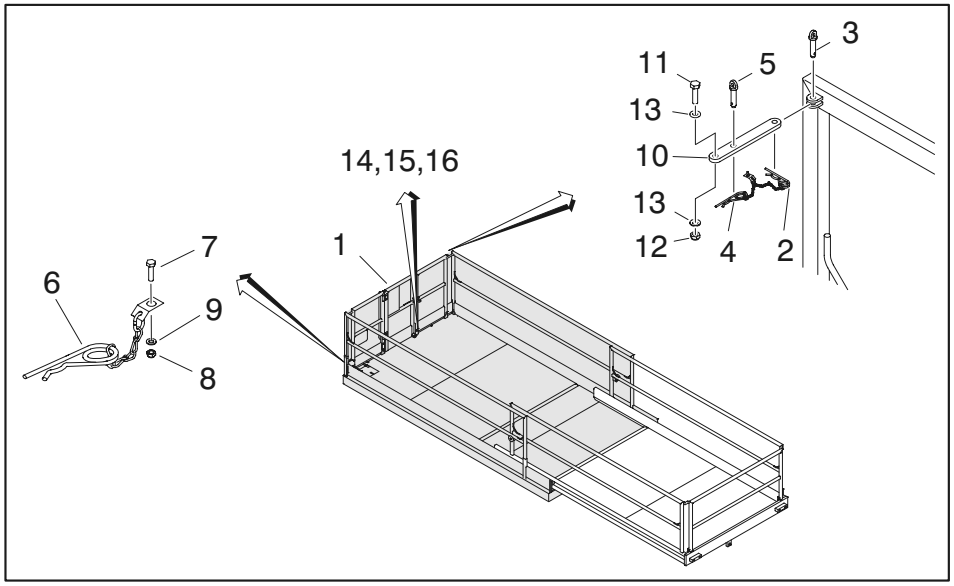
NOTE: *Extension side rails weigh approximately 19.5 kg (43 lbs) each.*

Installation:

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

1. Carefully place extension 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.

Main Platform End Rails



1. End Rails (Right, Left, and Gate)
2. Hairpin Spring, M3
3. Pin
4. Hairpin Spring, M3
5. Pin
6. Hairpin Spring, M4
7. Bolt, M8 x 20mm
8. Nut, M8
9. Flatwasher, M8
10. Link
11. Bolt, M10 x 40mm
12. Nut, M10
13. Flatwasher, M10
14. Bolt, M10 x 80mm
15. Nut, M10
16. Flatwasher, M10

Figure 3-30. End Rail Removal

Removal:

1. Disconnect End Rails (1) from side rails by removing the Hairpin Springs (2). Remove the Pins (3).
2. Remove second set of Hairpin Springs (4) and Pins (5).
3. Rotate Link (10) to opposite side.
4. Remove Hairpin Springs (6) on the legs of the end rails.
5. Carefully fold end rails inward so they are in the stowed position.
6. Remove the end rails from the platform by removing the four Bolts (14), Nuts (15), and Flatwashers (16).

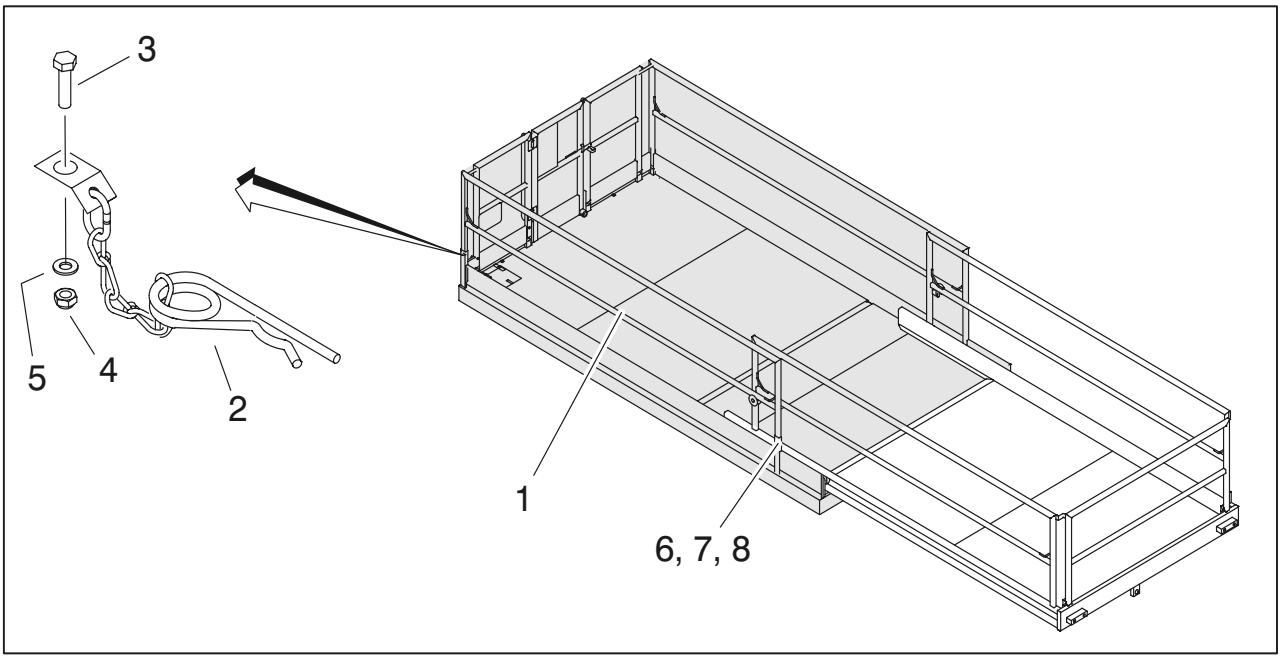
NOTE: *The gate can be detached from the left end rail by removing the screws on each of the hinges.*

Installation:

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

NOTE: *The gate can be attached to the left end rail by replacing the screws on each of the hinges.*

Main Platform Side Rails



1. Side Rail
2. Hairpin Spring, M4
3. Bolt, M8 x 20mm
4. Nut, M8
5. Flatwasher, M8
6. Capscrew, M10 x 80mm
7. Locknut, M10
8. Washer, 10mm

Figure 3-31. Side Rails Removal

NOTE: *Stow or remove Main Platform End Rails and Platform Extension Side Rails before removing the Main Platform side rails. (See instructions on previous pages).*

All removal procedures apply to both left and right sides.

Removal:

1. Remove the two Hairpin Springs (2) on each leg of the rail.
2. The Chain Assemblies can be removed from the platform by removing the Bolts (3), Nuts (4), and Flatwashers (5).
3. Carefully fold the rails inward to the stowed position.
4. Remove rails from the platform by removing the Capsrews (6), Locknuts (7), and Washers (8) from the legs on each rail.

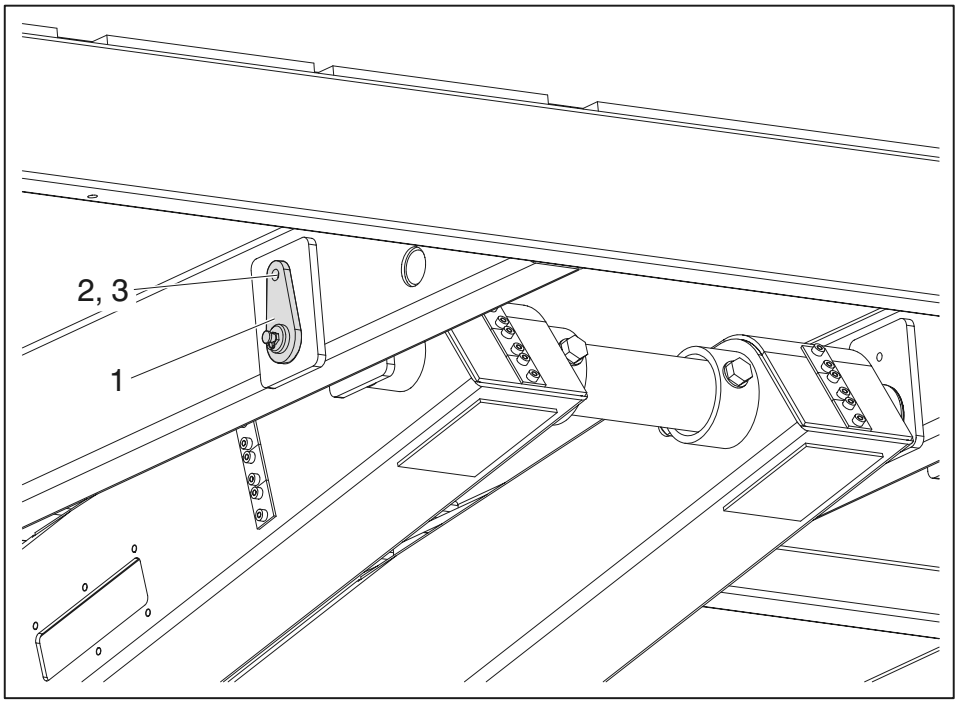
NOTE: *Each side rail weighs approximately 19.7 kg (43 lbs).*

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

Installation:

1. Carefully place 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, M20 x 35mm
3. Lockwasher, M20

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

Figure 3-32. Platform Removal - 1 of 2 (Front of Platform)

Machine Stabilization:

The arm stack can be supported by using an overhead crane, Figure 4-28. If an overhead crane is not available the stack may also be lifted by using a forktruck using the following instructions:

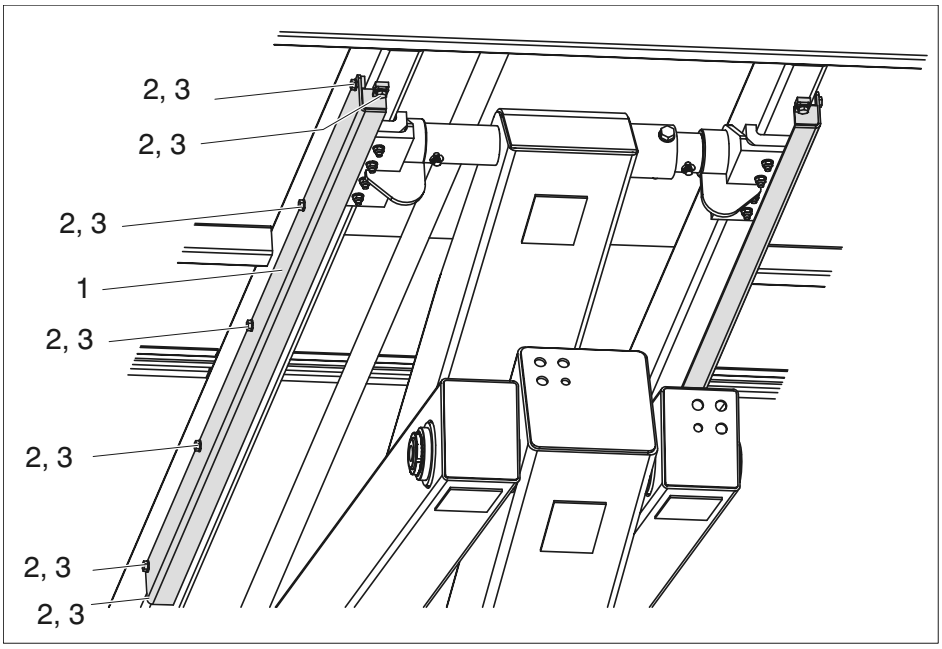
1. With the forks on the forktruck slid close together, enter from the front of the machine and place the forks on the cross tube of the second arm weldment below the platform.
2. Slowly lift the arm stack with the forktruck while the manual descent valve is being engaged (this allows the oil to drain 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 two Bolts (2) and Lockwashers (3) attaching the two Platform Pivot Pins (1) to the Platform.
4. Continue on to the rear of the machine. (See next page)



1. Platform Retaining Bracket
2. Capscrew, M10 x 20mm
3. Flatwasher, M10

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

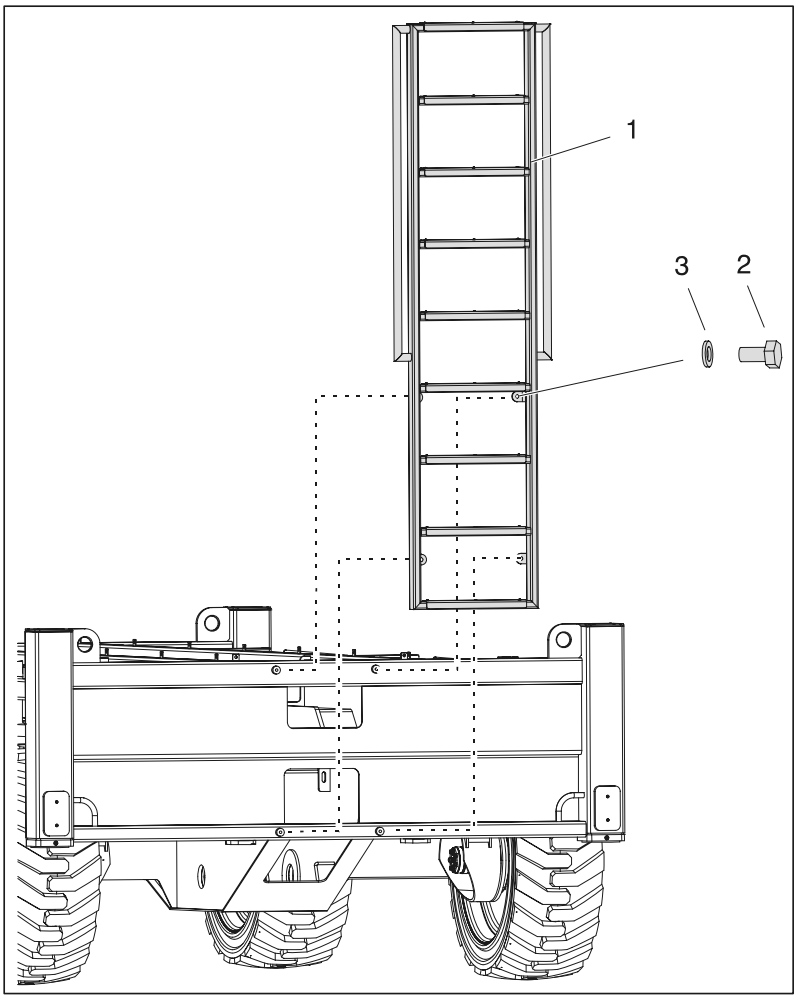
Figure 3-33. Platform Removal - 2 of 2 (Rear of Platform)

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 fourteen Capscrews (2) and Flatwashers (3) attaching both Platform Retaining Brackets (1) to the Platform.
3. Lift the platform from the armstack.

3.11 LADDER INSTALLATION



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

Figure 3-34. Ladder Installation

Removal:

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

⚠ CAUTION

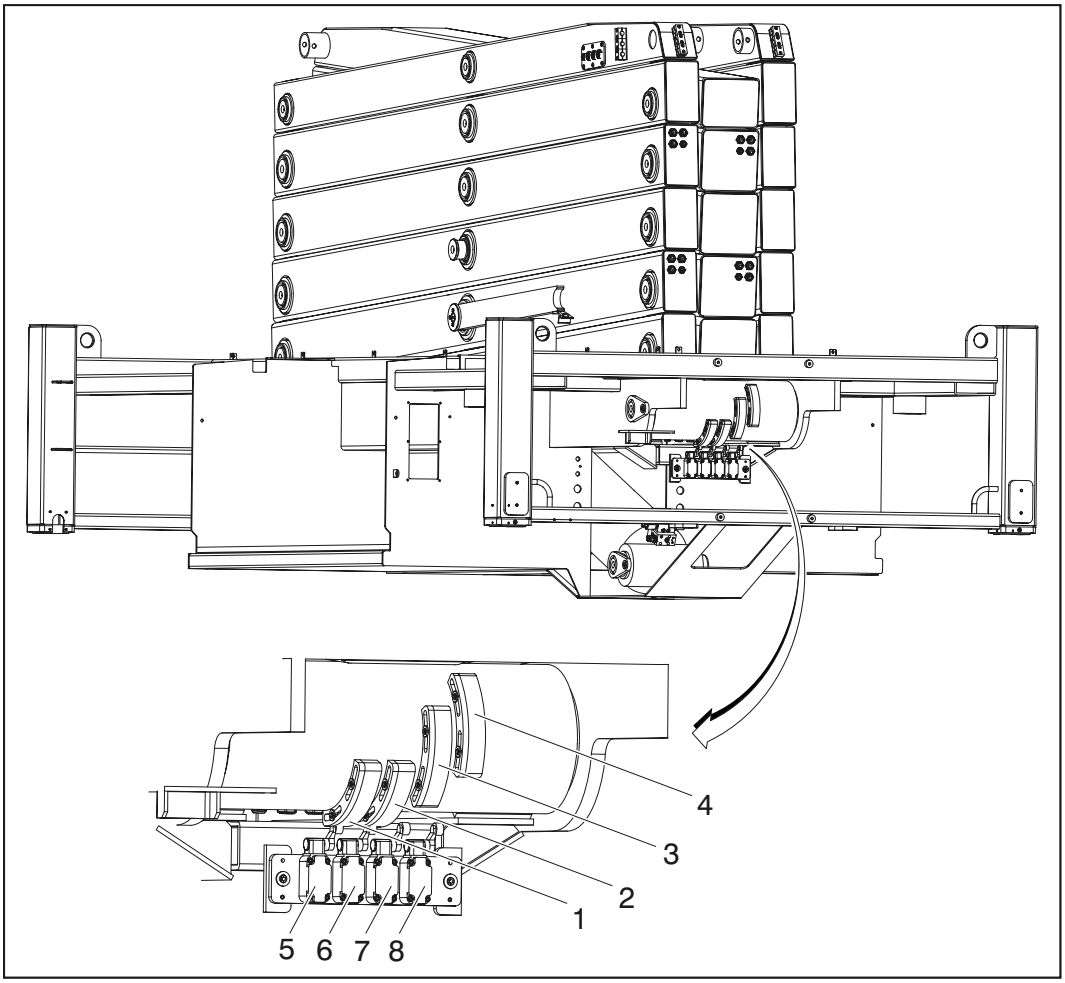
USE CAUTION WHEN REMOVING THE LADDER. THE LADDER WEIGHS APPROXIMATELY 38.9 KG (85.6 LBS)

Installation:

1. Lift 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 Spring Lockwashers (3).

3.12 SCISSOR ARMS

Limit Switches



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

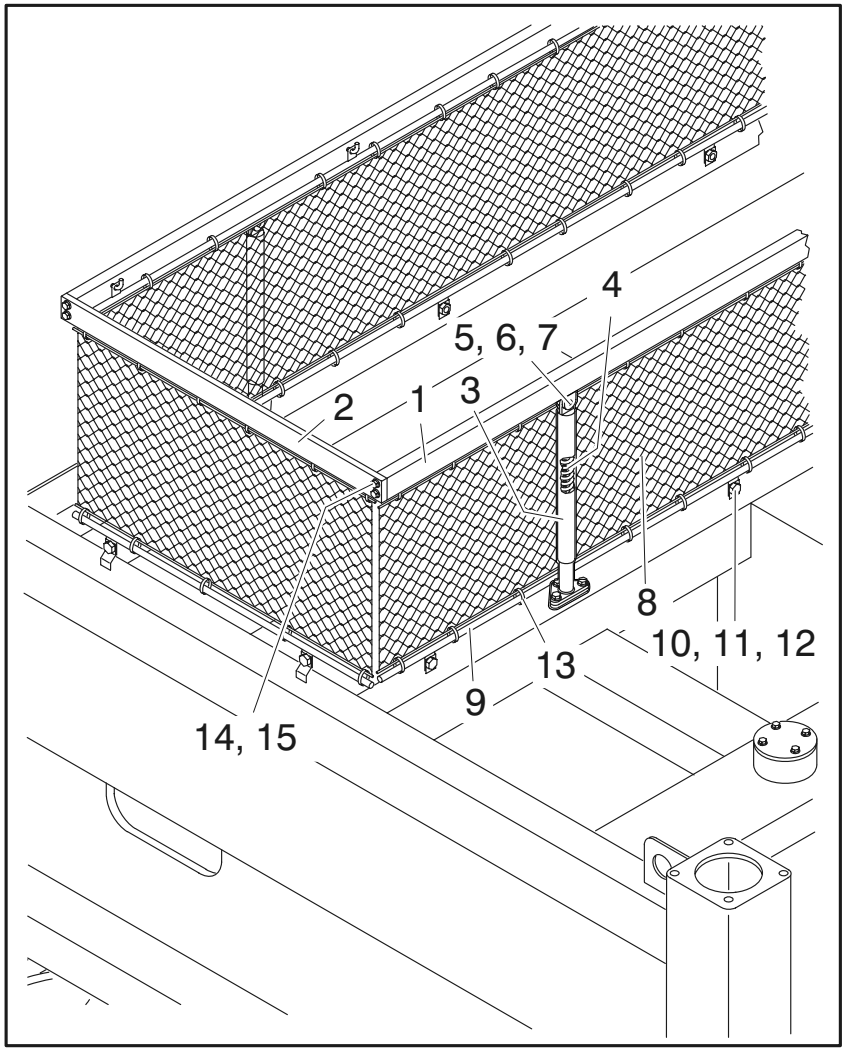
Figure 3-35. Scissor Arm Limit Switch Adjustment

Cam Adjustment:

1. Adjust Cam 1 (1) to activate Platform Stowed/Jacks Retract 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 3.5 m (11.5 ft).
3. Adjust Cam 3 (3) to activate Max Drive Height Limit Switch (7) when platform is at a height of 15.3 m (50 ft).
4. Adjust Cam 4 (4) to activate Max Height Limit Switch (8) when platform is at a height of 20.3 m (66.6 ft).

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 35mm
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 25mm
15. Lockwasher, M10

Figure 3-36. Arm Guards Removal

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) and Lockwashers (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

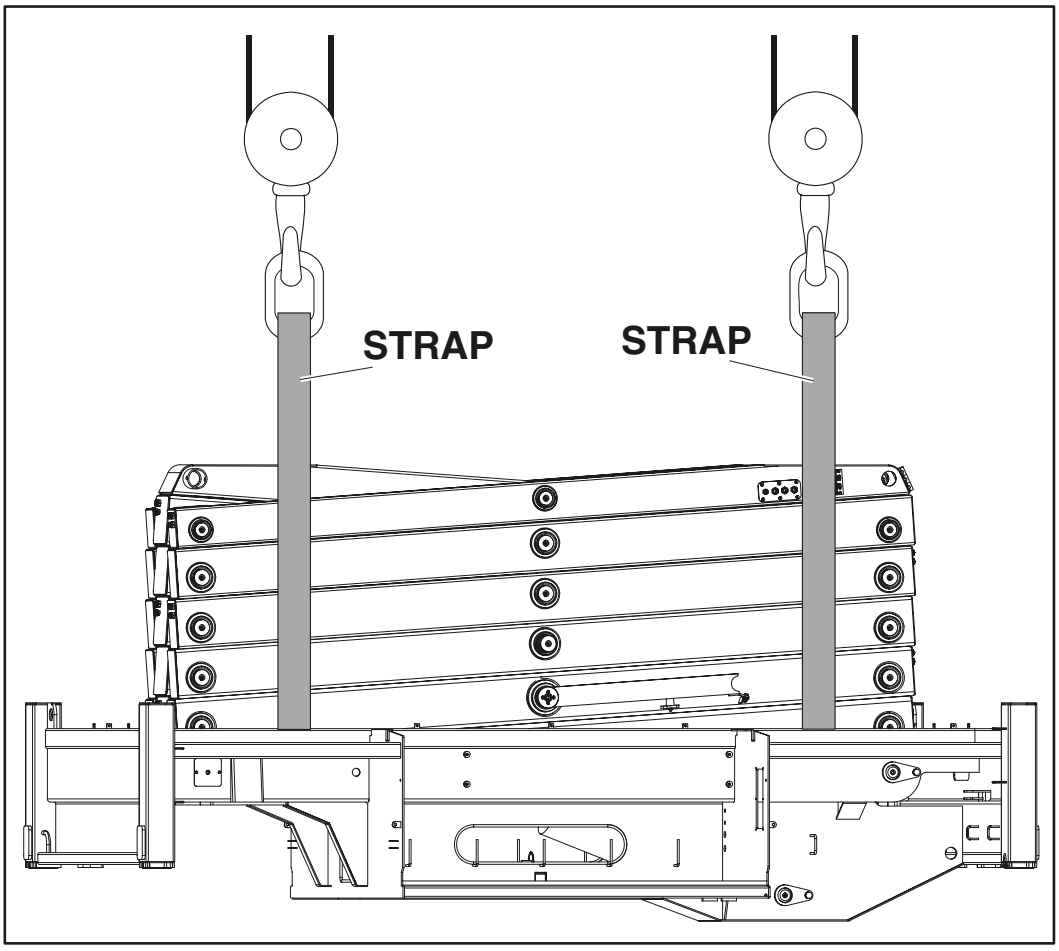
⚠ WARNING

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.

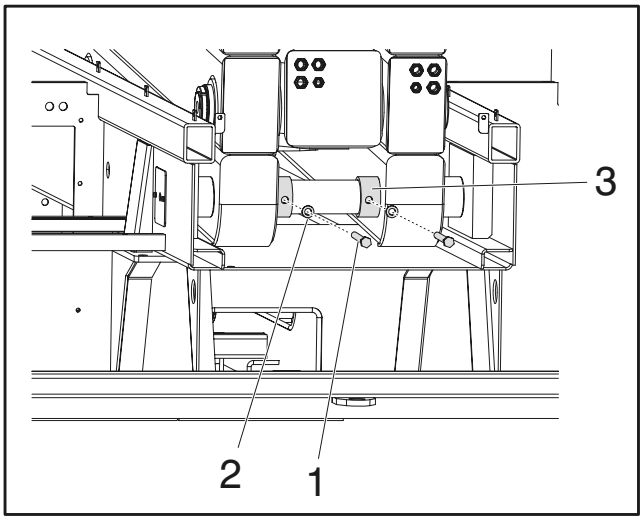
NOTE: *It is recommended to remove the scissor arm assembly as a whole unit.*

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 3-33 and 3-34)
3. Secure scissor arm assembly with two lifting straps attached to an overhead lifting device.

NOTE: *Scissor arm assembly weighs approximately 5100 kg (11,243 lbs). Straps and lifting device must be capable of lifting the scissor assembly.*

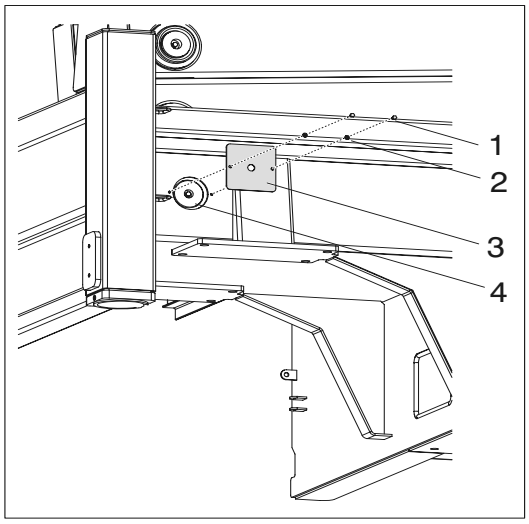


4. Remove one pin from the steering linkage to gain access to the scissor arms pin behind the wheel. (see Section 3.3, Steering Assembly).
5. Remove the cable from the ground control socket in the valve compartment. Remove the hydraulic hoses for the platform extension. (refer to Figure 4-33., Main Valve Block). Cap the fittings and secure the cable and hoses 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.
6. Remove the Bolts (1), Flatwashers (2), and Locknuts (4) on the bottom arm pin at the rear of the machine.



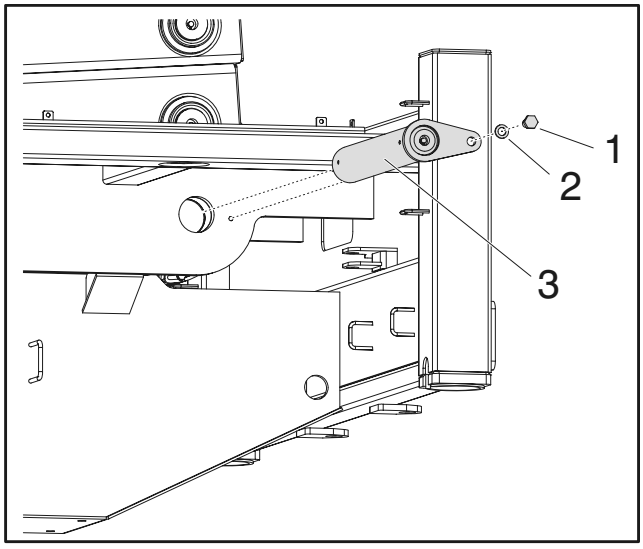
1. Bolt, M16 x 140mm
2. Flatwasher, M16
3. Spacer
4. Locknut, M16 (not shown)

7. Slightly lift the scissor stack up with the overhead crane so that the rear sliding blocks in the chassis are free.
8. 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

9. Remove the plate with the limit switches attached. (refer to Figure 3-35., Scissor Arm Limit Switch Adjustment)
10. 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.



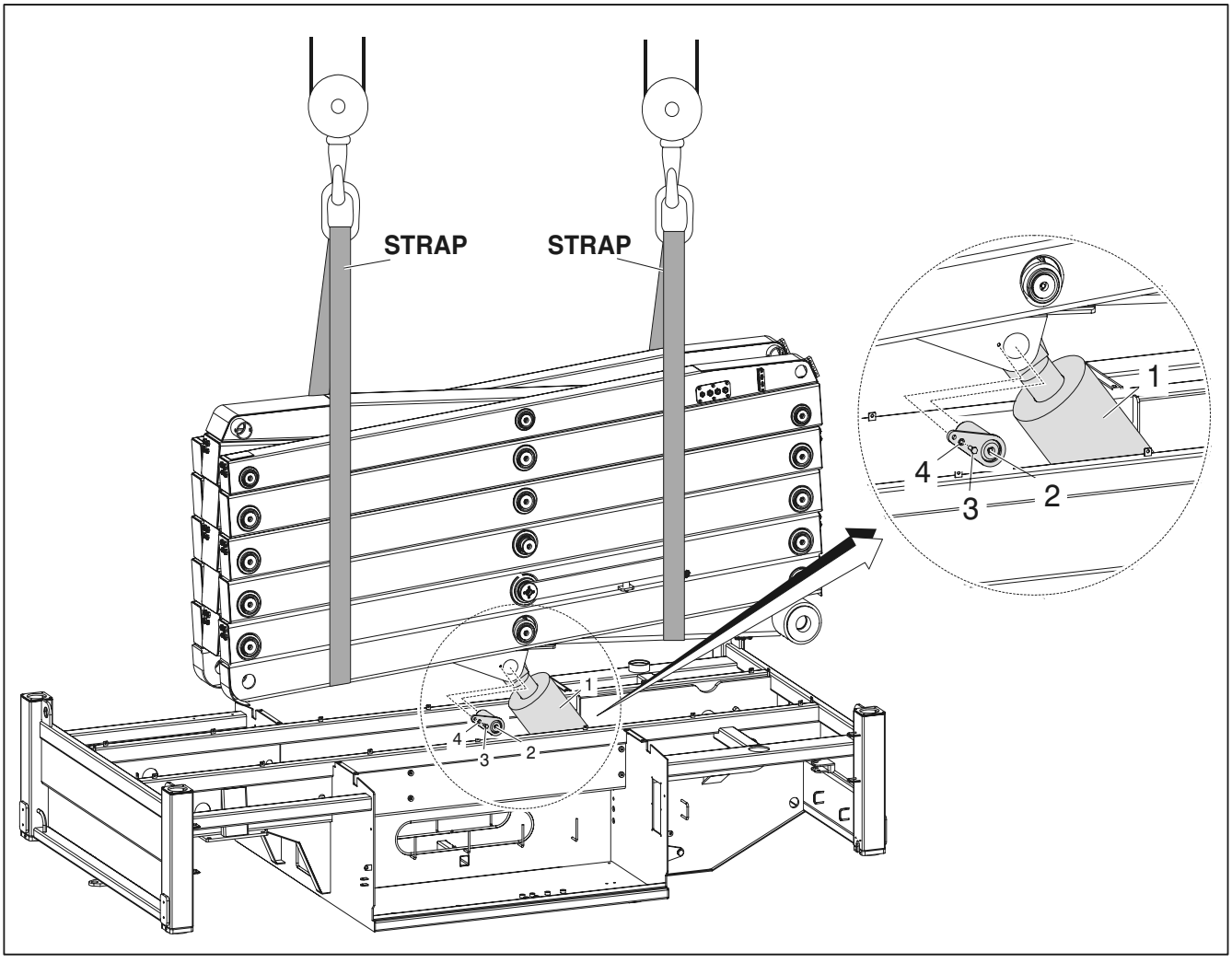
1. Bolt, M20 x 35mm
2. Lockwasher, M20
3. Pin

11. 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.

NOTICE

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.

12. 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
3. Bolt, M12 x 35mm
4. Lockwasher, M12

13. 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

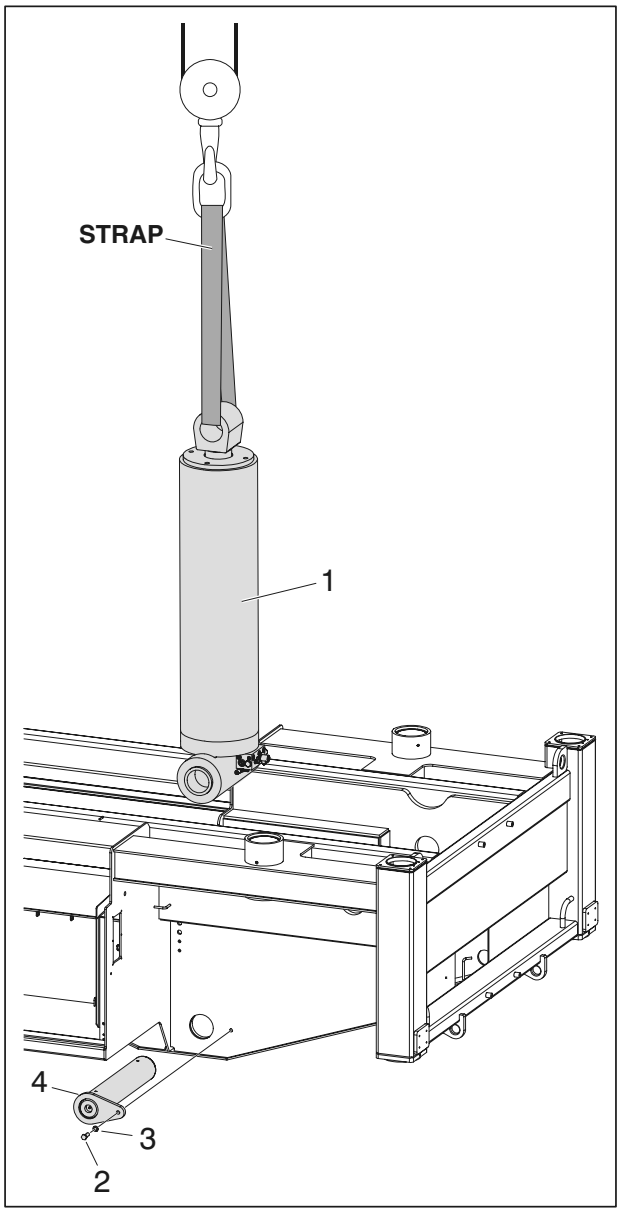
USE CAUTION WHEN REMOVING AND MOVING THE LIFT CYLINDER. THE LIFT CYLINDER ASSEMBLY WEIGHS APPROXIMATELY 450 KG (992 LBS). USE APPROPRIATE LIFTING DEVICES.

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 3-20.). Remove all hoses and/or wires from the Lift Cylinder (1).

NOTICE

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. Bolt, M20 x 35mm
3. Lockwasher, M20
4. Pin

Figure 3-37. Lift Cylinder Removal

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

Scissor Arms Disassembly

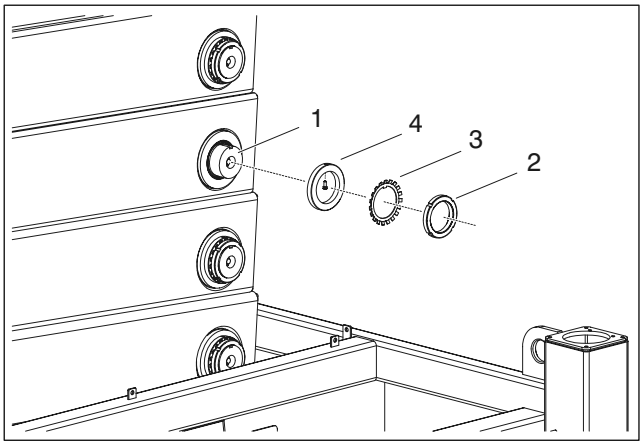
⚠ CAUTION

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 3-20.) .
2. Remove Platform (see Figure 3-32., Platform Removal - 1 of 2 (Front of Platform) and Figure 3-33., Platform Removal - 2 of 2 (Rear of Platform)).
3. 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.
4. 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.*

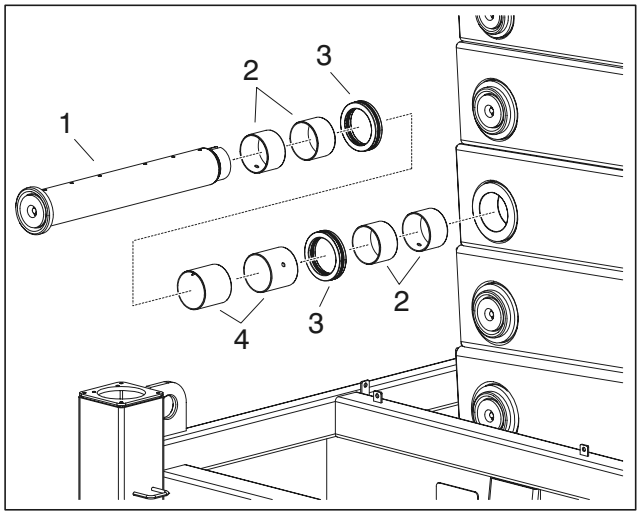
5. On the left side of the machine, remove the Nut (2) with a spanner wrench. Next, remove the Retaining Washer (3) and Washer and Pin (4).



1. Arm Pin (75mm, 90mm, 100mm, or 120mm)
2. Nut (M60, M80, M90, or 100mm)
3. Retaining Washer (MB18, MB20, 60mm, or 80mm)
4. Washer & Pin

Figure 3-38. Scissor Arm Removal (Left Side)

6. Move to the right side of the machine. The Arm Pin (1) can now be pulled out of the scissor arm stack. Remove the four Bushings (2), two Ball Thrust Bearings (3), and two Bushings (4).



1. Arm Pin (75mm, 90mm, 100mm, or 120mm)
2. Bushing (75 x 60mm, 90 x 60mm, 100 x 60mm, or 120 x 60mm)
3. Ball Thrust Bearing
4. Bushing (75 x 60mm, 75 x 80mm, 100 x 80mm, 90 x 90mm, or 120 x 100mm)

Figure 3-39. Scissor Arm Removal (Right Side)

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

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

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

Deck Extension Cylinder:

The deck is extended and retracted by means of a double acting cylinder controlled by the first section in the main control valve (see Figure 4-33., Main Valve Block). The service line relief valve in the control valve is set at 80 bar (1160 psi) for extend and 210 bar (3046 psi) for retract.

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 (see Figure 4-33.). Lift speed is limited by flow from section 1 in the pump.

Lowering is operated by energising the two solenoid holding valves together with the 3rd section of the main control valve (see Figure 4-33.). Descent speed is controlled by an adjustable line mounted flow 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 can be 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.

Outrigger Cylinders:

The automatic self leveling system is controlled by 4 double acting cylinders mounted at each corner of the machine chassis. These cylinders incorporate pilot operated holding valves on the piston side. The cracking pressure for these valves is 1 bar (15 psi) for the rear and 8 bar (116 psi) for the front.

Steer Cylinder:

Steering has a dedicated solenoid valve mounted in the valve compartment. This valve receives hydraulic power from the 3rd pump section and is protected by an inline filter. The steering valve incorporates a full flow pressure relief valve which is set at 175 bar (2538 psi).

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, then 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 Figure 4-24. thru Figure 4-27. for specific cylinder assembly breakdowns and for specific parts references. Refer to JLG Parts Manual 3121335 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 4-28.)

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.

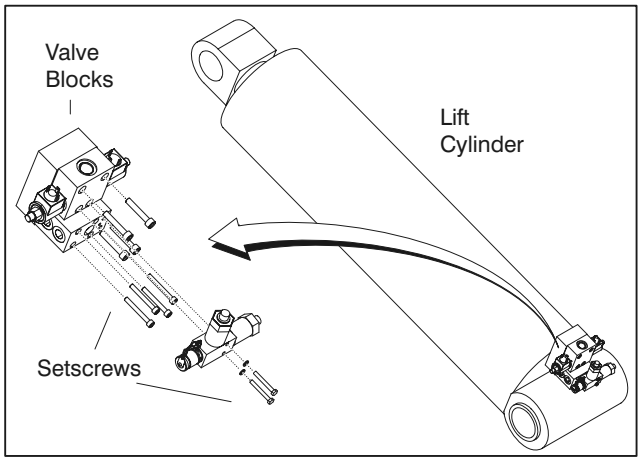


Figure 4-1. Lift Cylinder Valve Block Removal

NOTE: *Step 3 applies only to the Outrigger Cylinders.*

3. To prevent damage, remove the safety valve and limit switch from the top of the outrigger cylinders.

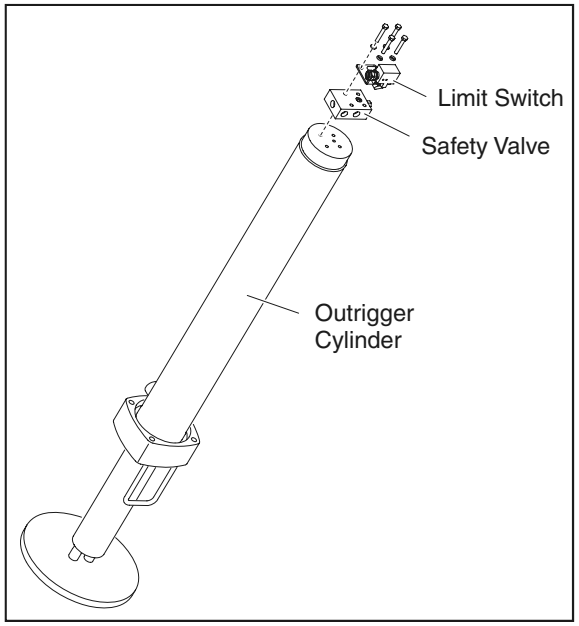


Figure 4-2. Safety Valve and Limit Switch Removal

NOTICE

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

4. 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.

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

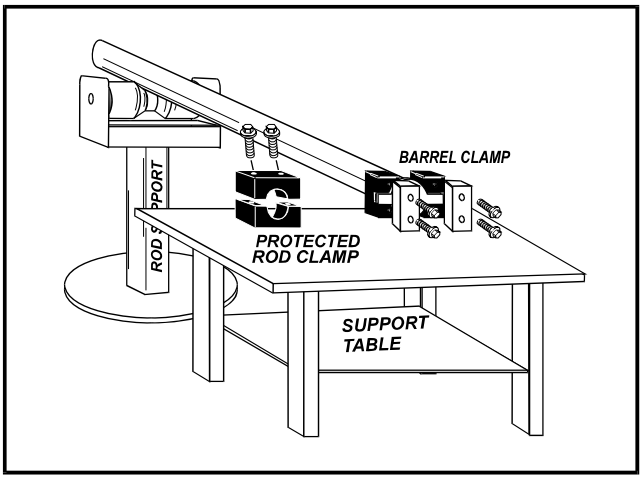


Figure 4-3. Cylinder Barrel Support

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

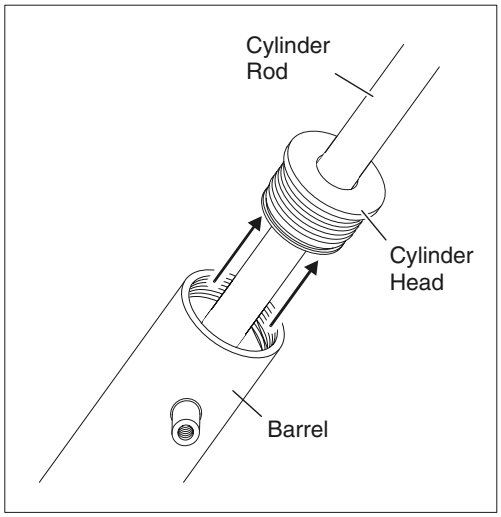


Figure 4-4. Cylinder Head Removal

NOTICE

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.

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

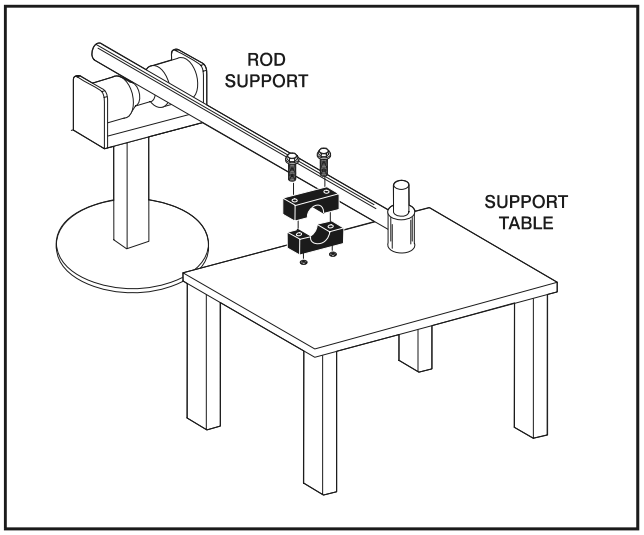


Figure 4-5. Cylinder Rod Support

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

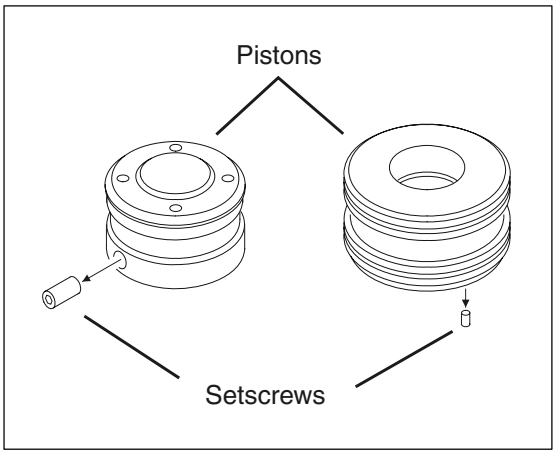


Figure 4-6. Piston Setscrew Removal

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

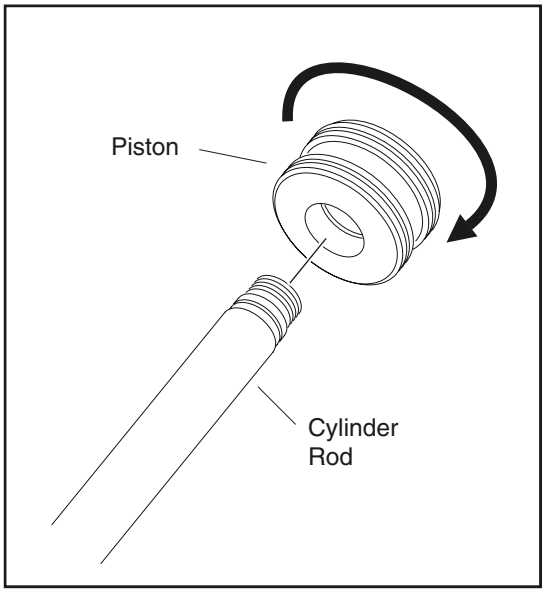


Figure 4-7. Piston Removal

13. Remove and discard the piston o-rings, seal rings, and, if applicable, the snap ring.

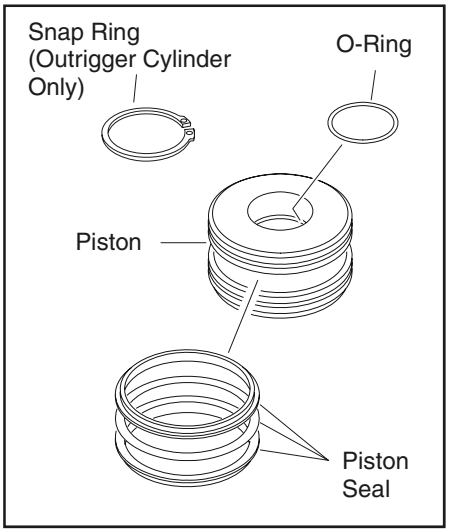


Figure 4-8. Piston Seals

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

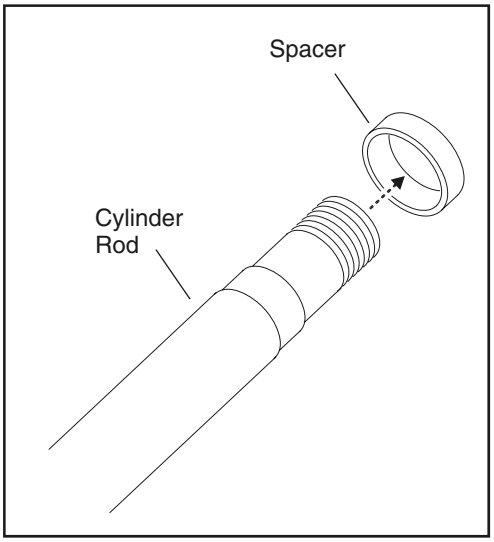


Figure 4-9. Spacer Removal

15. Remove the rod from the holding fixture.
16. Remove the cylinder head from the cylinder rod.

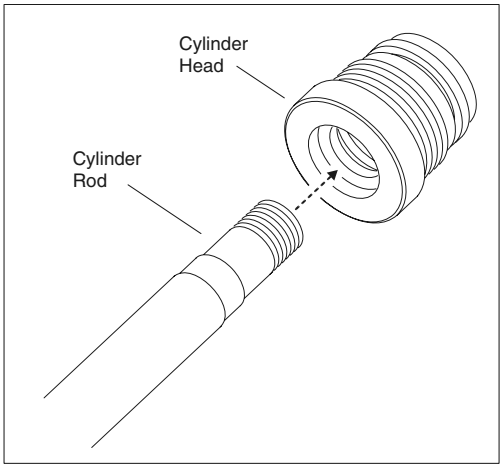


Figure 4-10. Cylinder Head Removal

17. If applicable, remove and discard the cylinder head seal, rod seal, wiper, o-ring(s), back-up ring, and snap ring.

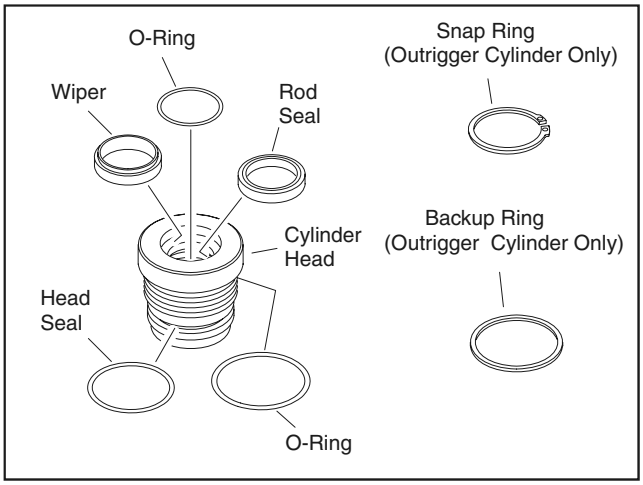


Figure 4-11. Cylinder Head Seals

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.

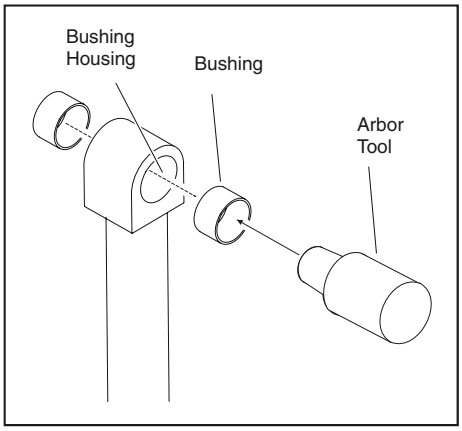


Figure 4-12. Bushing Installation

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 (3121335). 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.

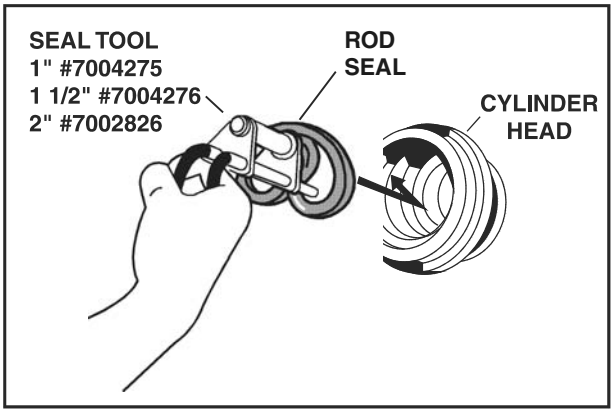


Figure 4-13. Rod Seal Installation

NOTICE

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

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.

3. Install a new head seal, new o-rings, and, if applicable, a new backup ring, in the appropriate outside diameter groove of the cylinder head.

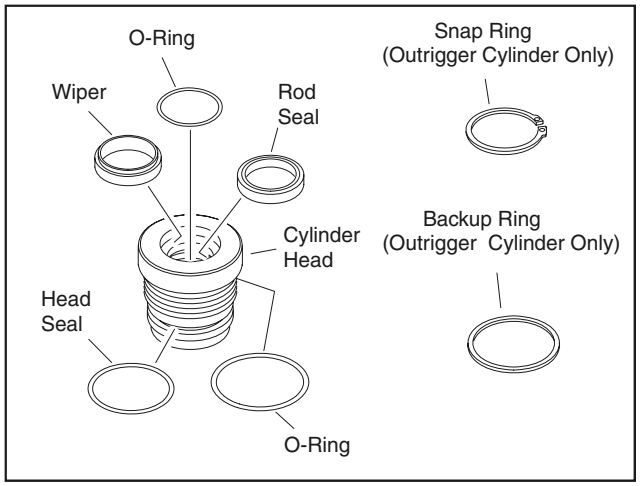


Figure 4-14. Cylinder Head Seal Installation

4. 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.

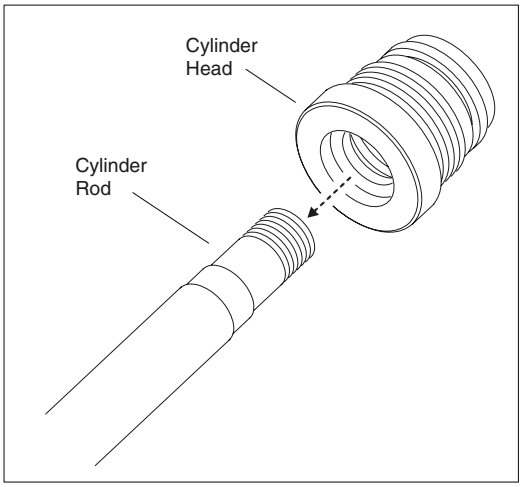


Figure 4-15. Cylinder Head Installation

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

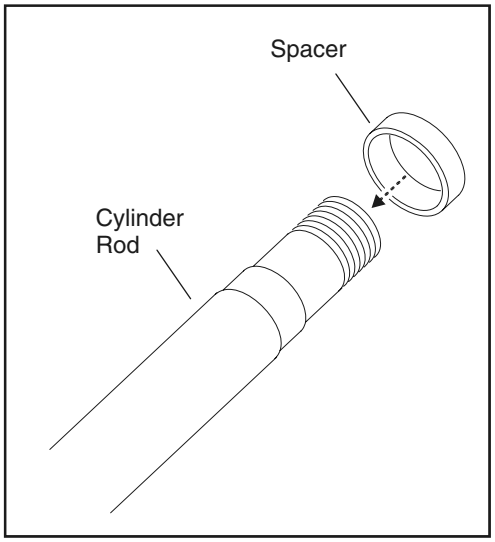


Figure 4-16. Spacer Installation

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

7. 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.)

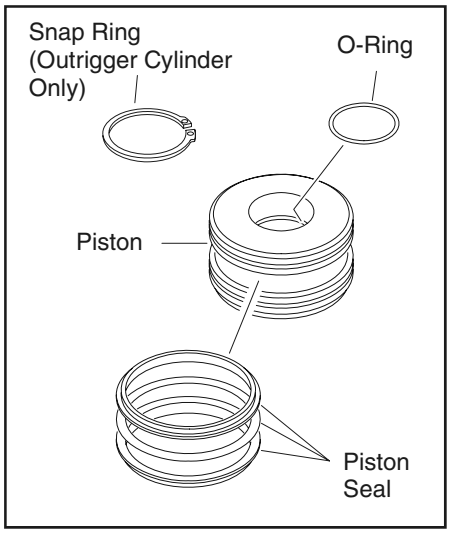


Figure 4-17. Piston Seal Installation

8. Using suitable protection, clamp the cylinder rod in a vise or similar holding fixture as close to the piston as possible.

9. 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.

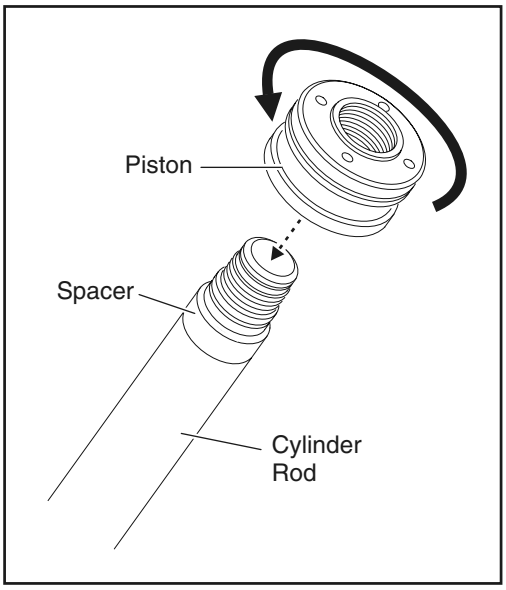


Figure 4-18. Piston Installation

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

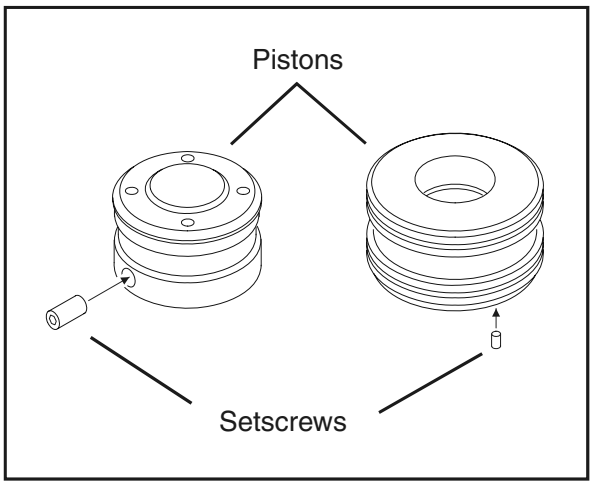


Figure 4-19. Piston Setscrew Installation

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

NOTICE

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.

13. With the 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.

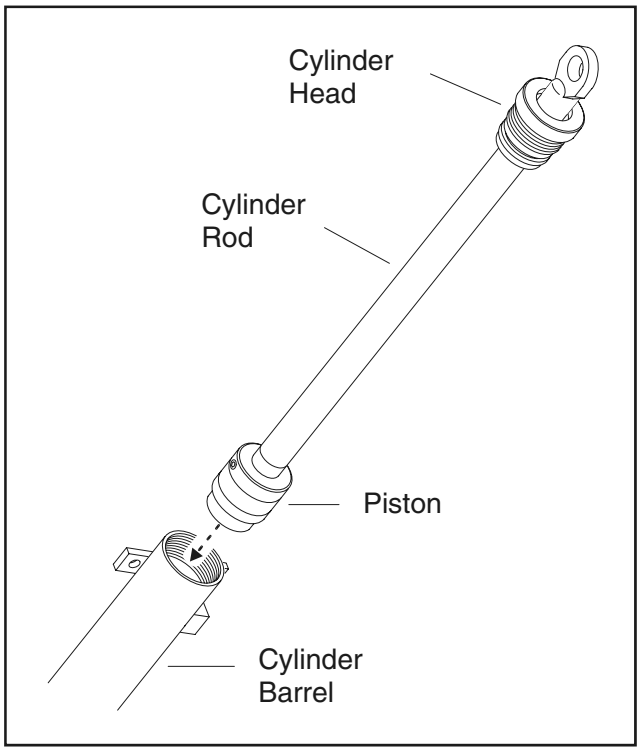


Figure 4-20. Rod Installation

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

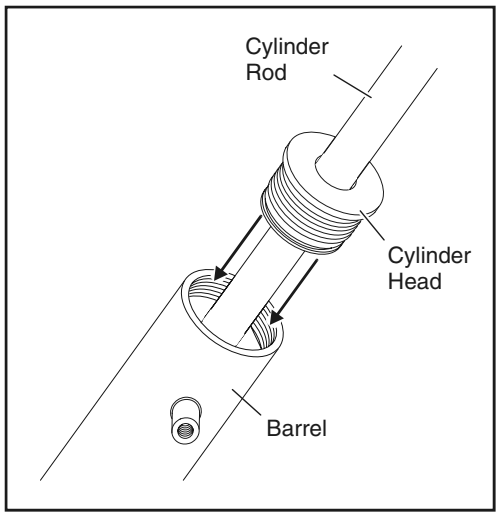
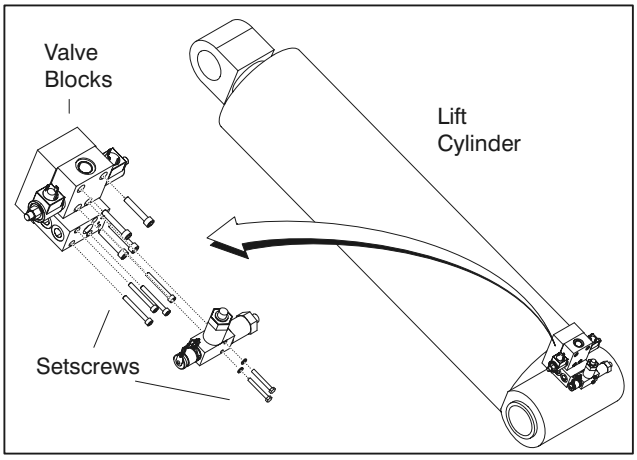


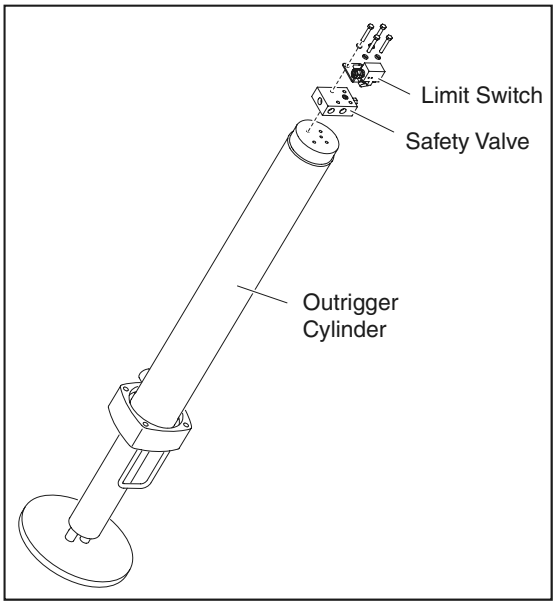
Figure 4-21. Rod Assembly Installation

15. Use a spanner wrench to tighten the cylinder head on the barrel.
16. 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.*

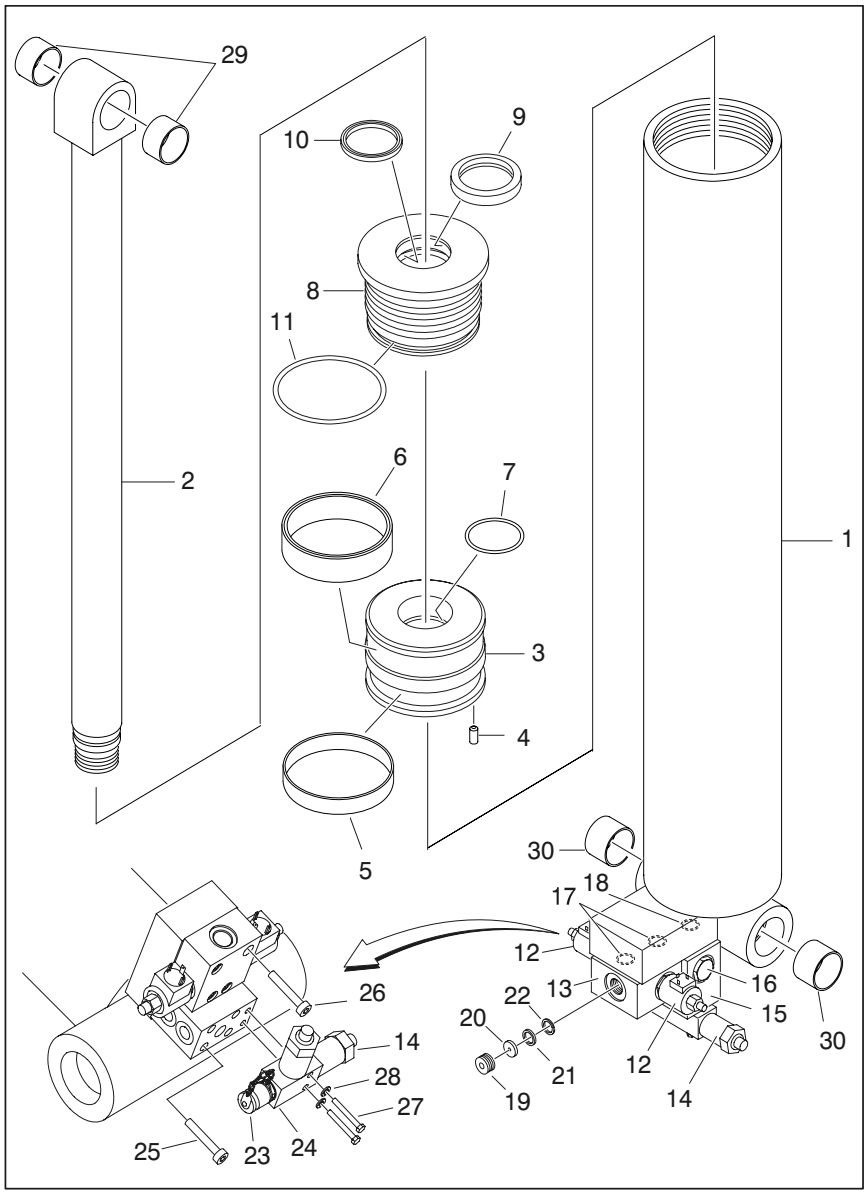
Figure 4-22. Valve Block Installation



NOTE: *Outrigger Cylinders only.*

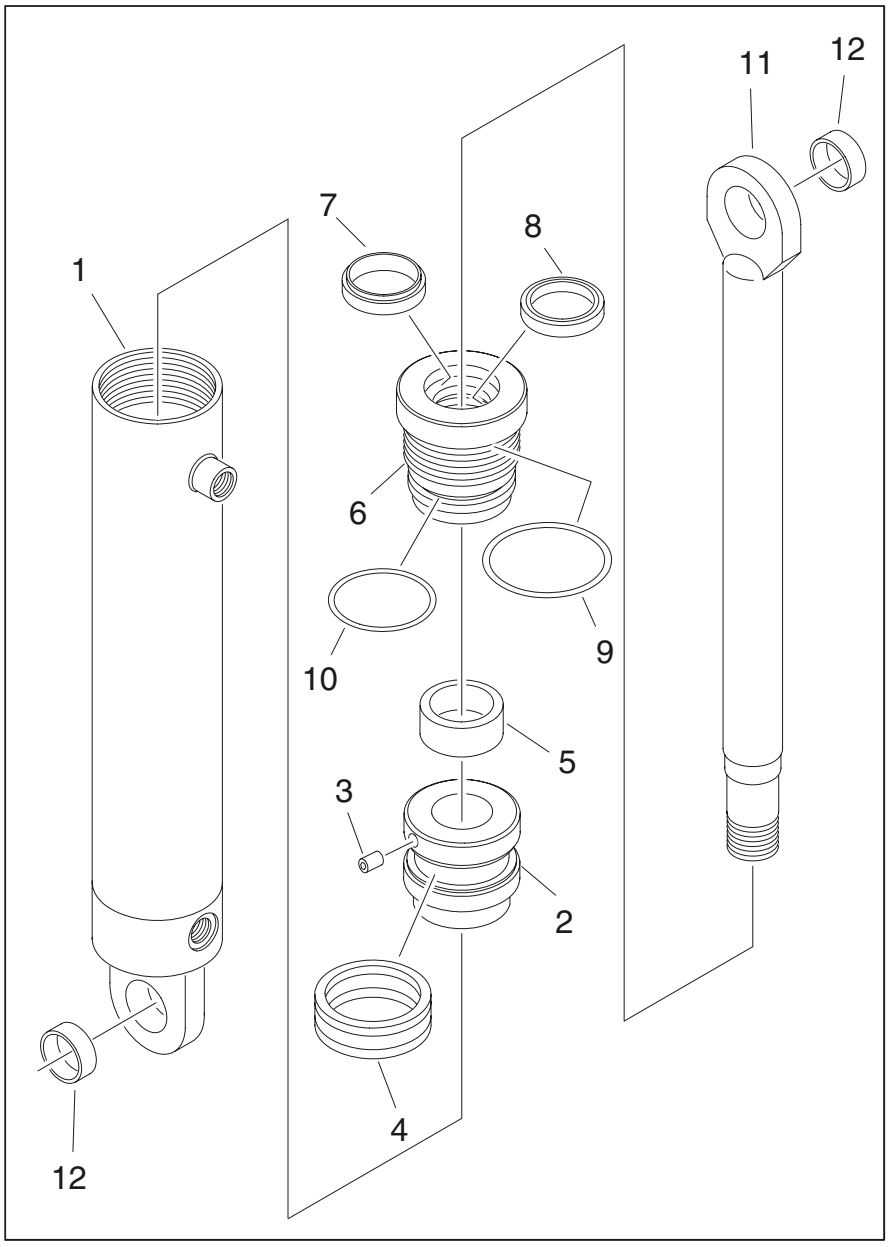
Figure 4-23. Safety Valve and Limit Switch Installation

NOTE: *Refer to Figure 1-3., Torque Chart - (In/Lb - Ft/Lb). (For ASTM Fasteners) to Figure 1-5., Torque Chart - (Nm) - (For Metric Class Fasteners). for setscrew torques.*



1. Barrel Weldment
2. "Rod Weldment
3. Piston
4. Setscrew
5. Wear Ring
6. Piston Seal
7. O-Ring
8. Head
9. Wiper Ring
10. Rod Seal
11. O-Ring
12. Valve Cartridge
13. Holding Valve Assembly
14. Pressure Sensor & Cover
15. Manual Descent Valve Assembly
16. Holding Valve
17. O-Ring
18. O-Ring
19. Throttle Screw
20. Throttle Plate
21. Throttle Ring
22. Retaining Ring
23. Test Fitting
24. Pressure Sensor Manifold
25. Capscrew, M6 x 50mm
26. Capscrew, M8 x 45mm
27. Bolt, M5 x 40mm
28. Lockwasher, M5
29. Bushing
30. Bushing

Figure 4-24. Lifting Cylinder Assembly

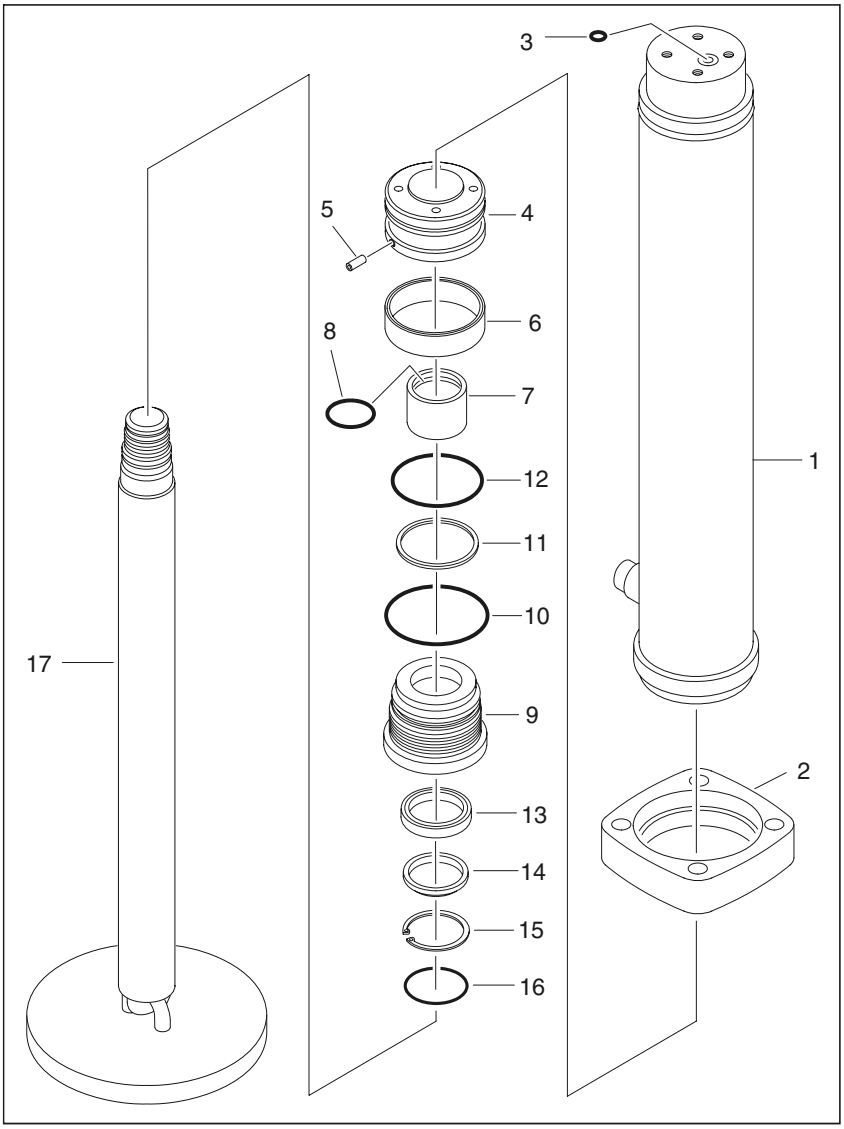


1. Barrel Weldment
2. Piston
3. Setscrew
4. Piston Seal
5. Spacer
6. Cylinder Head
7. Wiper
8. Rod Seal
9. O-Ring
10. Head Seal
11. Rod
12. Bushing

Figure 4-25. Steering Cylinder Assembly

Table 4-1. Steering Cylinder Specs

Maximum Working Pressure	210 bar (3046 psi)
Piston Head Torque (apply Loctite 242 prior to tightening)	260Nm (191.8 lb ft)
Max Speed	0.5 m/sec (1.6 ft/sec)
Max Operating Temperature	-20°C to 80°C (-4°F to 176°F)

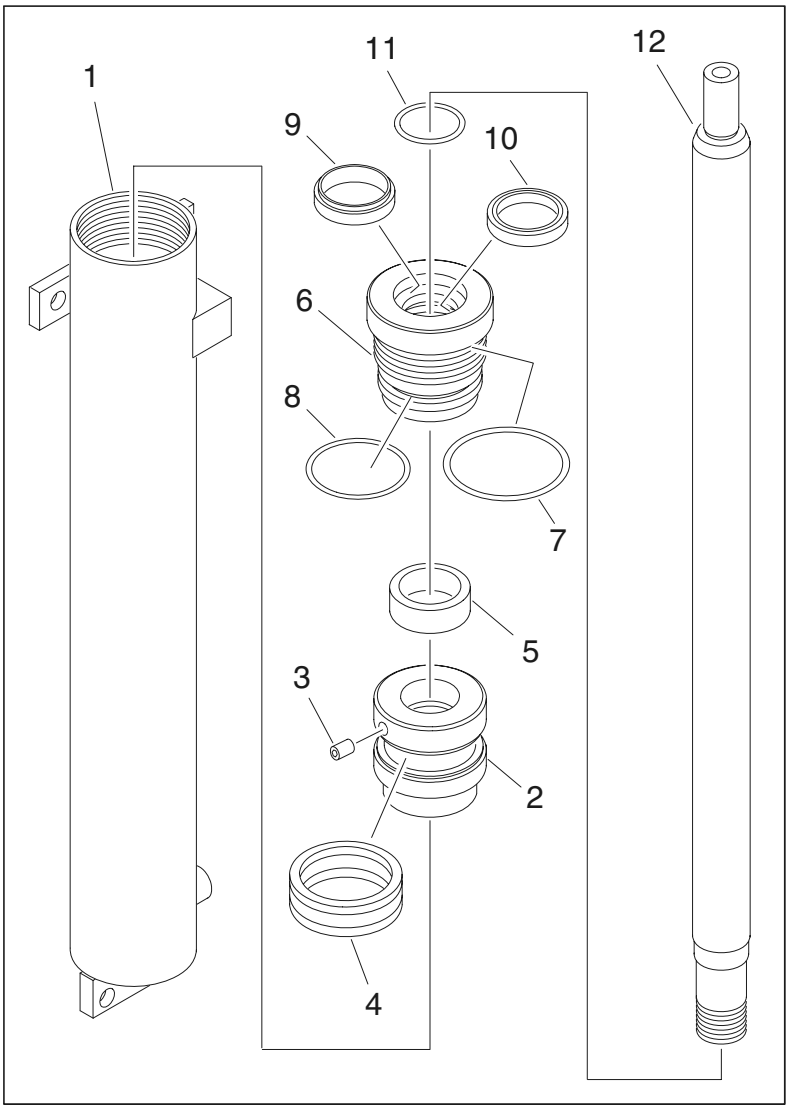


1. Barrel
2. Mounting Flange
3. O-Ring
4. Piston
5. Setscrew
6. Piston Seal
7. Spacer
8. O-Ring
9. Cylinder Head
10. O-Ring
11. Backup Ring
12. Head Seal
13. Rod Seal
14. Wiper
15. Snap Ring
16. O-Ring
17. Rod

Figure 4-26. Leveling Cylinder Assembly

Table 4-2. Leveling Cylinder Specs

Max Working Pressure	185 bar (2683.1 psi)
Piston Head Torque (Apply Loctite 243 prior to tightening) (torque with Rod End)	600 Nm (442.5 lb ft)
Setscrew Torque (Apply Loctite 222 prior to tightening)	20 Nm (14.8 lb ft)
Max Speed	0.5 m/sec (1.6 ft/sec)
Max Operating Temperature	-30°C to 100°C (-22°F to 212°F)



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

Figure 4-27. Extension Cylinder Assembly

Table 4-3. Extension Cylinder Specs

Max Working Pressure	210 bar (3046 psi)
Bore Relief Pressure	80 bar (1160 psi)
Piston Torque (Apply Loctite 242 prior to tightening)	200 Nm (147.5 lb ft)
Setscrew Torque (Apply Loctite 222 prior to tightening)	20 Nm (14.8 lb ft)
Max Speed	0.5 m/sec (1.6 ft/sec)
Max Operating Temperature	-30°C to 80°C (-22°F to 176°F)

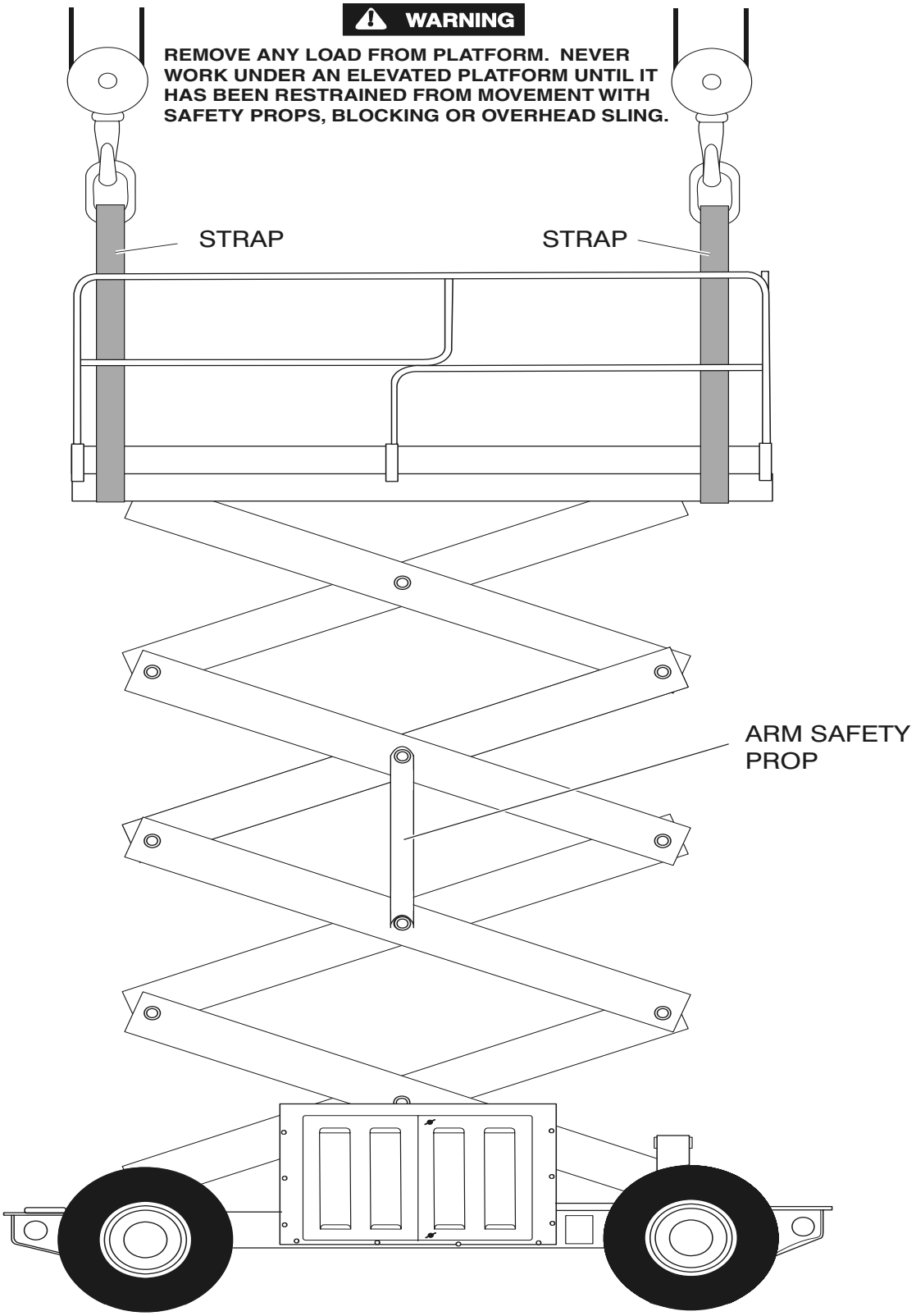
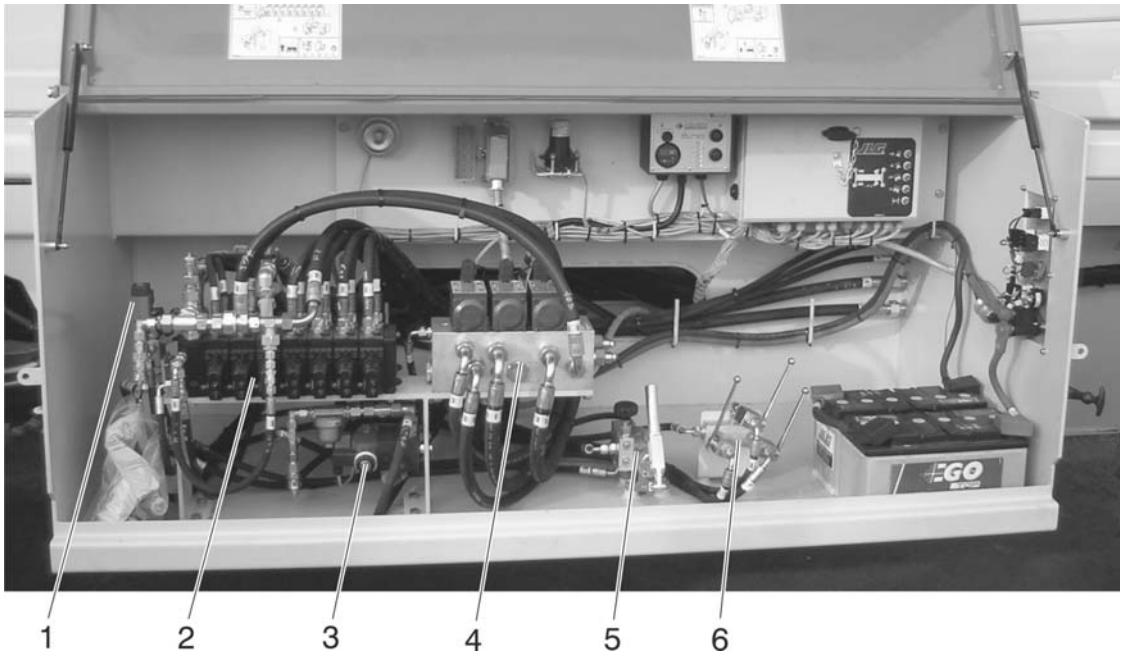


Figure 4-28. Arms and Platform Positioning and Support

4.5 VALVES

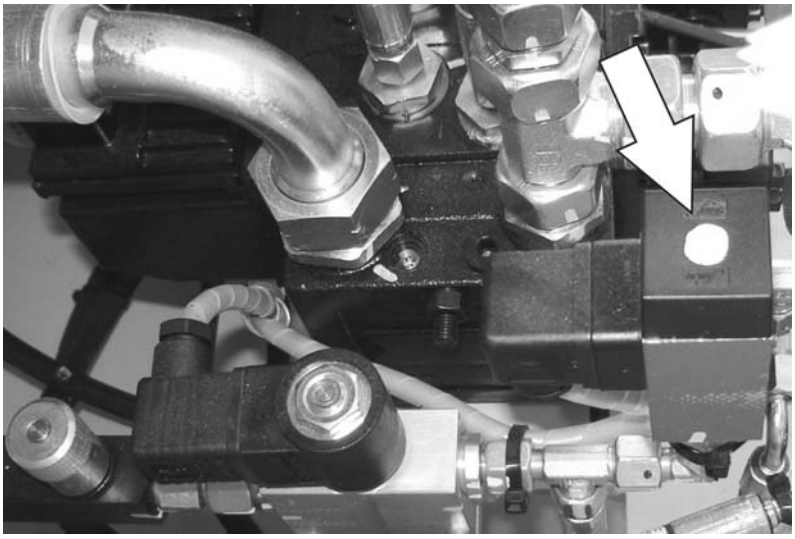
Valve Compartment



1. Pressure Switch, Drive Enable & Brake Valve
2. Main Valve Block
3. Steering Valve
4. Drive Valve
5. Hand Pump
6. Pressure Manifold

Figure 4-29. Valve/Hydraulic Compartment

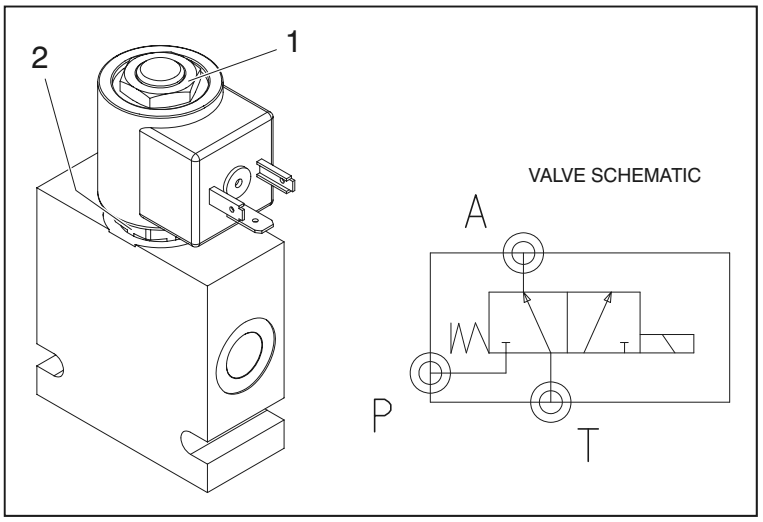
Pressure Switch, Drive Enable



- Operate the lower function to retract the jacks and adjust the switch (screw on the top of the switch) to trip at 185 bar (2683 psi)

Figure 4-30. Pressure Switch Adjustment

Brake Valve

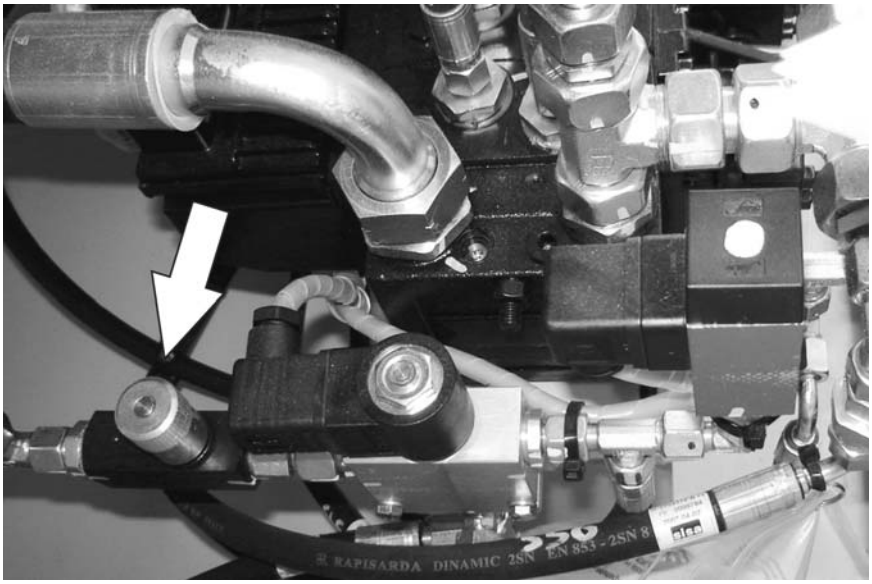


1. Torque to 6.8 Nm (5 ft lbs)
2. Torque to 27.1 Nm (20 ft lbs)

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

Figure 4-31. Brake Valve

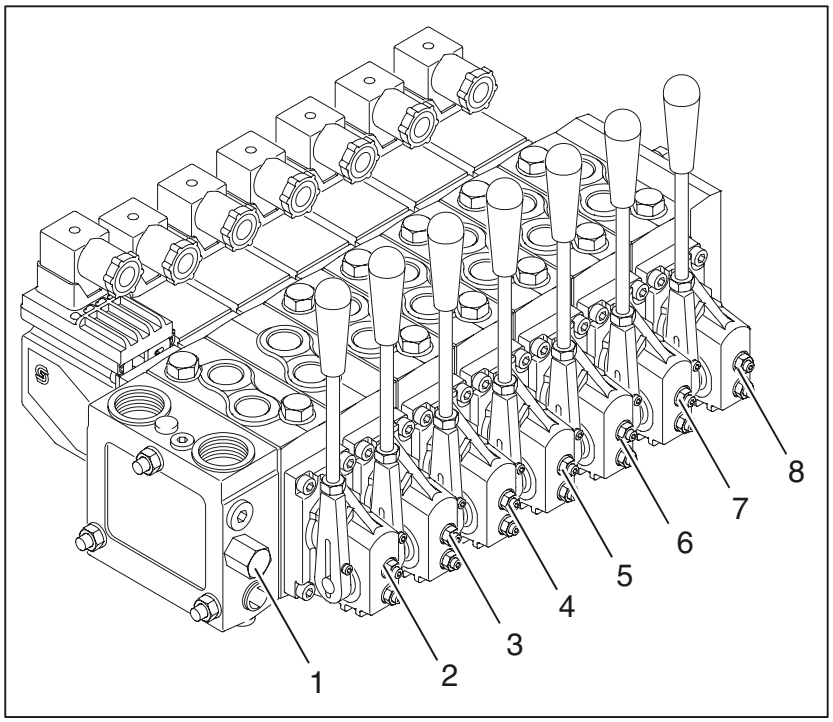
Brake Valve Adjustment:



- To achieve smooth deceleration when the joystick is returned quickly from the max forward or backward position to the neutral position, completely close the valve knob (shown to the left) then open the knob 1/2 of a revolution.

Figure 4-32. Brake Valve Adjustment

Main Valve Block



1. Main Pressure Block
2. Platform
3. Drive 1
4. Lifting
5. Leveling Rear Left
6. Leveling Rear Right
7. Leveling Front Left
8. Leveling Front Right

VALVE SCHEMATIC

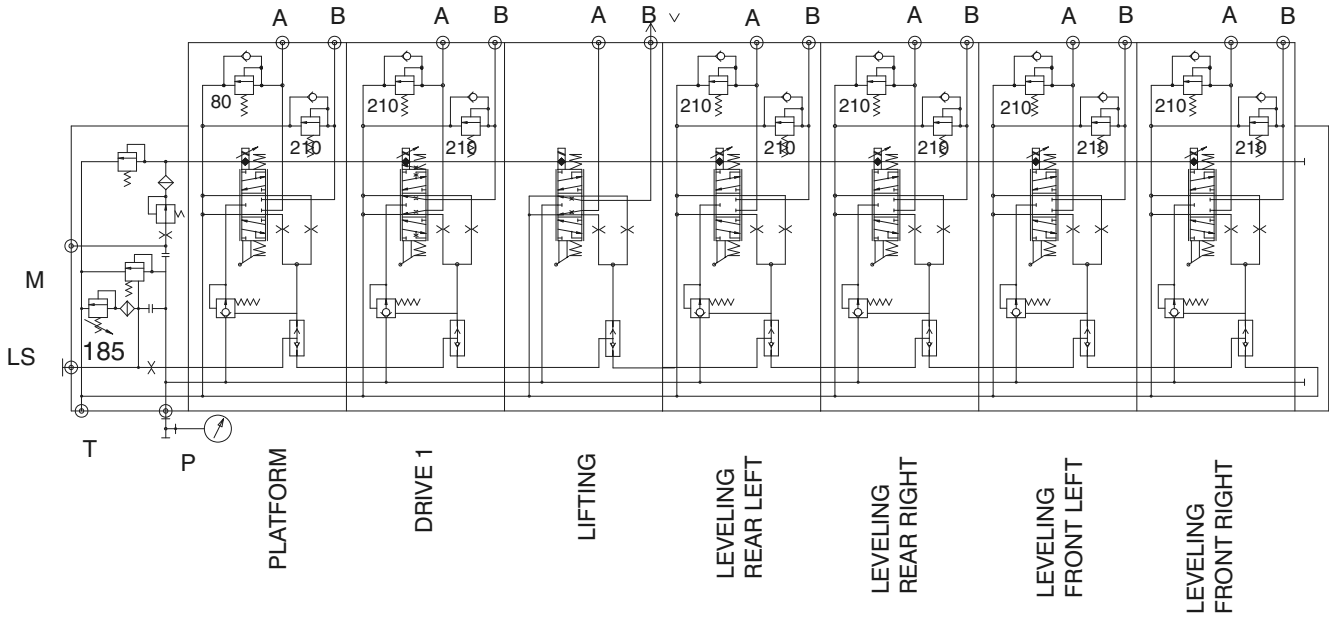


Figure 4-33. Main Valve Block

Adjust main pressure on top of the Main Pressure Block

- remove the cap and attach a pressure gauge to pressure test port (see Figure 4-34.)
- remove rubber plug from adjustment port on the Main Pressure Block
- adjust to 210 bar (3045.8 psi) (see Figure 4-35.)

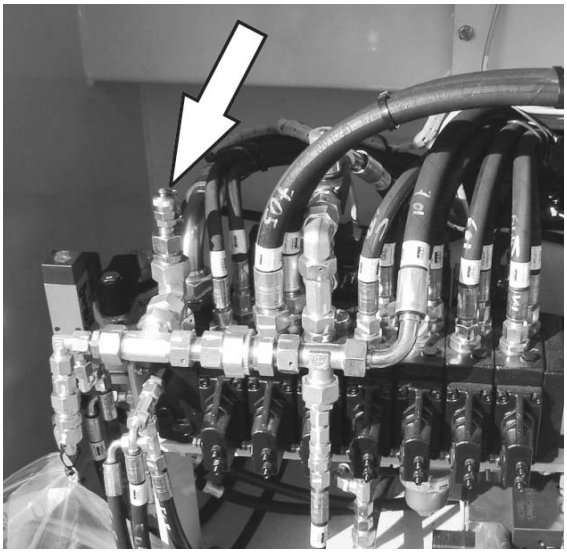


Figure 4-34. Pressure Test Port

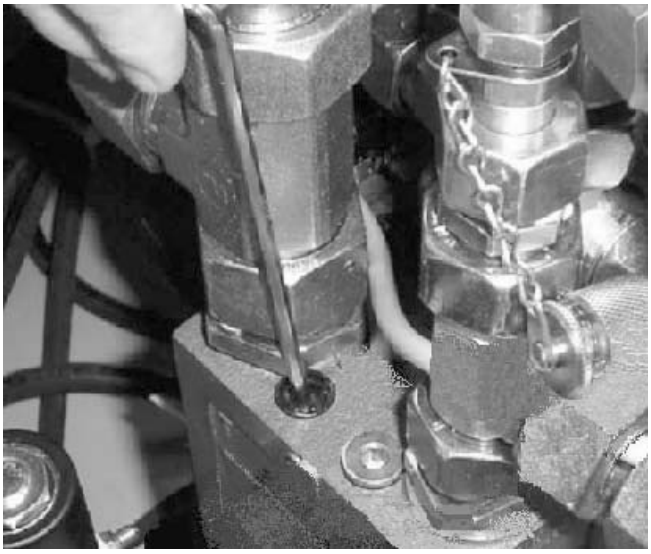


Figure 4-35. Main Valve Pressure Adjustment

Steering Valve

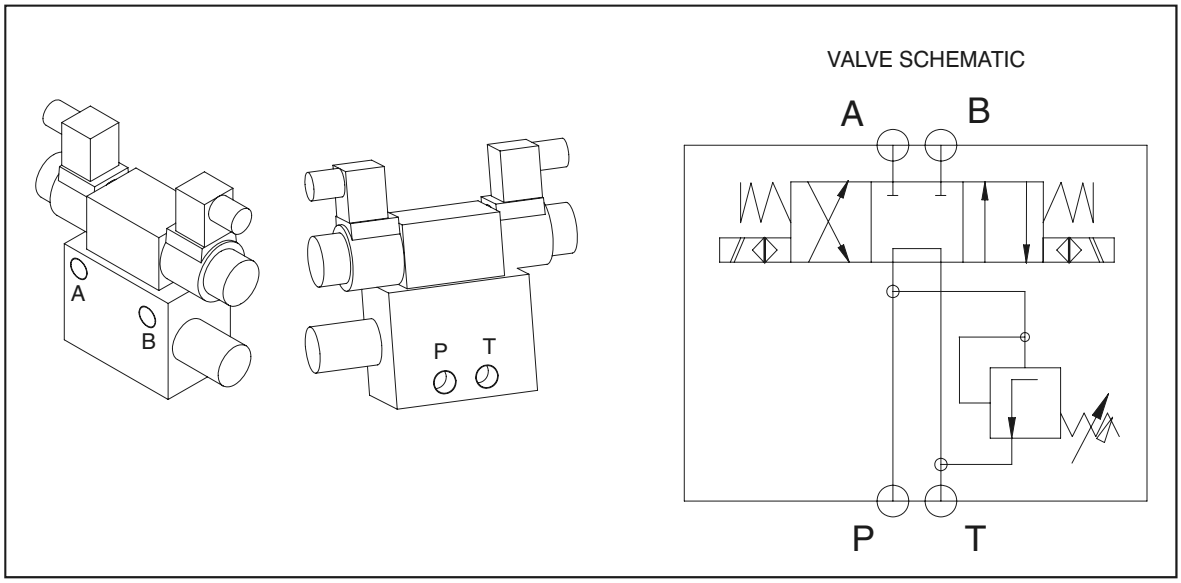


Figure 4-36. Steering Valve

Steer Valve Pressure Adjustment:

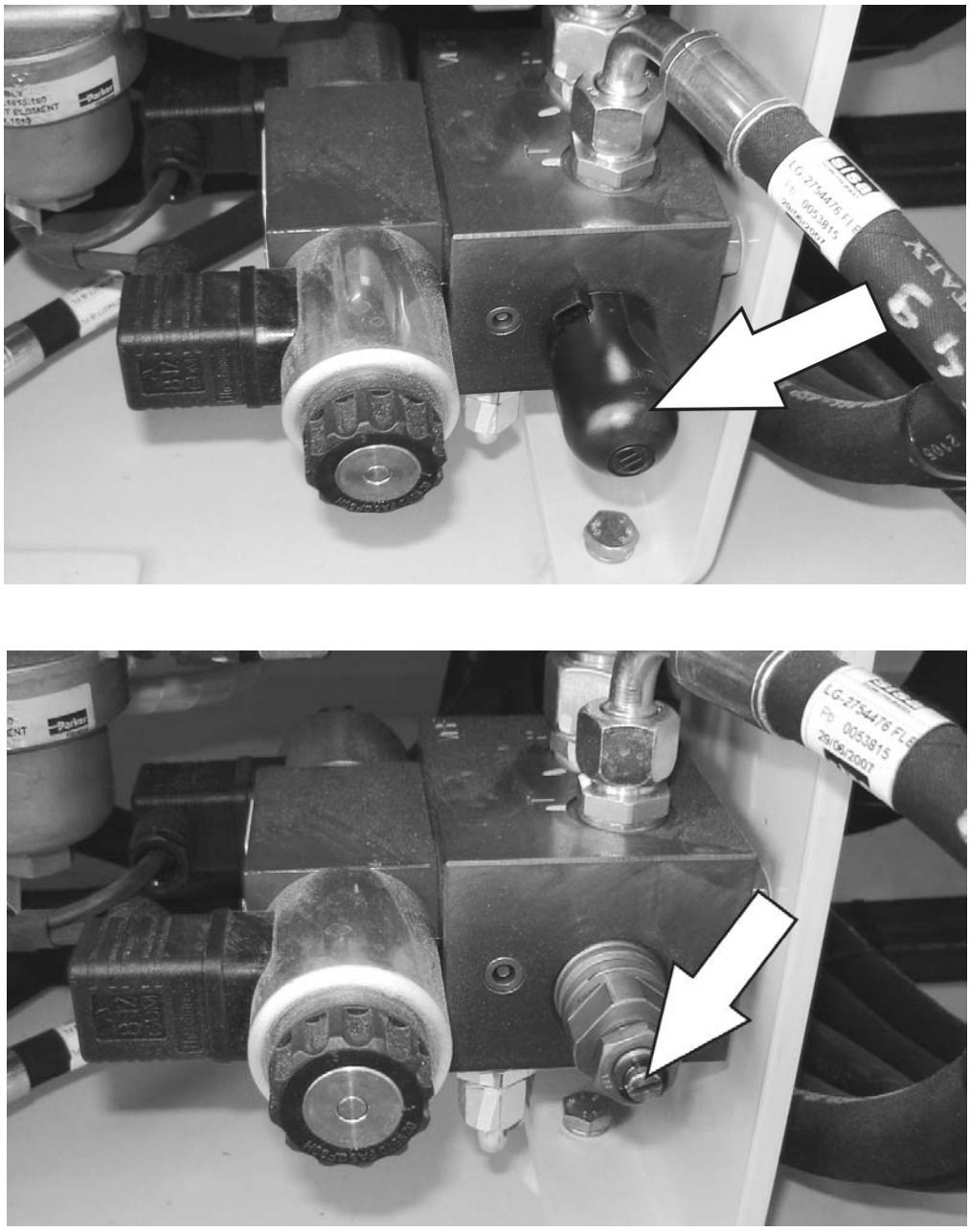
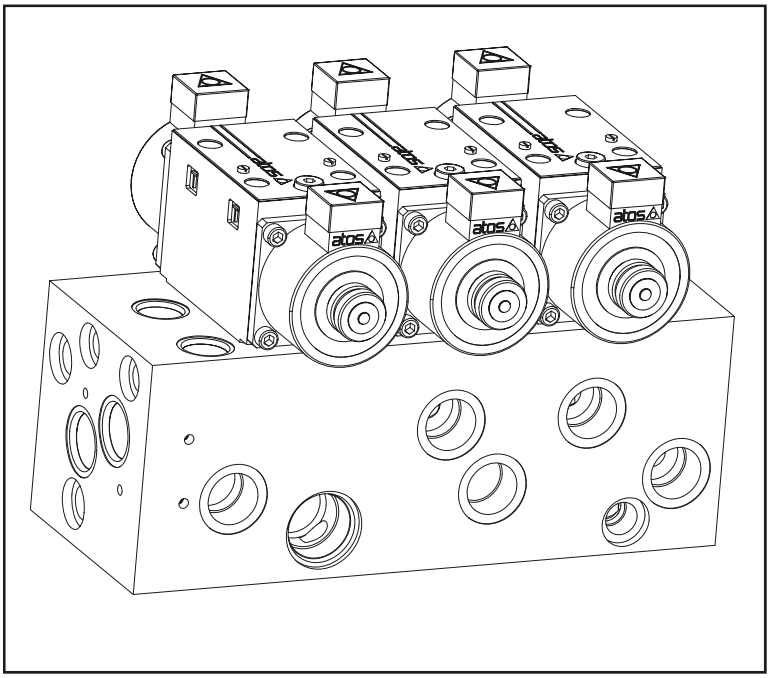


Figure 4-37. Steer Valve Pressure Adjustment

- remove the cap and attach a pressure gauge to pressure test port (see Figure 4-34.)
- remove the black cover (shown in top picture) to gain access to the adjustment screw (shown in bottom picture)
- operate the Steer Cylinder to end of stroke
- pressure can be set/adjusted by adjusting the screw in the port
- set pressure to 175 bar (2538 psi)

Drive Valve



VALVE SCHEMATIC

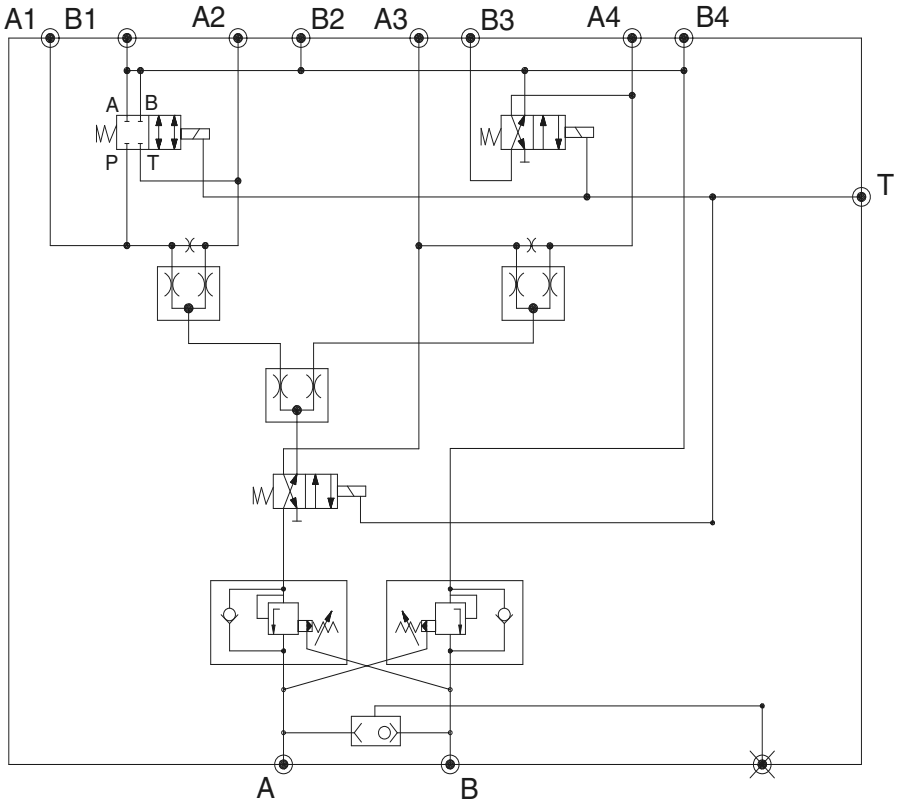
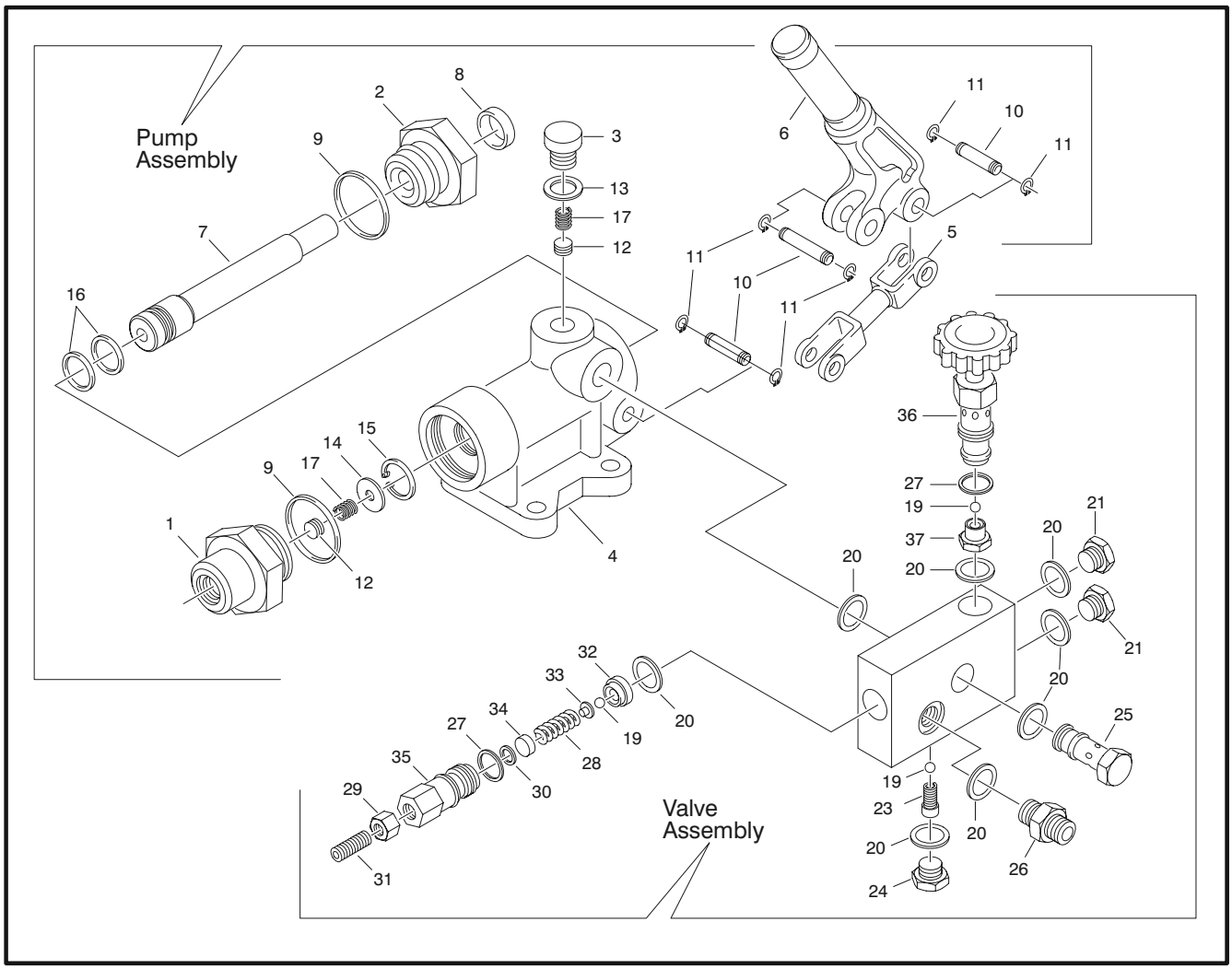


Figure 4-38. Drive Valve

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 4-39. Hand Pump Assembly

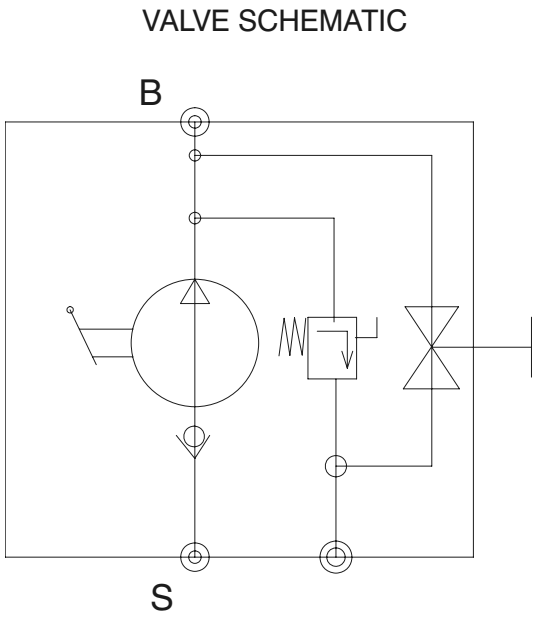
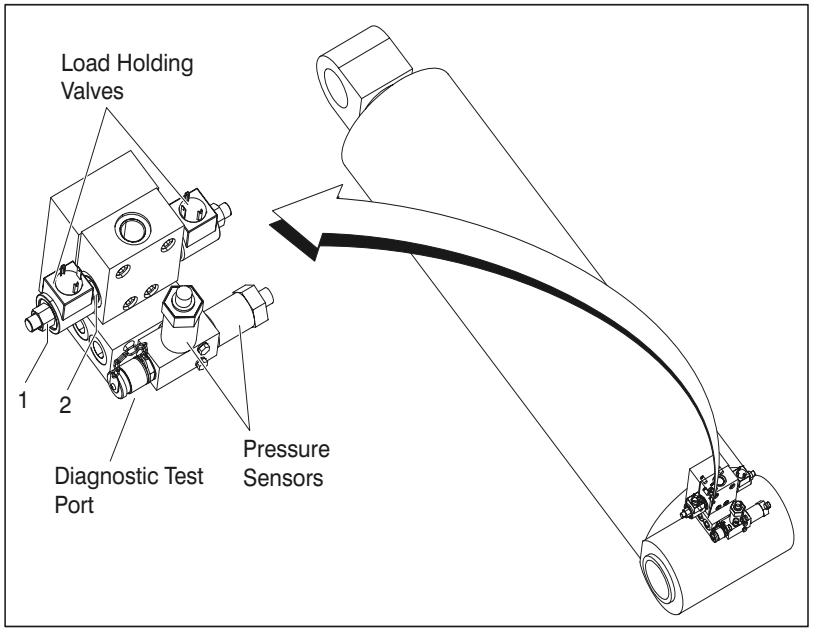


Figure 4-40. Hand Pump Schematic

Lift/Lower Valve Block



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)

Diagnostic Test Port

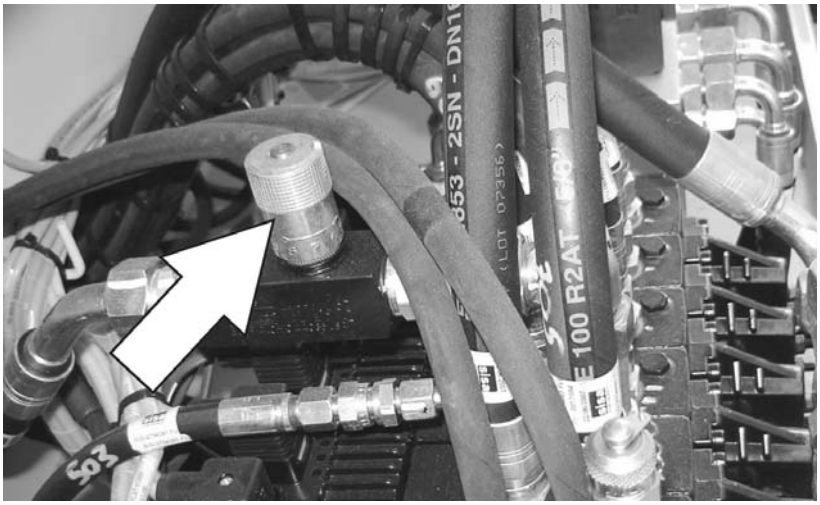
- Pressure Rating: 360 bar (5521 psi)

Pressure Sensors (Qty. 2)

- Torque to 25 Nm (18.4 ft lbs)

Figure 4-41. Lift/Lower Valve Block

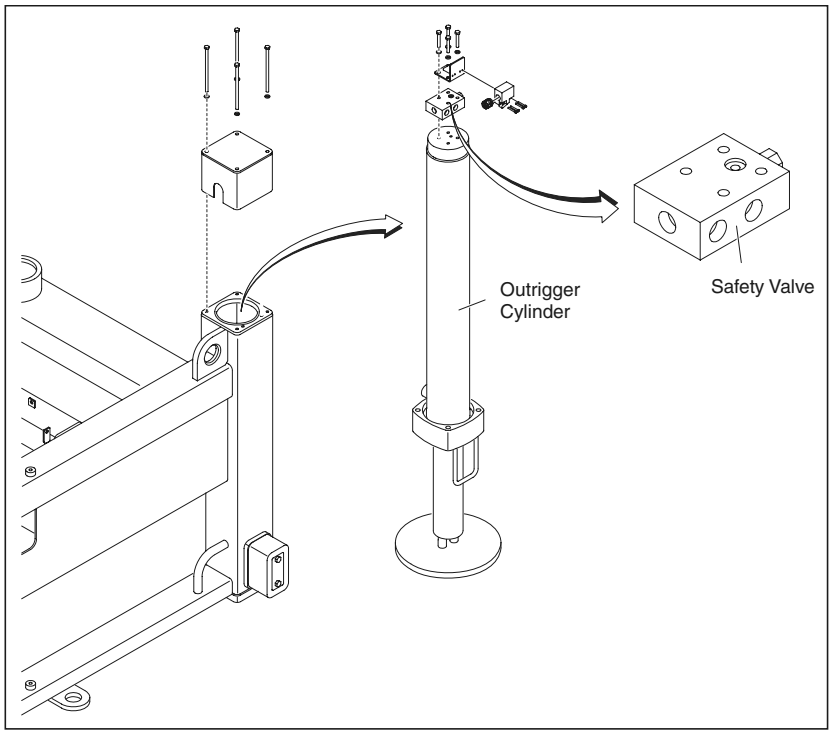
Platform Lower Flow Valve



- with the rated load on the platform (see Table 1-1), adjust the knob shown to the left to obtain the lowering speed as specified in (Table 1-1)

Figure 4-42. Platform Lower Flow Valve

Outrigger Safety Valves



Front Outriggers:

- Operating Pressure: 8 bar (116 psi)

Rear Outriggers:

- Operating Pressure: 1 bar (14.5 psi)

Figure 4-43. Outrigger Valves

NOTES:

SECTION 5. JLG CONTROL SYSTEM

5.1 MAIN TERMINAL BOX CIRCUIT BOARDS

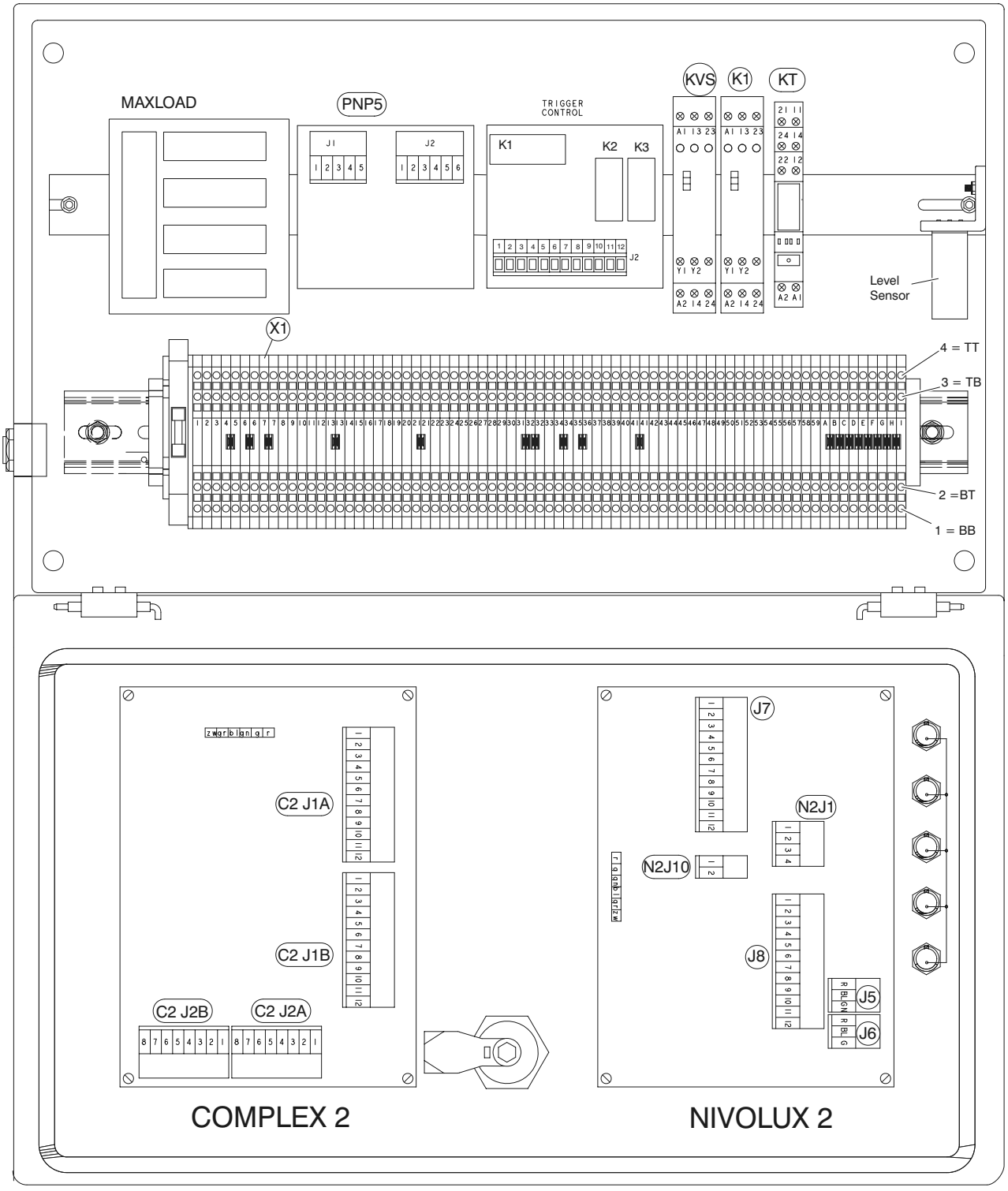


Figure 5-1. Main Terminal Box

5.2 CONTROL CARD COMPLEX 2

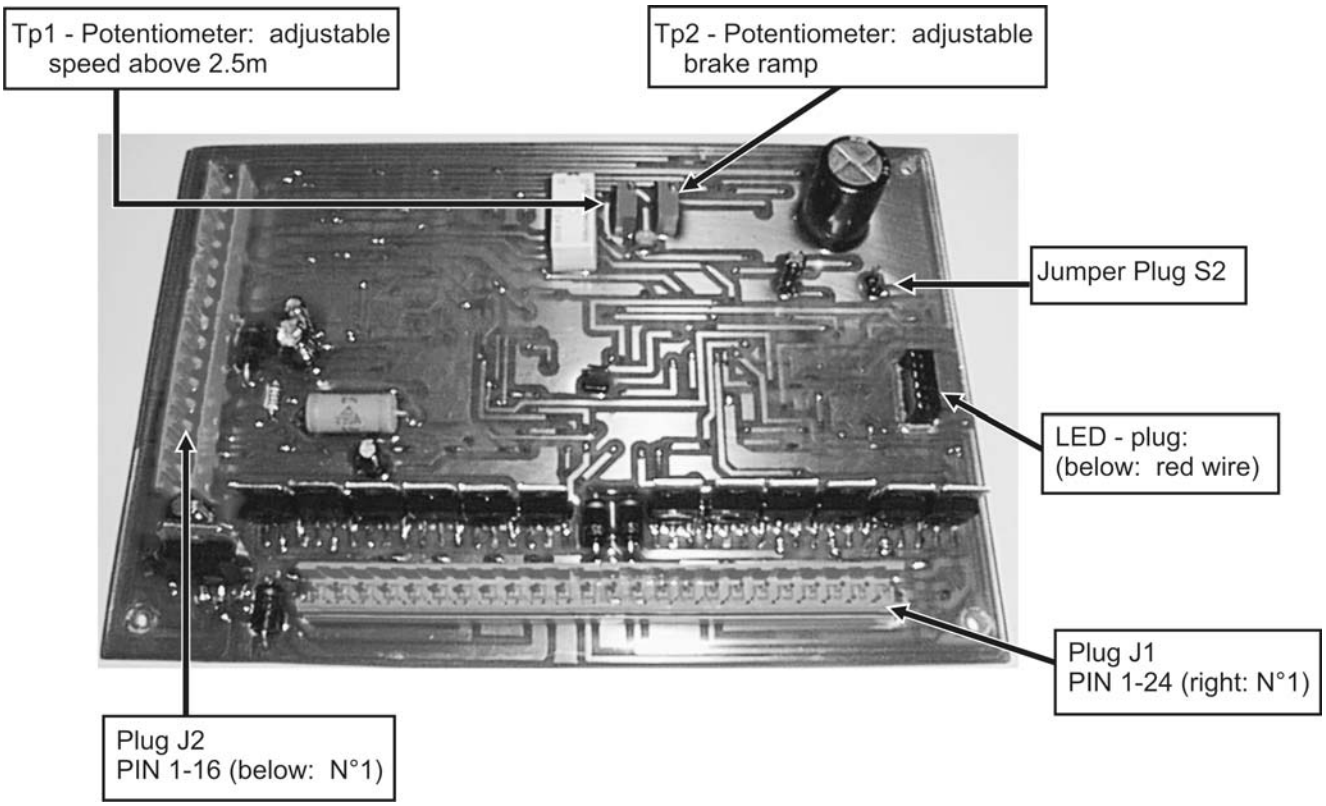


Figure 5-2. Control Card Complex 2 Board

General Description of Components and Functions

The Complex 2 Control circuit board is an electronic printed circuit board which processes the input signals from the control console (and the joystick trigger switch circuit board) and enables outputs to the rest of the machine control system.

The circuit board is located on the lid of the Main Terminal Box.

TP1 & TP2:

There are 2 potentiometers installed on the circuit card indentified as TP1 and TP2 which adjust the creep speed and the drive on/off ramp.

- TP1 - This is used to adjust the elevated creep speed by modifying the analogue output voltage to the drive control valve section. With the platform in an elevated position (fast drive speed limit switch tripped) and operating the machine with the console in the platform position, adjust the TP1 potentiometer to obtain the correct creep drive speed of 0.5 km/h.
- TP2 - This is used to adjust the ramp time to engage and disengage the drive control valve section. With the platform in the lowered position and operating the machine with the console in the platform position, adjust the TP2 potentiometer to obtain a drive acceleration and deceleration to ensure smooth operation. (nominal setting should be 2 seconds)

S2:

The connection S2 must be closed with a jumper plug to enable the Lift and Lower output signals.

Table 5-1. J1 Connector

J1 Connector	
1	Drive
2	Drive Height LS
3	Lower
4	Ground
5	Lift
6	Joystick Analog Signal
7	Pump 1
8	Max Height L/S
9	Steer Right
10	Steer Left
11	Tilt Switch
12	Fast Drive
13	Fast Drive L/S
14	Not Used
15	Ignition
16	Pump 2
17	Start
18	Diff Lock
19	Platform In
20	Not Used
21	Ground
22	Platform Out
23	Horn
24	24V Power

Table 5-1 Key	
	= Output Signal
	= Input Signal
	= Not Used

Table 5-2. J2 Connector

J2 Connector	
1	24V to Console
2	Deck Extension
3	Ignition
4	Start
5	Horn
6	Not Used
7	Not Used
8	Differential Lock
9	Trigger Switch
10	Ground
11	Not Used
12	Steer Right
13	Lift Select
14	Steer Left
15	Fast Drive
16	Joystick Analog Signal

Table 5-2 Key	
	= Output Signal
	= Input Signal
	= Not Used

Table 5-3. J3 Connector

J3 Connector	
1	Not Used
2	Fast Drive LED
3	Max Height LED
4	Drive Height LED
5	Not Used
6	Ground

Table 5-3 Key	
	= Output Signal
	= Input Signal
	= Not Used

Table 5-4. Complex 2 Circuit Board

OUTPUT SIGNAL		INPUT SIGNAL	Platform Select	Lift Select	Signal + VS	Start (Switch)	Horn (Switch)	S2 Jumper Closed	Signal Diff Lock	Joystick Trigger Switch	Steering Left (on Joystick)	Steering Right (on Joystick)	Signal Fast Drive	Joystick Analog Signal	Joystick - GND	S Drive Available (S 8/18/21M)	S Max Platform Height	S Tilt Switch (not tilted)	S 2.5M (Fast Drive Available)
			J2/2	J2/13	J2/3	J2/4	J2/5		J2/8	J2/9	J2/14	J2/12	J2/15	J2/16	J2/10	J1/2	J1/8	J1/11	J1/13
Ignition (signal diesel and relais K)	J1/15				1														
Starter	J1/17				1	1													
Drive Signal (during Drive)	J1/1				1									1	1	1			
Drive Signal (during Steering)	J1/1				1						(1)	(1)				1			
Analog	J1/6				1									1	1				
Lift	J1/5		1	1				X						1	1		1		
Lower	J1/3		1	1				X						1	1				
Right Steer	J1/9			1								1				1			
Left Steer	J1/10			1							1					1			
SER/PAR	J1/12			1									1	1	1				1
Differential Lock	J1/18			1					1										
Platform In	J1/19	1		1										1	1				
Platform Out	J1/22	1		1										1	1				
Pump 1 & RPM (Lift or Lower Platform)	J1/7		1	1				X		1				1	1		1	(1)	(1)
Pump 1 & RPM (Drive)	J1/7			1						1				1	1				
Pump 1 & RPM (Steer)	J1/7			1							(1)	(1)							
Pump 1 & RPM (Ext/Retract Pltf)	J1/7	1		1						1				1	1			(1)	(1)
Pump 2, Drive Mode (if applicable)	J1/16			1						1			1	1	1	1		1	1
Pump 2, Lift Mode (if applicable)	J1/16		1	1				X		1			1	1	1		1	1	
LED S8/18/21M (Drive Available)	J3/4			1												1			
LED Max Height (Lift Available)	J3/3			1													1		
LED S2.5M (Fast Drive Available)	J3/2			1															1
Horn	J1/23			1		1													
Board Power																			
(Linked to J1/21 on Diesel units) Ground	J1/4				"Or" Signals (1)						S1 Jumper Closed								
Power (24V) Vs	J1/24																		

5.3 NIVOLUX - AUTOMATIC SELF-LEVELING SYSTEM

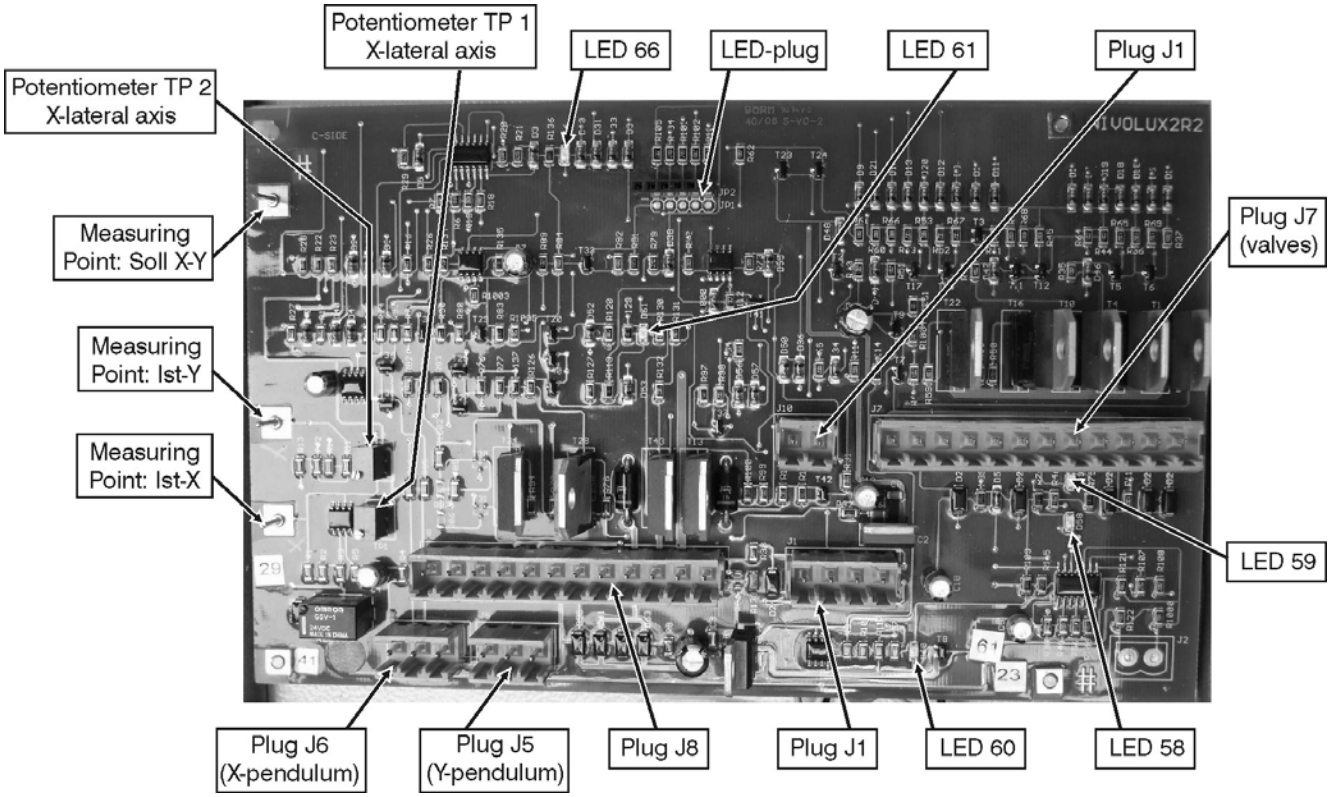


Figure 5-3. Nivolux Control Board

Introduction

Normally the operation of leveling the chassis on a Mobile Elevating Work Platform (MEWP) is very time consuming. The Liftlux NIVOLUX automatic self-leveling system eliminates this additional time, as it is a feature, when selected, of the normal lift and lowering operation. The estimated time saved over conventional systems can be in excess of 60%.

The System

A pair of angle sensors located inside the Main Terminal Box (MTB) senses the chassis angle of the MEWP. As indicated on the MTB decal, the inclination of the longitudinal axis is designated "Y" and the lateral axis is designated "X." The leveling function is achieved by hydraulic outrigger cylinders mounted at each corner of the chassis. Switches mounted on the top of each outrigger cylinder sense outrigger ground contact. The system is controlled by an electronic circuit board mounted in the MTB.

- The NIVOLUX automatic self-leveling system on JLG MEWPs is a selectable system.
- Deployment of the outriggers is not necessary to achieve the maximum platform height.
- The system is intended for use when the machine is positioned on uneven ground.
- The system, when selected, operates automatically in conjunction with the control console when connected to either the platform, or chassis position. It does not operate in conjunction with the ground control station.

Operation

- The activation of the NIVOLUX self-leveling system is part of the lifting process. The system starts the leveling function when the lifting function is operated and the outrigger mode is selected. By activating the lifting function via the controller (joystick), the automatic measuring system is powered up, the drive function is blocked and the control LED's on the MTB indicate the chassis tilt attitude.
- The leveling process starts by powering the lowest outrigger until the difference of the measured angle to set

point is less than 0.5°. The next lowest outrigger is then powered to level one axis within 0.5°.

- This process continues until both axes are within 0.5°. (i.e. the chassis is level)
- When the system completes the leveling process (sensed angle is within 0.5° of set point in both axis), the NIVOLUX system checks that all 4 outriggers have ground contact and then powers up the lift valve.

NOTE: *If ground contact is lost on any one of the 4 outriggers, the lift function will be cut. In this event, the platform should be fully lowered and the ground conditions checked before attempting to re-level the chassis.*

- All the above operation is performed with the engine at low idle speed. After the initial lift movement (a short time delay), the high engine speed solenoid is energized to deliver the required oil capacity for normal lifting operation.
- Above the Fast Speed Cutout Height (limit switch S 2.5m), the NIVOLUX Board cuts all output to the outrigger valves. This ensures that no leveling function can be performed with a raised platform.
- To retract the outriggers, it is necessary to maintain the lowering function via the controller (joystick) after the platform is in the fully lowered position. This position is sensed by the limit switch (Platform Down) and the NIVOLUX system automatically increases the engine speed from low idle and powers up the 4 outrigger retract valves.
- When all outriggers are retracted, the hydraulic system pressure increases to the relief setting. This pressure is sensed at approximately 185 bar (2683 psi) by a pressure switch and signals the NIVOLUX system to re-enable the drive function.
- This completes a full lifting cycle.

NIVOLUX Board LED's

LED	Meaning
Elevating the MEWP with outriggers selected:	
Red LED N° 59	Level OK
Red LED N° 60	Leveling Finished
Red LED N° 58	Ground Bearing Pressure Reached
Red LED N° 61	Ground Bearing Pressure OK and Start Lifting
After retracting the outriggers:	
Green LED N° 66	All Outriggers Retracted
Elevating the MEWP with outriggers OFF:	
Green LED N° 66	All Outriggers Retracted

Setting and Adjustment of the NIVOLUX Board

- Located on the circuit board is a potentiometer for each axis ("Y" longitudinal and "X" lateral) to set a zero point. There are three measuring points to accommodate a conventional voltmeter.

To Check and Set Adjustment:

1. Place the MEWP on an even, flat, and level surface. Ensure the MEWP is level to within ±0.5° of 0°.

NOTE: *The MEWP can be manually leveled by using the outrigger handles on the main valve block (refer to Figure 4-33., Main Valve Block). Lower outriggers by engaging the handles until the machine is level to within ±0.5° of 0° from front to back and right to left. Check with a digital level gauge.*

2. Ensure the Battery Disconnect is ON. Turn the select switch to Platform and switch outriggers select to Outriggers ON.
3. Power up the NIVOLUX board by switching the ignition switch on the console to ON.
4. Open the MTB and measure the voltage between the measuring points **SOLL X/Y** (supposed value) and **IST Y** (actual value) which are the upper and center measuring points. A voltage of +0.1V (100mV) represents about 1° of inclination (nose up). A value of -0.1V represents about 1° of inclination (nose down).
5. Adjust **TP2** (see Figure 5-2.) with a small screwdriver until your voltmeter shows zero. Turning counterclockwise reduces the value.
6. Measure the voltage between the measuring points **SOLL X/Y** (supposed value) and **IST X** (actual value) and follow the same steps as in step 5. **+0.1V** represents an inclination of approximately **1°** to the right and **-0.1V** represents an inclination of approximately **1°** to the left.
7. Turn off the ignition switch and close the MTB.

Table 5-5. NIVOLUX Circuit Board

Output Signal	Input Signal	J8/2 S2.5M (Fast Drive Available)	J8/3 RPM (Complex Out)	J8/6 Lift (From Complex Out)	J8/8 Lower (From Plat Down LS)	J8/9 +VS (k VS)	J5/3 X- Leveling (<7.5V)	J5/3 X+ Leveling (>7.5V)	J6/3 Y- Leveling (<7.5V)	J6/3 Y+ Leveling (>7.5V)	J10/2 24V (From Jacks Select Sw - Off)	J1/2 24V (from P Switch or K1)
RPM (to Deutz box & PNP) Lift wth NIVOLUX	J8/4		1	1								
RPM (to Deutz box & PNP) Lift wthout NIVOLUX	J8/4		1	1		1					1	
RPM (to Deutz box & PNP) Lowering	J8/4	1			1							
Lift Valve	J8/7			1		1						1
Drive OK with NIVOLUX	J8/10			0	(1)*	1					0	1
Drive OK without NIVOUX	J8/10					1					1	1
Front Left IN	J7/1	1			1						0	
Front Left OUT during leveling	J7/2	1		1			1		1		0	
Front Left OUT establishing ground pressure	J7/2	1		1			&	&	&	&	0	0
Front Right IN	J7/4	1			1						0	
Front Right OUT during leveling	J7/5	1		1				1	1		0	
Front Right OUT establishing ground pressure	J7/5	1		1			&	&	&	&	0	0
Rear Right IN	J7/7	1			1						0	
Rear Right OUT during leveling	J7/8	1		1				1		1	0	
Rear Right OUT establishing ground pressure	J7/8	1		1			&	&	&	&	0	0
Rear Left IN	J7/10	1			1						0	
Rear Left OUT during leveling	J7/11	1		1			1			1	0	
Rear Left OUT establishing ground pressure	J7/11	1		1			&	&	&	&	0	0
X Supply (15V)	J5/1	15V Output with Board Power On										
Y Supply (15V)	J6/1	15V Output with Board Power On										
24V (to P Switch and K1 23/24 contacts)	J1/1	24V Output with Board Power On										
24V (to Jack Select Switch) with NIVOLUX	J10/1			(1#)		1					0	
24V (to Jack Select Switch) without NIVOLUX	J10/1					1					1	
LED Left High	D42			(1)-)				1			0	
LED Right High	D43			(1)-)			1				0	
LED Front High	D44			(1)-)						1	0	
LED Rear High	D45			(1)-)					1		0	
LED No Drive (on)	D54			(1)-)							0	
Board Power												
Ground	J8/11											
Vs (24V)	J8/1											

* = This input is only necessary to establish output on J1/2. after the output J1/2 is established input J8/8 is not a necessity.

= J1/10 output is cut with a momentary lift input and reset with a J1/2 input, or recycling power.

& = 7.5V signal which is level input from sensors.

(1)-) = This input is only necessary to establish this output, after the output is established the input is not necessary.

5.4 PNP5 CIRCUIT BOARD

System

The PNP5 circuit board is an electronic printed circuit board mounted on the Din rail situated in the MTB (refer to Figure 5-1., Main Terminal Box).

Operation

The circuit acts on the control system in the following ways:

1. Amplifies signals to activate the drive and series/parallel hydraulic valves.
2. Activates the oscillating axle hydraulic valves when the platform is not elevated and the drive function is operated.
3. Enables the output to activate 2nd pump (if fitted and selected) when the platform is not elevated. Also delays this output until the engine speed and torque are sufficient. This delay is adjustable by means of a potentiomter on the board.

Adjustment

- With the platform stowed, position the drive speed select switch to 'High Speed.' Operate the drive function and adjust the potentiometer to produce a 2 second time delay pump 2 output (signal on J2/2) following the engine speed increase.

Table 5-6. PNP Circuit Board - I/O

IN		OUT Seris Parallel J1/3	Drive J1/5	Osc. Axle J2/3	Pump 2 J2/5
Drive	J1/1		1	1	
Series Parallel	J1/4	1			
Pump 2	J2/2				1*
S2.5m Limit Switch	J2/4			1	
High Engine (RPM)	J2/6				1*

Board Power	
24V (Vs)	J1/2
Ground	J2/1

*Adjust Potentiometer to delay Pump 2 output after RPM input. (allows engine to begin torque before adding load)

Table 5-7. Connector J1

Drive In	J1/1
Power 24V	J1/2
Series Parallel Out	J1/3
Series Parallel In	J1/4
Drive Out	J1/5

Table 5-8. Connector J2

Ground	J2/1
Pump 2 In	J2/2
Oscillating Axle	J2/3
S 2.5 In	J2/4
Pump 2 Out	J2/5
Engine RPM In	J2/6

5.5 TRIGGER CONTROL CIRCUIT CARD

Relay K1

NOTE: *Refer to Table 5-9 for numbers.*

1. Energized when there is a trigger input at 2.
2. When a start input signal is applied to 5, and there is no input from the trigger switch (no input on 2), the start ouput signal passes through the N.C. contacts on relays K1 and K2 to 6.
3. When a trigger input signal is present at 2, there is a 6 second window to receive a pump/lower input signal at 4 to keep K1 energized. This trigger input passes through the N.O. contacts to produce a trigger output on 3.
4. If there is no pump/lower input within this time (e.g. the trigger switch is taped closed), K1 is de-energized and the trigger output at 3 is cut.

Relay K2

1. Energized when there is a trigger input at 2.
2. This input passes through the N.O. contacts to produce a drive output on 8.
3. When this trigger input is removed, there is a 3 second time delay before K2 is de-energized and the drive output on 8 is cut. (Anti bounce function for the drive function).

Relay K3

1. Energized when there is a trigger output at 3.
2. The analogue input signal 4 passes through a set of N.O. contacts to produce an analogue output on 11.
3. The pump input signal 10 or lower input signal 9 passes through a set of N.O. contacts. This ouptu signal maintains the Trigger input signal 2 which energizes relay K1.

Table 5-9. Connector CON1

1	24V Supply
2	Trigger Switch Input
3	Trigger Switch Output
4	Analog Signal Input
5	Start Input
6	Start Output
7	Drive Input
8	Drive Output
9	Lower Signal Input
10	Pump Signal Output
11	Analogue Signal Output
12	Ground

Table 5-10. Trigger Control Circuit Board

	INPUT	Trigger Switch J2/2	Pupm or Lower J2/4	Start J2/5	Drive J2/7	Spare J2/9	Spare J2/11
OUTPUT							
Trigger Switch	J2/3	1				(1)	(1)
Start	J2/6	0		1			
Drive	J2/8	1			1		
Spare	J1/10	1	1			(1)	(1)

Board Power	
24V (Vs)	J2/1
Ground	J2/12

(1) Trigger Input = Pump/Lower input within 6 seconds

5.6 LIMIT SWITCH & SENSOR OPERATION

NOTE: *Refer to Figure 1-1., Limit Switch Locations for locations of limit switches.*

Height Limit Switches

Platform Stowed/Jacks Retract Limit Switch (S Platform Down):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack.

- When the platform is fully lowered, this switch is closed and permits a platform lower signal (from the Complex Board) to enable the NIVOLUX board to retract the outriggers.
- When this switch is activated, the outriggers can not be retracted.

High Drive Speed Cutout Limit Switch (S 2.5m):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack . When the platform is within approximately 0.5m (1.6 ft) of the fully lowered position, this switch is closed and 2 x 24V outputs are available.

- The Control System (Complex Board) uses one of these signals to enable fast drive and bypass the tilt switch lift cutout feature. The Self-Leveling System (NIVOLUX Board) also uses this signal to enable the outrigger valve outputs.
- The second bypasses the oscillating axle sensing switches.
- When this switch is activated, the drive speed is limited to slow speed. The Self-Leveling system valve outputs are cut and the tilt switch circuit controls the lift function which is cut out.

Maximum Drive Height Limit Switch (S 18m):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack. When the platform is below the maximum permitted drive height, this switch is closed and 24V output is available.

- The Control System (Complex Board) uses this signal to enable the drive function.
- When this switch is activated, the drive function is cut.

Maximum Height Limit Switch (S Max. Height):

This limit switch is mounted on the chassis and is activated by a cam mounted on the pivot of the scissor pack.

- When the platform is below the maximum height, this switch is closed. One contact passes a 24V signal to the Control System (Complex Board) to enable lift up.
- The other contact passes 24V from Relay KT contacts to the Ground control Lift Up Switch.
- When this switch is activated, the lift function is cut.

Tilt Switch

S Tilt Switch:

The scissor lift is equiped with a chassis inclination sensor set to trip at 3°. The value of the incline will be monitored by a tilt switch, which will cut off lifting, driving, and steering once the platform is raised [above High Drive Speed Cutout Limit Switch (S 2.5m)] and the set angle is reached. The lowering function remains available to bring the platform below the High Drive Speed Cutout Limit Switch (S 2.5m) height. This permits the drive function to enable the MEWP to be repositioned on a level surface. This multi axis tilt switch is mounted in the valve compartment to sense the angle of the chassis. The Control System (Complex Board) uses the input signal from the High Drive Speed Cutout Limit Switch (S 2.5m) to bypass this tilt switch.

- When the chassis is within the set point angle limits, there is a constant output of 24V. The Control System (Complex Board) uses this signal to permit the lift up, drive, and steering functions when the machine is elevated (S 2.5m is cut).
- When tilted beyond 3°, there is zero output and a red LED on the console is turned on by means of relay KT. Also, when S 2.5m Limit Switch is activated, the functions of lift, drive, and steer are also cut.

Adjustment:

Place the machine on a flat level surface. Using a digital level, ensure the chassis is level. Adjust the X and Y axis nuts to place the top mounted bubble level in the center.

Outrigger Limit Switches

ST1, ST2, ST3, & ST4 Switches:

These 4 limit switches are mounted on the top (barrel end) of each outrigger cylinder and work in conjunction with the NIVOLUX Automatic Self-Leveling System. They are utilized to sense when the outrigger pad makes ground contact and are wired in series on both the normally open (N.O.) and normally closed (N.C.) contacts.

- Refer to Section 5.3, NIVOLUX - Automatic Self-Leveling System for a description of the operation.

Pressure Switch

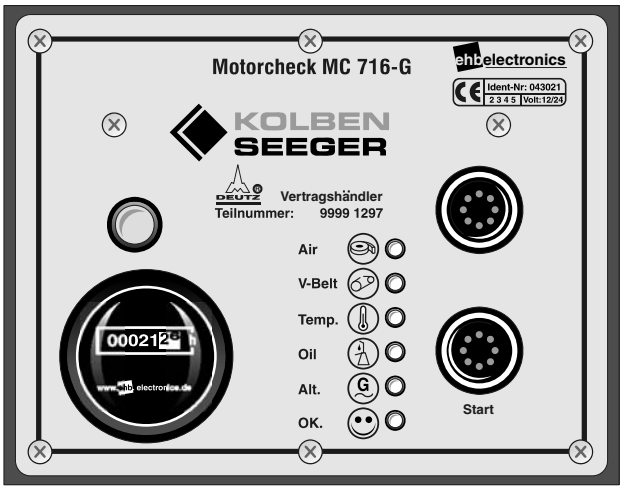
A pressure switch is line mounted in the drive brake hydraulic line. This pressure switch works in conjunction with the NIVOLUX Automatic Self-Leveling System.

- Refer to Section 5.3, NIVOLUX - Automatic Self-Leveling System for a description of the operation.

Table 5-11. Limit Switches

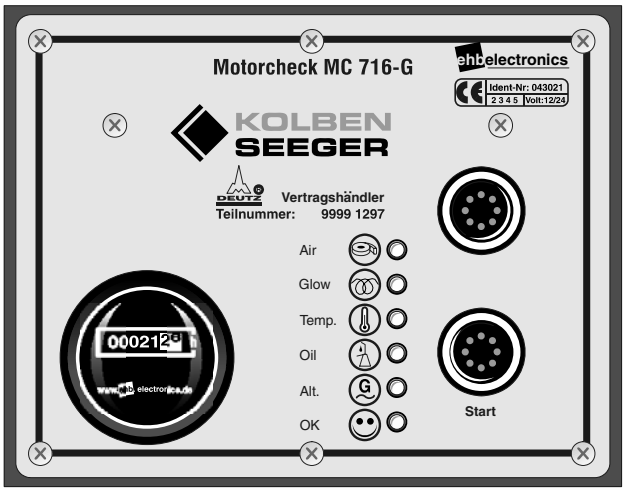
Switch	Purpose
Outriggers	**Jacks Selected** = No switch input to X1/43 and N.C. contacts wired in series to sense ground contact for all jacks then enable lift up by energizing relay K1.
	Jacks Not Selected = Switch input to X1/43 and N.O. contacts wired in series to sense all jacks retracted and enable lift up by energizing relay K1.
S Platform Down	**N.C. contacts** sense when platform is fully lowered. Enables jacks retract (select by resetting lift switch when fully lowered and continue to lower) and re-enable drive function. Only when jacks are selected.
S 2.5m	**N.C. contacts** sense at +/- 3.7m (12 ft) platform height and interlock fast drive speed. Interlock drive and lift if tilted (tilt switch tripped). Also indicates lift available LED at console.
S 18m	**N.C. contacts** sense max permitted drive height of the platform and interlocks drive function. Senses max lift height when outriggers are not deployed. Also indicates lift available LED at console.
S Max Height	**N.C. contacts** sense max platform height and interlocks lift up. Also indicates lift available LED at console.

5.7 ENGINE CONTROL SYSTEM



H005559

OR



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Functional Description

NOTE: *For desciptions in ( ), refer to Figure 6-23., Electrical Schematic - Sheet 6 of 18.*

1. An ignition input on X1/1 (15) creates an output at X2/8 (fuel solenoid). (on H005559, this input also powers up the glow plug relays at X2/23). Initially all 6 LEDs will flash 3 times, to test the system and the LEDs. After this startup check, only the OK LED should flash. An additional 7 seconds later, the system monitoring system is activated and the circuit recognizes fault input signals.

2. A start input on X1/2 (50e) creates an output at X2/7 (start relay). This input is ignored by the system after 10 sec. to protect against short circuit, or switch "contact stuck closed" situations. The output is also dependant on the alternator input signal.

3. The alternator input X2/10 (W) is monitored in the following way:

   a. When a start signal is applied to X1/2 (50e), the input on X2/10 needs to be less than 4Hz to enable an output at X2/7 (50f). (Start lockout feature when engine is running).

   b. When X2/10 reaches 150Hz, the X2/7 output is cut (engine is sensed to be running and start signal is cut).

NOTE: *An input frequency of 80Hz can be achieved when the engine is cranking, but not started. If this occurs, increase the sensing trip point in the E-prom on the circuit board to 150Hz. This ensures the engine is running before cutting the start signal.*

   c. When a start signal is applied to X1/2 (50e) and the input on X2/10 remains zero, after 1 second of cranking, the output X2/7 is cut and the G LED turns on (no input from alternator).

NOTE: *The field current strength, during initial start in cold temperatures, from the W input (600mA) can be insufficient to generate a sensed signal. If this occurs, increase the field current sensed to 1A by reducing the exciter resistor to 23.5 Ohm from 39 Ohm. This ensures sufficient initial start signal strength in cold weather.*

   d. If X2/10 goes to zero when the engine is running, the output to X2/8 is cut and the G LED turns on (lost input from alternator).

4. There is a 6 second time delay between start attempts. The 6 seconds starts when there is zero input on X2/10.

5. The main use of the additional push button "Start Assist" is to prime the fuel line. When this button is operated simultaneously with the start button, the start cut out control feature is ignored. This condition continues for 3 minutes during which only one start attempt can be made.

6. When there is an imput to X2/11 the Glow Time LED (lamp on H005559) is turned on. The duration of the time on is controlled by the glow relays.

7. When there is an air intake filter clogged input (ground) on X2/4 (Air), the fault LED on the panel is illuminated. This is an indication warning only. It does not cut the engine. This warning signal

remains on, even if the switch resets, until the ignition input X1/1 (15) is recycled.

8. The monitoring system will shut the engine down (ouput to X1/7 is cut) if one of the following fault input signals is present for 3 seconds:
   a. No frequency on W - X2/10
   b. Input on Oil - X2/1
   c. Input on Temp - X2/3
9. When there is a 24V output on X2/9 (50f), the engine speed is increased by energizing the throttle solenoid. The circuit card generates this output from a 24V input on X1/3 (Aux2).

Table 5-12. Deutz Engine Control Board

IN		OUT: Start Solenoid X2/7	Fuel Solenoid X2/8	Throttle Solenoid (RPM) X2/9
Ignition	X1/1	1	1	1
Start	X1/2	1		
RPM	X1/3			1
Oil Pressure Switch (Ground)	X2/1		0	
Alternator (D+)	X2/2			
Temperature Switch (Ground)	X2/3		0	
Air Filter Switch (Ground)	X2/4		0	
Alternator (W)	X2/10	"0"		
Glow Time (Ground) or Vee Belt (Ground	X2/11			
Power 24V	X2/5	+	+	+
Ground	X2/6	-	-	-

"0" = Zero frequency

Table 5-13. Deutz Engine

Connector X1	
Ignition	X1/1
Start	X1/2
RPM	X1/3

Connector X2	
Oil Pressure Switch (Ground)	X2/1
Alternator (D+)	X2/2
Temperature Switch (Ground)	X2/3
Air Filter Switch Ground)	X2/4
Power 24V	X2/5
Ground	X2/6
Start	X2/7
Fuel Solenoid	X2/8
RPM Solenoid	X2/9
Alternator (W)	X2/10
Glow Plug (Ground) or Vee Belt (Ground)	X2/11

Through Line Connector
24V Power (direct to battery)
24V Power Alternator (B+)

Input	
	Output

5.8 LOAD SENSING SYSTEM (LSS)

LSS Re-Calibration Procedure

Required Tools & Equipment

1. Calibrated Weights (refer to Table 5-14, LSS Load Height Chart)
2. Pressure Gauge, capable of reading 150 bar (2176 psi) (digital gauge recommended)
3. Measuring tape, up to 6 m (19.7 ft) in length
4. Standard Mechanics Tools

⚠ WARNING

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

STAGE 1

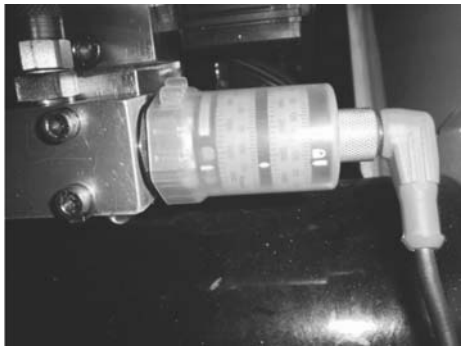
1. Ensure all scissor pins and wear pads are sufficiently greased before any calibration is carried out. Any tight pins or wear pads will affect the accuracy of the set-up procedure.
2. Load the scissor deck evenly with the maximum rated load, plus an additional 15% (refer Table 5-14).

Table 5-14. LSS Load Height Chart

Model	203-24
Max Load	750 kg (1653.4 lbs)
Max Load plus 15%	865 kg (1907 lbs)
Height	5.1 m (16.7 ft)
Both Reset Rings	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 Figure 5-14).

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 obstructions, 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 Figure 5-14). 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.

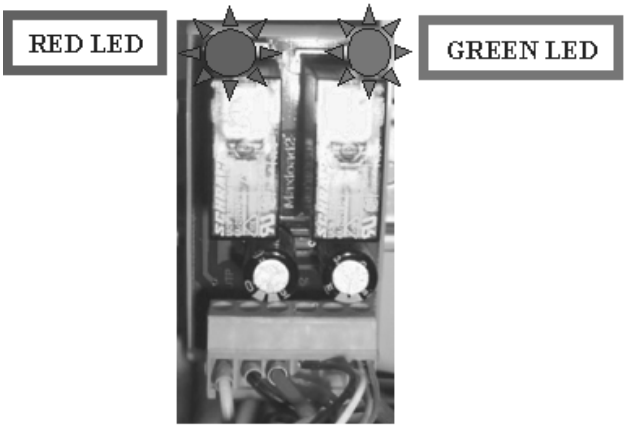
4. Once the platform has cut-out the lift function and the Green and Yellow LED's are lit, the manual descent taps and hand pump must be used each time to return the platform back down to the stowed position. Continue to adjust Max Pressure xxx to match Max Height yyy.

NOTE: *To achieve the correct setting make ± 2 bar (±29 psi) changes to the Set Ring scale.*

At this stage you are trying to set the pressure on sensor No/1 to stop the up-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 (3626 psi), so that it is +2 bar (+29 psi) higher than the locked Set Pressure now on Sensor No/1.

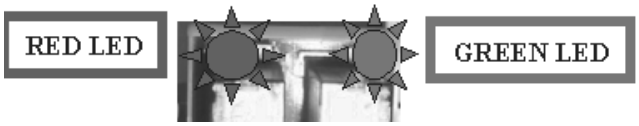
4. Lift the platform until it cuts up-lift.

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, the Engine has stopped, 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. The Engine will cut and 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. Test several times for correct operation.

NOTES:

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

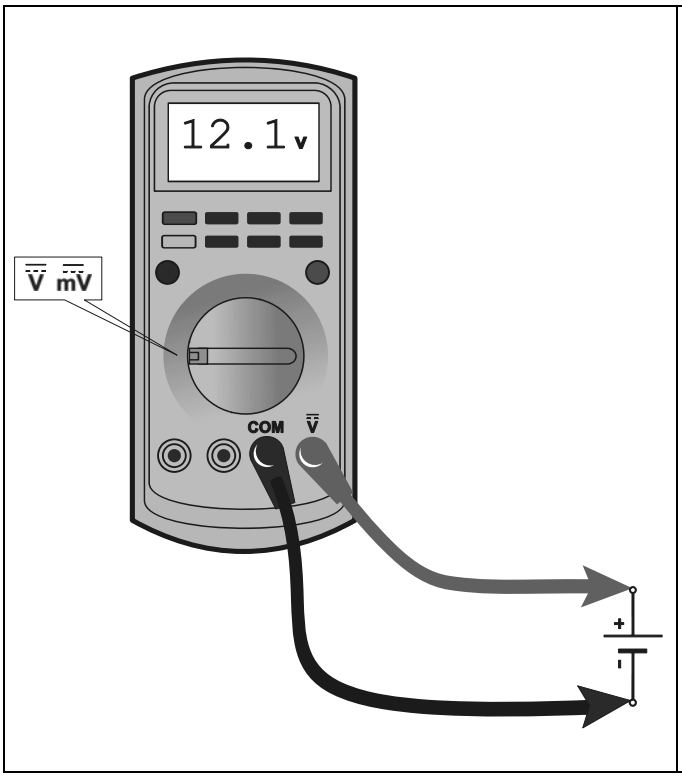


Figure 6-1. Voltage Measurement (DC)

- 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

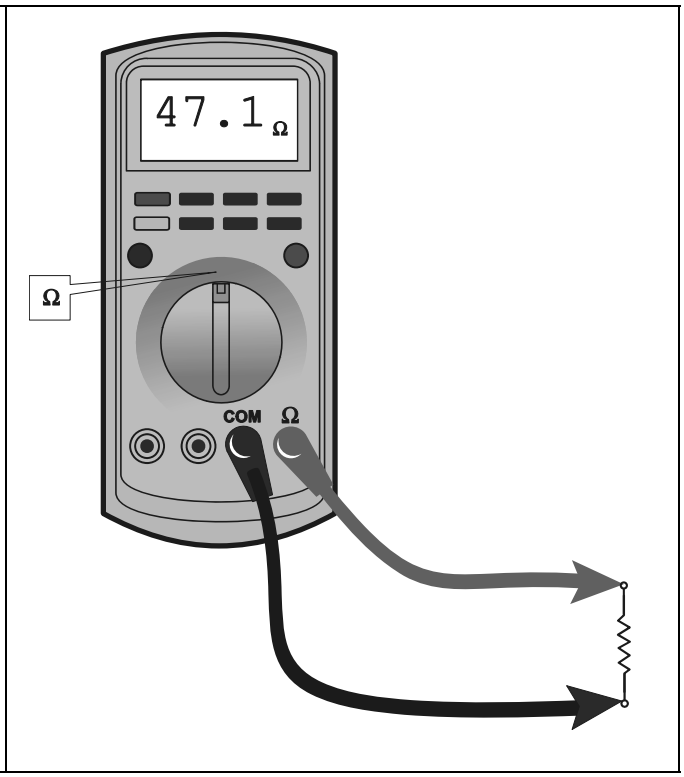


Figure 6-2. Resistance Measurement

- 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

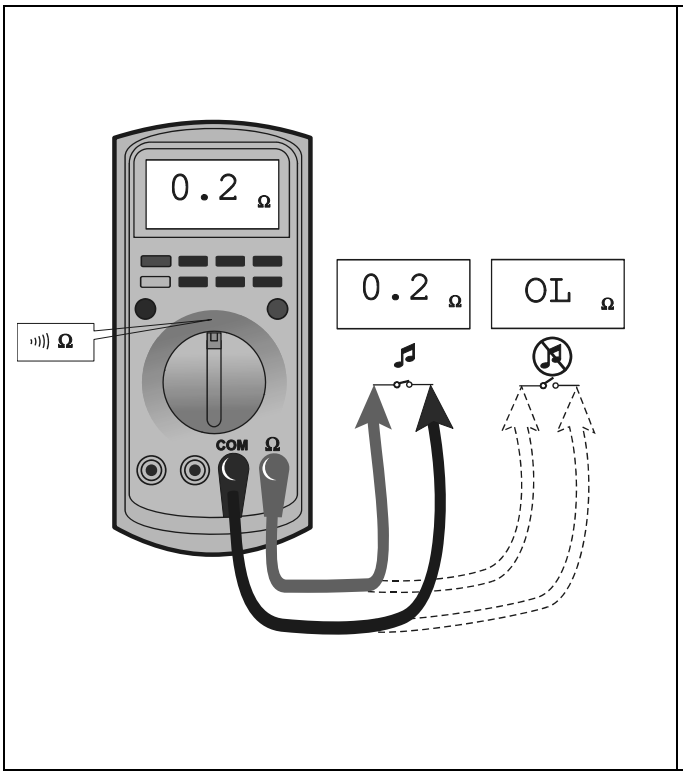


Figure 6-3. Continuity Measurement

- 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

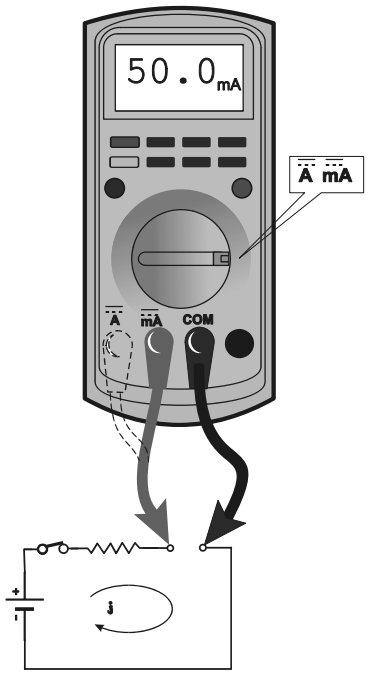


Figure 6-4. Current Measurement (DC)

- 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.

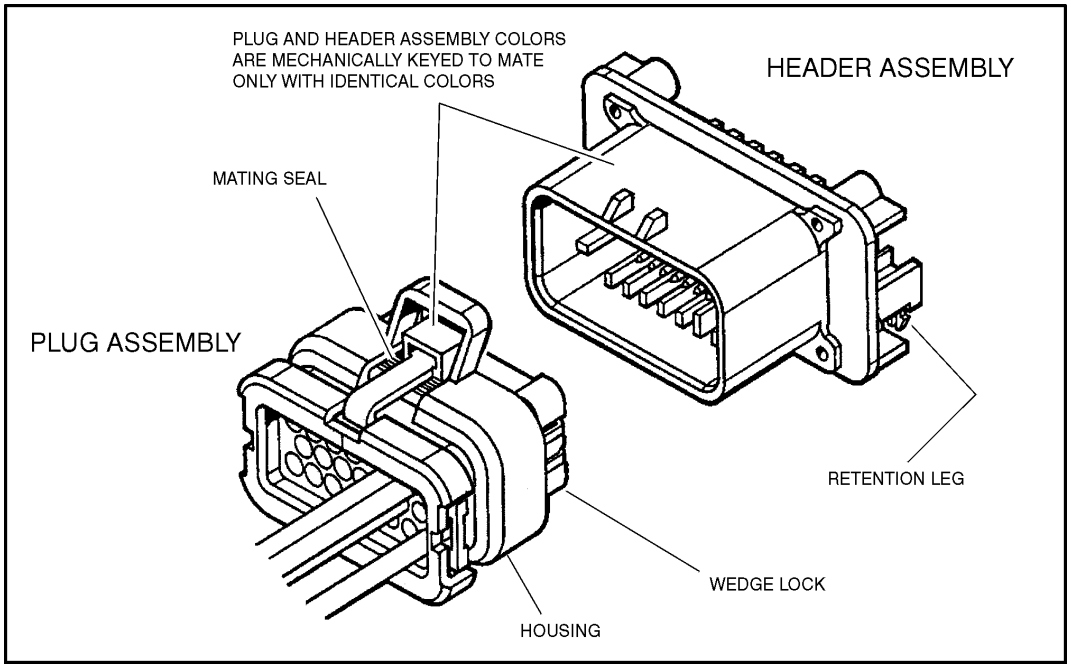


Figure 6-5. AMP Connector

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:

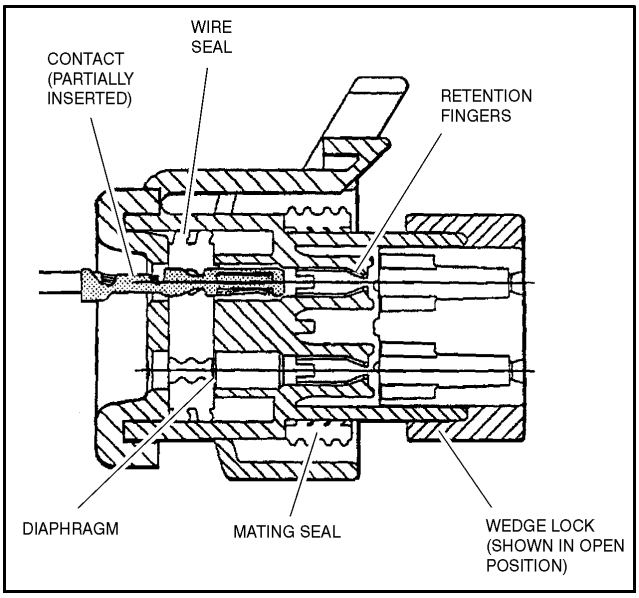


Figure 6-6. Connector Assembly (1 of 4)

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)).

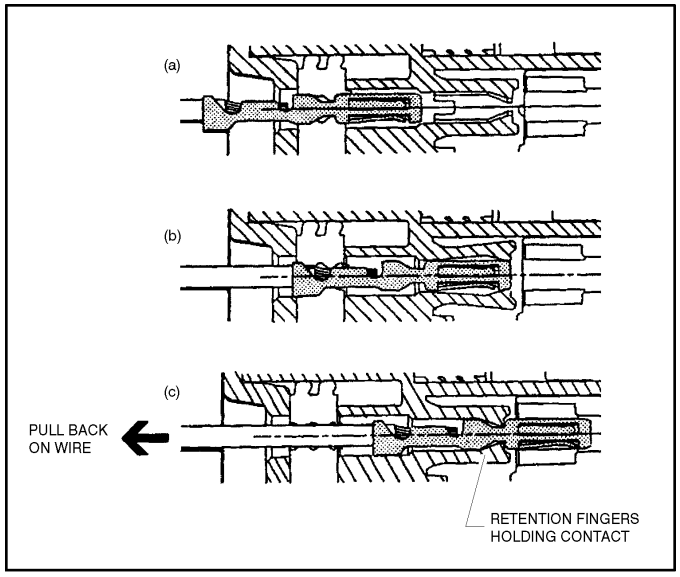


Figure 6-7. Connector Assembly (2 of 4)

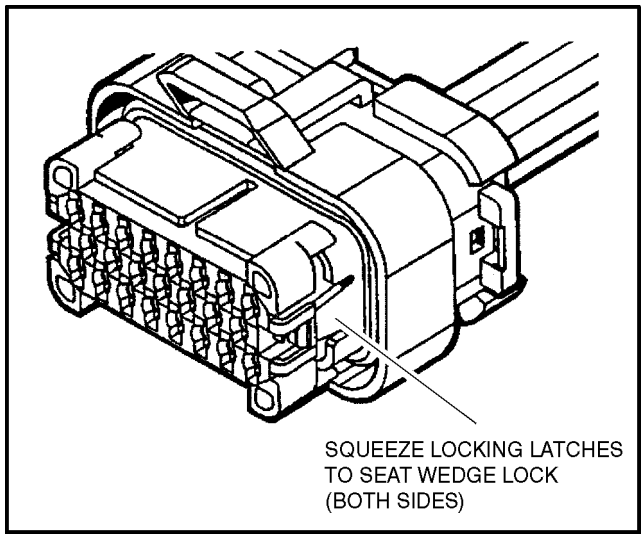


Figure 6-8. Connector Assembly (3 of 4)

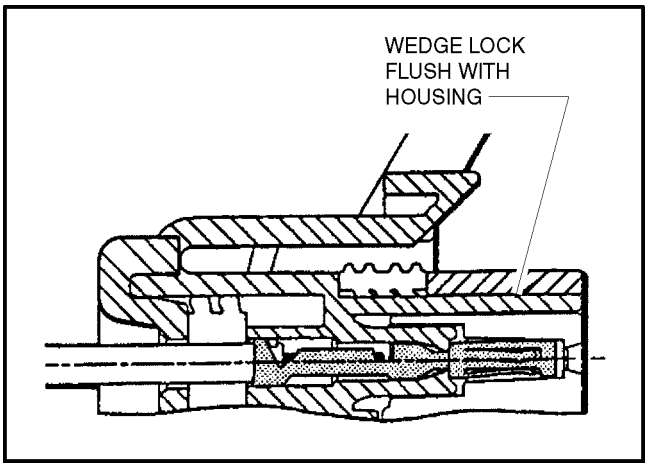


Figure 6-9. Connector Assembly (4 of 4)

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.

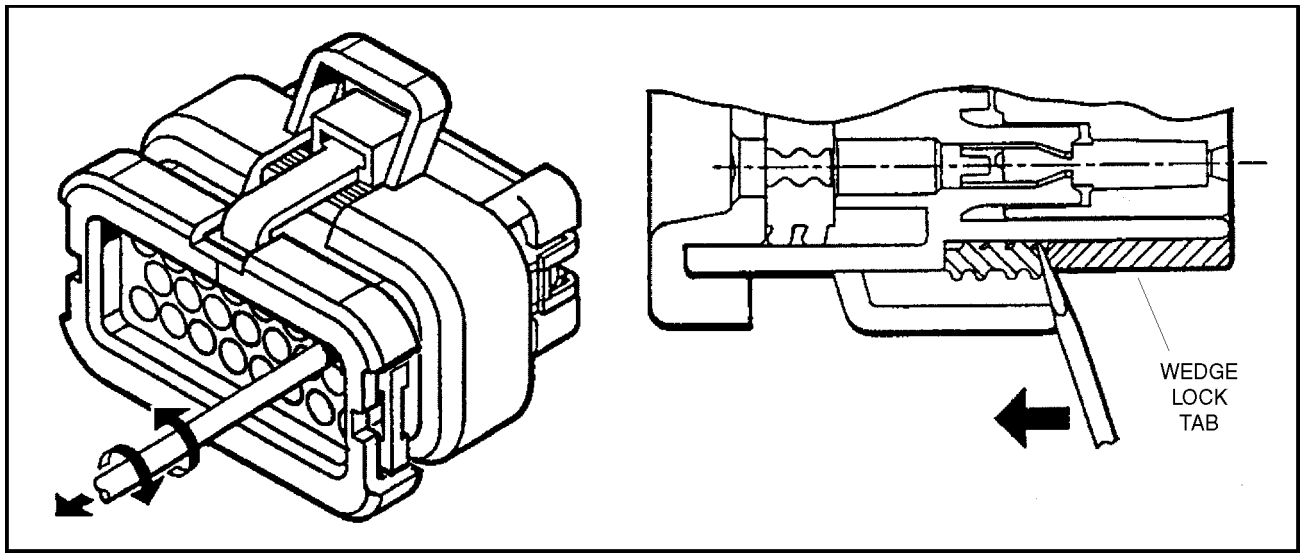


Figure 6-10. Connector Disassembly

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.

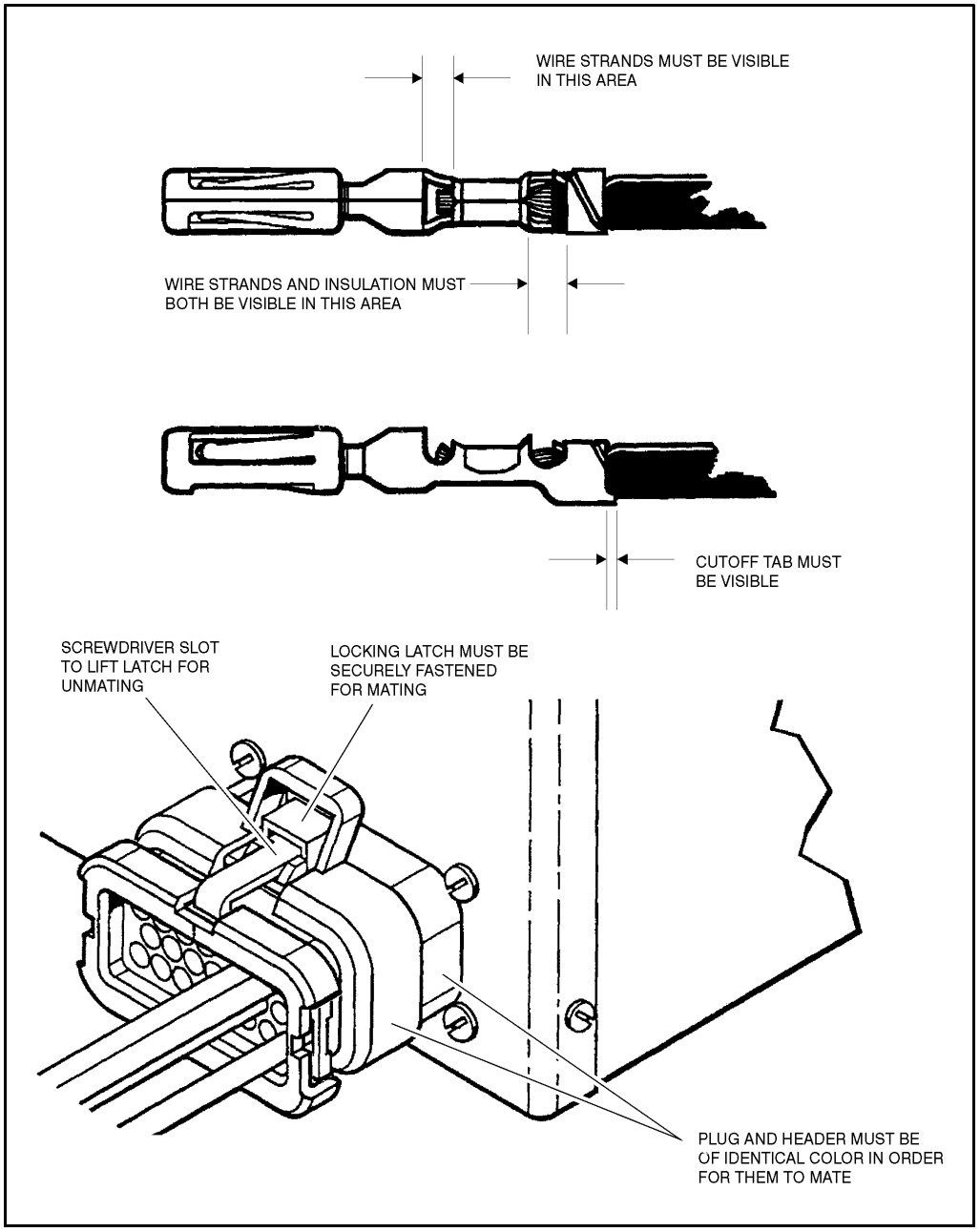


Figure 6-11. Connector Installation

6.4 WORKING WITH DEUTSCH CONNECTORS

DT/DTP Series Assembly

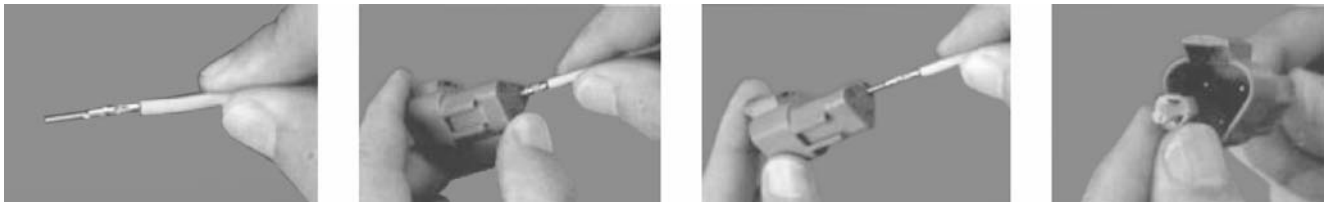


Figure 6-12. DT/DTP Contact Installation

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

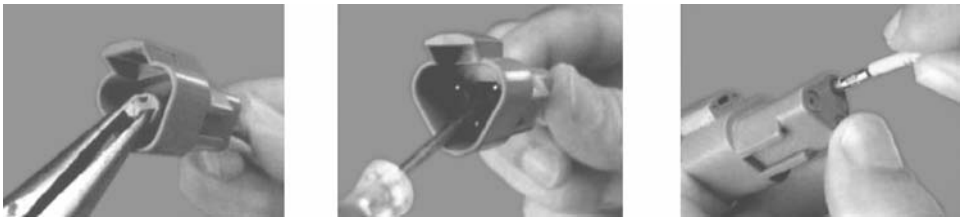


Figure 6-13. DT/DTP Contact Removal

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.

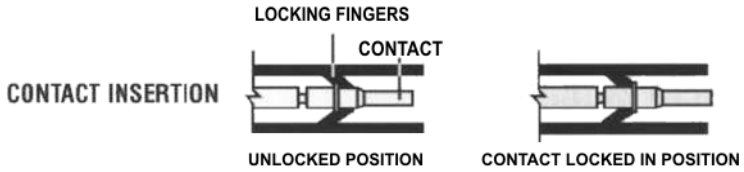


Figure 6-15. HD/HDP Locking Contacts Into Position

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

HD30/HDP20 Series Disassembly

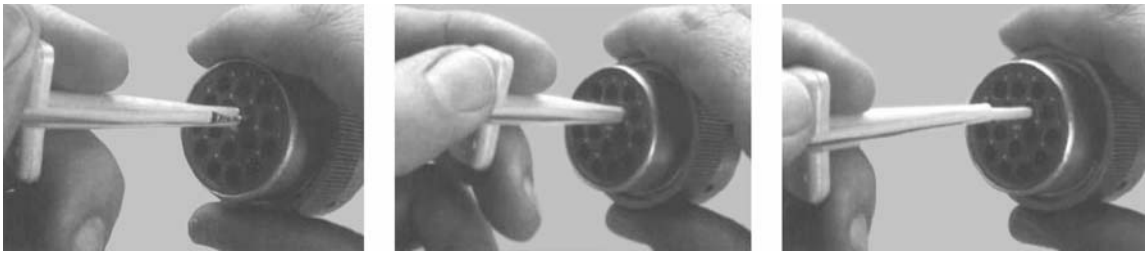


Figure 6-16. HD/HDP Contact Removal

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.

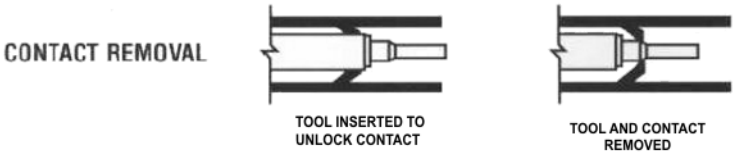


Figure 6-17. HD/HDP Unlocking Contacts

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

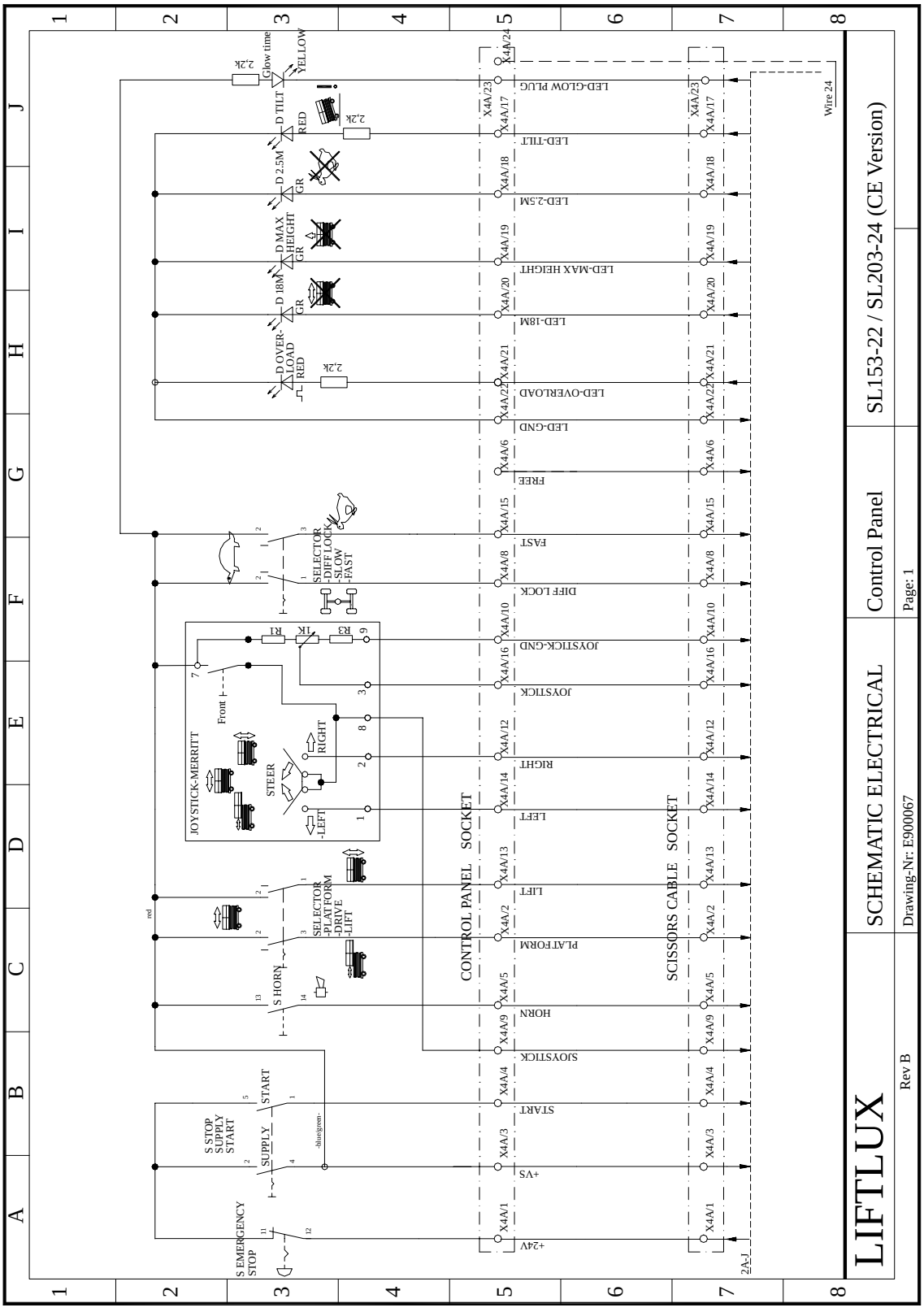


Figure 6-18. Electrical Schematic - Sheet 1 of 18

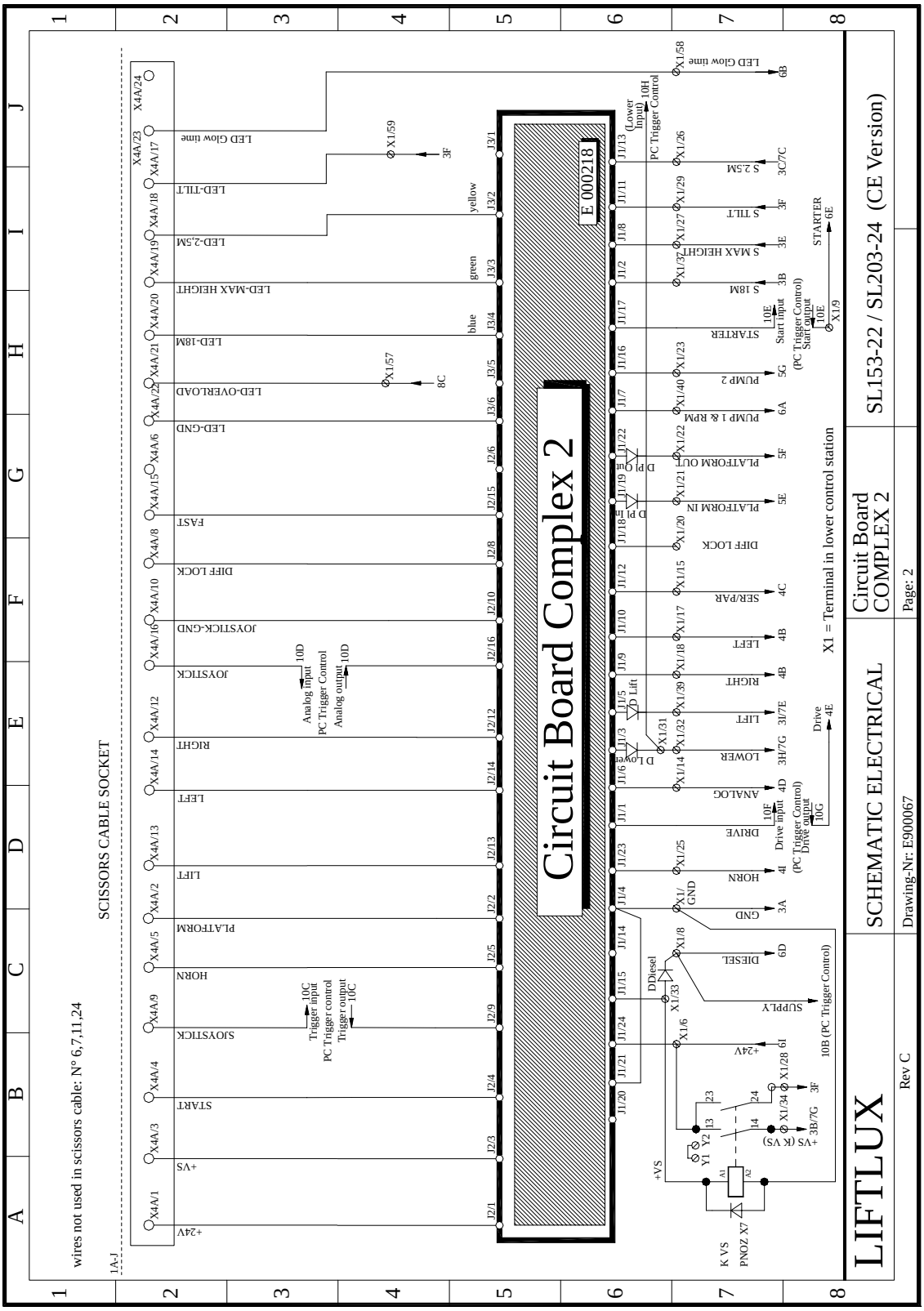


Figure 6-19. Electrical Schematic - Sheet 2 of 18

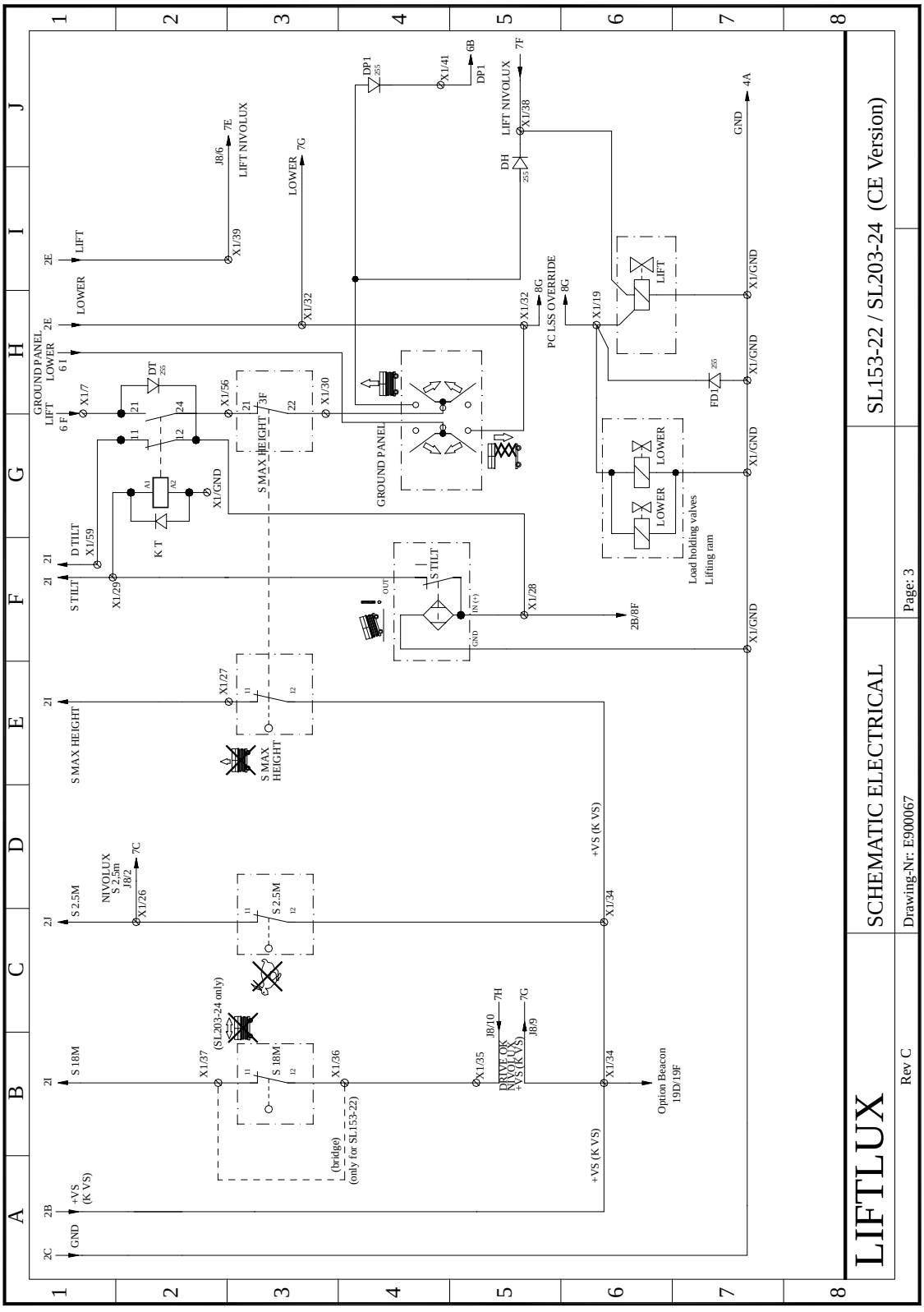


Figure 6-20. Electrical Components - Sheet 3 of 18

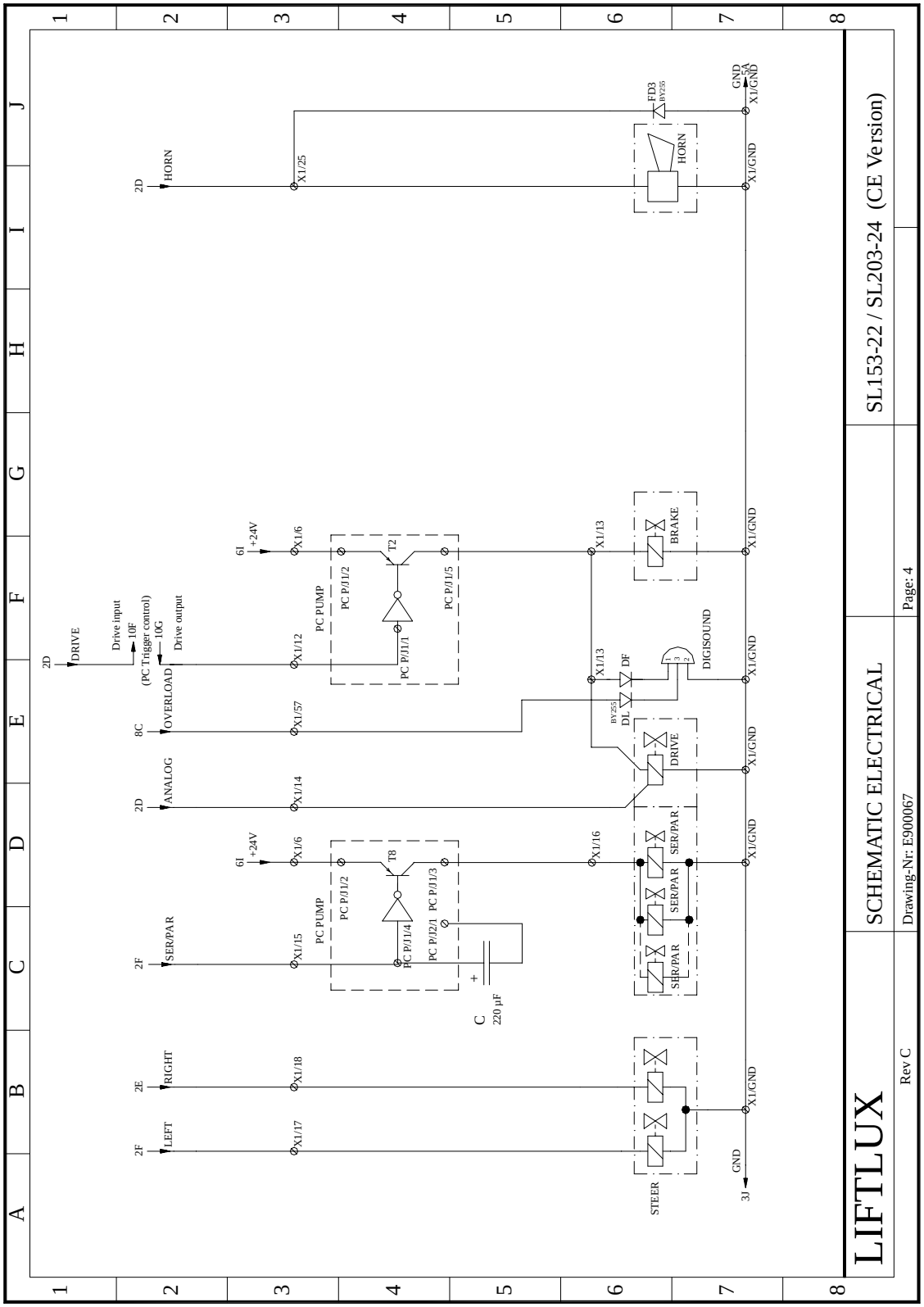


Figure 6-21. Electrical Schematic - Sheet 4 of 18

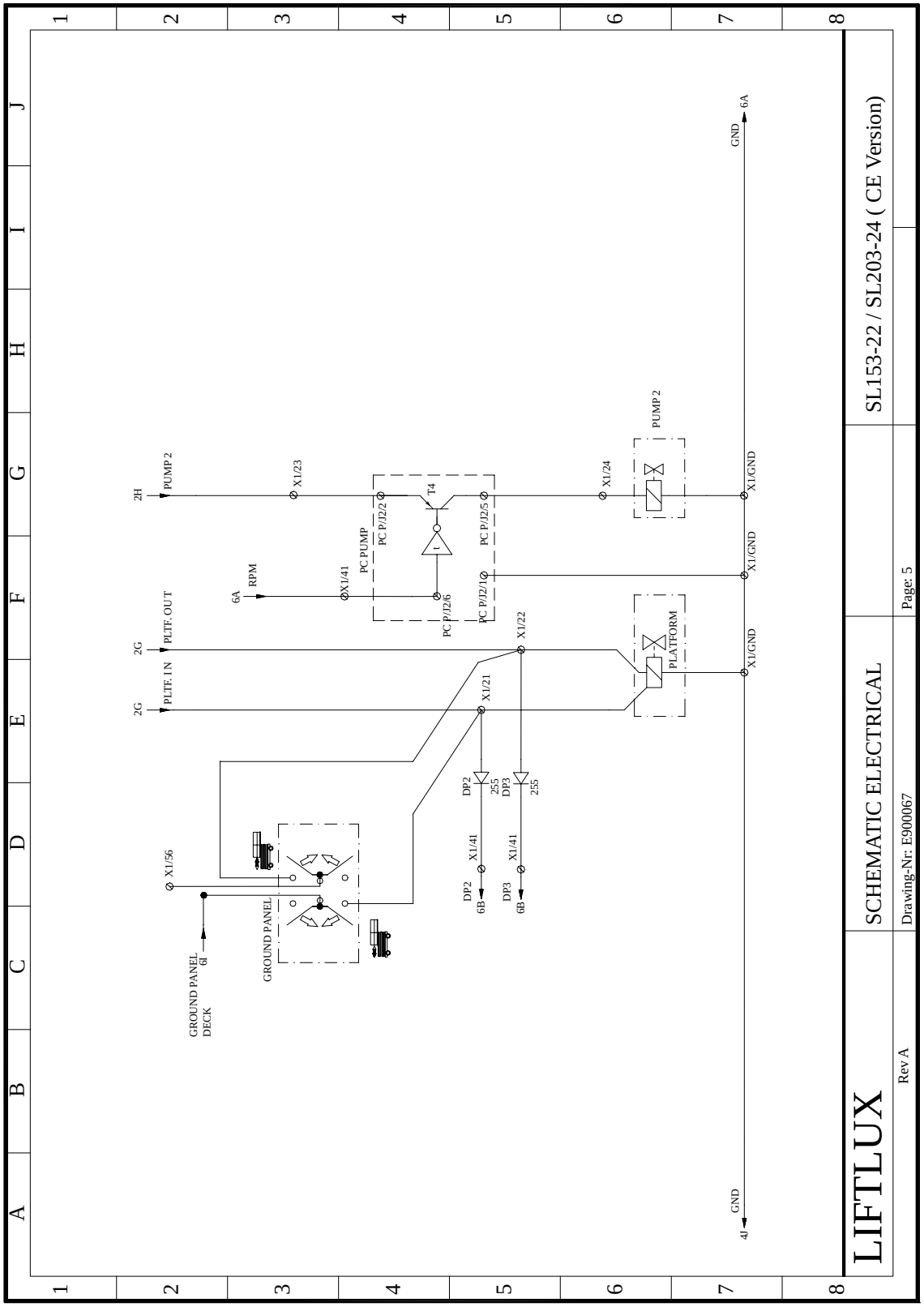


Figure 6-22. Electrical Schematic - Sheet 5 of 18

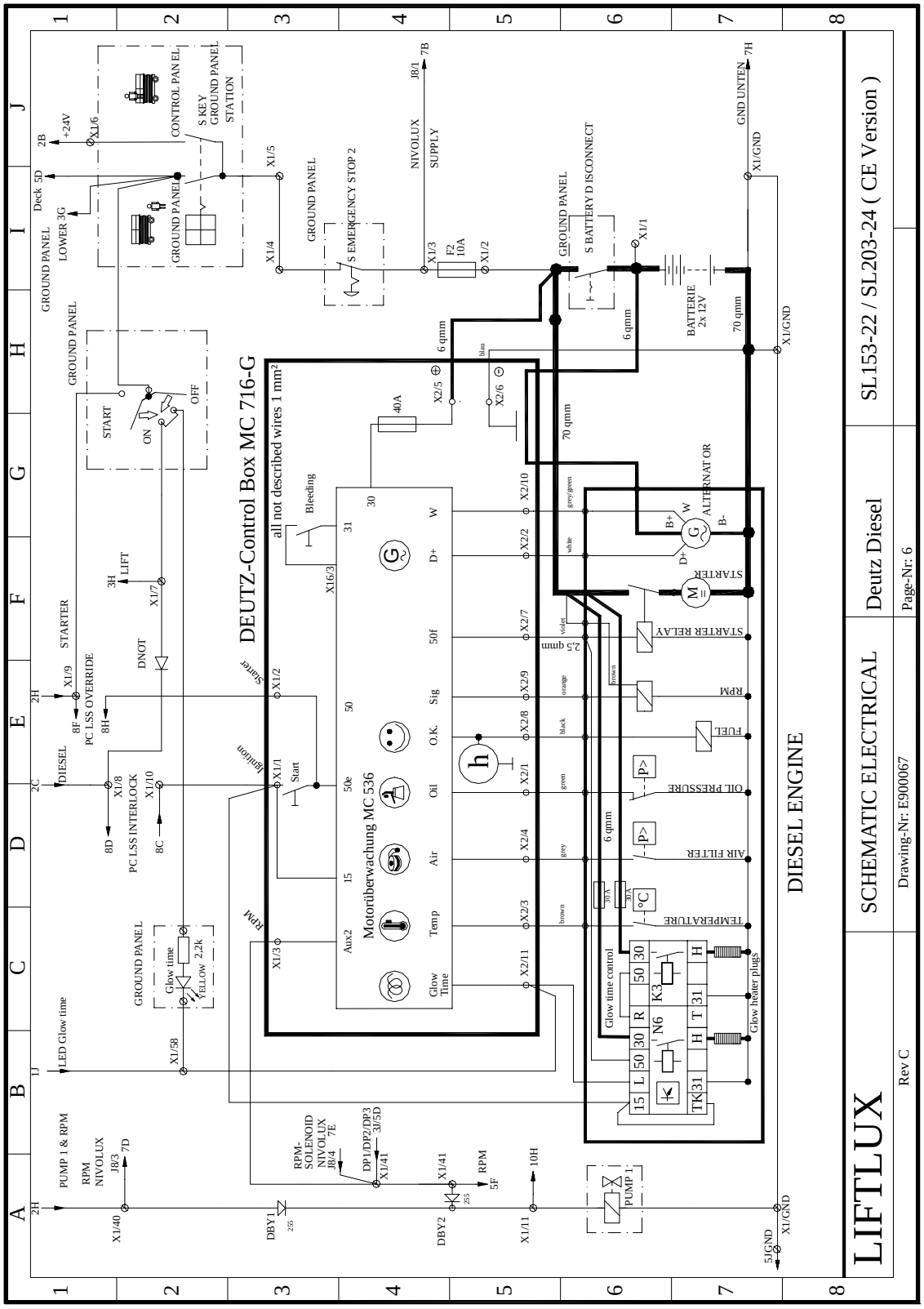


Figure 6-23. Electrical Schematic - Sheet 6 of 18

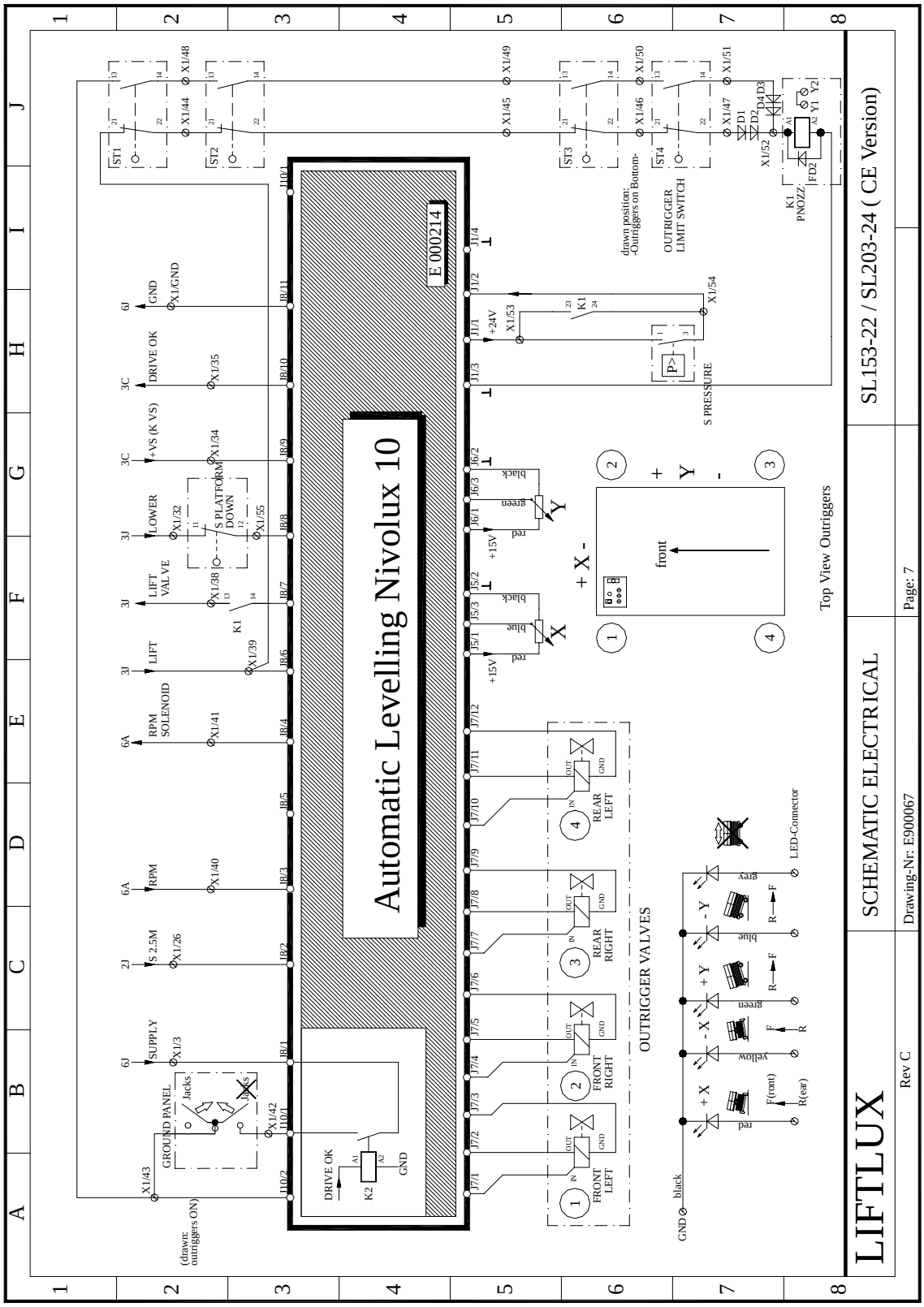


Figure 6-24. Electrical Schematic - Sheet 7 of 18

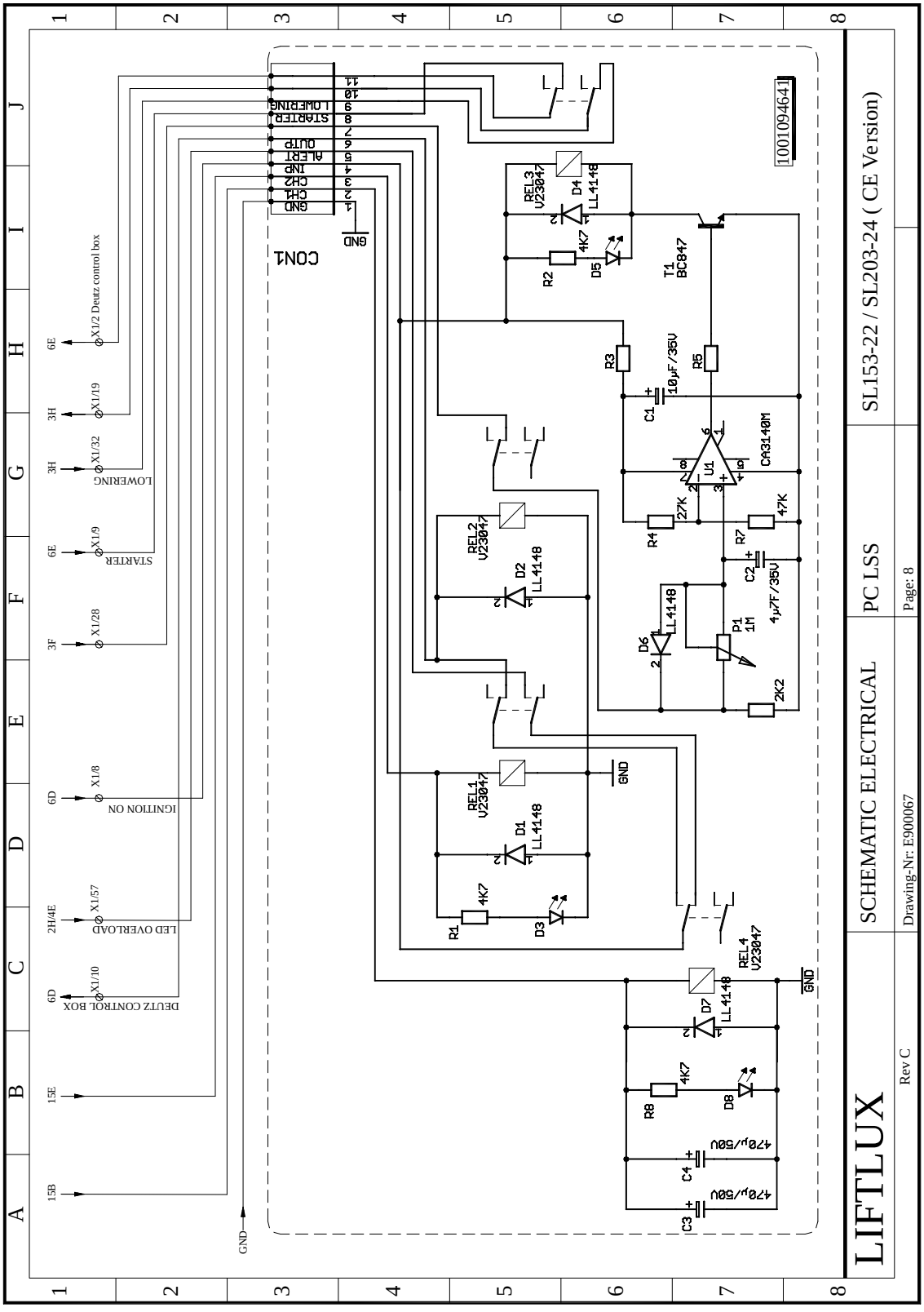


Figure 6-25. Electrical Schematic - Sheet 8 of 18

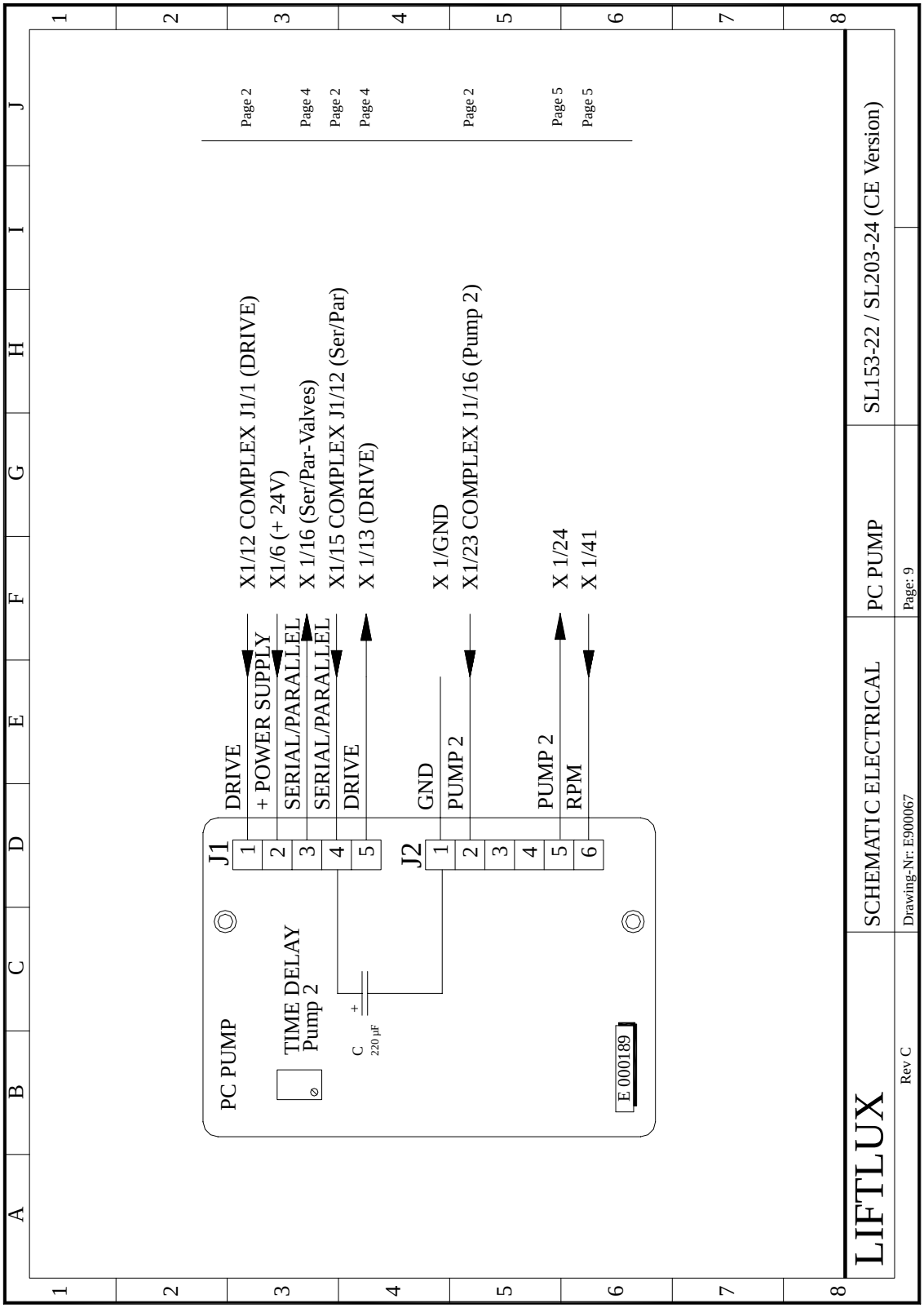


Figure 6-26. Electrical Schematic - Sheet 9 of 18

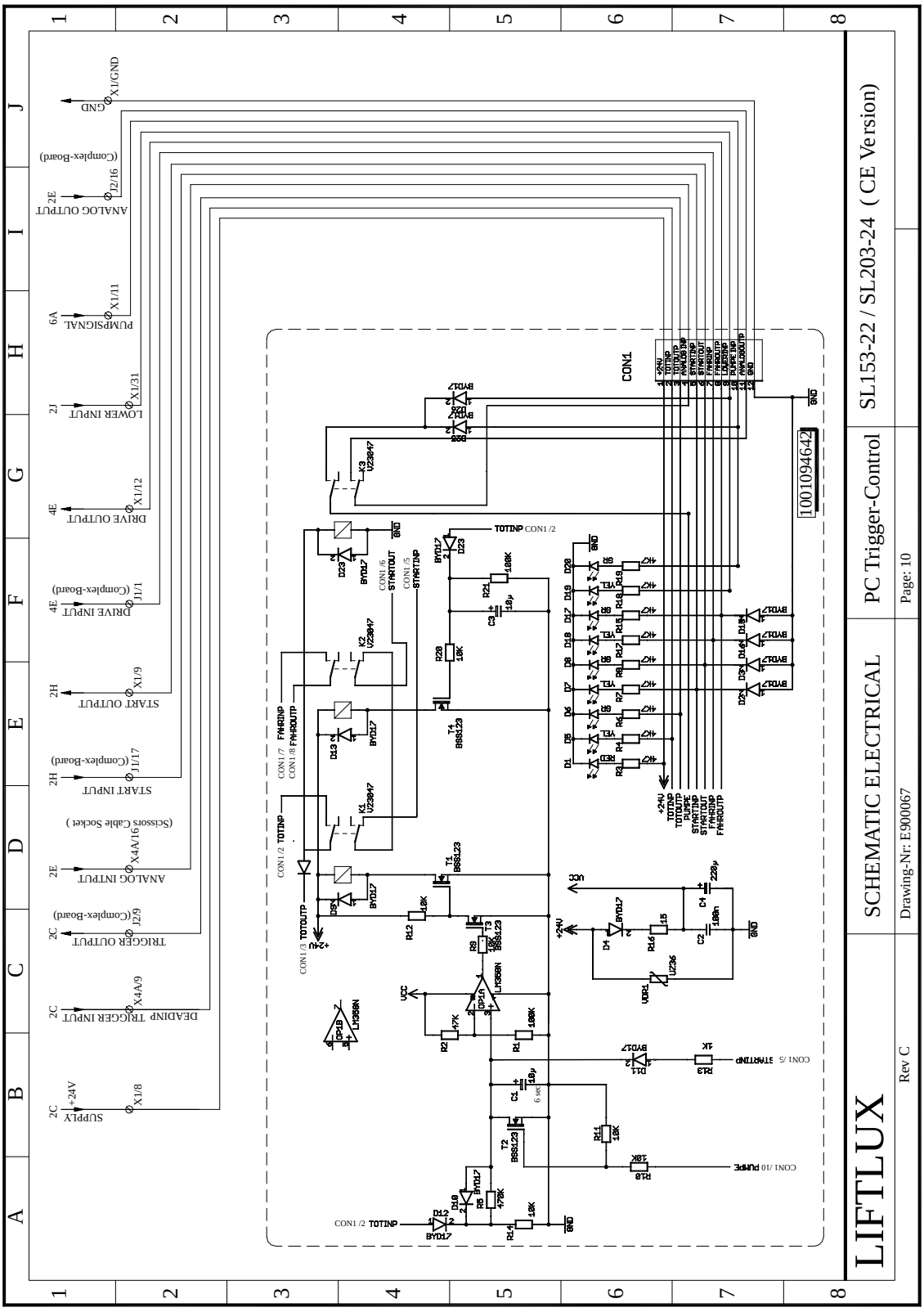


Figure 6-27. Electrical Schematic - Sheet 10 of 18

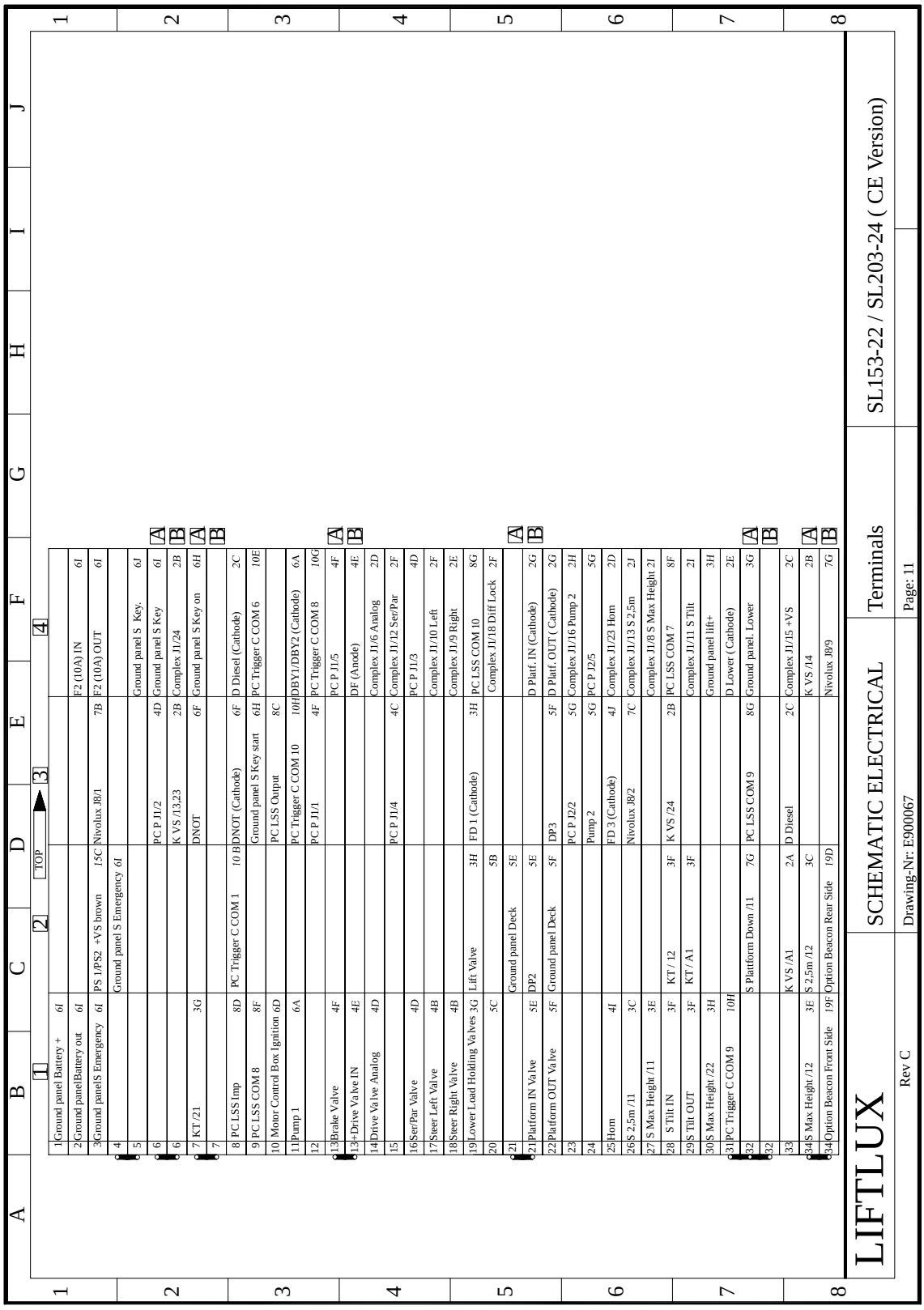


Figure 6-28. Electrical Schematic - Sheet 11 of 18

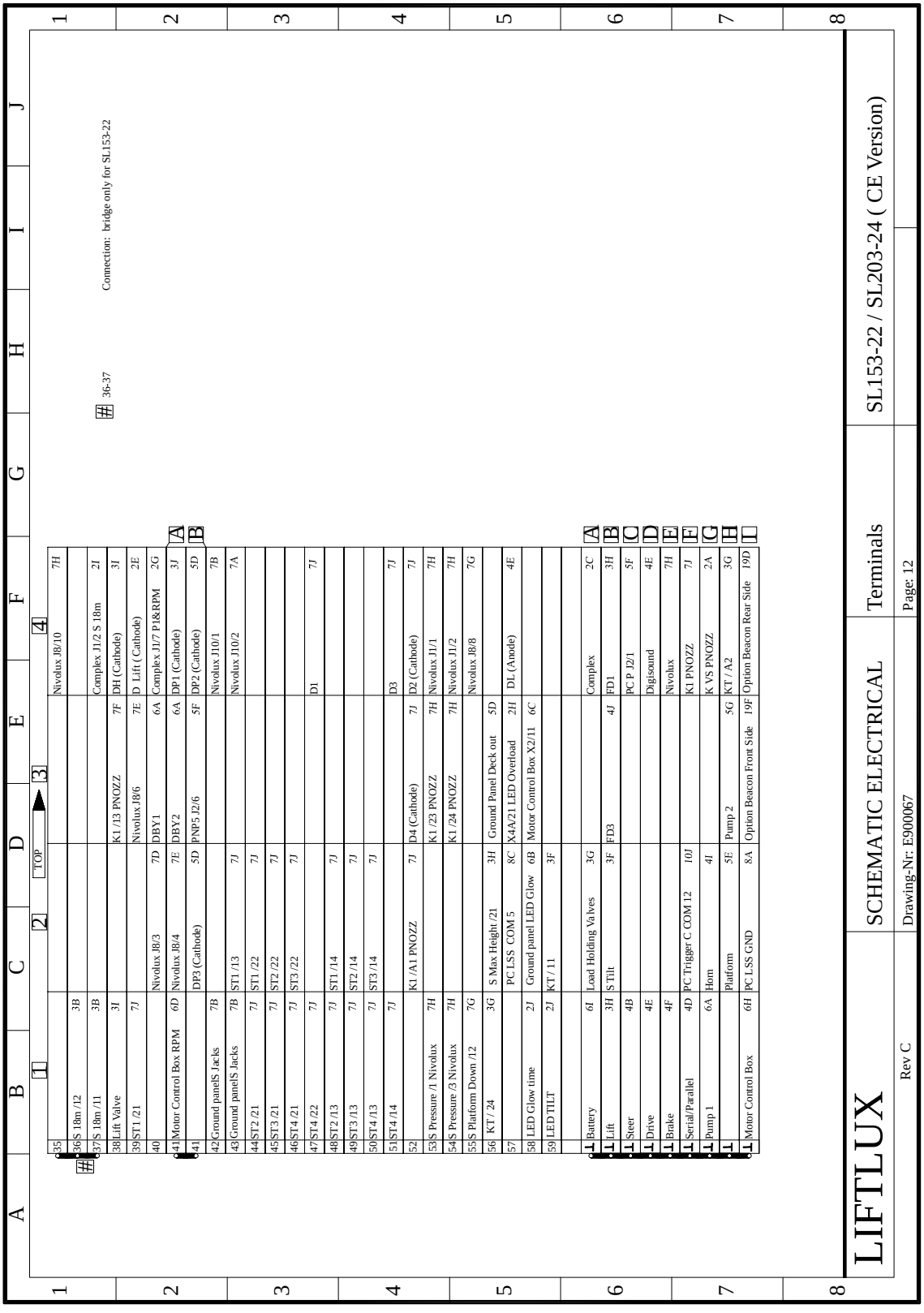


Figure 6-29. Electrical Schematic - Sheet 12 of 18

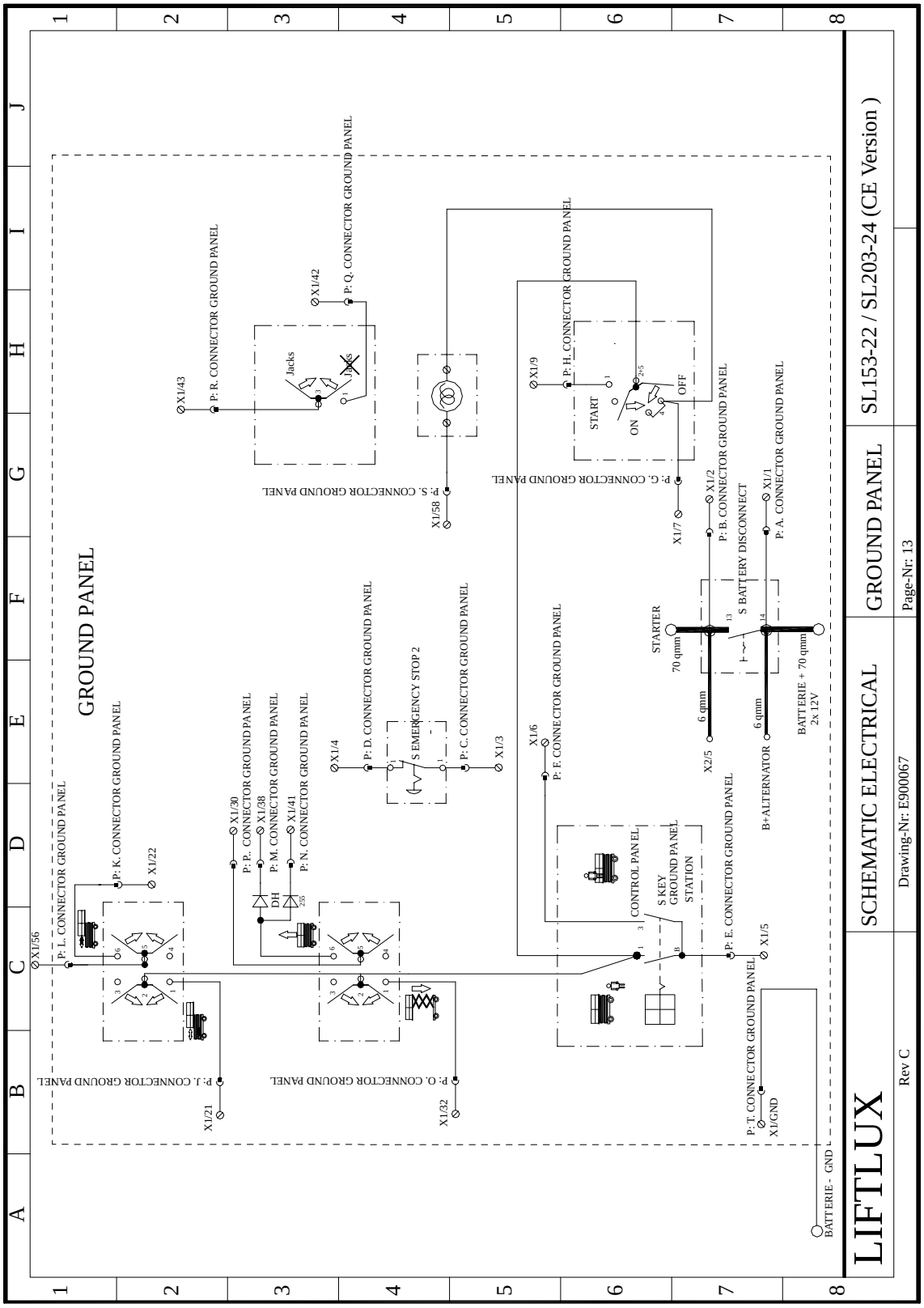


Figure 6-30. Electrical Schematic - Sheet 13 of 18

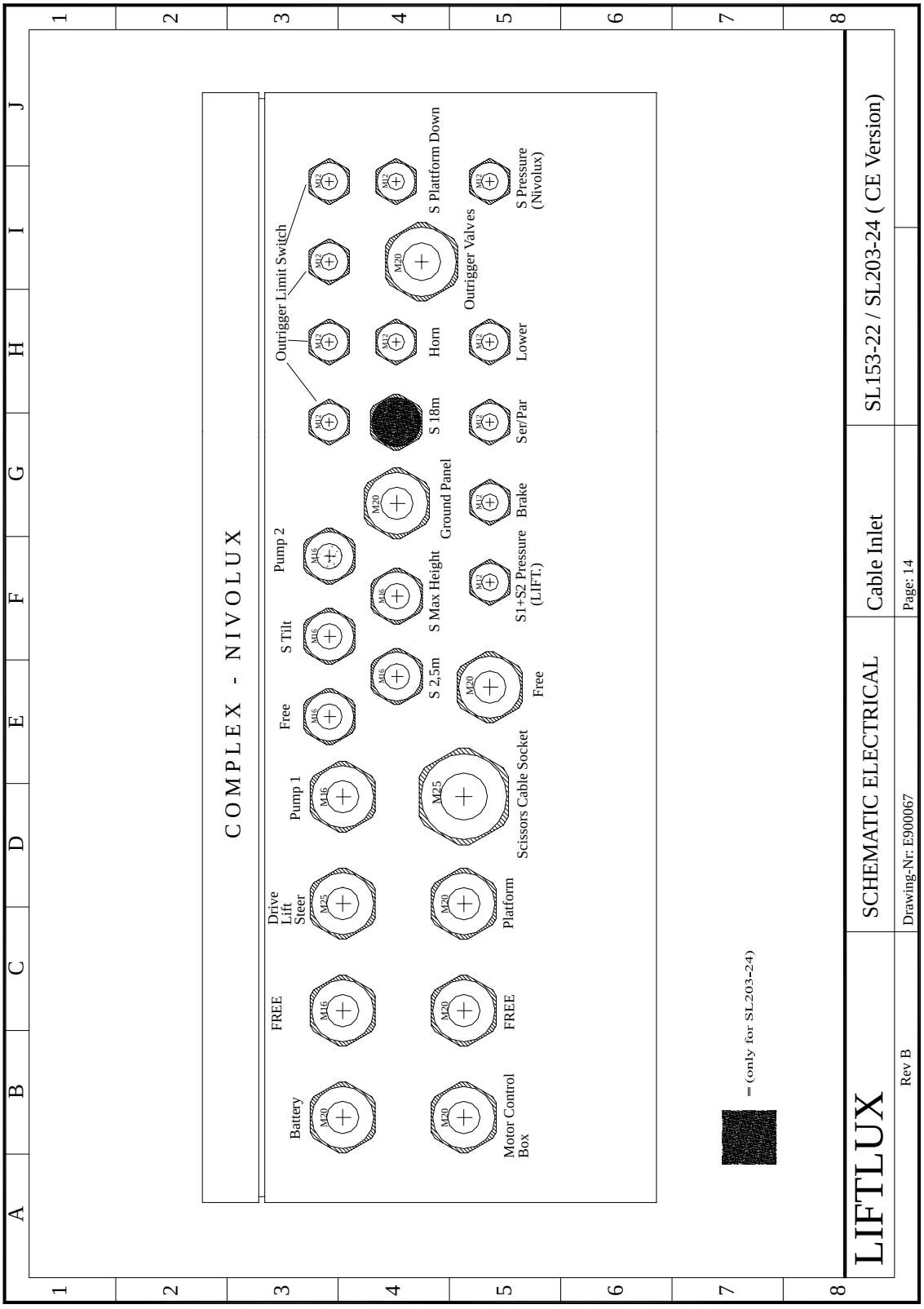


Figure 6-31. Electrical Schematic - Sheet 14 of 18

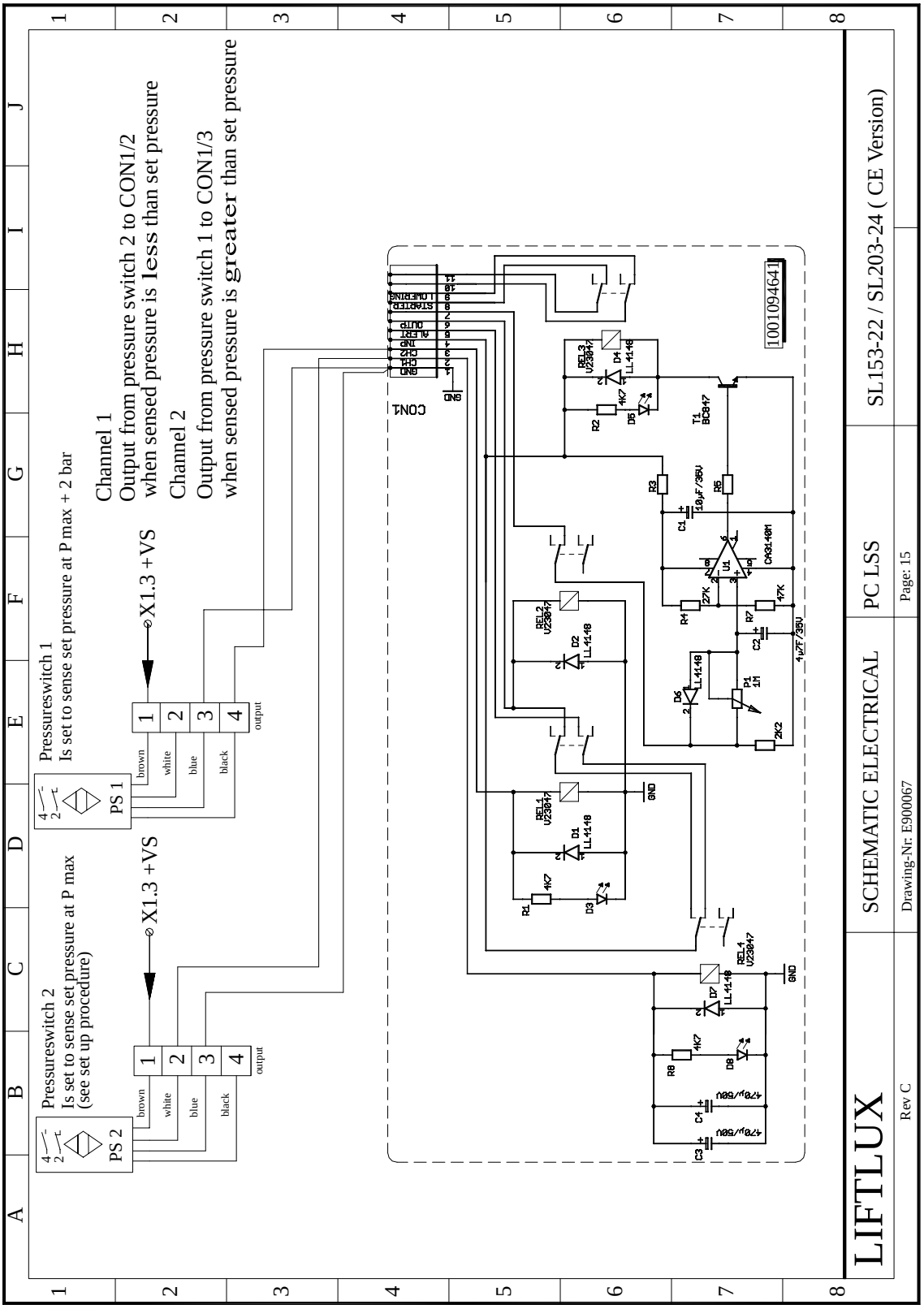


Figure 6-32. Electrical Schematic - Sheet 15 of 18

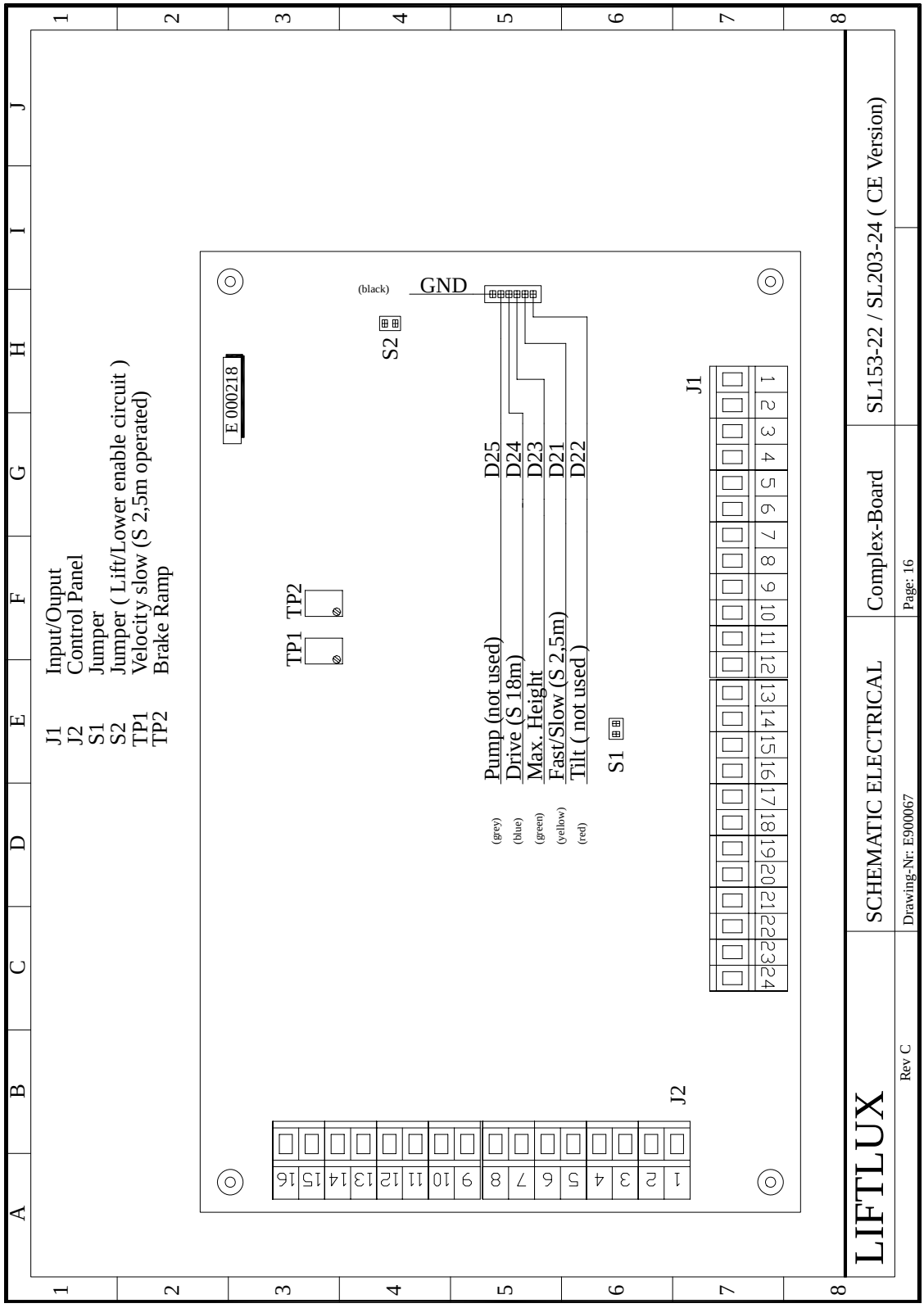


Figure 6-33. Electrical Schematic - Sheet 16 of 18

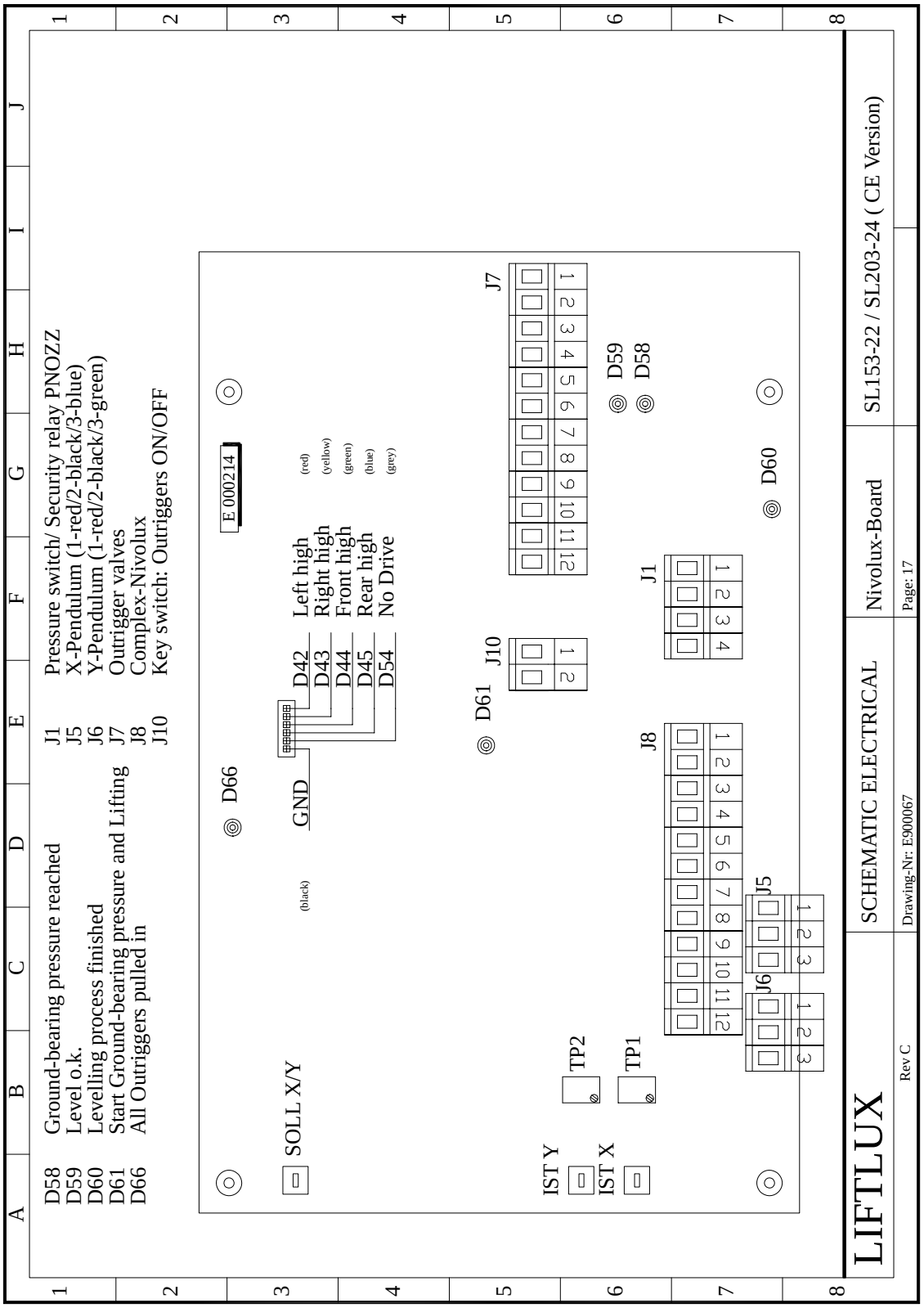


Figure 6-34. Electrical Schematic - Sheet 17 of 18

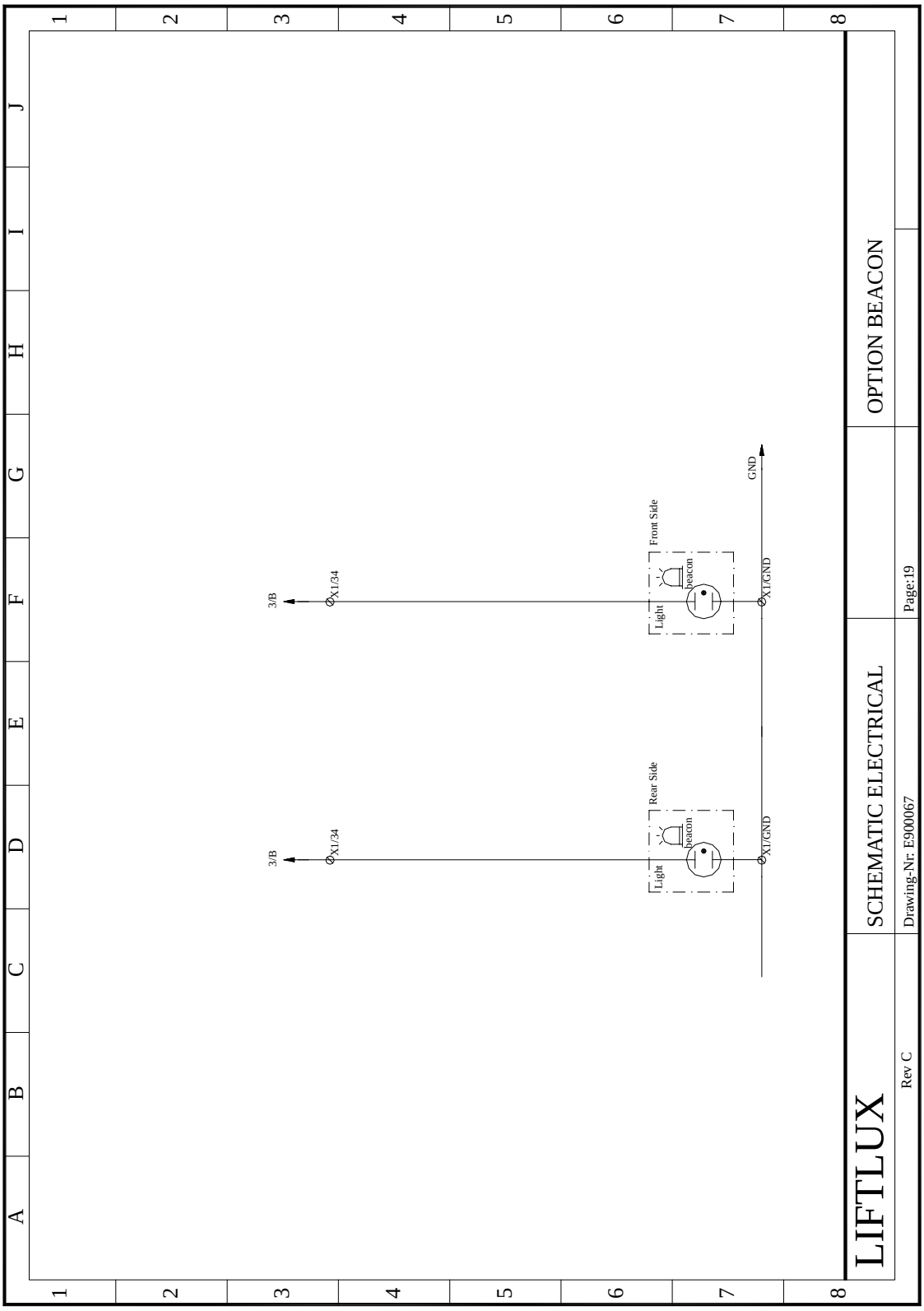


Figure 6-35. Electrical Schematic - Sheet 18 of 18

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
1	UL 1569 18OR	X1/12-3	PC P J1/1	
2	UL 1569 18R	X1/6-3	PC P J1/2	
3	UL 1569 18GR	X1/16-4	PC P J1/3	
4	UL 1569 18BR	X1/13-4	PC P J1/5	
5	UL 1569 18P	X1/15-3	PC P J1/4	
6	UL 1569 18P	ELCO/+	PC P J1/4	
7	UL 1569 18BL	ELCO/-	PC P J2/1	
8	UL 1569 18BL	X1/C-4	PC P J2/1	
9	UL 1569 18G	X1/23-3	PC P J2/2	
11	UL 1569 18W	X1/24-4	PC P J2/5	
12	UL 1569 18ZW	X1/41-3	PC P J2/6	
13	UL 1569 18GR	X1/33-2	K VS/A1	
14	UL 1569 18GR	X1/G-4	K VS/A2	
15	UL 1569 18GR	X1/6-3	K VS/13	
16	UL 1569 18GR	K VS/23	K VS/13	
17	UL 1569 18GR	X1/B34-4	K VS/14	
18	UL 1569 18GR	X1/28-3	K VS/24	
25	UL 1569 18GR	X1/56-1	KT/24	
26	UL 1569 18GR	X1/7-1	KT/21	
27	UL 1569 18GR	X1/F-2	TRIG CONTR J2/12	
28	UL 1569 18GR	TRIG CONTR J2/1	X1/8-2	
29	UL 1569 18GR	X1/28-2	KT/12	
30	UL 1569 18GR	X1/59-2	KT/11	
31	UL 1569 18GR	X1/H-4	KT/A2	
32	UL 1569 18GR	X1/29-2	KT/A1	
33	UL 1569 18R	DIODE 3/K	BUZ/3	
34	UL 1569 18BR	DIODE 3/A	X1/57-4	
35	UL 1569 18BL	X1/D-4	BUZ/2	
36	UL 1569 18R	DIODE 4/K	BUZ/1	
37	UL 1569 18BR	DIODE 4/A	X1/13-4	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
38	UL 1569 18R	K1/Y1	K1/Y2	
39	UL 1569 18BL	X1/54-3	K1/24	
40	UL 1569 18P	X1/53-3	K1/23	
41	UL 1569 18W	X1/38-3	K1/13	
42	UL 1569 18R	K1/A1	DIODE 5/K	
43	UL 1569 18BL	K1/A2	DIODE 5/A	
44	UL 1569 18R	K1/A1	X1/52-2	
45	UL 1569 18GR	K1/A2	N2J1/3	
46	UL 1569 18GR	K1/14	J8/7	
47	UL 1569 18GR	J8/11	X1/E-4	
48	UL 1569 18GR	J8/8	X1/55-4	
49	UL 1569 18GR	N2J1/2	X1/54-4	
50	UL 1569 18GR	N2J1/1	X1/53-4	
51	UL 1569 18GR	N2J10/1	X1/42-4	
52	UL 1569 18GR	N2J10/2	X1/43-4	
53	UL 1569 18GR	J8/10	X1/35-4	
54	UL 1569 18GR	C2 J1A/1	TRIG CONTR J2/7	
55	UL 1569 18GR	C2 J1A/2	X1/37-4	
56	UL 1569 18GR	C2 J1A/3	DIODE 9/A	
57	UL 1569 18GR	C2 J1A/4	X1/A-4	
58	UL 1569 18GR	C2 J1A/4	C2 J1B/9	
59	UL 1569 18GR	C2 J1A/5	DIODE 10/A	
60	UL 1569 18GR	C2 J1A/6	X1/14-4	
61	UL 1569 18GR	C2 J1A/7	X1/40-4	
62	UL 1569 18GR	C2 J1A/8	X1/27-4	
63	UL 1569 18GR	C2 J1A/9	X1/18-4	
64	UL 1569 18GR	C2 J1A/10	X1/17-4	
65	UL 1569 18GR	C2 J1A/11	X1/29-4	
66	UL 1569 18GR	C2 J1A/12	X1/15-4	
67	UL 1569 18GR	C2 J1B/1	X1/26-4	
68	UL 1569 18GR	C2 J1B/3	X1/33-4	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
69	UL 1569 18GR	C2 J1B/4	X1/23-4	
70	UL 1569 18GR	C2 J1B/5	TRIG CONTR J2/5	
71	UL 1569 18GR	C2 J1B/6	X1/20-4	
72	UL 1569 18GR	C2 J1B/7	DIODE 6/A	
73	UL 1569 18GR	C2 J1B/10	DIODE 7/A	
74	UL 1569 18GR	C2 J1B/11	X1/25-4	
75	UL 1569 18GR	C2 J1B/12	X1/6-4	
76	UL 1569 18GR	F2 FUSE/B	X1/2-4	
77	UL 1569 18GR	F2 FUSE/T	X1/3-4	
78	UL 1569 18GR	J8/1	X1/3-3	
79	UL 1569 18GR	J8/9	X1/A34-4	
80	UL 1569 18GR	J8/2	X1/26-3	
81	UL 1569 18GR	J8/6	X1/39-3	
82	UL 1569 18GR	J8/3	X1/40-2	
83	UL 1569 18GR	J8/4	X1/41-2	
84	LIYYJZ 5x0.5 UL			OUTRIGGER 4 SWITCH
	ADER 1	X1/46-1		
	ADER 2	X1/47-1		
	ADER 3	X1/50-1		
	ADER 4	X1/51-1		
85	LIYYJZ 5x0.5 UL			OUTRIGGER 3 SWITCH
	ADER 1	X1/45-1		
	ADER 2	X1/46-2		
	ADER 3	X1/49-1		
	ADER 4	X1/50-2		
86	LIYYJZ 5x0.5 UL			OUTRIGGER 2 SWITCH
	ADER 1	X1/44-1		
	ADER 2	X1/45-2		
	ADER 3	X1/48-1		
	ADER 4	X1/49-2		
87	LIYYJZ 5x0.5 UL			OUTRIGGER 1 SWITCH

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
	ADER 1	X1/39-1		
	ADER 2	X1/44-2		
	ADER 3	X1/43-2		
	ADER 4	X1/48-2		
88	LIYYJZ 2x1 UL			DOWN SWITCH
	ADER 1	X1/32-2		
	ADER 2	X1/55-1		
90	LIYYJZ 2x1 UL			PUMP 2 VALVE
	ADER 1	X1/24-1	1	
	ADER 2	X1/H-3	2	
91	LIYYJZ 2x1 UL			PUMP 1 VALVE
	ADER 1	X1/11-1	1	
	ADER 2	X1/G-1	2	
93	LIYYJZ 4x0.75 UL			TILT SWITCH
	ADER 1	X1/28-1		
	ADER 2	X1/29-1		
	ADER 3	X1/B-2		
95	LIYYJZ 2x1 UL			PRESSURE NIVO SWITCH
	ADER 1	X1/53-1	1	
	ADER 2	X1/54-1	2	
96	LIYYJZ 2x1 UL			HORN
	ADER 1	X1/25-1		
	ADER 2	X1/G-2		
98	LIYYJZ 2x1 UL			LOWERING VALVE
	ADER 1	X1/19-1	SPLICE 2/L	
	ADER 2	X1/A-2	SPLICE 3/L	
99	LIYYJZ 2x1 UL			SER/PAR
	ADER 1	X1/16-1	1	
	ADER 2	X1/F-1	2	
101	LIYYJZ 2x1 UL			BRAKE VALVE
	ADER 1	X1/13-1	1	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
	ADER 2	X1/E-1	2	
102				MAX HEIGHT SWITCH
	ADER 1	X1/34-1		
	ADER 2	X1/27-1		
	ADER 3	X1/56-1		
	ADER 4	X1/30-1		
103	LIYYJZ 5x1 UL			ENGINE BOX
	ADER 1	X1/10-1		
	ADER 2	PC LSSJ1/11		
	ADER 3	X1/41-1		
	ADER 4	X1/58-3		
	ADER 5	X1/1-1		
104	LIYYJZ 5x1 UL			2.5M SWITCH
	ADER 1	X1/34-2		
	ADER 2	X1/26-1		
105	LIYYJZ 5x1 UL			PLATFORM VALVE
	ADER 1	X1/22-1	1	
	ADER 2	X1/21-1	2	
	ADER 3	X1/H-2	PE	
106	LIYYJZ 2x1 UL			LIFT VALVE
	ADER 1	X1/38-1	1	
	ADER 2	X1/19-2	2	
	ADER 3	X1/B-1	PE	
107	LIYYJZ 4x0.75 UL			DRIVE VALVE
	ADER 1	X1/13-1	1	
	ADER 2	X1/14-1	2	
	ADER 3	X1/D-1	PE	
108	LIYYJZ 4x0.75 UL			STEERING VALVE
	ADER 1	X1/18-1	A/1	
	ADER 2	X1/17-1	B/1	
	ADER 3	X1/C-1	A/2	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
109	LIYYJZ 12x0.75 UL			OUTRIGGER VALVES
	ADER 1	J7/1	1	OUTRIGGER 1 VALVE
	ADER 2	J7/2	2	
	ADER 3	J7/3	PE	
	ADER 4	J7/4	1	OUTRIGGER 2 VALVE
	ADER 5	J7/5	2	
	ADER 6	J7/6	PE	
	ADER 7	J7/7	1	OUTRIGGER 3 VALVE
	ADER 8	J7/8	2	
	ADER 9	J7/9	PE	
	ADER 10	J7/10	1	OUTRIGGER 4 VALVE
	ADER 11	J7/11	2	
	GGN	J7/12	PE	
110	LIYYJZ 25x1 UL			
	ADER 1	X2/1	C2 J2A/1	
	ADER 2	X2/2	C2 J2A/2	
	ADER 3	X2/3	C2 J2A/3	
	ADER 4	X2/4	C2 J2A/4	
	ADER 5	X2/5	C2 J2A/5	
	ADER 6	X2/6	NC	
	ADER 7	X2/7	NC	
	ADER 8	X2/8	C2 J2A/8	
	ADER 9	X2/9	TRIG CONTR J2/2	
	ADER 10	X2/10	C2 J2B/2	
	ADER 11	X2/11	NC	
	ADER 12	X2/12	C2 J2B/4	
	ADER 13	X2/13	C2 J2B/5	
	ADER 14	X2/14	C2 J2B/6	
	ADER 15	X2/15	C2 J2B/7	
	ADER 16	X2/16	TRIG CONTR J2/4	
	ADER 17	X2/17	X1/59-1	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
	ADER 18	X2/18	C2 LED/YELLOW	
	ADER 19	X2/19	C2 LED/GREEN	
	ADER 20	X2/20	C2 LED/BLUE	
	ADER 21	X2/21	X1/57-3	
	ADER 22	X2/22	C2 LED/BLACK	
	ADER 23	X2/23	X1/58-1	
	ADER 24	X2/24	NC	
	GGN	NC	NC	
112	LIYYJZ 2x1 UL			
	ADER 1	1	SPLICE 2/R	
	ADER 2	2	SPLICE 3/R	
113	LIYYJZ 2x1 UL			
	ADER 1	1	SPLICE 2/R	
	ADER 2	2	SPLICE 3/R	
115	UL1569 18GR	TRIG CONTR J2/3	C2 JBA/1	
117	UL1569 18GR	TRIG CONTR J2/8	X1/12-4	
118	UL1569 18GR	TRIG CONTR J2/6	X1/9-4	
124	UL1569 18ZW			
125	UL1569 18ZW			
126	LIYYJZ 25x0.75 UL			GROUND PANEL
	ADER 1	X1/1-1	PA	
	ADER 2	X1/2-1	PB	
	ADER 3	X1/3-1	PC	
	ADER 4	X1/4-2	PD	
	ADER 5	X1/5-4	PE	
	ADER 6	X1/6-4	PF	
	ADER 7	X1/7-4	PG	
	ADER 8	X1/9-3	PH	
	ADER 9	X1/21-2	PJ	
	ADER 10	X1/22-2	PK	
	ADER 11	X1/56-3	PL	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
	ADER 12	X1/38-4	PM	
	ADER 13	X1/41-4	PN	
	ADER 14	X1/32-4	PO	
	ADER 15	X1/30-2	PP	
	ADER 16	X1/42-1	PQ	
	ADER 17	X1/43-1	PR	
	ADER 18	X1/58-2	PS	
	ADER 19	X1/A-1	PT	
	ADER 20	NC	PU	
	ADER 21	NC	PV	
	ADER 22	NC	PW	
	ADER 23	NC	PX	
	ADER 24	NC		
127	UL1569 18ZW		1	
128	UL1569 18ZW		2	
129	UL1569 18R	K VS/Y1	K VS/Y2	
130	UL1569 18GR	TRIG CONTR J2/11	C2 J2B/8	
131	UL1569 18GR	DIODE 6/K	X1/21-4	
132	UL1569 18GR	DIODE 7/K	X1/22-4	
134	UL1569 18GR	DIODE 9/K	X1/31-4	
135	UL1569 18GR	DIODE 10/K	X1/39-4	
136	UL1569 18GR	X1/10-3	PC LSSJ1/6	
137	UL1569 18GR	X1/57-2	PC LSSJ1/5	
138	UL1569 18GR	X1/8-1	PC LSSJ1/4	
139	UL1569 18GR	X1/1-2	PC LSSJ1/1	
140	UL1569 18GR	X1/32-3	PC LSSJ1/9	
141	UL1569 18GR	X1/19-4	PC LSSJ1/10	
144	UL1569 18GR	X1/28-4	PC LSSJ1/7	
147	UL1569 18GR	X1/9-1	PC LSSJ1/8	
153	UL1569 18GR	X1/31-1	TRIG CONTR J2/9	
154	UL1569 18GR	X1/11-3	TRIG CONTR J2/10	

Table 6-1. Main Terminal Box Wiring Description

Wire Number	Wire Type	Position 1	Position 2	Label (External Harness)
D1	DIO BY550	X1/8-3	X1/7-3	
D2	398 ANSI DIO	X1/8-4	X1/33-3	
D3	398 ANSI DIO	X1/11-4	X1/41-3	
D4	398 ANSI DIO	X1/11-4	X1/40-3	
D5	398 ANSI DIO	X1/25-3	X1/B-3	
D7	398 ANSI DIO	X1/41-4	X1/21-2	
D9	398 ANSI DIO	K VS/A1	K VS/A2	
D10	398 ANSI DIO	KT/12	KT/21	
D11	398 ANSI DIO	X1/41-2	X1/22-3	
D12	DIO BY550	KT/A1	KT/A2	
D13	398 ANSI DIO	X1/19-3	X1/B-4	
D22	398 LIFTLUXDIO2	X1/52	X1/47	
D23	398 LIFTLUXDIO2	X1/52	X1/51	

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NOTE: *Position 1 = Termination point in the Main Terminal Box (There are 4 connections at each terminal position on X1. These are designated as 1 = Top Top, 2 = Tob Bottom, 3 = Bottom Top, and 4 = Bottom Bottom. Refer to Figure 5-1., Main Terminal Box).*

Position 2 = The position on the end item (if not specified in the table, it can be located on the electrical schematic).

NOTES:

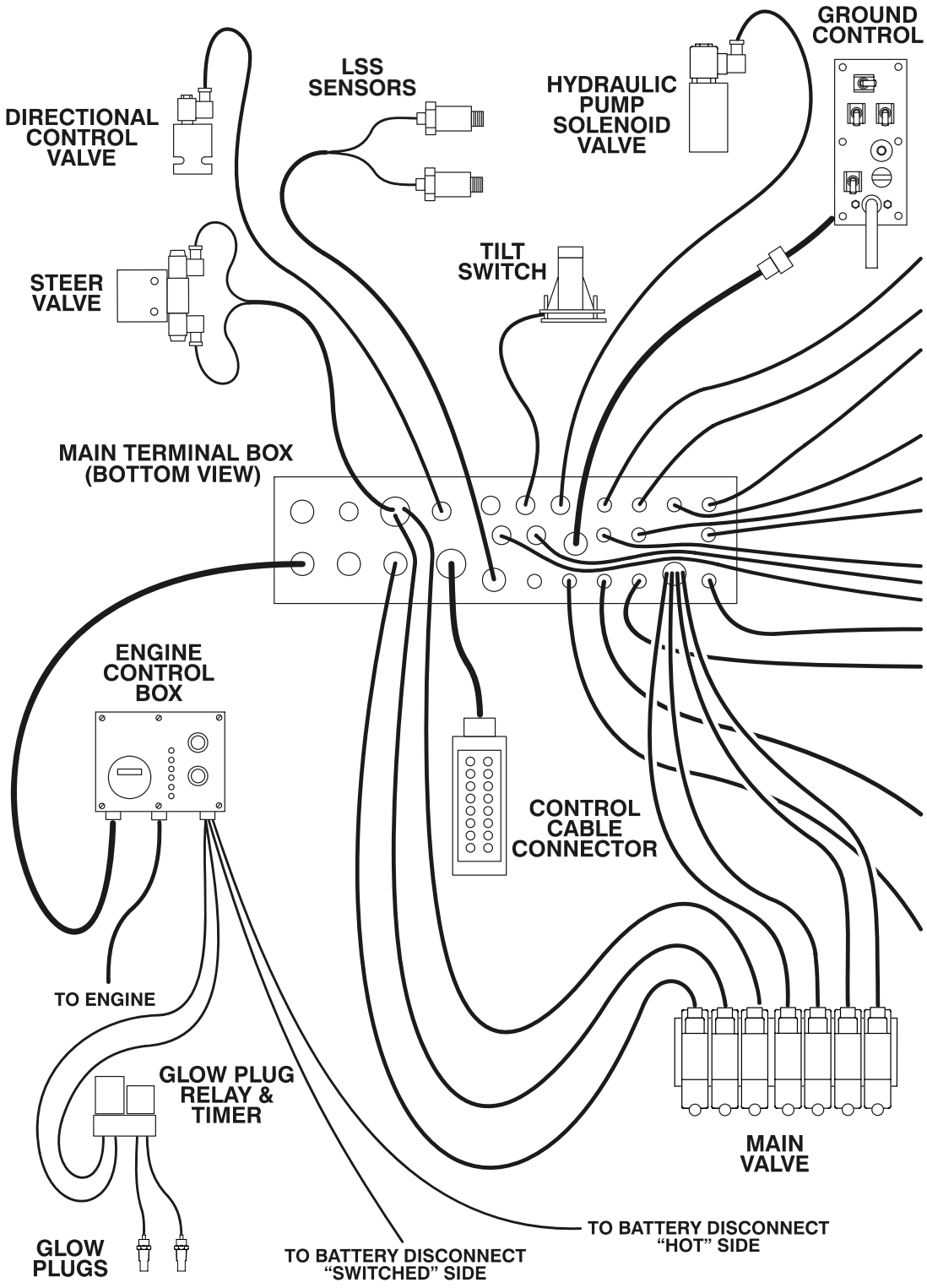

Figure 6-36. Electrical Diagram - Sheet 1 of 2

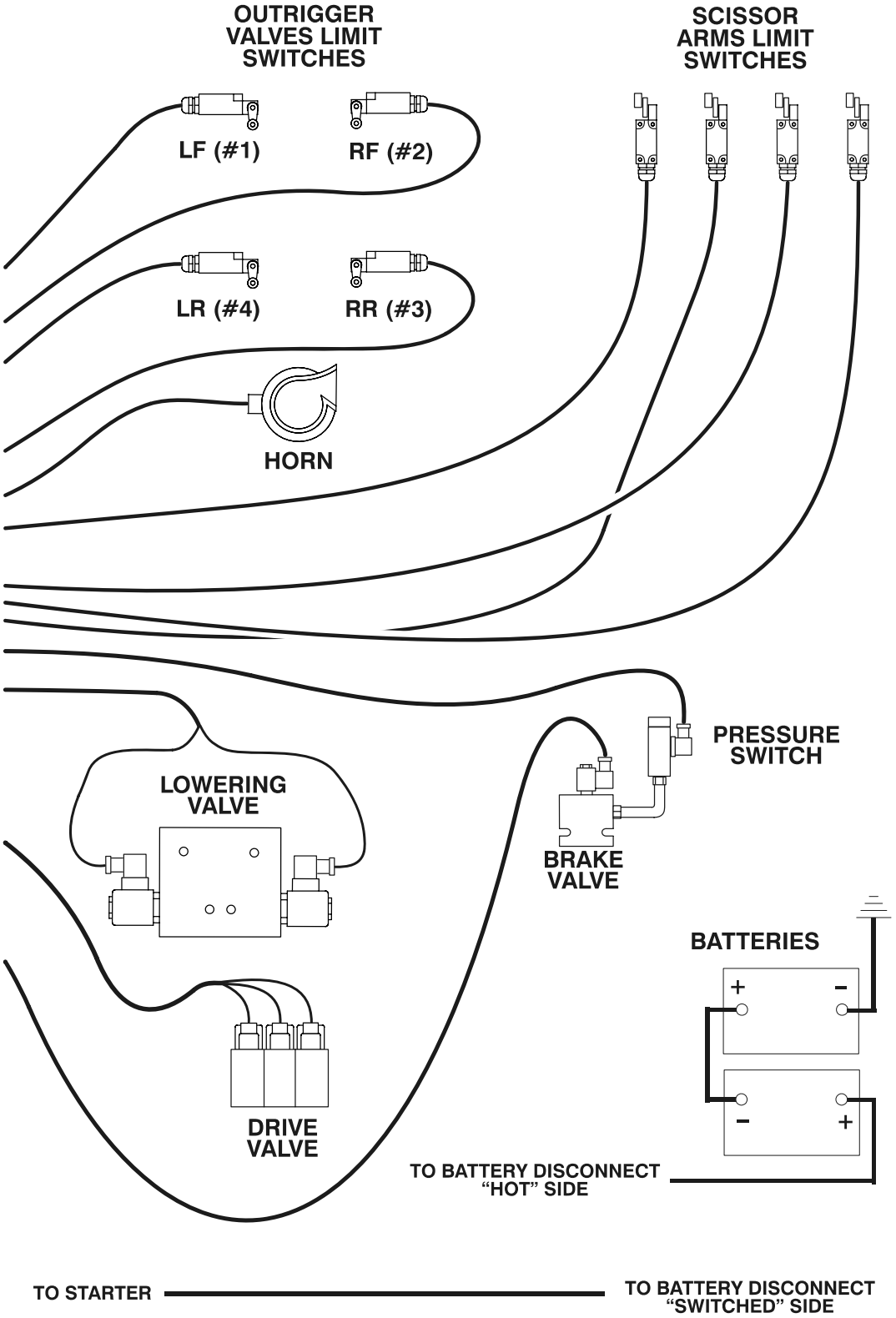

Figure 6-37. Electrical Diagram - Sheet 2 of 2

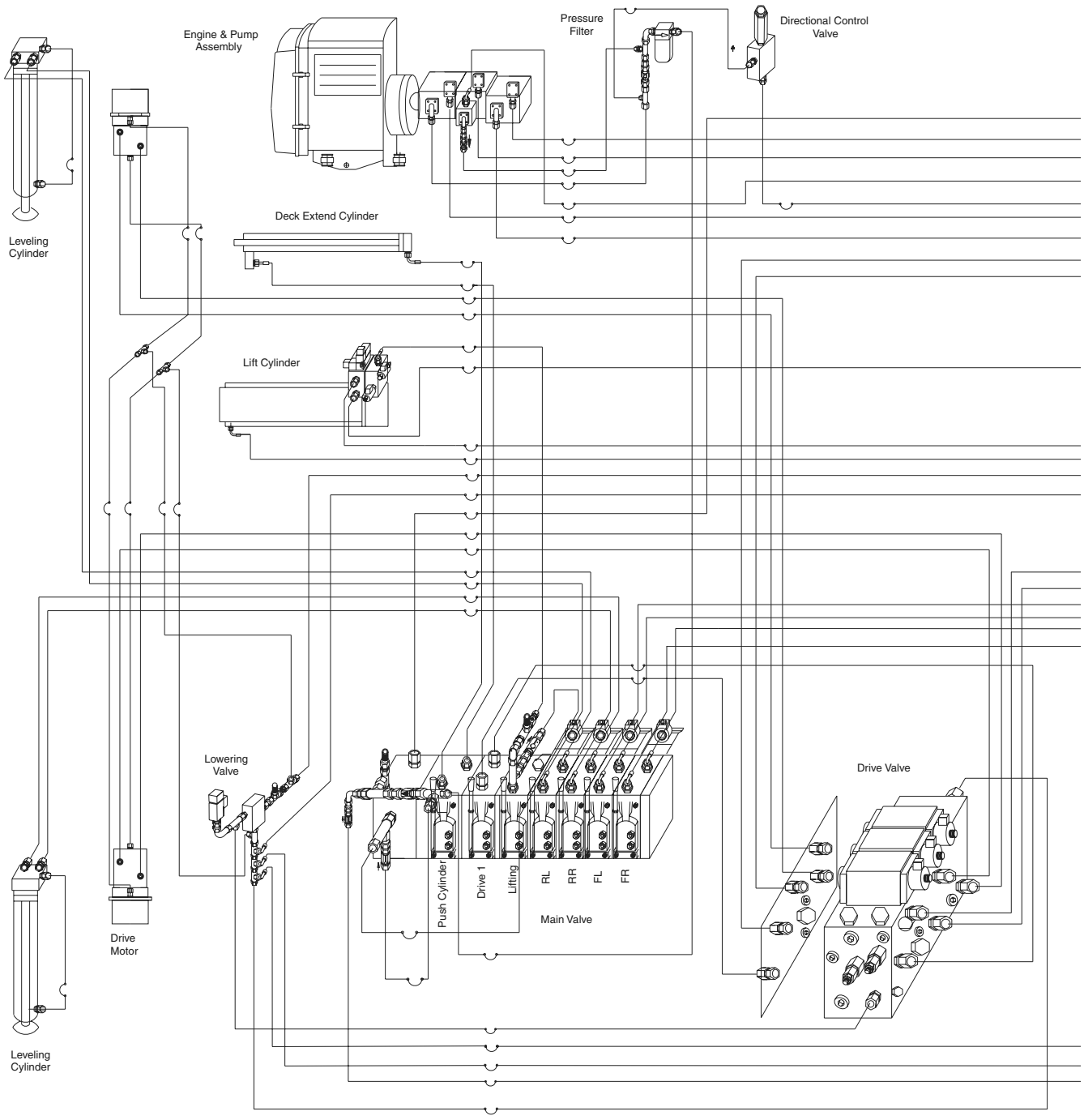

Figure 6-38. Hydraulic Diagram - Sheet 1 of 2

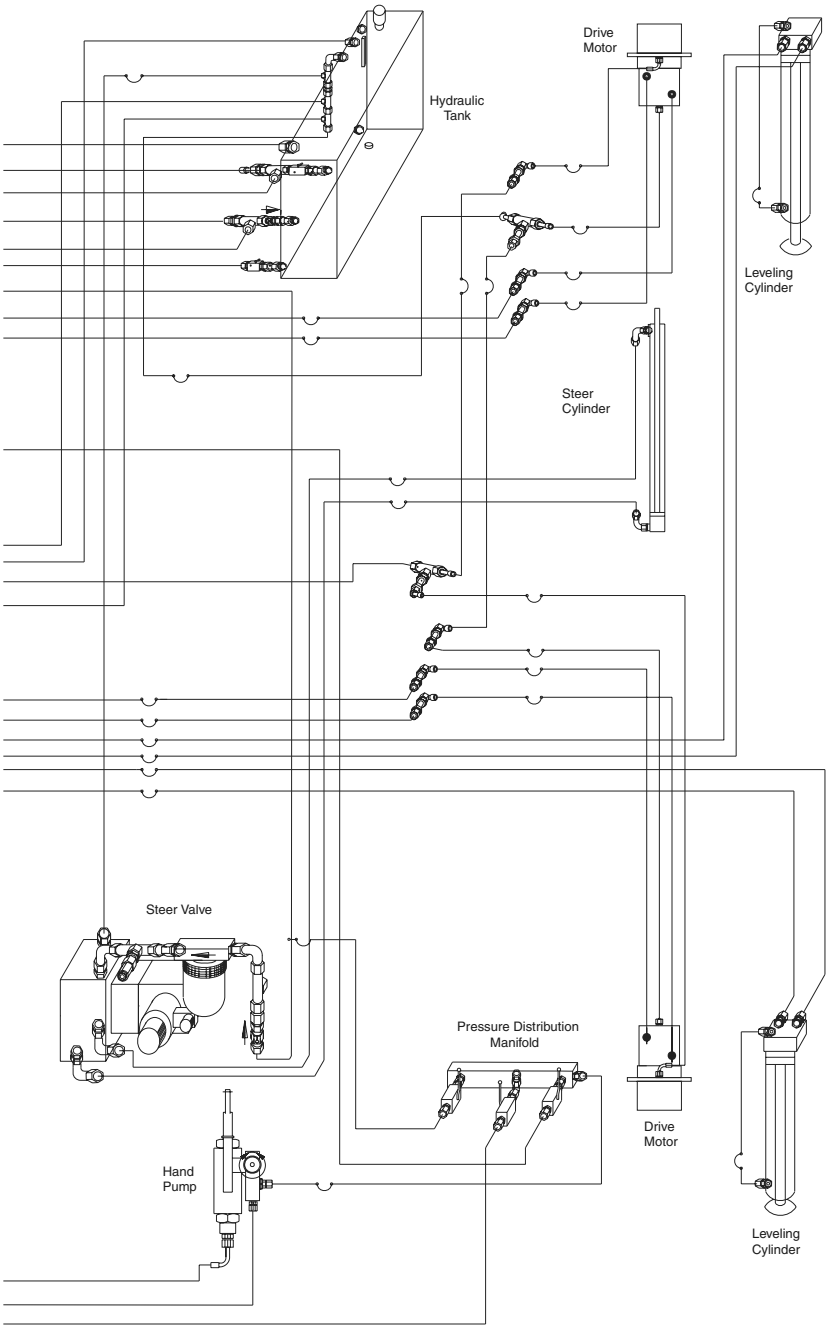

Figure 6-39. Hydraulic Diagram - Sheet 2 of 2

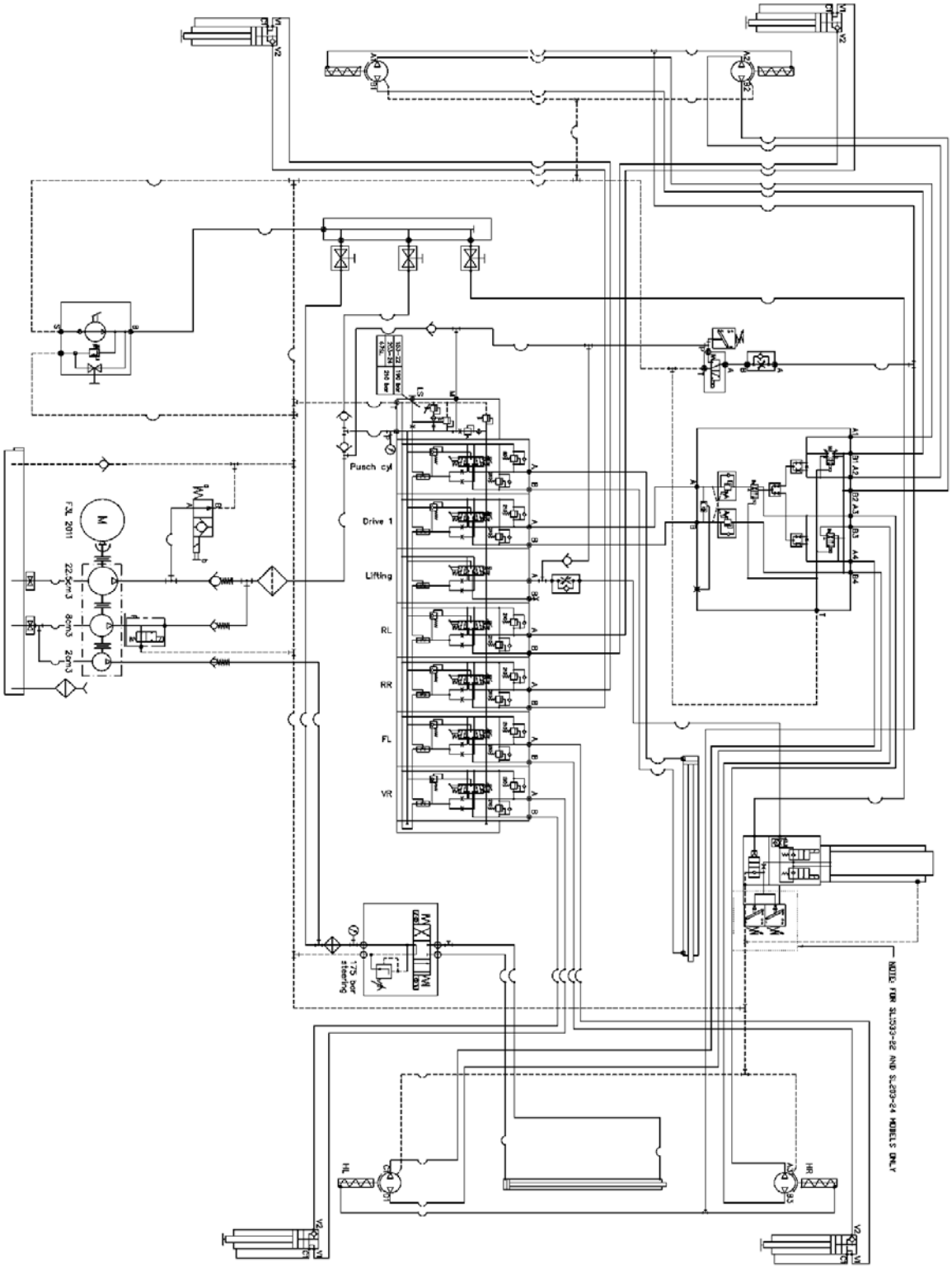

Figure 6-40. Hydraulic Schematic - 1001091308 RevB

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