Service Manual

Models
L2906H, 2906H, 3507H, 619A, 723A
Agrovector
29.6LP, 29.6, 35.7

31200568

Revised
March 7, 2011

An Oshkosh Corporation Company

EFFECTIVITY PAGE

May 30, 2009 - A - Original Issue Of Manual

March 7, 2011 - B - Added Models 29.6LP, 29.6 & 35.7. Updated all Loctite® 242™ with Loctite® 243™. Revised covers and pages 1-3 & 9-10 thru 9-100.

EFFECTIVITY PAGE

SECTION CONTENTS

Section	Subject	Page

Section 1
Safety Practices

Contents

1.1 INTRODUCTION

This service manual provides general directions for accomplishing service and repair procedures. Following the procedures in this manual will help assure safety and equipment reliability.

Read, understand and follow the information in this manual, and obey all locally approved safety practices, procedures, rules, codes, regulations and laws.

These instructions cannot cover all details or variations in the equipment, procedures, or processes described, nor provide directions for meeting every possible contingency during operation, maintenance, or testing. When additional information is desired consult the local **JLG** dealer.

Many factors contribute to unsafe conditions: carelessness, fatigue, overload, inattentiveness, unfamiliarity, even drugs and alcohol, among others. For optimal safety, encourage everyone to think, and to act, safely.

Appropriate service methods and proper repair procedures are essential for the safety of the individual doing the work, for the safety of the operator, and for the safe, reliable operation of the machine. All references to the right side, left side, front and rear are given from the operator's seat looking in a forward direction.

Supplementary information is available from the manufacturer in the form of Service Bulletins, Service Campaigns, Service Training Schools, the service website, other literature, and through updates to the manual itself.

1.2 DISCLAIMER

All information in this manual is based on the latest product information available at the time of publication. The manufacturer reserves the right to make changes and improvements to its products, and to discontinue the manufacture of any product, at its discretion at any time without public notice or obligation.

1.3 OPERATION & SAFETY MANUAL

The mechanic must not operate the machine until the Operation & Safety Manual has been read and understood, training has been accomplished and operation of the machine has been completed under the supervision of an experienced and qualified operator.

An Operation & Safety Manual is supplied with each machine and must be kept in the manual holder located in the cab. In the event that the Operation & Safety Manual is missing, consult the local **JLG** dealer before proceeding.

1.4 DO NOT OPERATE TAGS

Place **Do Not** Operate Tags on the ignition key switch and the steering wheel before attempting to perform any service or maintenance. Remove key and disconnect battery leads.

1.5 SAFETY INFORMATION

To avoid possible death or injury, carefully read, understand and comply with all safety messages.

In the event of an accident, know where to obtain medical assistance and how to use a first-aid kit and fire extinguisher/fire suppression system. Keep emergency telephone numbers (fire department, ambulance, rescue squad/paramedics, police department, etc.) nearby. If working alone, check with another person routinely to help assure personal safety.

1.5.1 Safety Alert System and Signal Words

DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

1.6 SAFETY INSTRUCTIONS

Following are general safety statements to consider ***before*** performing maintenance procedures on the telehandler. Additional statements related to specific tasks and procedures are located throughout this manual and are listed prior to any work instructions to provide safety information before the potential of a hazard occurs.

For all safety messages, carefully read, understand and follow the instructions ***before*** proceeding.

1.6.1 Personal Hazards

PERSONAL SAFETY GEAR: Wear all the protective clothing and personal safety gear necessary to perform the job safely. This might include heavy gloves, safety glasses or goggles, filter mask or respirator, safety shoes or a hard hat.

LIFTING: **NEVER** lift a heavy object without the help of at least one assistant or a suitable sling and hoist.

1.6.2 Equipment Hazards

LIFTING OF EQUIPMENT: Before using any lifting equipment (chains, slings, brackets, hooks, etc.), verify that it is of the proper capacity, in good working order, and is properly attached.

NEVER stand or otherwise become positioned under a suspended load or under raised equipment. The load or equipment could fall or tip.

DO NOT use a hoist, jack or jack stands only to support equipment. Always support equipment with the proper capacity blocks or stands properly rated for the load.

HAND TOOLS: Always use the proper tool for the job; keep tools clean and in good working order, and use special service tools only as recommended.

1.6.3 General Hazards

SOLVENTS: Only use approved solvents that are known to be safe for use.

HOUSEKEEPING: Keep the work area and operator's cab clean, and remove all hazards (debris, oil, tools, etc.).

FIRST AID: Immediately clean, dress and report all injuries (cuts, abrasions, burns, etc.), no matter how minor the injury may seem. Know the location of a First Aid Kit, and know how to use it.

CLEANLINESS: Wear eye protection, and clean all components with a high-pressure or steam cleaner before attempting service.

When removing hydraulic components, plug hose ends and connections to prevent excess leakage and contamination. Place a suitable catch basin beneath the machine to capture fluid run-off.

It is good practice to avoid pressure-washing electrical/ electronic components. In the event pressure-washing the machine is needed, ensure the machine is shut down before pressure-washing. Should pressure-washing be utilized to wash areas containing electrical/electronic components, it is recommended a maximum pressure of 52 bar (750 psi) at a minimum distance of 30,5 cm (12 in) away from these components. If electrical/electronic components are sprayed, spraying must not be direct and for brief time periods to avoid heavy saturation.

Check and obey all Federal, State and/or Local regulations regarding waste storage, disposal and recycling.

1.6.4 Operational Hazards

ENGINE: Stop the engine before performing any service unless specifically instructed otherwise.

VENTILATION: Avoid prolonged engine operation in enclosed areas without adequate ventilation.

SOFT SURFACES AND SLOPES: **NEVER** work on a machine that is parked on a soft surface or slope. The machine must be on a hard level surface, with the wheels blocked before performing any service.

FLUID TEMPERATURE: **NEVER** work on a machine when the engine, cooling or hydraulic systems are hot. Hot components and fluids can cause severe burns. Allow systems to cool before proceeding.

FLUID PRESSURE: Before loosening any hydraulic or diesel fuel component, hose or tube, turn the engine OFF. Wear heavy, protective gloves and eye protection. **NEVER** check for leaks using any part of your body; use a piece of cardboard or wood instead. If injured, seek medical attention immediately. Diesel fluid leaking under pressure can explode. Hydraulic oil and diesel fuel leaking under pressure can penetrate the skin, cause infection, gangrene and other serious personal injury.

Relieve all pressure before disconnecting any component, part, line or hose. Slowly loosen parts and allow release of residual pressure before removing any part or component. Before starting the engine or applying pressure, use components, parts, hoses and pipes that are in good condition, connected properly and are tightened to the proper torque. Capture fluid in an appropriate container and dispose of in accordance with prevailing environmental regulations.

RADIATOR CAP: The cooling system is under pressure, and escaping coolant can cause severe burns and eye injury. To prevent personal injury, NEVER remove the radiator cap while the cooling system is hot. Wear safety glasses. Turn the radiator cap to the first stop and allow pressure to escape before removing the cap completely. Failure to follow the safety practices could result in death or serious injury.

FLUID FLAMABILTITY: **DO NOT** service the fuel or hydraulic systems near an open flame, sparks or smoking materials.

NEVER drain or store fluids in an open container. Engine fuel and hydraulic oil are flammable and can cause a fire and/or explosion.

DO NOT mix gasoline or alcohol with diesel fuel. The mixture can cause an explosion.

PRESSURE TESTING: When conducting any test, only use test equipment that is correctly calibrated and in good condition. Use the correct equipment in the proper manner, and make changes or repairs as indicated by the test procedure to achieve the desired result.

LEAVING MACHINE: Lower the forks or attachment to the ground before leaving the machine.

TIRES: Always keep tires inflated to the proper pressure to help prevent tipover. **DO NOT** over-inflate tires.

NEVER use mismatched tire types, sizes or ply ratings. Always use matched sets according to machine specifications.

MAJOR COMPONENTS: Never alter, remove, or substitute any items such as counterweights, tires, batteries or other items that may reduce or affect the overall weight or stability of the machine.

BATTERY: **DO NOT** charge a frozen battery. Charging a frozen battery may cause it to explode. Allow the battery to thaw before jump-starting or connecting a battery charger.

1.7 SAFETY DECALS

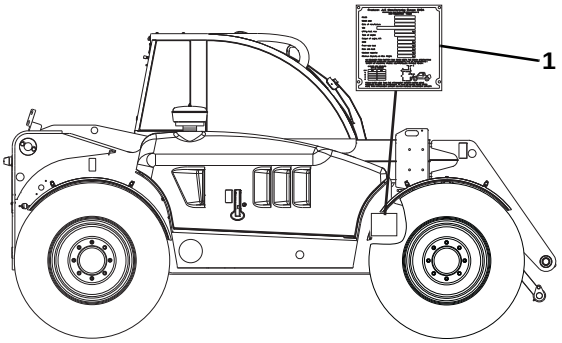
Check that all safety decals are present and readable on the machine. Refer to the Operation & Safety Manual supplied with machine for information.

Section 2
General Information and Specifications

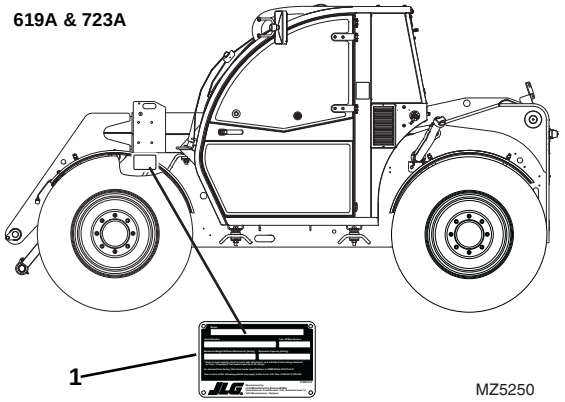
Contents

2.1 REPLACEMENT PARTS AND WARRANTY INFORMATION

L2906H, 2906H, 3507H, 29,6LP, 29.6 & 35.7



619A & 723A



Before ordering parts or initiating service inquiries, make note of the machine serial number. The machine serial number plate (**1**) is located as indicated in the figure.

Note: *The replacement of any part on this machine with any other than factory authorized replacement parts can adversely affect the performance, durability, or safety of the machine, and will void the warranty.* ***JLG*** *disclaims liability for any claims or damages, whether regarding property damage, personal injury or death arising out of the use of unauthorized replacement parts.*

A warranty registration form must be filled out by the local **JLG** dealer, signed by the purchaser and returned to the manufacturer when the machine is sold and/or put into use.

Registration activates the warranty period and helps to assure that warranty claims are promptly processed. To guarantee full warranty service, verify that the local **JLG** dealer has returned the business reply card of the warranty registration form to the manufacturer.

2.2 TORQUES

2.2.1 SAE Fastener Torque Chart

				Values for Zinc Yellow Chromate Fasteners (Ref 4150707)								
				SAE GRADE 5 BOLTS & GRADE 2 NUTS								
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry)		Torque Lubricated		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)		Torque (Loctite® 262™ or Vibra-TITE™ 131)	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	8	0.9	6	0.7				
	48	0.1120	0.00661	420	9	1.0	7	0.8				
6	32	0.1380	0.00909	580	16	1.8	12	1.4				
	40	0.1380	0.01015	610	18	2.0	13	1.5				
8	32	0.1640	0.01400	900	30	3.4	22	2.5				
	36	0.1640	0.01474	940	31	3.5	23	2.6				
10	24	0.1900	0.01750	1120	43	4.8	32	3.5				
	32	0.1900	0.02000	1285	49	5.5	36	4				
1/4	20	0.2500	0.0318	2020	96	10.8	75	9	105	12		
	28	0.2500	0.0364	2320	120	13.5	86	10	135	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	17	23	13	18	19	26	16	22
	24	0.3125	0.0580	3700	19	26	14	19	21	29	17	23
3/8	16	0.3750	0.0775	4940	30	41	23	31	35	48	28	38
	24	0.3750	0.0878	5600	35	47	25	34	40	54	32	43
7/16	14	0.4375	0.1063	6800	50	68	35	47	55	75	45	61
	20	0.4375	0.1187	7550	55	75	40	54	60	82	50	68
1/2	13	0.5000	0.1419	9050	75	102	55	75	85	116	68	92
	20	0.5000	0.1599	10700	90	122	65	88	100	136	80	108
9/16	12	0.5625	0.1820	11600	110	149	80	108	120	163	98	133
	18	0.5625	0.2030	12950	120	163	90	122	135	184	109	148
5/8	11	0.6250	0.2260	14400	150	203	110	149	165	224	135	183
	18	0.6250	0.2560	16300	170	230	130	176	190	258	153	207
3/4	10	0.7500	0.3340	21300	260	353	200	271	285	388	240	325
	16	0.7500	0.3730	23800	300	407	220	298	330	449	268	363
7/8	9	0.8750	0.4620	29400	430	583	320	434	475	646	386	523
	14	0.8750	0.5090	32400	470	637	350	475	520	707	425	576
1	8	1.0000	0.6060	38600	640	868	480	651	675	918	579	785
	12	1.0000	0.6630	42200	700	949	530	719	735	1000	633	858
1 1/8	7	1.1250	0.7630	42300	800	1085	600	813	840	1142	714	968
	12	1.1250	0.8560	47500	880	1193	660	895	925	1258	802	1087
1 1/4	7	1.2500	0.9690	53800	1120	1518	840	1139	1175	1598	1009	1368
	12	1.2500	1.0730	59600	1240	1681	920	1247	1300	1768	1118	1516
1 3/8	6	1.3750	1.1550	64100	1460	1979	1100	1491	1525	2074	1322	1792
	12	1.3750	1.3150	73000	1680	2278	1260	1708	1750	2380	1506	2042
1 1/2	6	1.5000	1.4050	78000	1940	2630	1460	1979	2025	2754	1755	2379
	12	1.5000	1.5800	87700	2200	2983	1640	2224	2300	3128	1974	2676

NO. 5000059 REV. J

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

MY3141

2.2.1 SAE Fastener Torque Chart (Continued)

				Values for Zinc Yellow Chromate Fasteners (Ref 4150707)						
				SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*						
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263) K= 0.20		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K=.18		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474	1320	43	5				
10	24	0.1900	0.01750	1580	60	7				
	32	0.1900	0.02000	1800	68	8				
1/4	20	0.2500	0.0318	2860	143	16	129	15		
	28	0.2500	0.0364	3280	164	19	148	17		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m
5/16	18	0.3125	0.0524	4720	25	35	20	25	20	25
	24	0.3125	0.0580	5220	25	35	25	35	20	25
3/8	16	0.3750	0.0775	7000	45	60	40	55	35	50
	24	0.3750	0.0878	7900	50	70	45	60	35	50
7/16	14	0.4375	0.1063	9550	70	95	65	90	50	70
	20	0.4375	0.1187	10700	80	110	70	95	60	80
1/2	13	0.5000	0.1419	12750	105	145	95	130	80	110
	20	0.5000	0.1599	14400	120	165	110	150	90	120
9/16	12	0.5625	0.1820	16400	155	210	140	190	115	155
	18	0.5625	0.2030	18250	170	230	155	210	130	175
5/8	11	0.6250	0.2260	20350	210	285	190	260	160	220
	18	0.6250	0.2560	23000	240	325	215	290	180	245
3/4	10	0.7500	0.3340	30100	375	510	340	460	280	380
	16	0.7500	0.3730	33600	420	570	380	515	315	430
7/8	9	0.8750	0.4620	41600	605	825	545	740	455	620
	14	0.8750	0.5090	45800	670	910	600	815	500	680
1	8	1.0000	0.6060	51500	860	1170	770	1045	645	875
	12	1.0000	0.6630	59700	995	1355	895	1215	745	1015
1 1/8	7	1.1250	0.7630	68700	1290	1755	1160	1580	965	1310
	12	1.1250	0.8560	77000	1445	1965	1300	1770	1085	1475
1 1/4	7	1.2500	0.9690	87200	1815	2470	1635	2225	1365	1855
	12	1.2500	1.0730	96600	2015	2740	1810	2460	1510	2055
1 3/8	6	1.3750	1.1550	104000	2385	3245	2145	2915	1785	2430
	12	1.3750	1.3150	118100	2705	3680	2435	3310	2030	2760
1 1/2	6	1.5000	1.4050	126500	3165	4305	2845	3870	2370	3225
	12	1.5000	1.5800	142200	3555	4835	3200	4350	2665	3625

NO. 5000059 REV. J

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

MY3151

2.2.1 SAE Fastener Torque Chart (Continued)

				SOCKET HEAD CAP SCREWS						
				Magni Coating (Ref 4150701)*						
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K = .17		Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140 OR Precoat 85® K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604							
	48	0.1120	0.00661							
6	32	0.1380	0.00909							
	40	0.1380	0.01015							
8	32	0.1640	0.01400							
	36	0.1640	0.01474							
10	24	0.1900	0.01750							
	32	0.1900	0.02000							
1/4	20	0.2500	0.0318	2860	122	14	114	13		
	28	0.2500	0.0364	3280	139	16	131	15		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	4720	20	25	20	25	20	25
	24	0.3125	0.0580	5220	25	35	20	25	20	25
3/8	16	0.3750	0.0775	7000	35	50	35	50	35	50
	24	0.3750	0.0878	7900	40	55	40	55	35	50
7/16	14	0.4375	0.1063	9550	60	80	55	75	50	70
	20	0.4375	0.1187	10700	65	90	60	80	60	80
1/2	13	0.5000	0.1419	12750	90	120	85	115	80	110
	20	0.5000	0.1599	14400	100	135	95	130	90	120
9/16	12	0.5625	0.1820	16400	130	175	125	170	115	155
	18	0.5625	0.2030	18250	145	195	135	185	130	175
5/8	11	0.6250	0.2260	20350	180	245	170	230	160	220
	18	0.6250	0.2560	23000	205	280	190	260	180	245
3/4	10	0.7500	0.3340	30100	320	435	300	410	280	380
	16	0.7500	0.3730	33600	355	485	335	455	315	430
7/8	9	0.8750	0.4620	41600	515	700	485	660	455	620
	14	0.8750	0.5090	45800	570	775	535	730	500	680
1	8	1.0000	0.6060	51500	730	995	685	930	645	875
	12	1.0000	0.6630	59700	845	1150	795	1080	745	1015
1 1/8	7	1.1250	0.7630	68700	1095	1490	1030	1400	965	1310
	12	1.1250	0.8560	77000	1225	1665	1155	1570	1085	1475
1 1/4	7	1.2500	0.9690	87200	1545	2100	1455	1980	1365	1855
	12	1.2500	1.0730	96600	1710	2325	1610	2190	1510	2055
1 3/8	6	1.3750	1.1550	104000	2025	2755	1905	2590	1785	2430
	12	1.3750	1.3150	118100	2300	3130	2165	2945	2030	2760
1 1/2	6	1.5000	1.4050	126500	2690	3660	2530	3440	2370	3225
	12	1.5000	1.5800	142200	3020	4105	2845	3870	2665	3625

NO. 5000059 REV. J

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

MY3161

2.2.1 SAE Fastener Torque Chart (Continued)

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

NO. 5000059 REV. J

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

MY3400

2.2.2 Metric Fastener Torque Chart

			Values for Zinc Yellow Chromate Fasteners (Ref 4150707				
			CLASS 8.8 METRIC BOLTS CLASS 8 METRIC NUTS				
SizePITCH		Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™)	Torque (Lub)	Torque (Loctite® 262™ OR Vibra-TITE™ 131)	Torque (Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140)
		Sq mm	KN	[N.m]	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.3	1.0	1.2	1.4
3.5	0.6	6.78	2.95	2.1	1.6	1.9	2.3
4	0.7	8.78	3.82	3.1	2.3	2.8	3.4
5	0.8	14.20	6.18	6.2	4.6	5.6	6.8
6	1	20.10	8.74	11	7.9	9.4	12
7	1	28.90	12.6	18	13	16	19
8	1.25	36.60	15.9	26	19	23	28
10	1.5	58.00	25.2	50	38	45	55
12	1.75	84.30	36.7	88	66	79	97
14	2	115	50.0	140	105	126	154
16	2	157	68.3	219	164	197	241
18	2.5	192	83.5	301	226	271	331
20	2.5	245	106.5	426	320	383	469
22	2.5	303	132.0	581	436	523	639
24	3	353	153.5	737	553	663	811
27	3	459	199.5	1080	810	970	1130
30	3.5	561	244.0	1460	1100	1320	1530
33	3.5	694	302.0	1990	1490	1790	2090
36	4	817	355.5	2560	1920	2300	2690
42	4.5	1120	487.0	4090	3070	3680	4290

NO. 5000059 REV. J

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

MY3171

2.2.2 Metric Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)						
CLASS 10.9 METRIC BOLTS CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3 - M5*						
Size	PITCH	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263™) K = 0.20	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K= 0.18	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	3.13			
3.5	0.6	6.78	4.22			
4	0.7	8.78	5.47			
5	0.8	14.20	8.85			
6	1	20.10	12.5			
7	1	28.90	18.0	25.2	22.7	18.9
8	1.25	36.60	22.8	36.5	32.8	27.4
10	1.5	58.00	36.1	70	65	55
12	1.75	84.30	52.5	125	115	95
14	2	115	71.6	200	180	150
16	2	157	97.8	315	280	235
18	2.5	192	119.5	430	385	325
20	2.5	245	152.5	610	550	460
22	2.5	303	189.0	830	750	625
24	3	353	222.0	1065	960	800
27	3	459	286.0	1545	1390	1160
30	3.5	561	349.5	2095	1885	1575
33	3.5	694	432.5	2855	2570	2140
36	4	817	509.0	3665	3300	2750
42	4.5	1120	698.0	5865	5275	4395

NO. 5000059 REV. J

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS
2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%
*3. ASSEMBLY USES HARDENED WASHER OR FASTENER IS PLACED AGAINST PLATED STEEL OR RAW ALUMINUM
MY3181 4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

2.2.2 Metric Fastener Torque Chart (Continued)

			Magni Coating (Ref 4150701)*			
			CLASS 12.9 SOCKET HEAD CAP SCREWS M6 AND ABOVE*			
SizePITCH		Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K = .17	Torque (Lub OR Loctite® 242™ or 271™ OR Vibra-TITE™ 111 or 140) K = .16	Torque (Loctite® 262™ OR Vibra-TITE™ 131) K = .15
		Sq mm	kN	[N.m]	[N.m]	[N.m]
3	0.5	5.03				
3.5	0.6	6.78				
4	0.7	8.78				
5	0.8	14.20				
6	1	20.10	12.5	13	12	11
7	1	28.90	18.0	21	20	19
8	1.25	36.60	22.8	31	29	27
10	1.5	58.00	36.1	61	58	54
12	1.75	84.30	52.5	105	100	95
14	2	115	71.6	170	160	150
16	2	157	97.8	265	250	235
18	2.5	192	119.5	365	345	325
20	2.5	245	152.5	520	490	460
22	2.5	303	189.0	705	665	625
24	3	353	220.0	900	845	790
27	3	459	286.0	1315	1235	1160
30	3.5	561	349.5	1780	1680	1575
33	3.5	694	432.5	2425	2285	2140
36	4	817	509.0	3115	2930	2750
42	4.5	1120	698.0	4985	4690	4395

NO. 5000059 REV. J

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

MY3191

2.2.3 Hydraulic Hose Torque Chart

O-Ring Face Seal & JIC Torque Chart			
Size	**ORFS**	**JIC**	**Flats Method**
4	18 Nm (13 lb-ft)	18 Nm (13 lb-ft)	1.5 to 1.75
6	31 Nm (23 lb-ft)	31 Nm (23 lb-ft)	1 to 1.5
8	54 Nm (40 lb-ft)	54 Nm (40 lb-ft)	1.5 to 1.75
10	81 Nm (60 lb-ft)	81 Nm (60 lb-ft)	1.5 to 1.75
12	100 Nm (136 lb-ft)	115 Nm (85 lb-ft)	1.0 to 1.5
16	156 Nm (115 lb-ft)	156 Nm (115 lb-ft)	.75 to 1.0
20	230 Nm (170 lb-ft)	230 Nm (170 lb-ft)	.75 to 1.0
24	271 Nm (200 lb-ft)	271 Nm (200 lb-ft)	.75 to 1.0
32	N/A	366 Nm (270 lb-ft)	.75 to 1.0

Note: *By definition the "Flats Method" will contain some variance. Use the "Flats Method" only when accessibility with a torque wrench is not possible.*

Torque Wrench:

1. Identify the appropriate application and refer to the above chart for the correct torque value.
2. If equipped, lubricate o-ring with hydraulic oil. Hand tighten the swivel nut until no lateral movement of the swivel nut can be detected. Average hand torque is 4 Nm (3 lb-ft).
3. Use the double wrench method while tightening to avoid hose twist.
4. Torque wrench must be held at the center of the grip. Apply constant force until it clicks.
5. After the connection has been properly tightened, mark a straight line across the connecting parts indicating that the connection has been properly tightened.

Flats Method:

1. If equipped, lubricate o-ring with hydraulic oil. Hand tighten the swivel nut until no lateral movement of the swivel nut can be detected. Average hand torque is 4 Nm (3 lb-ft).
2. Mark a dot on one of the swivel nut flats and another dot in line on the hex of the adapter it's connecting to.
3. Use the double wrench method while tightening to avoid hose twist.
4. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots indicating that the connection has been properly tightened.

2.3 SPECIFICATIONS

2.3.1 Travel Speed

	L2906H, 2906H, 29.9LP, 29.6 & 619A	3507H, 35.7 & 723A
First Gear	10 kmph (6 mph)	7 kmph (4 mph)
Second Gear	34 kmph (21 mph)	33 kmph (20 mph)

2.3.2 Hydraulic Cylinder Performance Specifications

Note: *Machine with no load, engine at full throttle, hydraulic oil above 54° C (130° F) minimum, engine at operating temperature.*

Function	Approximate Times (sec.)
Boom Extend	6
Boom Retract	4
Boom Lift	6
Boom Lower	4
Quick Attach - UP	2
Quick Attach - DOWN	2

2.3.3 Electrical System

Note: *Refer to Section 9.8, "Fuses and Relays," for more information.*

Battery	
Type, Rating	12V, Negative (-) Ground, Tapered Top Post, Maintenance Free
Quantity	1
Reserve Capacity	1000 Cold Cranking Amps @ -18° C (0° F)
Group/Series	BCI Group 31
Alternator	12V, 95 Amps
Starter	12V, 3,0 KW Type EV (Gear Reduction)

2.3.4 Engine Performance Specifications

Description	
Engine Make/Model	Deutz TCD2012L04V02 Tier III
Low Idle	925 ±50 rpm
High Idle	2370 ±50 rpm
Horsepower	74.9 kW/100.4 BHP @ 2200 rpm
Fuel Delivery	Fuel Injection
Air Cleaner	Dry Type, Replaceable Primary and Safety Elements
Average Fuel Consumption (dependant on load/duty)	6,1 l/hr (1.6 gal/hr)

2.3.5 Tires

Note: *Standard wheel lug nut torque is 300 Nm (220 lb-ft).*

Note: *Pressures for Foam filled tires are for initial fill ONLY.*

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
405/70-20 (L2906H, 2906H & 3507H)	MPT-01	Bias - 14 Ply	Pneumatic	3,5 bar (51 psi)
405/70-24 (2906H, 3507H, 29.6 & 35.7)	MPT-01	Bias - 14 Ply	Pneumatic	4,0 bar (58 psi)
405/70-20 (L2906H, 2906H,3507H & 619A)	MPT-04	Bias - 14 Ply	Pneumatic	3,5 bar (51 psi)
405/70-20 (619A)	MPT-04	Bias - 14 Ply	Foam - Approx. 200 kg (441 lb)	
405/70-24 (2906H, 3507H, 29.6, 35.7 & 723A)	MPT-04	Bias - 14 Ply	Pneumatic	4 bar (58 psi)
405/70-24 (723A)	MPT-04	Bias - 14 Ply	Foam - Approx. 240 kg (529 lb)	
400/70R20	XMCL	Radial Ply	Pneumatic	4 bar (58 psi)
445/70R24 (3507H, 35.7 & 723A)	XMCL	Radial Ply	Pneumatic	4,1 bar (60 psi)
460/70R24 (3507H, 35.7 & 723A)	EM-01	Radial Ply	Pneumatic	4 bar (58 psi)

2.4 FLUIDS, LUBRICANTS AND CAPACITIES

Engine Crankcase Oil

Capacity w/Filter Change	10,4 liter (11 quart)
Filter Capacity	1,0 liter (1.05 quart)
Oil Type	
L2906H, 2906H, 3507H, 619A & 723A	15W-40 CE
29.6LP, 29.6 & 35.7	DF Super ENGINE OIL 15W-40

Fuel Filters

Primary Fuel Filter Capacity	Approx. 1,0 liter (1.05 quart)
Fuel Filter Capacity	0,6 liter (0.16 quart)

Fuel Tank

Capacity	
L2906H, 2906H, 29.6LP, 29.6 & 619A	95 liter (25 gallon)
3507H, 35.7 & 723A	102 liter (27 gallon)
Type of Fuel	#2 Diesel

Cooling System

System Capacity w/o Heater	19 liter (5 gallon)
Overflow Bottle Capacity	3 liter (3.2 gallon)
Type of Fluid	50/50 mix of ethylene glycol & water

Hydraulic System

System Capacity	
L2906H, 2906H, 29.6LP, 29.6 & 619A	98 liter (26 gallon)
3507H, 35.7 & 723A	102 liter (27 gallon)
Reservoir Capacity to FULL Mark	
L2906H, 2906H, 29.6LP, 29.6 & 619A	60 liter (16 gallon)
3507H, 35.7 & 723A	95 liter (25 gallon)
Type of Fluid	
L2906H, 2906H 3507H,619A & 723A	Mobilfluid® 424Tractor Hydraulic Fluid (ISO 46)
29.6LP, 29.6 & 35.7	DF UTTO Tractor Hydraulic Fluid

Air Conditioning

Capacity	1,1 kg (2.4 lb)
Type of Refrigerant	R-134a

Axles

Differential Housing Capacity - Front	
L2906H, 2906H, 29.6LP, 29.6 & 619A	9,5 liter (10 quart)
3507H, 35.7 & 723A	10 liter (10.6 quart)
Differential Housing Capacity - Rear	
L2906H, 2906H, 29.6LP, 29.6 & 619A	5,5 liter (5,8 quart)
3507H, 35.7 & 723A	8 liter (8.5 quart)
Wheel End Capacity	
L2906H, 2906H, 29.6LP, 29.6 & 619A	0,8 liter (0.8 quart)
3507H, 35.7 & 723A	Front - 0,6 liter (0.6 quart) Rear - 0,7 liter (0.7 quart)

Transfer Box

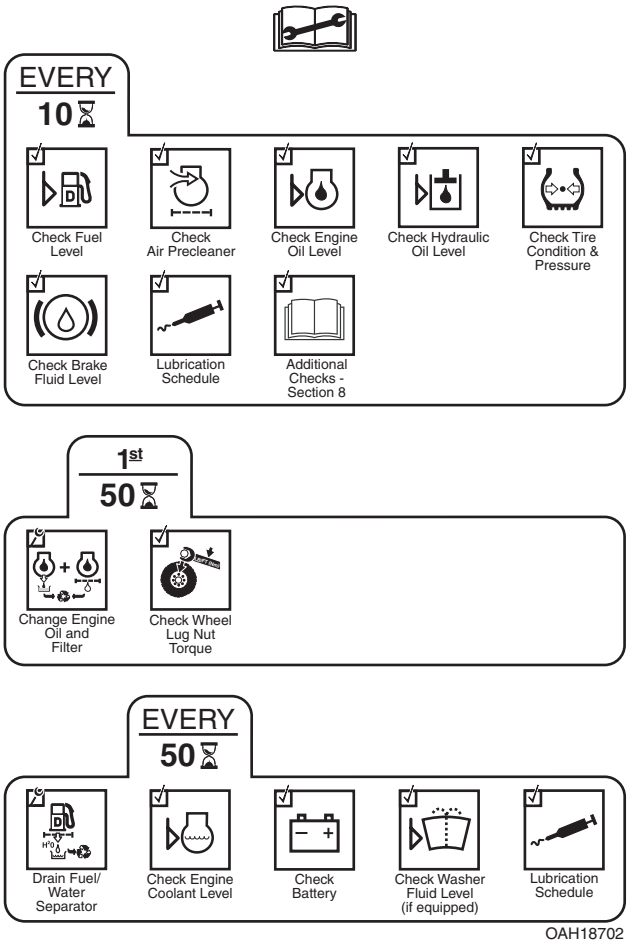
Capacity	0,5 liter (0.5 quart)
Type of Fluid	
L2906H, 2906H 3507H,619A & 723A	Mobilube HDLS 80W-90, Mobilfluid® 424Tractor Hydraulic Fluid (ISO 46), Shell Spirax LS, Esso Torque Fluid 62, Selenia Ambra STF 80W-90
29.6LP, 29.6 & 35.7	DF GEAR 90 LS

Brakes

Master Cylinder Capacity	0,7 liter (0.7 quart)

2.5 MAINTENANCE SCHEDULES

2.5.1 10,1st 50 & 50 Hour Maintenance Schedule



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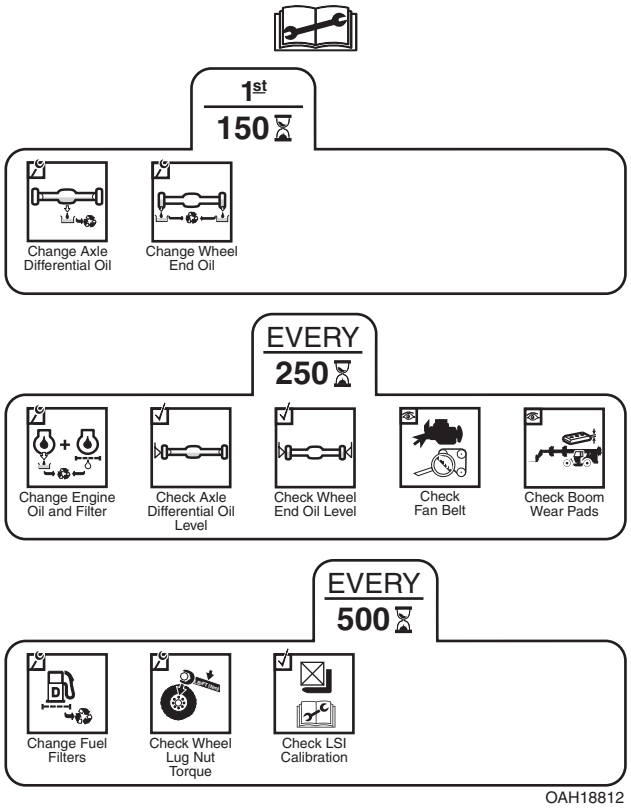
2.5.2 1st 150, 250 & 500 Hour Maintenance Schedule



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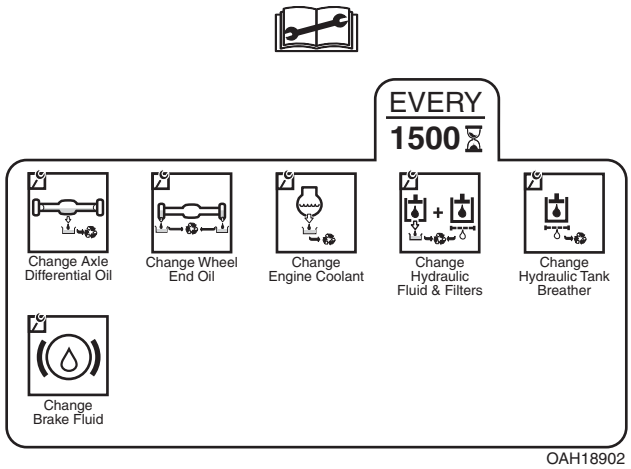
2.5.3 1500 Hour Maintenance Schedule



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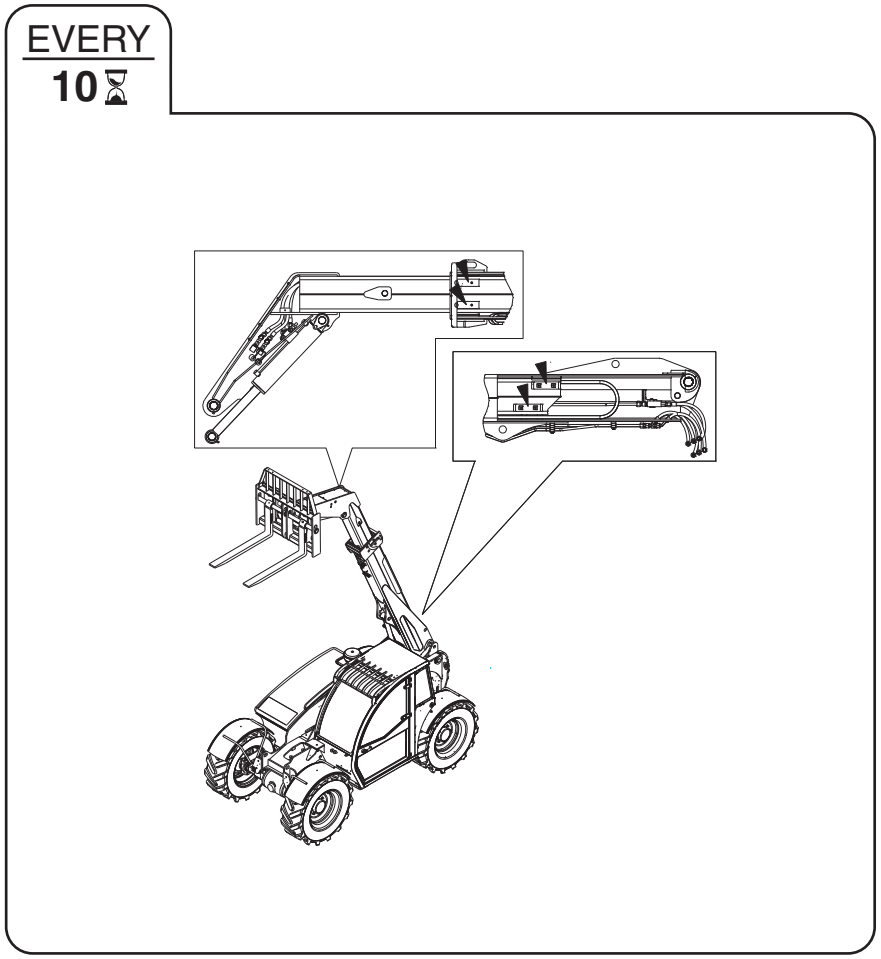
2.6 LUBRICATION SCHEDULE

2.6.1 10 Hour Lubrication Schedule



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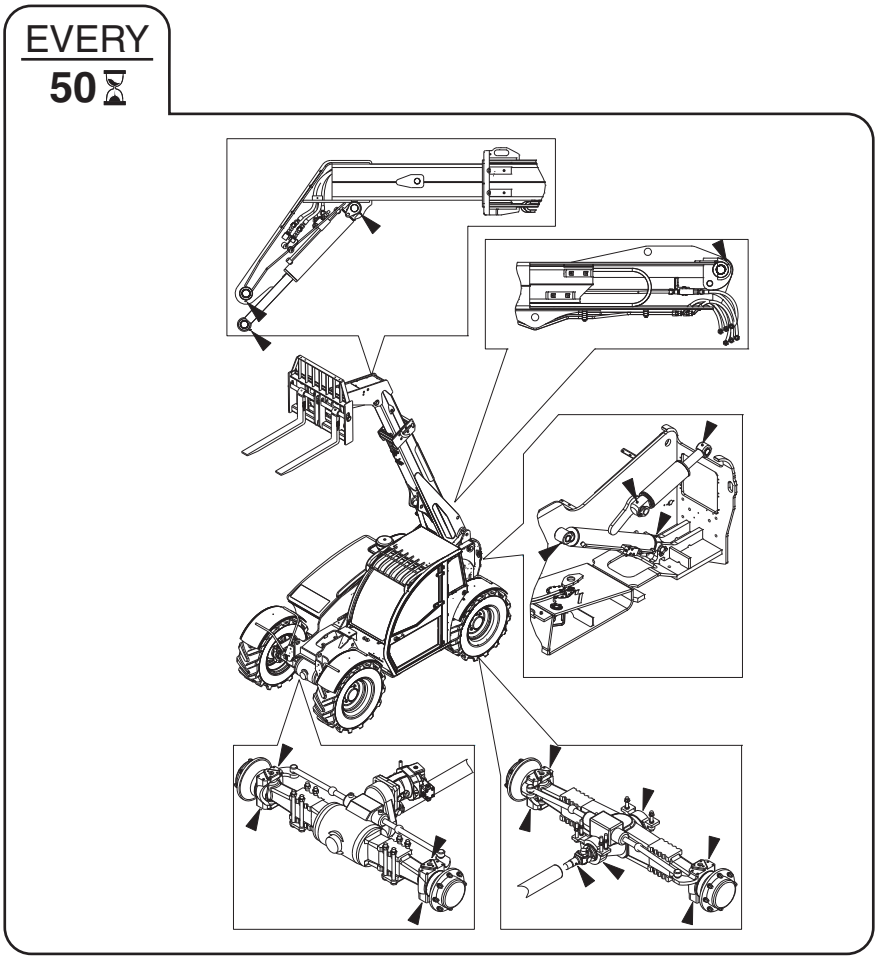
2.6.2 50 Hour Lubrication Schedule



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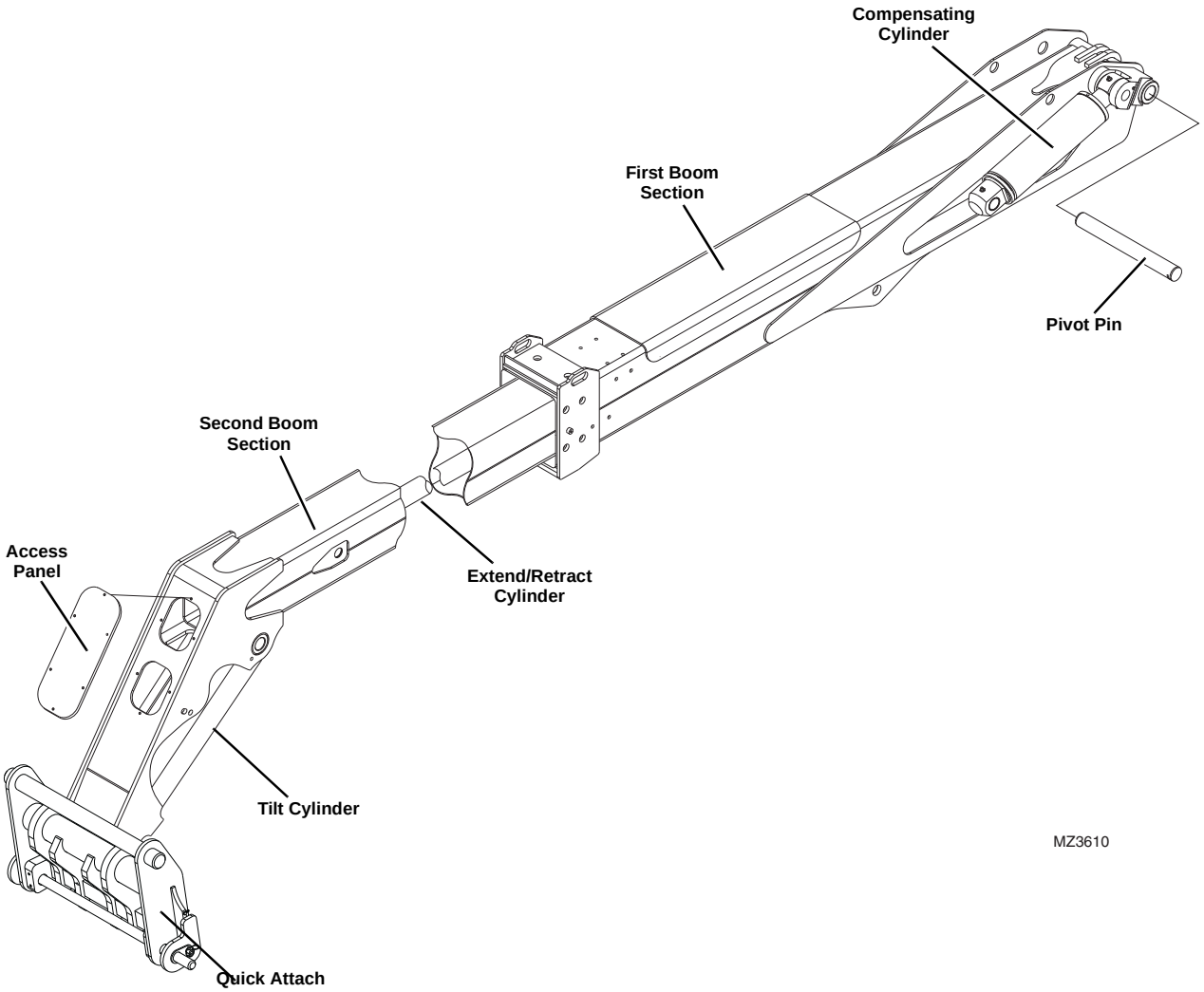
Section 3
Boom

Contents

3.1 BOOM SYSTEM COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the major assemblies of the boom system. The following illustration identifies the components that are referred to throughout this section.



3.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in the “Safety Practices” section of this manual.

3.3 BOOM SYSTEM - TWO SECTION BOOM

3.3.1 Boom System Description

The boom operates via an interchange among the electrical, hydraulic and mechanical systems. Components involved include the joystick, tilt cylinder, extend/retract cylinder, lift/lower cylinder, compensating cylinder, electronic sensors, various pivots, supporting hardware and other components.

3.4 BOOM ASSEMBLY MAINTENANCE

The boom assembly consists of the first and second section booms and supporting hardware.

Note: *Before removing the boom or boom section, the carriage or any other attachment must be removed from the quick attach.*

Before beginning, conduct a visual inspection of the machine and work area, and review the task about to be undertaken. Read, understand and follow these instructions.

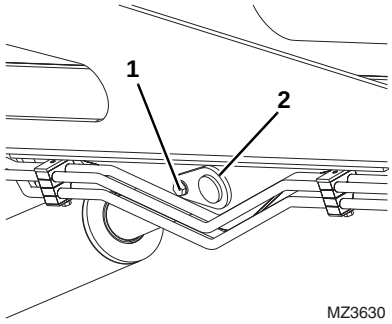
During service of the boom, perform the following:

1. Check wear pads. (Refer to Section 3.5.1, “Wear Pad Inspection.”)
2. Apply grease at all lubrication points (grease fittings). (Refer to Section 2.6, “Lubrication Schedule.”)
3. Check for proper operation by operating all boom functions through their full ranges of motion several times.

Depending on your particular circumstance, the following procedures explain the removal/installation of individual boom sections or removal/installation of the complete boom.

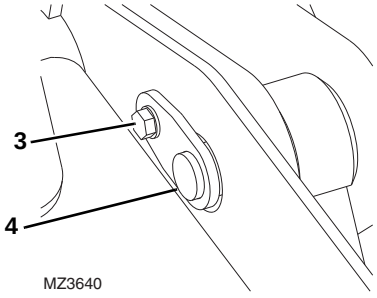
3.4.1 Boom Removal

1. Remove any attachment from the quick switch assembly.
2. Be sure there is enough room in front of the machine to allow the boom sections to be removed. Park the machine on a hard, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
3. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
4. Properly disconnect the battery.
5. Open the engine cover. Allow the system fluids to cool.
6. Remove the quick switch assembly. Refer to Section 3.6.1, “Quick Attach Removal.”



MZ3630

7. Support the front of the boom by placing a sling behind the boom head. Support the lift/lower cylinder and remove the lock bolt (**1**) and pin from the rod end of the lift/lower cylinder (**2**). Lower the lift/lower cylinder onto the frame rails.
8. Label and disconnect the tilt and auxiliary hydraulic hoses attached to the machine at the rear of the boom. Plug and cap the hose ends to prevent dirt and debris from entering the hydraulic system.
9. Label and disconnect the extend/retract hydraulic hoses at the extend/retract cylinder.



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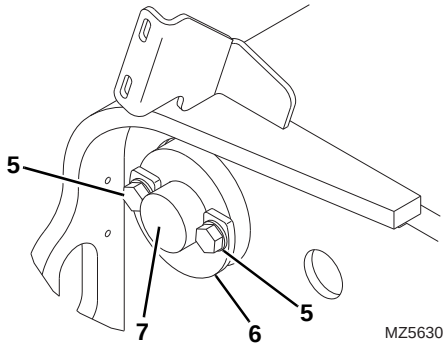
10. Remove the lock bolt (**3**) and pin (**4**) from the rod end of the compensating cylinder on the first boom section. Rest the cylinder on the machine frame.
11. Lower the boom to a level position and place a suitable support under the rear of the boom. Reposition the slings to each end of the boom.

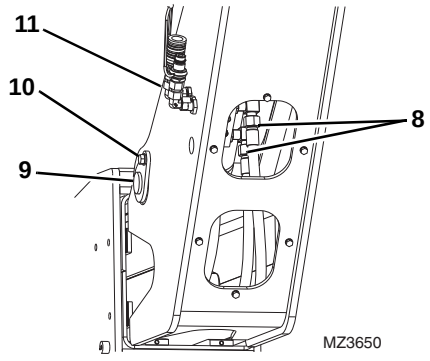


12. Remove the lock bolts (**5**), keeper plate (**6**) and pivot pin (**7**) from rear of first boom section.
13. Lift the complete boom off machine and set on level ground or supports being careful not to damage the tubes on the bottom of the boom.

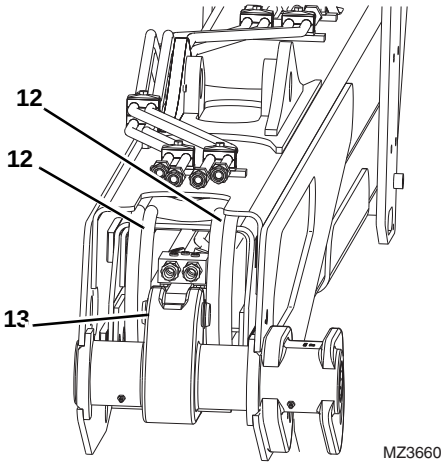
3.4.2 Second Section Boom Removal

1. Set the complete boom on level ground and by repositioning the slings, turn boom over on to the top side. Set the complete boom on suitable stands to begin tear down.
2. Remove the access cover from the boom head.

Note: *With the complete boom setting upside down, the second boom section, tilt cylinder and hoses are made more accessible. This also eliminates the need to remove the hose rack on the bottom of the boom.*



3. At the boom head, attach a sling through rod end of tilt cylinder. Label and disconnect both hoses (**8**) from tilt cylinder. Plug and cap the hose ends to prevent dirt and debris from entering the hydraulic system.
4. Remove the lock bolt (**9**) and pin (**10**) from the barrel end of tilt cylinder. Lift the tilt cylinder out of the boomhead.
5. From the access opening on the bottom front of the boom, label and disconnect both auxiliary hoses (**11**). Plug the hose ends to prevent dirt and debris from entering the hydraulic system.



6. Carefully pull the tilt, auxiliary and extend/retract hydraulic hoses (**12**) through the rear of the second boom section.
7. Remove the two snap rings and pin (**13**) from barrel end of the extend/retract cylinder.
8. Pull the second boom section out 15 cm to 20 cm (6 in to 8 in) to be able to loosen and remove all the bolts and remove all the wear pads, backing plates and shims from the front inside of the first section boom. Tag each pad, backing plate, shim and bolts from each location.

⚠ WARNING

NEVER weld or drill the boom. The structural integrity of the boom will be impaired if subjected to any repair involving welding or drilling.

9. Remove the clip and pin from the rod end of the extend/retract cylinder and pull through the rear of the second boom section.
10. Pull out the remainder of the second boom section.
11. Inspect the boom and welds. Consult your local **JLG** distributor if structural damage is detected.
12. Inspect hoses, hardware, wear pads, mounting points and other components visible with the first boom section. Replace any item if damaged.
13. Inspect all wear pads for wear. (Refer to Section 3.5.1, “Wear Pad Inspection.”)

3.4.3 Second Section Boom Installation

1. Insert the extend/retract cylinder through the rear of the second boom section and attach the pin and clip to the rod end.
2. Install the bottom rear wear pads, washers and bolts into the first boom section. Apply Loctite® 243™ and torque to 90 Nm (66 lb-ft). Install the bottom rear left and right side wear pads, backing plate and bolts (do not shim or tighten bolts). Install top rear wear pads, backing plates and bolts (front bolts are drilled and tapped for zerk fittings, do not shim or tighten bolts).
3. Grease the inside of the first boom section on areas where the second boom section wear pads will slide.
4. Using a suitable sling, carefully slide the second boom section 1 m to 1.5 m (3 ft to 4 ft) into the front of the first boom section. Set the second boom section head onto suitable supports and reset sling under the boom head of the second section. Carefully slide the second section into the first section. Leave 15 cm to 20 cm (6 in to 8 in) of the second section out to be able to install wear pads in front of the first boom section.
5. With the sling still under the boom head, install the top wear pads, washers and bolts in the front of the first boom section. Apply Loctite® 243™ and torque to 90 Nm (66 lb-ft). Lower the second boom section and install the bottom wear pads, backing plates, shims and bolts in the front of the first boom section. Apply Loctite® 243™ and torque to 90 Nm (66 lb-ft). Install both left and right side front wear pads, backing plates, shims and bolts in the front of the first boom section. Apply Loctite® 243™ and torque to 90 Nm (66 lb-ft).

Note: *Light lubrication of the boom wear surfaces with a factory authorized grease is recommended to keep the boom wear surfaces lubricated properly.*

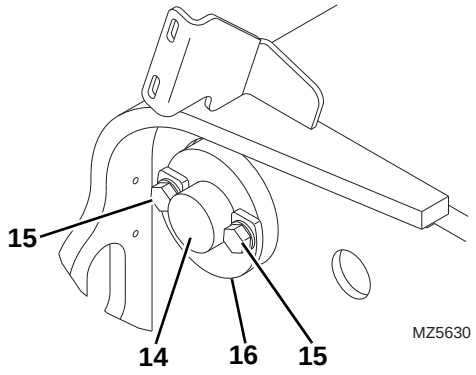
6. Tighten all rear wear pad bolts after ensuring the minimum gap requirements have been met. Refer to Section 3.5.1, “Wear Pad Inspection.”
7. Insert the pin and clip into the barrel end of the extend/retract cylinder.
8. Lift the tilt cylinder into place and insert the pins and clips to secure the cylinder to the boomhead.
9. Slide the tilt and auxiliary hoses between the boom sections.
10. Uncap and reconnect the tilt and auxiliary hoses and attach to their appropriate locations.
11. Install the access cover on the front of the boom head.

3.4.4 Boom Installation

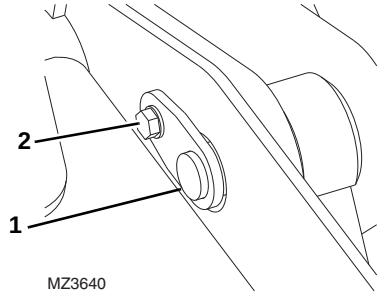
Note: *Light lubrication of the boom wear surfaces with a factory authorized grease is recommended to keep the boom wear surfaces lubricated properly. Light lubrication of the boom wear surfaces is also recommended when the machine is stored, to help prevent rusting.*

1. Park the machine on a hard, level surface, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Using suitable slings, turn boom back over to original orientation.

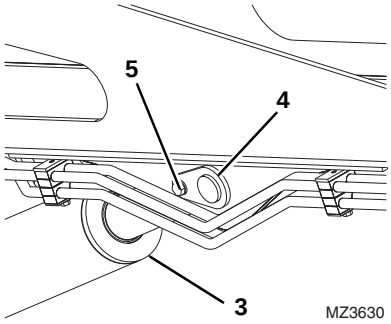
Note: *Grease the boom pivot bore, compensating cylinder rod ends, lift/lower cylinder rod end and pins before installing.*



5. Using suitable slings, balance the boom assembly, lift and carefully guide the boom into place. Align the frame pivot bore with the boom assembly pivot bore. Install boom pivot pin (**14**) with keeper plate slot facing down. Apply Loctite® 243™ to the mounting bolts (**15**). Install the keeper plate (**16**), lock bolts (**15**) and torque to 90 Nm (66 lb-ft).



6. With the sling still in place, install the comp cylinder pin (**1**) and lock bolt (**2**). Apply Loctite® 243™ and torque to 90 Nm (66 lb-ft).



7. With the sling still in place, install the rod end of the lift/lower cylinder (**3**), pin (**4**) and lock bolt (**5**). Apply Loctite® 243™ and torque to 90 Nm (66 lb-ft).

Note: *Raising the boom up or down with the sling may be necessary so the boom, compensating and lift/lower cylinder bores can be aligned for easier pin installation.*

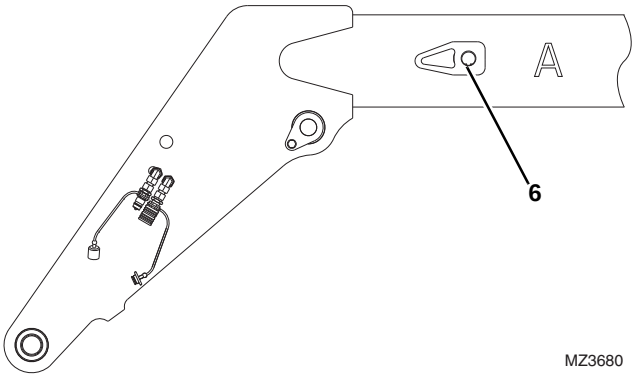
8. Uncap and reconnect the extend/retract cylinder fittings and plugs from extend/retract cylinder hoses. Attach each hose to the extend/retract cylinder fittings and tighten until wrench-tight. Mark the fitting, then tighten each hose firmly 1 to 1,5 flats.
9. Uncap and reconnect both the tilt and auxiliary hoses. Attach both sets to their appropriate tubes until wrench-tight. Mark the fitting, then tighten each hose firmly 1 to 1,5 flats.
10. Properly connect the battery.
11. Start the engine and operate all boom functions several times to bleed any air out of the hydraulic system. Check for oil leaks. Check the hydraulic oil level in the tank and add oil as required.
12. Clean up all debris, hydraulic oil, etc., in, on, near and around the machine.
13. Close and secure the engine cover.
14. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

3.4.5 Extend/Retract Cylinder Removal

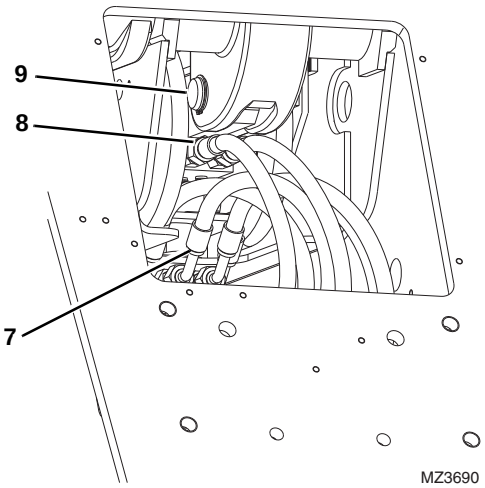
1. Remove any attachment from the quick attach assembly. Refer to Section 3.6, “Quick Attach Assembly.”
2. Park the machine on a hard, level surface, extend the boom approximately 1 m (3 ft) to gain access to the extend/retract cylinder pin in the second boom section, level the boom assembly, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.

Note: *The boom must be properly aligned (level) with the access hole at the rear of the frame to allow removal of the extend/retract cylinder barrel mounting pin.*

3. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
4. Open the engine cover. Allow the system fluids to cool.
5. Properly disconnect the battery.



6. Remove the cylinder rod eye snap rings and mounting pin (**6**) at the side of the second boom section.



7. Loosen and remove the cover plate from the rear of the frame assembly.
8. Label and disconnect the tilt and auxiliary hydraulic hoses (**7**) attached to the tubes at the bottom rear of the boom. Plug and cap the hose and tube ends to prevent dirt and debris from entering the hydraulic system.
9. Label and disconnect the extend/retract cylinder hoses at the rear of the extend/retract cylinder (**8**). Plug the hose ends to prevent dirt and debris from entering the hydraulic system.
10. Loosen and remove both fittings from the bottom of the extend/retract cylinder barrel. Plug the openings in the extend/retract cylinder barrel.
11. Remove the snap ring on each side of the extend/retract cylinder mounting pin.
12. Remove the mounting pin (**9**).
13. Attach a sling or other suitable lifting device to the extend/retract cylinder and carefully pull the extend/retract cylinder free of the machine through the rear of the boom/chassis assembly.
14. Place the extend/retract cylinder in a designated area for the next operation.

3.4.6 Extend/Retract Cylinder Installation

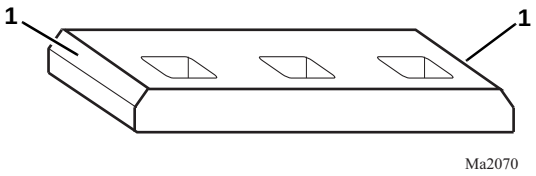
1. Using a suitable sling, carefully install the extend/retract cylinder into the rear of the boom and line up the barrel end of the cylinder with the pin bores on the first boom section.
2. Install the mounting pin (**9**) through the frame access hole on the chassis and the first boom section bore and cylinder barrel. Secure with snap rings.
3. Remove the plugs in the bottom of the extend/retract cylinder and install the previously removed fittings.
4. Uncap and connect the hoses to the previously labeled fittings at the extend/retract cylinder (**8**). Apply Loctite® 545™ to the fittings.
5. Uncap and reconnect the tilt hoses and auxiliary hoses (**7**) to their appropriate fittings until wrench-tight. Mark the fitting and torque to specification. Refer to Section 2.2.3, “Hydraulic Hose Torque Chart.”
6. Install the cover plate at the rear of the boom assembly.
7. Properly connect the battery.
8. Start the machine and extend the extend/retract cylinder until the rod eye of the cylinder aligns with the pin bore in the second boom section.
9. Shut the engine OFF.
10. Install the mounting pin through the side of the second boom section (**6**) and secure with the snap rings.
11. Start the machine and cycle the extend/retract cylinder to bleed any air out of the hydraulic system. Check for oil leaks or any alignment problems. Check the hydraulic oil level in the tank and add oil as required.
12. Close and secure the engine cover.
13. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

3.5 BOOM WEAR PADS

A total of 14 wear pads are installed on the boom.

Twelve of the fourteen wear pads on this boom are flat rectangular wear pads with metal inserts. Two wear pads on the bottom of the second section boom are channeled for tilt hose and auxiliary hose clearance.

3.5.1 Wear Pad Inspection



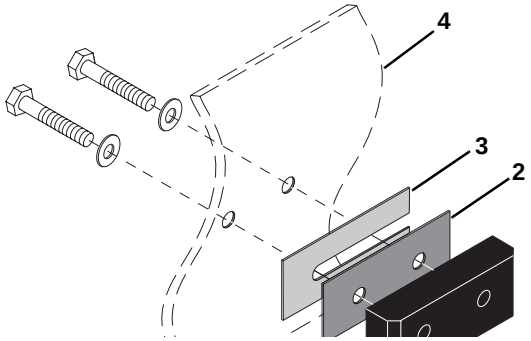
Inspect all wear pads for wear. If the angle indicators (**1**) on the ends of the wear pads are visible, the wear pads can be reused. If the pads show uneven wear (front to back), they should be replaced. Replace pads as a set if worn or damaged.

3.5.2 Wear Pad Installation and Lubrication

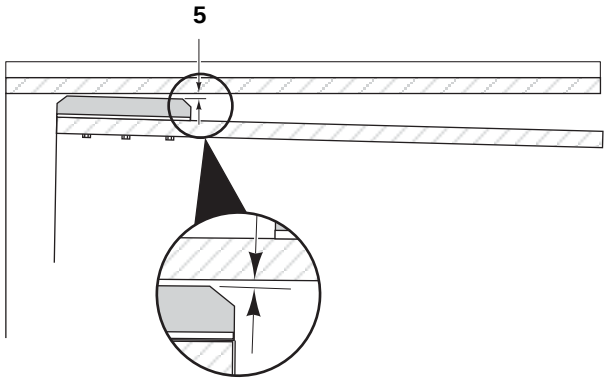
Note: *Inspect all wear pads. Replace as necessary.*

The following wear pad procedure must be followed to insure the proper wear pad installation:

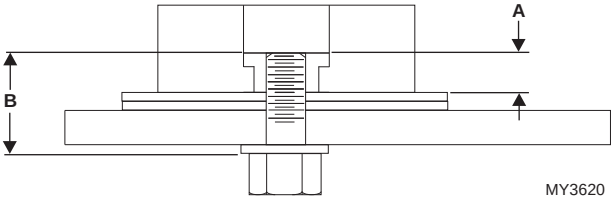
- The wear pad inserts and mounting bolts MUST be clean from any grease, oil or other contaminates before applying Loctite® 243™ and installing mounting bolts.
- Apply Loctite® 243™ to all wear pad mounting bolts.



- A spacer (**2**) with holes must be used before any shim (**3**) is used.
- A shim (**3**) must be inserted between the spacer (**2**) and wear pad support plate, block or boom section (**4**).
- The number of shims can vary at each shim point.
- The bottom wear pads must be shimmed equally on each side.



- Maintain a total boom section clearance (**5**) of 1,78 - 3,30 mm (0.070 - 0.130 in) both the horizontal and vertical directions.



- The length of the wear pad bolt depends on the number of shims, spacers and washers being used.
- The thickness of each threaded wear pad insert is 7,92 mm (0.312 in)(**A**).
- The bolt length should be determined by measuring the distance from the face of the insert to the face of the boom (**B**) including any spacer, shim(s) and washer(s).
- Bolt thread engagement in the wear pad insert should be 6,98 ± 1,0 mm (0.275 ± 0.040 in).
- One or two hardened washers are to be used on each wear pad bolt except where noted otherwise. DO NOT use more than two hardened washers.
- Use only one hardened washer if mounting bolts are recessed.
- Wear Pad Bolt Torque:
  M10x20 Bolt, 50 Nm (37 lb-ft)
  M10x25 Bolt, 50 Nm (37 lb-ft)
  M10x30 Bolt, 50 Nm (37 lb-ft)
  M10x40 Bolt, 50 Nm (37 lb-ft)
  M10x45 Bolt, 50 Nm (37 lb-ft)
  M10x50 Bolt, 50 Nm (37 lb-ft)
  M12x20 Bolt, 90 Nm (66 lb-ft)
  M12x25 Bolt, 90 Nm (66 lb-ft)
  M12x30 Bolt, 90 Nm (66 lb-ft)
- Torque wear pad bolts after shimming is completed.
- Lubricate the face and pockets of each wear pad after being installed.

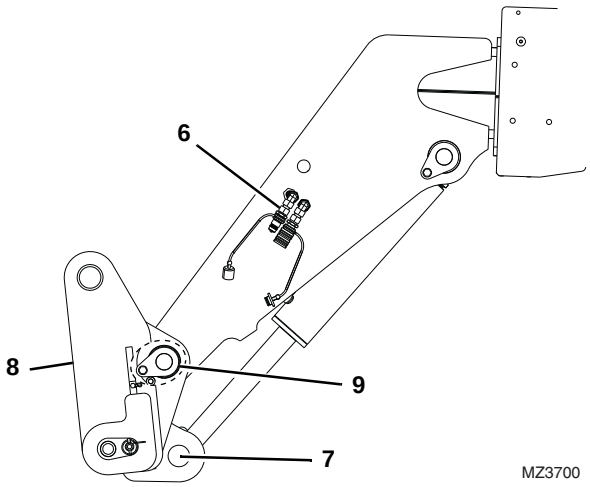
Boom Section Wear Pad Pathway Lubrication:

- Clean and lightly grease all wear pad pathways with Mystik Tetrimoly grease.
- Clean and lightly grease the hose carrier guide bar pathways with Mystik Tetrimoly grease.

3.6 QUICK ATTACH ASSEMBLY

3.6.1 Quick Attach Removal

1. Park the machine on a firm, level surface. Place the transmission control lever in (N) NEUTRAL, engage the park brake switch.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.



5. If equipped with a hydraulic quick attach device, remove both hydraulic hoses (**6**) from the valve on the left side of the boom head. Plug and cap the hose ends to prevent dirt and debris from entering the hydraulic system.
6. Remove the lock bolt holding the tilt cylinder rod end pin (**7**) to the quick attach assembly (**8**). Remove the tilt cylinder pin (**7**).
7. Support the quick attach assembly (**8**). Remove the lock bolt holding the quick attach pin (**9**) to the quick attach assembly. Remove the pin from the quick attach assembly from either side.
8. Inspect the above pin for nicks or surface corrosion. Use fine emery cloth to fix minor nicks or corrosion. If damaged or if it cannot be repaired the pin must be replaced.

3.6.2 Quick Attach Installation

1. Line up the quick attach between the mounts on the boom head. The quick attach should be centered in the boom head.
2. Coat the quick attach pivot pin (**9**) with an anti-seize compound. Insert the quick attach pivot pin through the quick attach (**8**) and boom head. Align the pivot pin and quick attach. Install the lock bolt and torque to 97 Nm (72 lb-ft).
3. Align the quick attach (**8**) with the tilt cylinder rod end and insert the tilt cylinder pin (**7**). Align the tilt cylinder pin and quick attach. Install the lock bolt and torque to 97 Nm (72 lb-ft).
4. If equipped, uncap and reconnect the hydraulic quick attach device hoses (**6**) to the valve on the left side of the boom head.
5. Properly connect the battery.
6. Clean up all debris, hydraulic oil, etc., in, on, near and around the machine.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

3.7 FORKS

Forks should be cleaned and inspected prior to being attached to carriage. If the following criteria is not met, forks must be removed from service immediately.

Daily Inspection

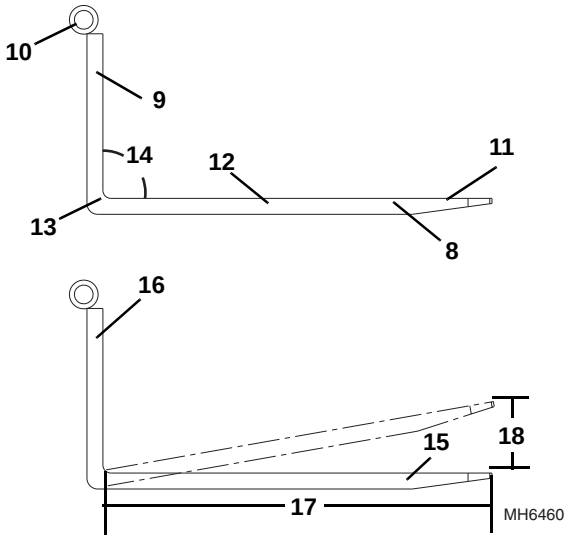
1. Inspect forks (**8**) for cracks, paying special attention to heel (**9**) and mounting tubes (**10**).
2. Inspect forks for broken or bent tips (**11**) and twisted blades (**12**) and shanks (**13**).

Yearly Inspection

1. Straightness of the upper face of blade (**12**) and the front face of shank (**13**) should not exceed 0.5 percent of the length of blade or height of shank.
2. Angle (**14**) between upper face of blade and front face of shank should not exceed 93 degrees.
3. Thickness of blade (**15**) and shank (**16**) should not be reduced to 90 percent of original thickness.

Note: *Contact the local **JLG** distributor with the fork part number to find the manufactured dimensions of the fork blade.*

4. Ensure fork length (**17**) is adequate for intended loads.
5. Fork markings should be legible, re-stamp if required.
6. Compare fork tips (**18**) when mounted on a carriage. Maximum difference in height of fork tips is 3 percent of the length of the blade (**15**).



3.8 BOOM PROP (IF EQUIPPED)

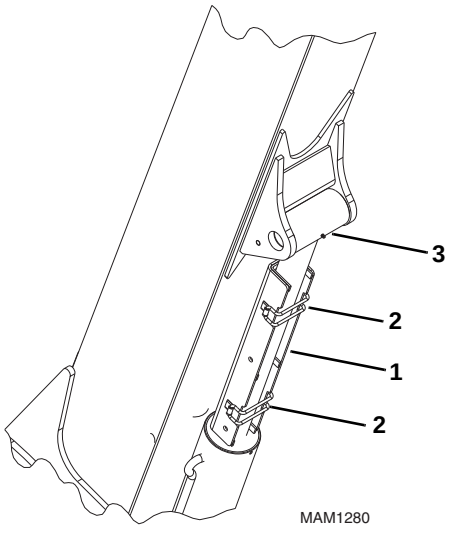
3.8.1 Installation and Removal Procedures

WARNING

A raised boom can fall if a hydraulic component is removed. Remove any load, retract the boom and install the boom prop or a suitable supporting stand before working under a raised boom.

a. Prop Installation

1. Park the machine on a firm, level surface. Place the transmission control lever in (N) NEUTRAL, engage the park brake switch.
2. Raise the boom to an angle of approximately 20 degrees. Shut engine OFF.
3. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
4. Before installing the boom prop, inspect the prop for damage. Do not use if the prop is damaged or if the o-rings are damaged or missing.



5. Install the boom prop (**1**) onto the lift/lower cylinder. Install o-rings (**2**). Align lift cylinder lock so the o-rings are on the bottom side of the lift/lower cylinder rod.
6. Start the engine and SLOWLY lower the boom until there is a clearance of 6 mm (0.25 in) between the end of the boom prop and the lift/lower cylinder rod end (**3**).
7. Shut engine OFF.

NOTICE

EQUIPMENT DAMAGE. DO NOT operate with the boom prop in place. Damage to the boom prop and/or the lift/lower cylinder could occur.

b. Prop Removal

1. If needed, start machine and slowly raise the boom until the boom prop is clear of the lift/lower rod end.
2. Remove the o-rings (**2**) and boom prop (**1**) from the cylinder. Return the boom prop to the proper location and secure.
3. Lower boom, shut engine OFF.

3.9 EMERGENCY BOOM LOWERING PROCEDURE

In case of an emergency, engine, hydraulic or electrical failure, use the following procedure to retract and/or lower the boom.

⚠ WARNING

To avoid instability of the machine, the extend/retract cylinder **MUST BE** fully retracted prior to retracting the lift cylinder. If circumstances prevent retraction of the extend/retract cylinder first, lower the lift cylinder the minimum amount necessary and resume retraction of the extend/retract cylinder as soon as possible.

3.9.1 Equipment and Supplies Required

Auxiliary Hydraulic Power Supply:

- Portable hydraulic unit or another machine with an auxiliary hydraulic power supply with a capacity to hold up to 11,4 L (3 gal) of hydraulic oil from the machine during lowering process.

NOTICE

EQUIPMENT DAMAGE. Auxiliary Hydraulic Power Supply hydraulic oil must be compatible with hydraulic oil shown in Section 2.4, “Fluids, Lubricants and Capacities.”

Hoses:

- Two Hydraulic Hoses - Approximately 3,0 m (10 ft) each, with a minimum I.D. of 9,5 mm (0.375 in) and a minimum rating of 275,8 bar (4000 psi).

Fittings:

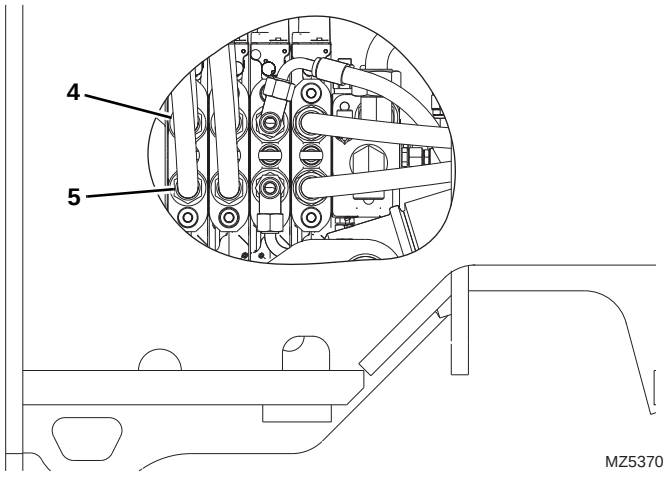
- Two 25,4 mm (1 in) - 14 ORFS Caps
- Two 25,4 mm (1 in) - 14 ORFS Plugs

Note: *Machine extend/retract and lift/lower hoses are - 14 ORFS. The adaptor size may vary depending on the hose ends of the auxiliary hydraulic power supply.*

3.9.2 Lowering Procedure

a. Retract the boom as follows:

1. Place a suitable receptacle under the hose connections.



2. From the rear of the machine, locate the extend/retract cylinder connection (**4** & **5**) at the rear of the main control valve.

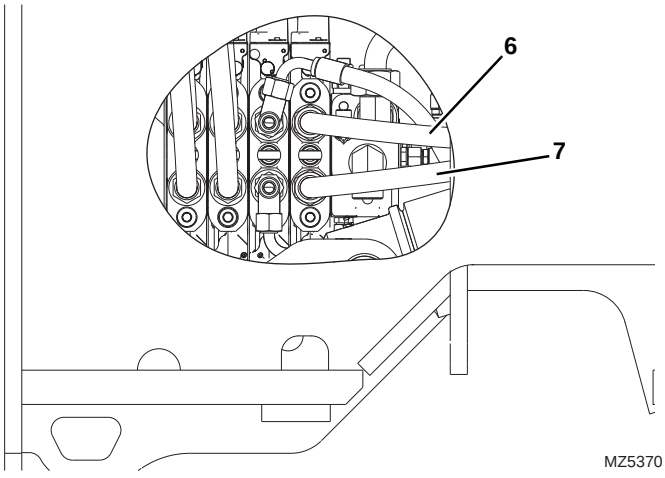
3. Label and disconnect both extend/retract hoses (**4** & **5**). Install plugs in hoses to prevent oil loss. Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.

Note: *Loss of hydraulic oil is limited to the amount trapped within each hose.*

4. Using the hoses and fittings specified previously, connect the jumper hoses between the auxiliary hydraulic power supply and the extend/retract hoses (**4** & **5**) of the affected machine. Ensure that the supply and return lines are installed in the proper order to ensure that the cylinder is retracted, not extended.
5. Use the auxiliary power supply to retract the extend/retract cylinder.
6. Loosen and remove the jumper hoses and reconnect the extend/retract cylinder hoses.
7. Transfer any hydraulic oil into a suitable, covered container, and label the container as “Used Oil.” Dispose of used oil at an approved recycling facility.
8. Clean up all debris, hydraulic oil, etc., in, on, near and around the machine.

b. Lower the boom as follows:

1. Place a suitable receptacle under the main control valve.



2. Label and disconnect the lift/lower cylinder hoses (**6** & **7**) from the main control valve. Install plugs in hoses to prevent oil loss. Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.

Note: *Loss of hydraulic oil is limited to the amount trapped within each hose.*

3. Using the hoses and fittings specified, connect the hoses between the auxiliary hydraulic power supply and the hoses removed from the main control valve lift/lower section of the affected machine. Hose (**7**) is the supply (lower) and hose (**6**) is the return. Connect the hoses in the proper order to ensure that the boom is lowered, not raised.
4. Use the auxiliary power supply to retract the lift cylinder.
5. After the boom has been lowered, loosen and remove the jumper hoses and reconnect the lift/lower cylinder hoses at the main control valve.
6. Transfer any hydraulic oil into a suitable, covered container, and label the container as “Used Oil.” Dispose of used oil at an approved recycling facility.
7. Clean up all debris, hydraulic oil, etc., in, on, near and around the machine.

3.10 TROUBLESHOOTING

This section provides an easy reference guide covering the most common problems that occur during operation of the boom.

Problem	Possible Causes	Remedy
1. Boom will not extend or retract.	1. Broken hydraulic hose(s) or tube(s) and/or connections leaking.	1. Locate break, replace hose(s) or tube(s), tighten connections.
	2. Extend/Retract hydraulic system not operating properly.	2. Refer to Section 8, “Hydraulic System.”
	3. Faulty extend/retract cylinder.	3. Repair cylinder (Refer to Section 8.12.4, “Cylinder Inspection.”)
2. Boom will not fully extend.	1. Extend/retract hydraulic system not operating properly.	1. Refer to Section 8, “Hydraulic System.”
3. Boom shifts to right or left when extending.	1. Boom side wear pads improperly shimmed or worn.	1. Shim wear pads to correct gap. Replace wear pads as needed. Refer to Section 3.5.1, “Wear Pad Inspection.”
4. Excessive pivot pin noise and/or wear.	1. Insufficient lubrication.	1. Lubricate at regular intervals. (Refer to Section 2.6, “Lubrication Schedule.”) Replace worn pins as needed.
	2. Worn bushing(s).	2. Replace bushing(s) and lubricate at regular intervals (Refer to Section 2.6, “Lubrication Schedule.”)
5. Boom will not raise or lower.	1. Broken hydraulic hoses or tubes and/or connection leaks.	1. Locate break, replace hose(s) or tube(s), tighten connections.
	2. Lift/lower hydraulic system not operating properly.	2. Refer to Section 8, “Hydraulic System.”
	3. Faulty lift cylinder.	3. Repair cylinder. (Refer to Section 8.12.4, “Cylinder Inspection.”)
	4. Seized boom pivot pin bushing.	4. Replace bushing.

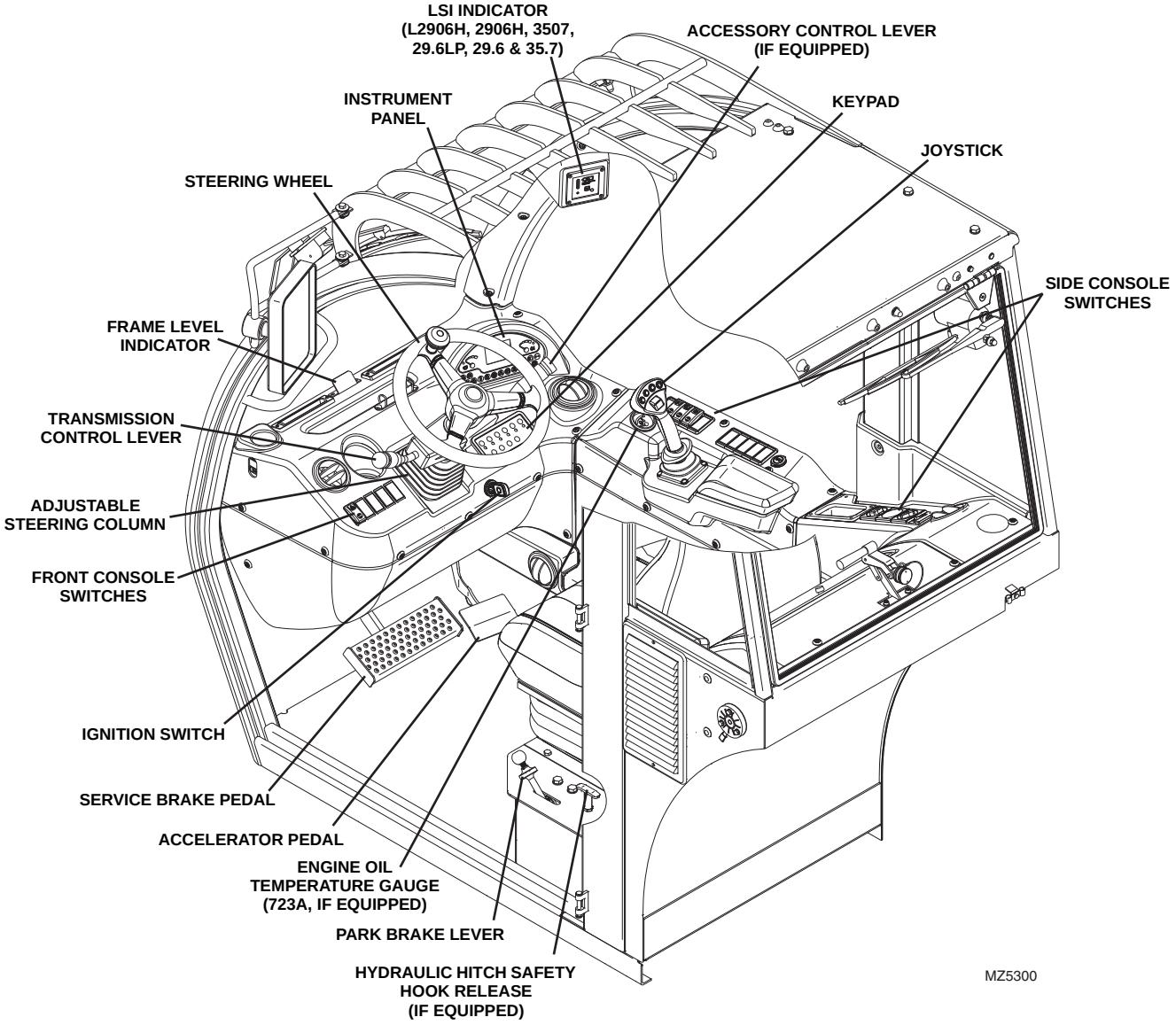
Problem	Possible Causes	Remedy
6. Rapid boom pad wear.	1. Incorrect wear pad gap.	1. Check wear pad gaps and correct as needed. Refer to Section 3.5.1, “Wear Pad Inspection.”
	2. Rapid cycle times with heavy loads.	2. Reduce cycle times.
	3. Contaminated, corroded or rusted wear pad sliding surfaces.	3. Remove contamination and/or corrosion from wear pad sliding surfaces and lubricate. If the surfaces cannot be reconditioned, replace the boom section(s).
	4. Operating in extremely dusty/ abrasive conditions.	4. Clean equipment frequently.
7. Auxiliary hydraulics will not operate.	1. Auxiliary hydraulic system not operating properly.	1. Refer to Section 8, “Hydraulic System.”

Section 4
Cab and Covers

Contents

4.1 OPERATOR CAB AND COVERS COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the major assemblies of the machine cab and covers. The following illustration identifies the components that are referred to throughout this section.



4.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in the “Safety Practices” section of this manual.

4.3 OPERATOR CAB

4.3.1 Operator Cab Description

The welded metal cab features a modular design, allowing for a relatively quick, simple exchange of the entire cab and/or component parts. The cab is bolted directly to the frame.

The operator cab is a protective structure. The cab itself contains rollover protective and falling object protective structures (ROPS/FOPS) for the operator.

WARNING

DO NOT weld, grind, drill, repair or modify the cab in any way. Any modification or damage to cab structural components requires cab replacement.

To help ensure optimum safety, protection and performance, replace the cab if it is damaged. Refer to the appropriate parts manual for ordering information.

The cab contains the seat, operating controls, numerous panels, steering and brake components, and more.

Covers and mirrors on the machine exist for safety, protection and appearance. They are relatively simple to remove and replace.

4.3.2 Serial Number Decal

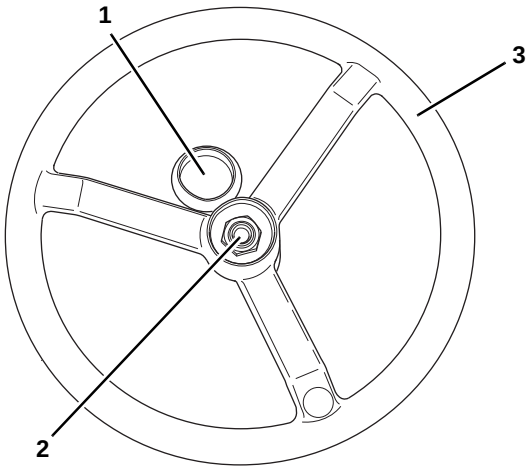
The cab serial number decal is located inside the cab, under the seat. Information specified on the serial number plate includes the cab model number, the cab serial number and other data. Write this information down in a convenient location to use in cab correspondence.

4.4 CAB COMPONENTS

4.4.1 Steering Wheel

a. Steering Wheel Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine covers. Allow the system fluids to cool.
4. Properly disconnect the battery.



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5. Carefully pry the center button (**1**) out of the steering wheel.
6. Mark the steering wheel and shaft to ensure proper installation. Remove the nut (**2**) securing the steering wheel (**3**) to the splined steering column shaft.
7. Use a steering wheel puller to remove the steering wheel (**3**) from the splined shaft.

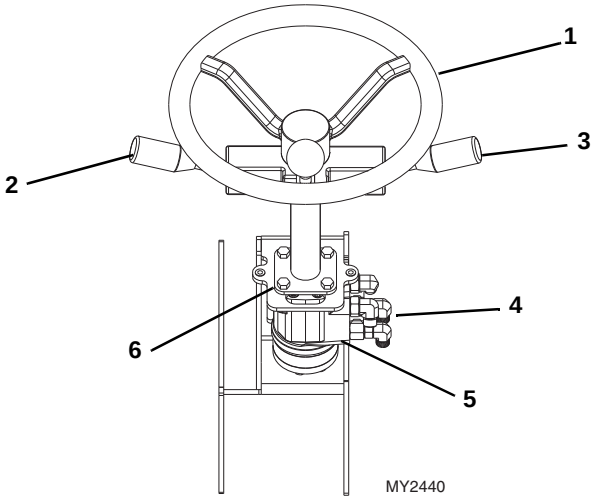
b. Steering Wheel Installation

1. Install the steering wheel (**3**) onto the splined steering column shaft.
2. Secure the steering wheel with the nut (**2**).
3. Press the center button (**1**) onto the steering wheel.
4. Properly connect the battery.
5. Close and secure the engine covers.
6. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

4.4.2 Steering Column/Valve Replacement

a. Steering Column and Valve Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine covers. Allow the system fluids to cool.
4. Properly disconnect the battery.



5. Remove the steering wheel (**1**) (Refer to Section 4.4.1, “Steering Wheel.”), transmission control lever (**2**) and accessory lever (if equipped)(**3**).
6. Loosen and remove the steering column cover.
7. Loosen and remove the dash cover.
8. Label, disconnect and cap the hydraulic hoses (**4**) and fittings on the steering orbitrol valve (**5**).
9. Remove the four hex-flange capscrews (**6**)(three if machine is equipped with tilt column) connecting the orbitrol valve to the steering column.
10. Pull the steering column assembly and orbitrol valve from the machine cab.

***Note:** **DO NOT** disassemble the steering orbitrol valve. The steering orbitrol valve is not serviceable and must be replaced in its entirety, if defective.*

b. Steering Column and Valve Installation

1. Install the four hex-flange capscrews (three if machine is equipped with tilt column) through the steering column, mounting bracket and into the top of the orbitrol valve.

***Note:** ALWAYS use new o-rings when servicing the machine.*

2. Uncap and if needed, install new o-rings into the fittings. Lubricate the o-rings with clean hydraulic oil.
3. Uncap and reconnect the previously labeled hydraulic hoses to their appropriate locations.
4. Install the dash cover.
5. Install the steering column cover.
6. Install the steering wheel (Refer to Section 4.4.1, “Steering Wheel.”), accessory lever and transmission control lever.
7. Properly connect the battery.
8. Start the engine and check the operation of all controls. Check for oil leaks. Check the hydraulic oil level in the tank and add oil as required.
9. Clean up all debris, hydraulic oil, etc., in, on, near and around the machine.
10. Close and secure the engine covers.
11. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

c. Power Steering Test

Conduct a pressure check of the steering hydraulic circuits at the test port on the implement pump. Refer to Section 8.6.6, “Steering Pressure Checking.”

4.4.3 Brake Pedal and Valve

a. Brake Valve Removal

Refer to Section 8.11.2, a. “Service Brake Valve Removal,” for removal information.

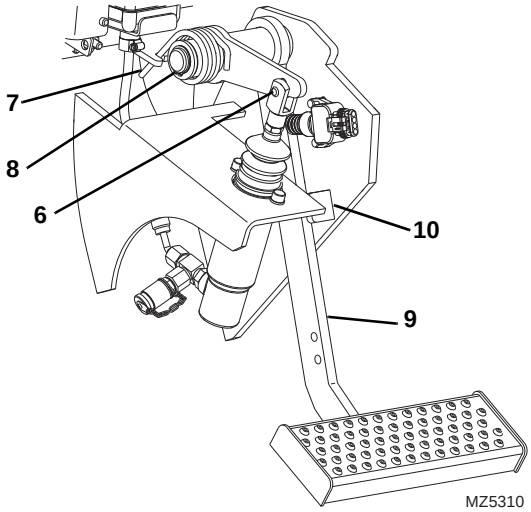
b. Brake Valve Installation

Refer to Section 8.11.2, b. “Service Brake Valve Installation,” for installation information.

c. Service Brake Pedal Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.

2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine covers. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. Remove the lower dash cover.



6. Remove the clip/pin (**6**) from the brake plunger fork link.
7. Remove the brake pedal return spring (**7**).
8. Remove the snap ring and washer (**8**).
9. Pull the brake pedal assembly (**9**) to the left to clear the pedal stop (**10**). Lift up the pedal, slide to the left and remove the brake pedal assembly from the cab.

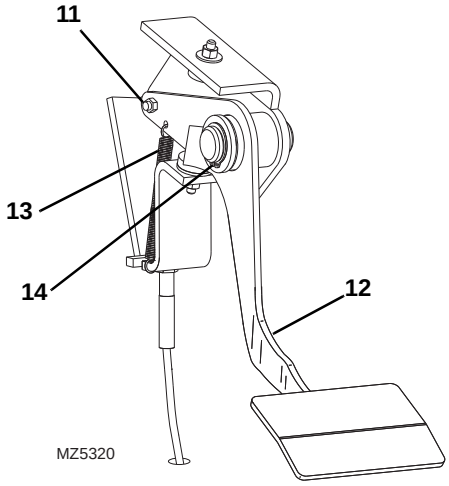
d. Service Brake Pedal Installation

1. Position the brake pedal assembly (**9**) in its mounting location within the cab.
2. Install the brake pedal being careful to reposition the brake plunger yoke. Install clip/pin (**6**) in brake plunger fork link.
3. Install the washer and snap ring(**8**).
4. Install the brake pedal return spring (**7**).
5. Adjust the brake pedal as needed.
6. Install and secure the lower dash cover.
7. Properly connect the battery.
8. Close and secure the engine covers
9. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

4.4.4 Throttle Pedal Replacement

a. Throttle Pedal Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine covers. Allow the system fluids to cool.
4. Properly disconnect the battery.

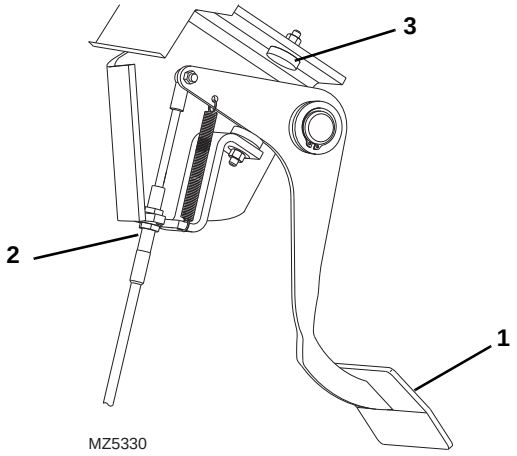


5. Loosen and remove the hex nut (**11**) securing the throttle cable to the throttle pedal assembly (**12**).
6. Remove the throttle pedal return spring (**13**).
7. Remove snap ring and washer (**14**) securing the throttle pedal assembly to the cab frame.
8. Remove the throttle pedal assembly from the cab.

b. Throttle Pedal Installation

1. Align the throttle pedal assembly with its mount holes under the cab dash.
2. Install the washer and snap ring (**14**) securing the throttle pedal assembly to the cab frame.
3. Install the throttle pedal return spring (**13**).
4. Install the hex nut (**11**) securing the throttle cable to the throttle pedal assembly (**12**).
5. Properly connect the battery.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

4.4.5 Throttle Cable Adjustment



1. With the engine OFF, lightly depress the accelerator pedal (**1**) to the full-throttle position.
2. Block the accelerator pedal to the full throttle position, check the throttle position on the fuel injector pump on the engine. The throttle lever should be bottomed against the limit-stop screw.
3. If there is an adjustment needed, return to the cab and adjust the throttle cable (**2**) so the lever on the fuel injector pump bottoms against the limit-stop just before the throttle pedal bottoms against the limit-stop (**3**) in the cab.
4. Remove the block holding the throttle before starting machine.

4.4.6 High Idle Adjustment

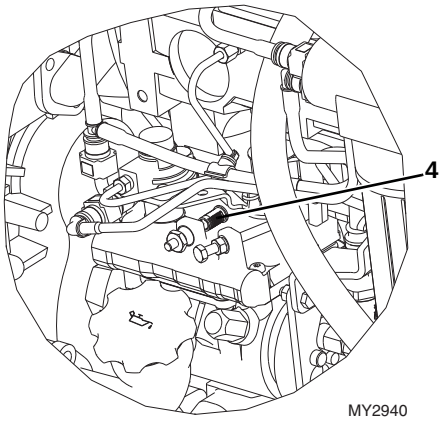
Note: *Engine coolant temperature must be between 10 and 38° C (50 and 100° F).*

ANSI Machines

1. Start the machine and allow engine to low idle for approximately 30 seconds.
2. Verify low idle (900 ± 50 rpm). Low idle is a factory non-adjustable setting.
3. Bring engine to full throttle. If high idle rpm is not 2335 ± 75 rpm, readjust the throttle cable at the throttle pedal in the cab.

CE Machines

1. Start the machine and allow engine to low idle for approximately 30 seconds.
2. Verify low idle (900 ± 50 rpm). Low idle is a factory non-adjustable setting.
3. Bring engine to full throttle. If high idle rpm is greater than or equal to 2340 rpm, a thick throttle stop will need to be installed. If high idle rpm is less than 2340 rpm, a thin throttle stop will need to be installed.
4. Return engine to low idle and shut engine OFF.



5. Allow the engine to cool. Install proper throttle stop (**4**) and verify high idle is correct.
6. Restart engine, bring engine to high idle. High idle must be between 2005 and 2090 rpm.

Note: *For the proper throttle stop, contact the local **JLG** dealer.*

NOTICE

During the full throttle check:

- ***DO NOT*** *operate any hydraulic function.*
- ***DO NOT*** *steer or apply any pressure to the steering wheel.*
- *Keep the transmission in (N) NEUTRAL.*

⚠ WARNING

Avoid breathing exhaust fumes, and prevent engine operation from becoming a cause of toxic emissions.

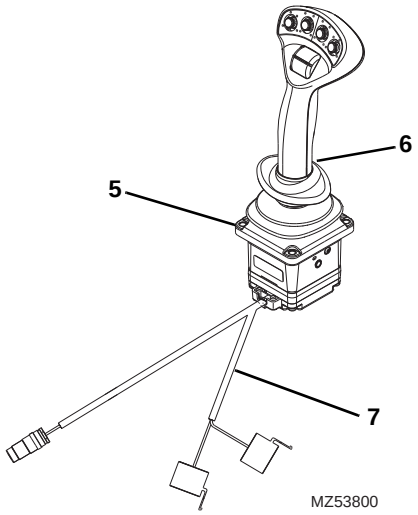
WARNING

Exhaust system components reach high temperatures and can cause severe burns. **DO NOT** come into contact with hot exhaust system components.

4.4.7 Joystick Replacement

a. Joystick Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine covers. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. Remove the access cover below the joystick.



6. Loose and remove the four capscrews (**5**) holding the joystick assembly (**6**) in place.
7. Lift the joystick assembly (**6**) and unplug the three electrical connections (**7**).
8. Remove the joystick.

b. Joystick Installation

1. Reconnect the electrical connections (**7**) and set the joystick assembly (**6**) in place.
2. Install the four capscrews in the joystick base.
3. Replace the access cover below the joystick.
4. Properly connect the battery.
5. Start the engine and test the boom joystick for proper functions.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

4.4.8 Windshield Wiper Assembly (If Equipped)

Refer to Section 9.12.1, “Windshield Wiper Motor (if equipped),” for removal and installation information.

4.4.9 Windshield Washer Assembly (If Equipped)

Refer to Section 9.12.3, “Windshield Washer Reservoir and Pump,” for removal and installation information.

4.4.10 Heater/Air Conditioning System (If Equipped)

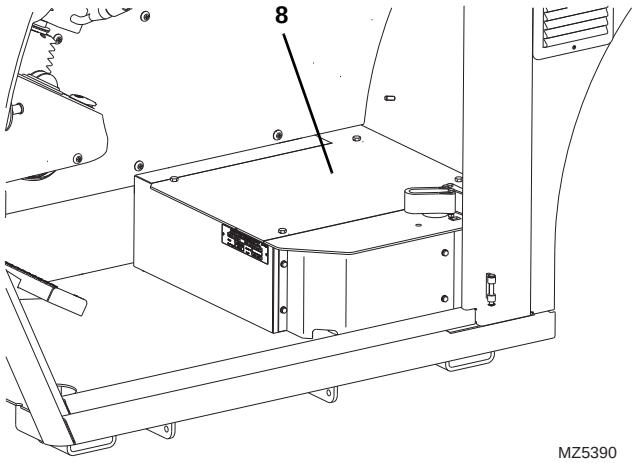
a. Heater Assembly Removal

Note: *If machine is equipped with air conditioning, DO NOT loosen or disconnect any air conditioning hoses until the air conditioning system has been properly drained by the* local ***JLG*** *dealer or certified air conditioning service center*.

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine covers. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. Place a suitable container beneath the radiator drain plug or petcock. Slowly turn the cap on the coolant overflow bottle to allow any pressure to escape. Remove the overflow bottle cap.
6. Place a funnel at the base of the radiator to channel the drained coolant into the container. Open the radiator drain plug or petcock and allow the coolant to drain. Replace the drain plug, or close the petcock.
7. Transfer the coolant into a suitable, covered container, and label as "Used Coolant". Dispose of used coolant at an approved recycling facility.

Note: *Label all hoses to ensure correct installation.*

8. Remove the seat/seat base.
9. Remove the seat plate (**8**) to expose the heater/ defroster element.



10. Loosen the hose clamps and disconnect the two heater hoses.
11. If equipped, loosen, label and disconnect the two air conditioning hoses.
12. Remove the capscrews, nuts and lockwashers securing the heater assembly to the cab.
13. Carefully pull out the heater assembly. Label and disconnect the wiring harness connections at the blower.
14. Remove the heater assembly.

b. Heater Assembly Installation

1. Install the heater assembly to its original orientation.
2. Connect the wiring harness connections at the blower.
3. Install the capscrews, nuts and lockwashers to secure the heater assembly to the cab.
4. Reconnect the two heater hoses.
5. If equipped, reconnect the air conditioning hoses.
6. Refill the cooling system at the coolant overflow bottle with coolant allowing time for the coolant to fill the engine block. See Section 2.4, “Fluids, Lubricants and Capacities,” for system capacities.
7. Recharge the air conditioning system. Refer to Section 4.4.11, “Air Conditioning (If Equipped).”
8. Properly connect the battery.
9. Start the engine, run it briefly at low idle and check the machine for any visual sign of fluid leakage. STOP the machine immediately if any leakage is noted, and make any necessary repairs before continuing.
10. Install the seat plate (**8**) in the cab.
11. Install the seat/seat base.
12. Check the coolant level. Add or remove fluid as required.
13. Verify the proper operation of the heating and air conditioning (if equipped) system.
14. Close and secure the engine covers.
15. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

4.4.11 Air Conditioning (If Equipped)

If the air conditioning system requires servicing, contact the local **JLG** dealer or certified air conditioning service center. Refer to Section 2.4, “Fluids, Lubricants and Capacities,” for refrigerant type and capacity.

4.5 CAB REMOVAL

WARNING

The protection offered by this ROPS/FOPS will be impaired if subjected to any modification or structural damage, at which time replacement is necessary. ROPS/FOPS must be properly installed using fasteners or correct size and grade, and torqued to their specified value.

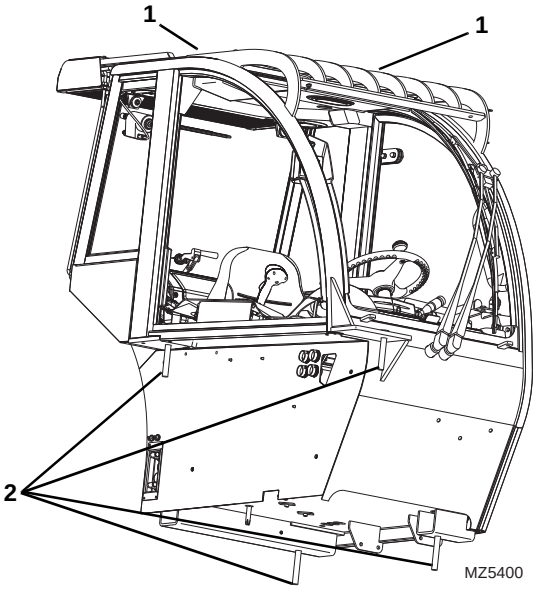
Note: *To help ensure safety and optimum performance, replace the cab if it is damaged. Refer to the appropriate parts manual for ordering information.*

Inspect the cab, its welds and mounts. If modification, damage, a cracked weld and/or fatigued metal is discovered, replace the cab. Contact the local **JLG** dealer with any questions about the suitability or condition of a cab.

Note: *Remove and label cab components as needed before removing the cab from the machine. Label, disconnect and cap hydraulic hoses. Transfer cab parts to the replacement cab after the replacement cab is securely mounted on the machine.*

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Block all four wheels to help prevent the machine from moving. Assure that there is sufficient overhead and side clearance for cab removal.

3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. If equipped with a cab heater, Refer to Section 4.4.10, b. “Heater Assembly Installation.”
6. Working underneath the cab, label, disconnect and cap all hydraulic hoses at the cab fittings. Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.
7. In the cab, disconnect the throttle cable at the throttle lever bracket. Route the cable away from the cab to prevent damage during removal.
8. Label and disconnect the cab harness connectors. Move the harnesses clear of the cab to prevent damage during cab removal.
9. Install two lifting eye bolts with a minimal lifting capacity of 363 kg (800 lb) in the existing holes at the top of the cab (**1**).
10. Use a hoist or overhead crane and sling with a minimal lifting capacity of 363 kg (800 lb) attached to the four lifting eye bolts. DO NOT attempt to lift the cab at this point.
11. Remove the bolts (**2**), washers and nuts securing the cab to the frame.



12. Remove the mirrors and all other cab components as needed, if not previously removed.
13. When all wiring, hydraulic hoses and fasteners are disconnected or removed, carefully and slowly lift the cab and remove it from the frame. Readjust the position of the sling as needed to help balance the cab during removal.
14. When the cab is completely clear of the machine, carefully lower it to the ground. Block up or support the cab so that it does not move or fall. Assure that no personnel enter the cab while it is being removed from the machine.
15. Inspect the condition of the fittings, clamps, hydraulic hoses, etc. Replace parts as indicated by their condition.
16. Inspect and replace other machine parts that are exposed with the cab removed. Repair or replace as required.

4.6 CAB INSTALLATION

1. Block all four wheels to help prevent the machine from moving. Assure that there is sufficient overhead and side clearance for cab installation.
2. Attach a sling with minimal lifting capacity of 363 kg (800 lb) through the previously installed eye bolts.
3. Use a hoist or overhead crane and sling attached to the cab. Carefully begin to align the cab with the mounting holes in the frame. Stop and check that wiring, hydraulic hoses, cables, etc., will not be pinched or damaged as the cab is positioned. Take special note of the fuel fill tube as well. Readjust the position of the sling as needed to help balance the cab during installation.
4. Install the cab-to-frame bolts, washers and nuts (**2**). Torque the upper cab bolts to 461 Nm (340 lb-ft). Torque the lower cab bolts to 719 Nm (530 lb-ft).
5. Remove the eye bolts from the top of the cab (**1**).
6. Connect the throttle cable to the throttle bracket in the cab.
7. Uncap and reconnect the hydraulic hoses at the cab locations.
8. Secure the throttle cable to the hydraulic hoses using nylon ties.
9. Install the cab-to-wiring harness connectors on side of the cab.
10. Uncap and connect the heater hoses to the engine. Secure with hose clamps.
11. If equipped with a cab heater, Refer to Section 4.4.10, “Heater/Air Conditioning System (If Equipped).”
12. Properly connect the battery.

13. Start the engine and check the operation of all controls. Check for hydraulic oil leaks. Check the hydraulic oil level in the tank and add oil as required

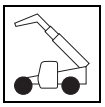
NOTICE

When the engine is initially started, run it briefly at low idle and check the machine for any visual sign of fluid leakage. STOP the engine immediately if any leakage is noted, and make any necessary repairs before continuing.

14. Verify the proper operation of the heating and air conditioning (if equipped) system after the operating temperature is achieved ensuring that the thermostat has opened.
15. Turn engine off and wait for the engine to cool and check the coolant level. Add coolant to the overflow bottle as required to bring the coolant to the proper level.
16. Install the protective cover to the front of the cab.
17. Install the mirrors and all other components as needed, if removed.
18. Unblock the wheels
19. Close and secure the engine cover
20. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

⚠ WARNING

Avoid breathing exhaust fumes, and prevent engine operation from becoming a cause of toxic emissions.

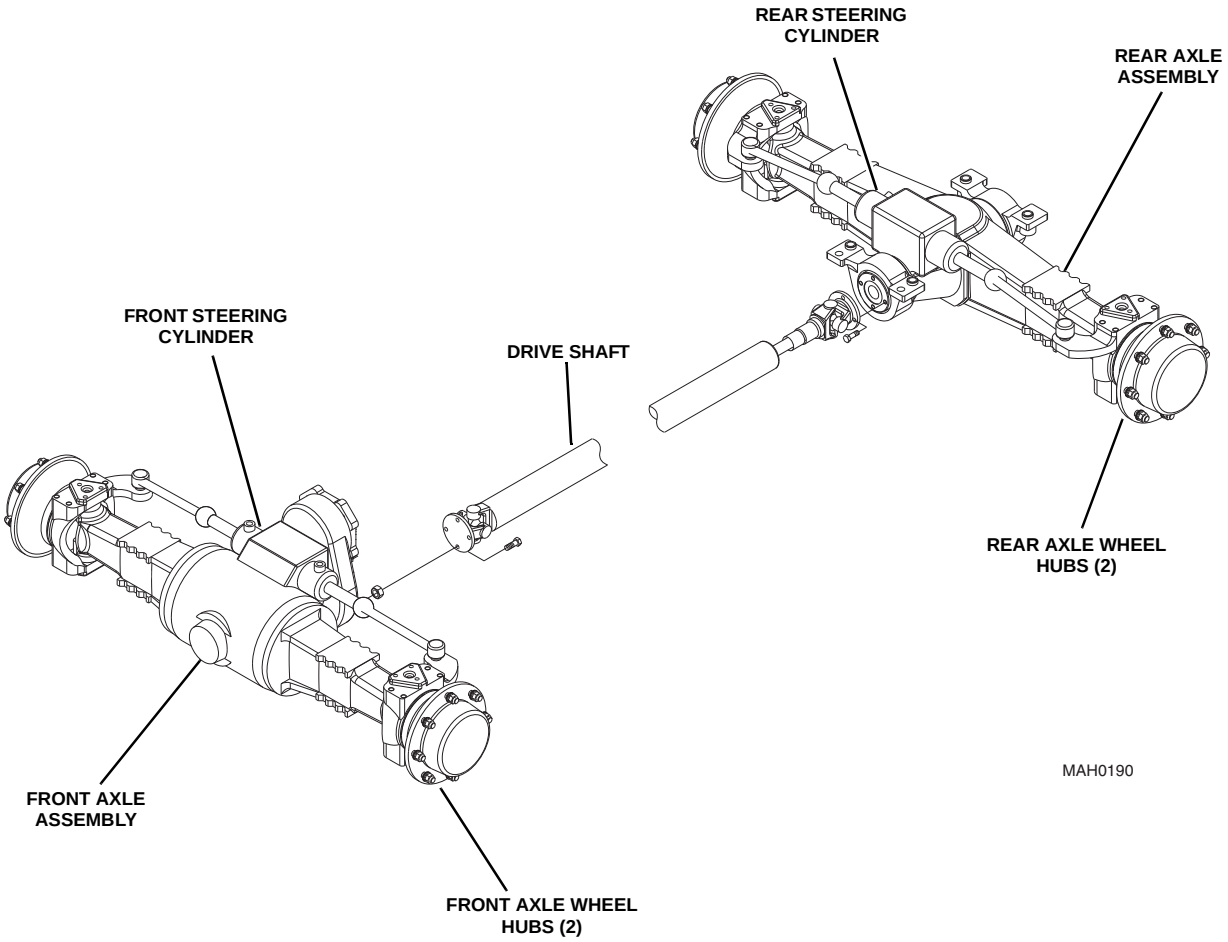


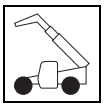
Section 5
Axles, Drive Shafts, Wheels and Tires

Contents

5.1 AXLE, DRIVE SHAFT AND WHEEL COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the major assemblies of the axles, drive shafts, wheels and tires. The following illustration identifies the components that are referred to throughout this section.





5.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in the “Safety Practices” section of this manual.

5.3 GENERAL INFORMATION

Before performing any inspection, maintenance or service operation, thoroughly clean the unit. The axles and drive shafts should be checked and repaired only by experienced service technicians who are aware of all safety instructions and particular component features.

Use suitable products to thoroughly clean all disassembled mechanical parts to help prevent personal injury to the worker and prevent damage to the parts. Carefully inspect the integrity of all moving parts (bearings, yokes, tubes, gears, shafts, etc.) and fasteners (nuts, bolts, washers, etc.) as they are subject to major stress and wear.

5.4 AXLE ASSEMBLIES

5.4.1 Axle Serial Number Plate

The front and rear axle serial number plate is located on the inside of each axle on the right side of the center section. Information on the serial number plate is required in correspondence regarding the axle.

Supply information from the axle serial number plate when communicating about an axle assembly or axle components.

5.4.2 Axle Specifications

General axle specifications are found in Section 2, “General Information and Specifications.”

Detailed axle service instructions (covering the axle, differential, brakes and wheel end safety, repair, disassembly, reassembly, adjustment and troubleshooting information) are provided in the appropriate Axle Disassembly & Assembly Manual.

Machine	Manual P/N
L2906H, 2906H, 29.6LP, 29.6 & 619A	Front - 31200634
	Rear - 31200635
3507H, 35.7 & 723A	Front - 31200636
	Rear - 31200637

5.4.3 Axle Maintenance

CLEANING: Clean parts with machined or ground surfaces (such as gears, bearings and shafts) with emulsion cleaners or petroleum-based cleaners. **DO NOT** steam clean internal components and the interior of the planetary hub and axle housing. Water can cause corrosion of critical parts. Rust contamination in the lubricant can cause gear and bearing failure. Remove old gasket material from all surfaces.

DRYING: Use clean, lintless towels to dry components after cleaning. **DO NOT** dry bearings by spinning them with compressed air; this can damage mating surfaces due to lack of lubrication. After drying, coat components with oil or a rust-preventive chemical to help protect them from corrosion. If storing components for a prolonged period, wrap them in wax paper.

PERIODIC OPERATION REQUIREMENT: Every two weeks, drive the machine far enough to cause the drive-train components to make several complete revolutions. This will help ensure that internal components receive lubrication to minimize deterioration caused by environmental factors such as high humidity.

SUBMERSION: If the machine has been exposed to water deep enough to cover the hubs, disassemble the wheel ends and inspect for water damage and contamination. If the carrier housing was submerged in water, especially if the water level was above the vent tube (breather), drain the axle and inspect internal parts for water damage and contamination. Before assembling and refilling the unit with the specified lubricant(s), clean, examine and replace damaged parts as necessary.

5.4.4 Axle Removal

WARNING

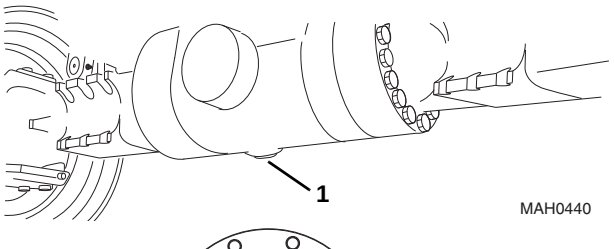
Safely raise and adequately support the machine so that it will remain stable and in place before attempting to remove an axle.

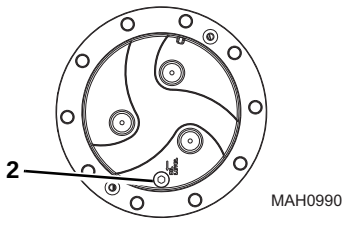
The front and rear axle assemblies differ in that the front axle assembly is equipped with a hydraulic drive pump, parking brake mechanism and a limited-slip feature; the rear axle has none of these. The following steps outline a typical axle removal procedure, suitable for either the front or the rear axle assembly.

Cleanliness is extremely important. Before attempting to remove the axle, thoroughly clean the machine. Avoid spraying water or cleaning solution on the stabilizer solenoids and other electrical components. If using a steam cleaner, seal all openings before steam cleaning.

IMPORTANT: *Clear the work area of all debris, unnecessary personnel, etc. Allow sufficient space to raise the machine and to remove the axle.*

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.





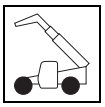
5. If the axle will be disassembled after removal, place a suitable receptacle under the axle (**1**) and wheel hubs (**2**) drain plugs. Remove the drain plugs and allow the axle oil to drain into the receptacle. Transfer the used axle oil into a suitable covered container, and label the container as "Used Oil." Dispose of the used oil at an approved recycling facility.
6. Label, disconnect and cap the steering and brake lines at the axle. Wipe up any spilled oil.
7. Block the front and rear of both tires on the axle that is not being removed. Ensure that the machine will remain in place during axle removal before proceeding.
8. Raise the machine using a suitable jack or hoist. Place suitable supports under both sides of the frame and lower the machine onto the supports. Ensure that the machine will remain in place during axle removal.
9. Support the axle that is being removed with a suitable jack, hoist or overhead crane and sling. **DO NOT** raise the axle or the machine.
10. Mark and remove both wheel and tire assemblies from the axle that is being removed. (Refer to Section 5.6.1, “Removing Wheel and Tire Assembly from Machine.”)

Note: *The wheel and tire assemblies must be re-installed later with the directional tread pattern “arrows” facing in the direction of forward travel.*

11. Remove the drive shaft assembly. (Refer to Section 5.5.3, “Drive Shaft Removal.”)
12. Remove the capscrews, locknuts and axle plates securing the axle to the frame.
13. Remove the axle from the machine using the jack, hoist or overhead crane and sling supporting the axle. **DO NOT** raise or otherwise disturb the machine while removing the axle. Balance the axle and prevent it from tipping, turning or falling while removing it from beneath the machine. Place the axle on a suitable support or holding stand.

5.4.5 Axle Installation

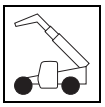
1. Before proceeding, ensure that the machine will remain in place during axle installation. Block the front and rear of both tires on the axle that is already installed on the machine.



2. If applicable, raise the machine using a suitable jack or hoist. Place suitable supports beneath the frame and lower the machine onto the supports, allowing enough room for axle installation. Ensure that the machine will remain in place during axle installation.
3. Using a suitable jack, hoist or overhead crane and sling, remove the axle from its support or holding stand. Balance the axle and prevent it from tipping, turning or falling while positioning it beneath the machine. **DO NOT** raise or otherwise disturb the machine while installing the axle. Keep the axle supported and balanced on the jack, hoist or overhead crane and sling throughout the installation procedure.
4. Position the axle under the frame, and align with the holes in the frame.
5. Install the axle with capscrews, locknuts and the axle plates. Torque the front and rear axles of the **L2906H, 2906H, 29.6LP, 29.6 & 619A** to 671 Nm (495 lb-ft). Torque the front axles of the **3507H, 35.7 & 723A** to 1170 Nm (863 lb-ft) and the rear axles to 671 Nm (495 lb-ft).
6. Install the drive shaft assemblies. (Refer to Section 5.5.5, “Drive Shaft Installation.”)
7. If reinstalling an axle previously removed from the machine, position the driveshaft yoke on the axle according to the alignment marks made earlier. If installing a new axle, note the position of the driveshaft yoke at the transmission. Align the driveshaft yoke on the axle in the same plane as the yoke on the transmission.
8. Tighten the axle oil drain plug, loosen and remove the axle oil fill plug. Fill axle with the appropriate oil. Refer to Section 2.4, “Fluids, Lubricants and Capacities,” for proper oil and capacities.
9. Rotate wheel hubs 90 degrees so the drain plug becomes the fill plug. Fill wheel hubs with the appropriate oil. Refer to Section 2.4, “Fluids, Lubricants and Capacities,” for proper oil and capacities.
10. Install the wheel and tire assemblies. (Refer to Section 5.6.2, “Installing Wheel and Tire Assembly onto Machine.”)
11. Carefully remove the jack, hoist or overhead crane and sling supporting the axle.
12. Carefully raise the machine using a suitable jack or hoist. Remove the supports from beneath the frame and lower the machine to the ground.
13. Remove the blocks from the front and rear of both tires on the other axle.
14. Uncap and reconnect the steering and brake lines at their axle fittings. Refer to Section 8.10.4, “Brake Test,” for brake bleeding procedures.
15. Check the hydraulic reservoir oil level.
16. Properly connect the battery.
17. Close and secure the engine cover.
18. Start the engine. Turn the steering wheel several times lock to lock and check the function of the brakes. Check for hydraulic leaks, and tighten or repair as necessary.
19. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

5.4.6 Axle Assembly and Drive Shaft Troubleshooting

Problem	Possible Causes	Remedy
1. Excessive axle noise while driving.	1. Oil level too low.	1. Fill oil to correct level. (Refer to Section 2.4, “Fluids, Lubricants and Capacities.”)
	2. Axle and/or wheel end housings filled with incorrect oil or oil level low.	2. Drain axle and/or wheel end housings and fill to correct level. (Refer to Section 2.4, “Fluids, Lubricants and Capacities.”)
	3. Incorrect alignment of ring and pinion gears.	3. Correct alignment by adding or removing shims as needed.
	4. Incorrect pinion (input) shaft bearing preload.	4. Correct bearing preload by adding or removing shims as needed.
	5. Worn or damaged bearings.	5. Replace bearings as needed.
	6. Worn or broken gear teeth.	6. Replace gears as needed.
	7. Contamination in the axle.	7. Drain axle and/or wheel end housings and fill to correct level. (Refer to Section 2.4, “Fluids, Lubricants and Capacities.”)
	8. Axle housing damaged.	8. Replace damaged parts.
2. Intermittent noise when traveling.	1. Universal joint(s) worn or damaged.	1. Repair or replace universal joints as needed.
	2. Differential ring and/or pinion gears damaged.	2. Determine cause and repair as needed.
3. Vibration or intermittent noise when traveling.	1. Drive shaft universal joint(s) assembly incorrectly tightened.	1. Tighten capscrews to correct torque.
	2. Drive shaft universal joint(s) worn or damaged.	2. Repair or replace universal joints as needed.
	3. Drive shaft damaged/ unbalanced.	3. Replace drive shaft as needed.



5.4.6 Axle Assembly and Drive Shaft Troubleshooting (Continued)

Problem	Possible Causes	Remedy
4. Oil leaking from axle (differential housing and/or axle housings).	1. Drain plugs loose and/or o-rings damaged or missing.	1. Replace o-rings as needed and tighten plugs 80 Nm (59 lb-ft).
	2. Hose fittings loose.	2. Tighten fittings.
	3. Axle shaft seal damaged or missing and/or worn or damaged shaft sealing surfaces.	3. Replace seal and/or joint coupling fork shaft (axle shaft).
	4. Input shaft multi-seal ring damaged or missing and/or worn or damaged pinion (input) shaft sealing surfaces.	4. Replace multi-seal ring and/or input shaft. Adjust ring and pinion alignment and bearing preload as described in the Axle Repair Manuals.
	5. Axle casing to brake housing and/or brake housing to differential assembly o-rings and/or seals worn or damaged.	5. Replace o-rings and seals.
	6. Axle housing mounting nuts and capscrews loose.	6. Tighten housing nuts and capscrews to 320 Nm (236 lb-ft).
	7. Differential and/or axle housing(s) damaged.	7. Replace housing(s) as needed.
5. Oil leaking from wheel end housing (planet carrier).	1. Oil level plugs loose and/or o-rings damaged or missing.	1. Replace o-rings as needed and tighten plugs to 80 Nm (59 lb-ft).
	2. O-ring between hub and housing (planet carrier) damaged or missing.	2. Replace o-ring.
	3. Shaft seal damaged or missing and/or worn or damaged shaft sealing surfaces.	3. Replace seal and/or fork joint shaft.
	4. Housing capscrews loose.	4. Tighten housing capscrews to 55 Nm (41 lb-ft).
	5. Housing (planet carrier) damaged.	5. Replace housing (planet carrier).
6. Oil leaking from steering cylinder.	1. Hose fittings loose.	1. Tighten fittings.
	2. Steering cylinder o-rings and/or seals worn or damaged.	2. Replace o-rings and seals.
	3. Piston rod seal worn or damaged.	3. Replace piston rod seal.
	4. Cylinder tube damaged.	4. Replace cylinder tube.

5.4.6 Axle Assembly and Drive Shaft Troubleshooting (Continued)

Problem	Possible Causes	Remedy
7. Axle overheating.	1. Oil level too high.	1. Fill oil to correct level. (Refer to Section 2.4, “Fluids, Lubricants and Capacities.”)
	2. Axle and/or wheel end housings filled with incorrect oil or oil contaminated or oil level low.	2. Drain axle and/or wheel end housing and fill to correct level. (Refer to Section 2.4, “Fluids, Lubricants and Capacities.”)
8. High steering effort required.	1. Steering (hydraulic) system not operating properly.	1. Refer to the appropriate Axle Repair Manual.
	2. Excessive joint housing swivel bearing preload.	2. Correct bearing preload by adding or removing shims as needed.
	3. Worn or damaged swivel bearings.	3. Replace swivel bearings as needed.
9. Slow steering response.	1. Steering (hydraulic) system not operating properly.	1. Refer to the appropriate Axle Repair Manual.
	2. Steering cylinder leaking internally.	2. Repair or replace steering cylinder as needed.
10. Excessive noise when brakes are engaged.	1. Brake discs worn.	1. Check brake discs for wear. Refer to appropriate Axle Repair Manual.
	2. Brake discs damaged.	2. Replace brake discs.
11. Brakes will not engage.	1. Brake (hydraulic) system not operating properly.	1. Refer to the appropriate Axle Repair Manual.
	2. Brake piston o-rings and seals damaged (leaking).	2. Replace o-rings and seals.
12. Brakes will not hold the machine or braking power reduced.	1. Brake discs worn.	1. Check brake discs for wear. Refer to the appropriate Axle Repair Manual.
	2. Brake (hydraulic) system not operating properly.	2. Refer to the appropriate Axle Repair Manual.
	3. Brake piston o-rings and seals damaged (leaking).	3. Replace o-rings and seals.

5.5 DRIVE SHAFTS

5.5.1 Drive Shaft Inspection

Whenever servicing the machine, conduct a visual inspection of the drive shaft and cross and bearing assembly (universal joints, or U-joints). A few moments spent doing this can help prevent further problems and down time later.

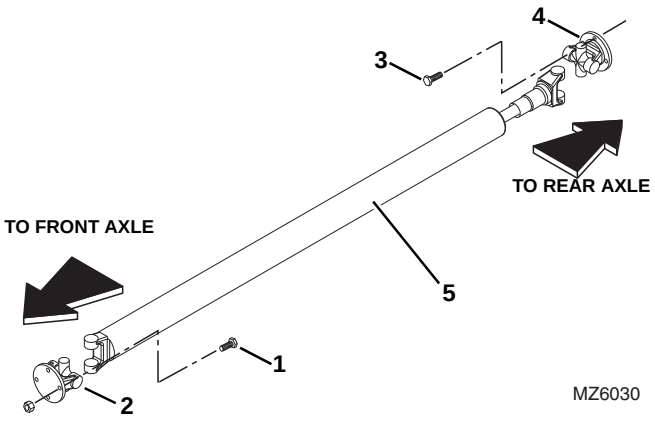
Inspect area where the drive shaft flange yoke and slip yoke mount to the drive shaft. Attempt to turn drive shaft in both directions. Look for excessive looseness, missing parts, cracks or other damage. Worn or damaged drive shaft and cross and bearing assembly may cause an excessive amount of vibration or noise.

5.5.2 Drive Shaft Maintenance

Refer to Section 2.6, “Lubrication Schedule,” for information regarding the lubrication of the grease fittings on the drive shafts.

5.5.3 Drive Shaft Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. The drive shaft assembly is a balanced assembly. Mark the yoke and axle, transmission and the shaft and slip yoke so that these components can be returned to their original positions when reinstalled. Yokes at both ends of the drive shaft must be in the same plane to help prevent excessive vibration.



6. Remove the four capscrews and four locknuts (**1**) securing the flange yoke (**2**) to the front axle flange.
7. Remove the four capscrews (**3**) securing the flange yoke (**4**) to the rear axle flange.
8. Remove the drive shaft assembly (**5**).

5.5.4 Drive Shaft Cleaning and Drying

1. Disassemble and clean all parts. Allow to dry.
2. Remove any burrs or rough spots from all machined surfaces. Re-clean and dry as required.

5.5.5 Drive Shaft Installation

1. Raise the drive shaft assembly (**5**) into position. The slip-yoke end of the drive shaft mounts toward the front axle. If reinstalling a drive shaft previously removed, align the flange yokes according to the alignment marks made during removal.

Note: *Yokes at both ends of the drive shaft must be in the same plane to help prevent excessive vibration.*

2. Install the four capscrews and four locknuts (**1**) securing the flange yoke (**2**) to the front axle using Loctite® 243™ and torque the capscrews to 139 Nm (102 lb-ft).
3. Install the four capscrews (**3**) securing the bearing crosses to the rear axle using Loctite® 243™ and torque the capscrews to 139 Nm (102 lb-ft).
4. Properly connect the battery.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

5.6 WHEELS AND TIRES

WARNING

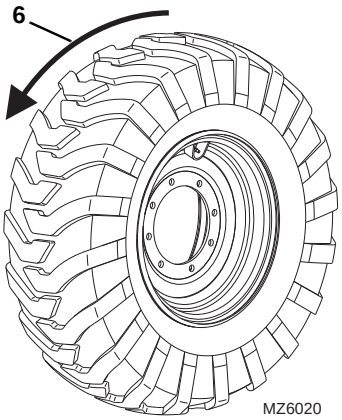
Mismatched tire sizes, ply ratings or mixing of tire types (radial tires with bias-ply tires) may compromise machine stability and may cause machine to tip over.

It is recommended that a replacement tire to be the same size, ply and brand as originally installed. Refer to the appropriate parts manual for ordering information. If not using an approved replacement tire, the replacement tires must 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.
- Approved for the application by the tire manufacturer (including inflation pressure and maximum tire load).

Unless specifically approved by JLG, do not replace a foam filled or ballast filled tire assembly with a pneumatic tire. Due to size variations between tire brands, when selecting and installing a replacement tire ensure both tires on the axle are the same.

The rims installed 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 unsafe condition regarding stability.



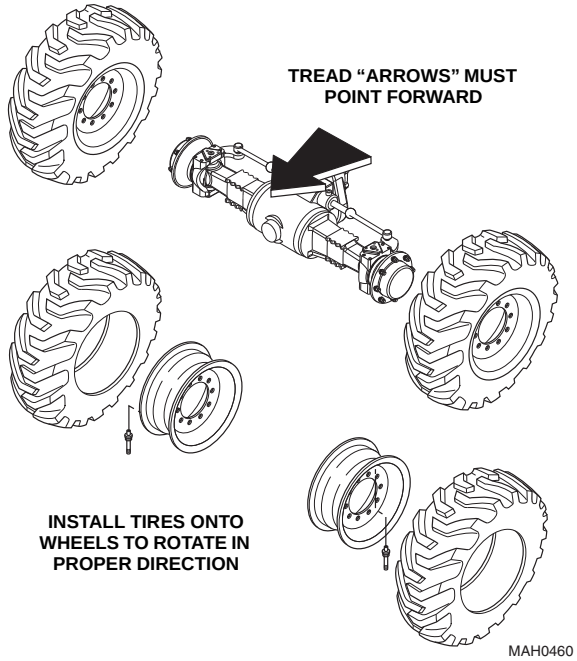
The wheel and tire assemblies must be installed with the directional tread pattern “arrows” (**6**) facing in the direction of forward travel.

5.6.1 Removing Wheel and Tire Assembly from Machine

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Loosen but **DO NOT** remove the lug nuts on the wheel and tire assembly to be removed.
4. Place a suitable jack under the axle pad closest to the wheel being removed. Raise the machine and position a suitable support beneath the axle. Allow sufficient room to lower the machine onto the support and to remove the wheel and tire assembly.
5. Lower the machine onto the support.
6. Remove lug nuts and washers in an alternating pattern.
7. Remove the wheel and tire assembly from the machine.

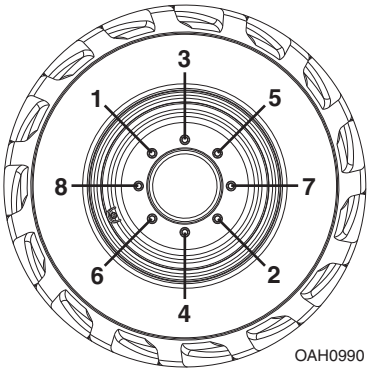
5.6.2 Installing Wheel and Tire Assembly onto Machine

Note: *The wheel and tire assemblies must be installed with the directional tread pattern “arrows” facing in the direction of forward travel.*



1. Position wheel onto studs on wheel end of axle.

2. Install washers on the wheel studs.
3. Start all lug nuts by hand to prevent cross threading. DO NOT use a lubricant on threads or nuts.



4. Tighten lug nuts in an alternating pattern as indicated in figure. Torque to 300 Nm (221 lb-ft).
5. Remove machine from supports,
6. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

5.7 STEERING ANGLE ADJUSTMENT

Detailed axle service instructions are provided in the Axle Disassembly & Assembly Manual, refer to Section 5.4.2, “Axle Specifications.”

5.8 BRAKES

5.8.1 Brake Disc Inspection

Detailed axle service instructions are provided in the Axle Disassembly & Assembly Manual, refer to Section 5.4.2, “Axle Specifications.”

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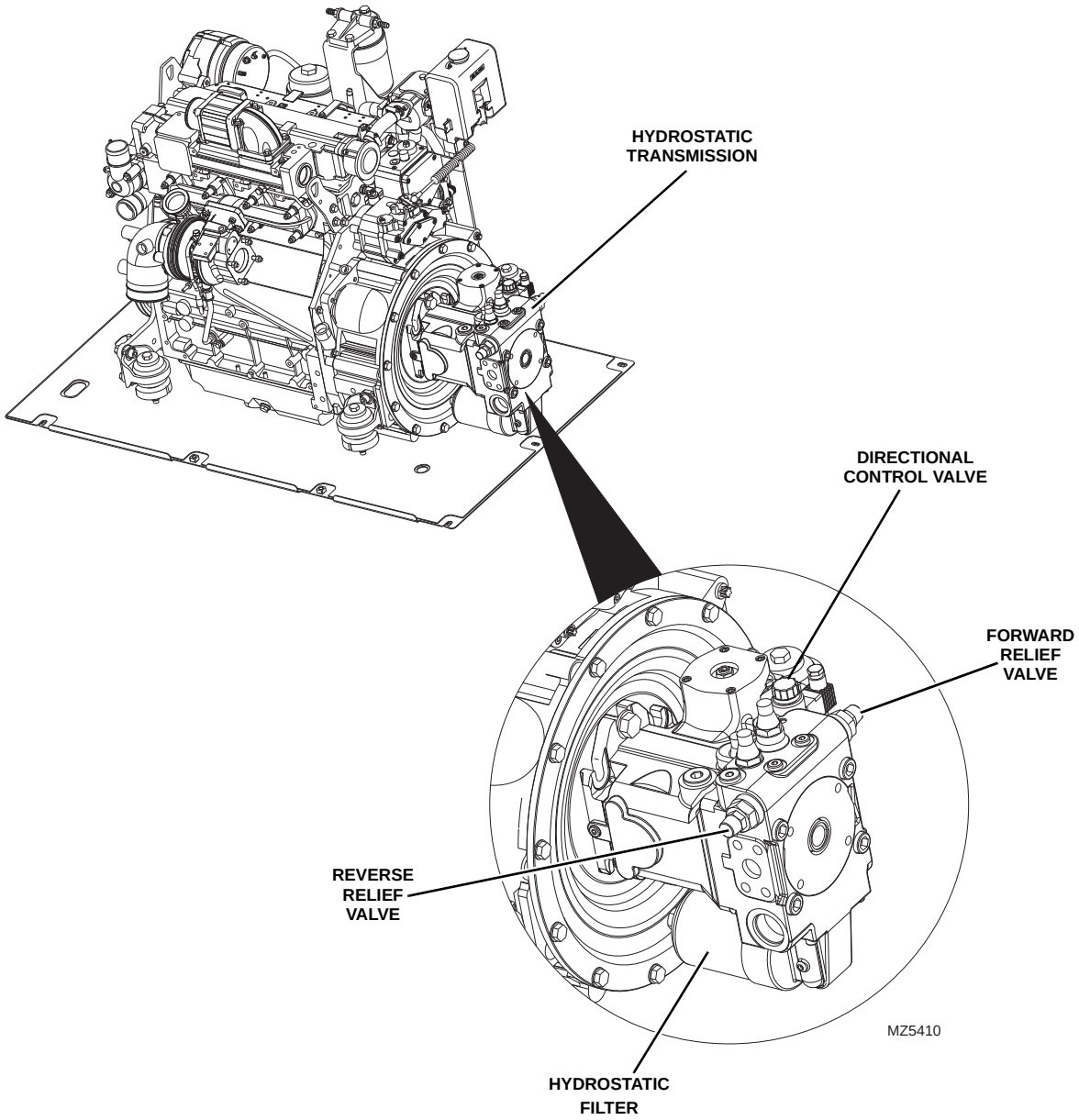
Section 6
Transmission

Contents

6.1 TRANSMISSION ASSEMBLY COMPONENT TERMINOLOGY

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the major assemblies of the transmission. The following illustration identifies the components that are referred to throughout this section.



6.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in the “Safety Practices” section of this manual.

6.3 TRANSMISSION DESCRIPTION

Instructions in this section pertain mainly to general specifications, towing, maintenance information, and transmission removal and installation procedures. For internal transmission service instructions and detailed specifications contact the local **JLG** dealer for a copy of the Rexroth Hydrostatic Transmission Repair Manual (P/N 31200124).

More information can be obtained from the serial number plate directly mounted on the transmission. Information specified on the serial number plate includes the transmission model number, the transmission serial number and other data. Information on the serial number plate is required in correspondence regarding the transmission.

6.4 TRANSMISSION SPECIFICATIONS

6.4.1 Transmission Maintenance

The transmission is a hydraulic component and requires the same maintenance as the hydraulic system. Refer to Section 2.5, “Maintenance Schedules.”

Performance criteria is based on full throttle engine speed unless otherwise specified or not applicable.

6.5 TRANSMISSION REPLACEMENT

Note: *Contact the local **JLG** dealer if internal transmission repair is required during the warranty period.*

Cleanliness is of extreme importance. Before attempting to remove the transmission, thoroughly clean the exterior of the transmission to help prevent dirt from entering during the replacement process. Avoid spraying water or cleaning solution onto or near the transmission shift solenoids and other electrical components.

6.5.1 Transmission Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, turn rear wheels to give easier access to rear of engine compartment, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. Remove the air cleaner assembly.
6. Remove hood support at rear of engine.
7. Drain the hydraulic oil reservoir. Refer to Section 8.8.2, “Hydraulic Oil Reservoir Draining.”
8. Label, disconnect and cap all hydraulic hoses attached to transmission, cap all fittings and openings to keep dirt and debris from entering hydraulic system.
9. Label and disconnect all electrical connections attached to the transmission.
10. Wipe up any spilled hydraulic oil.Vertically secure transmission with a lifting strap or chain. Use a suitable hoist or overhead crane. Operate the hoist or crane to remove slack from the chain, but **DO NOT** raise the transmission at this time.
11. Remove the two Allen head bolts that attach the transmission to the engine.

WARNING

The transmission may move while hoisting it out of the chassis. Carefully move the transmission and adjust the sling as needed. Keep fingers, hands, legs and other body parts clear of the transmission.

12. Carefully remove the transmission from the machine. Avoid causing damage to the transmission or surrounding parts.
13. Lift the transmission clear of the machine, and lower it onto suitable supports or secure it to a stand built especially for transmission or engine service. Secure the transmission so
14. overed in the Transmission Disassembly & Assembly Manual (P/N 31200456).

6.5.2 Transmission Installation

WARNING

NEVER lift a transmission alone; enlist the help of at least one assistant or use a suitable hoist or overhead crane and sling.

1. Use a lifting strap or chain attached to a hoist or overhead crane to position the transmission within the chassis.
2. Insert the two Allen head bolts that attach the transmission to the engine. Torque to 210 Nm (154 lb-ft).
3. Remove the hoist or overhead crane and sling.
4. Uncap and reconnect the previously labeled hoses and electrical connections to their appropriate locations.
5. Fill hydraulic reservoir and bleed the system.
6. Reinstall the hood support.
7. Reinstall the air cleaner assembly.
8. Properly connect the battery.
9. Close and secure the engine cover.
10. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

6.5.3 After Transmission Replacement

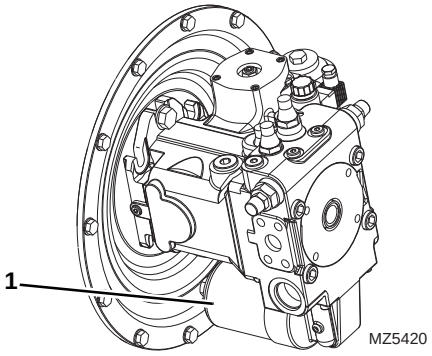
1. Install new hydraulic filters.
2. Check the hydraulic oil level and add oil as required.

NOTICE

DO NOT use flushing compounds for cleaning purposes.

3. Reassemble all components and fill the hydraulic reservoir with clean, fresh oil. **DO NOT** overfill.
4. Run the engine for two minutes at idle to help bleed any air from the hydraulic system.
5. Operate all boom functions to ensure any air is removed from the hydraulic system.
6. Retract and level the boom, recheck the level of the fluid in the reservoir.
7. Add oil as necessary to bring the fluid level up until it reaches the FULL mark on the reservoir. Recheck the oil level when it reaches operating temperature (83-94° C or 180-200° F).
8. Recheck all drain plugs, lines, connections, etc., for leaks, and tighten where necessary.

6.6 TRANSMISSION FILTER REPLACEMENT

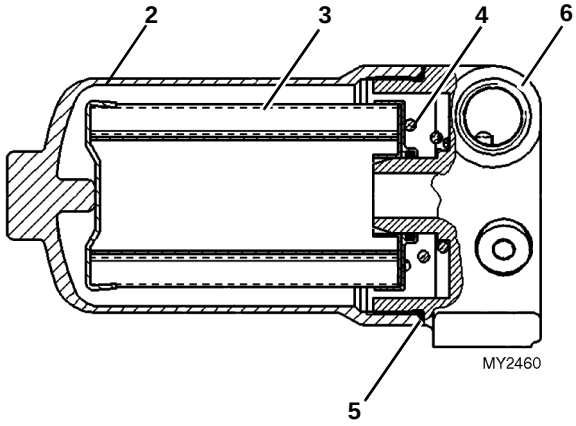


The hydrostatic pump filter is located on the left (inside) of the pump (**1**).

Cleanliness is of extreme importance. Before attempting to remove the transmission filter, thoroughly clean the exterior of the transmission to help prevent dirt from entering during the replacement process. Avoid spraying water or cleaning solution onto or near the transmission direction solenoids and other electrical components.

6.6.1 Filter Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, turn rear wheels to give easier access to rear of engine compartment, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. Remove the air cleaner assembly.
6. To allow easier access to the filter, label, disconnect and cap all hydraulic hoses in the filter area, cap all fittings and openings to keep dirt and debris from entering hydraulic system.
7. Place a container or shop rags below the filter housing to contain any spilled hydraulic oil.



8. Using a 25 mm (15/16 in) wrench, loosen and remove the filter housing (**2**), filter (**3**) and spring **(4**).

6.6.2 Filter Installation

1. Clean the area surrounding the hydraulic pump filter.
2. Install a new o-ring (**5**) on the base of the filter housing and lubricate the new o-ring with clean hydraulic oil.
3. Install the small end of the filter spring (**4**) into the filter base (**6**).
4. Install the filter (**3**) into the filter base (**6**) directly behind the filter spring.
5. Slowly screw the filter housing into the filter base keeping the filter and housing aligned.
6. Torque the filter housing to 45 Nm (33 lb-ft).
7. Uncap and reconnect the previously labeled hoses to their appropriate locations.
8. Fill hydraulic reservoir and bleed the system.
9. Reinstall the air cleaner assembly.
10. Properly connect the battery.
11. Close and secure the engine cover.
12. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

6.7 TOWING A DISABLED MACHINE

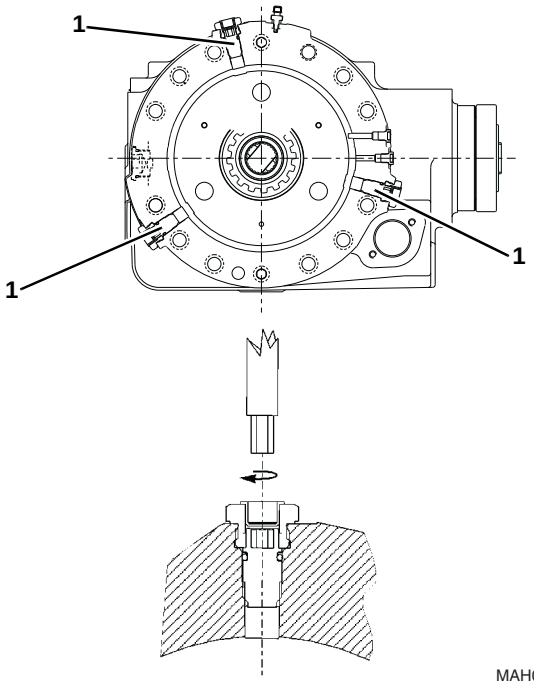
Towing a disabled machine should only be attempted as a last resort, after exhausting all other options. Make every effort to repair the machine, and move it under its own power.

Towing is only possible by using the "towing" feature built into the hydrostatic pump and disengaging the park brake on the front axle.

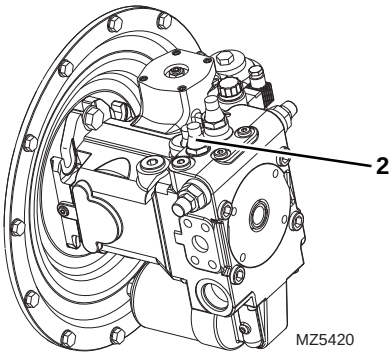
1. Securely block all four wheels.

⚠ WARNING

Block all four wheels when preparing the machine for towing to prevent any unexpected movement.



2. Locate the six brake release bolts (**1**) at the base of the front axle. Mark a line on the socket so you can accurately count the number of turns each bolt makes as you perform the procedure.
3. Alternately screw the release bolts clockwise in 1/2 turn increments. Turn until resistance is felt.
4. Alternately screw the bolts clockwise 5 to 5 1/2 turns in 1/2 turn increments.



5. Turn the tow option engagement screw (**2**) on the hydrostatic transmission counterclockwise three turns.
6. Carefully remove the blocking from each tire and tow the machine to a secure location.

Note: *This procedure does not alter any relief settings.*

7. After the machine has been towed to a secure location, reactivate the parking brake.
8. Block all four wheels.

⚠ WARNING

Do Not attempt to tow a machine that is loaded or the boom/attachment is raised more than approximately 610 mm (24 in).

9. Turn the tow option screw (**2**) on the hydrostatic transmission clockwise three turns.
10. Using a torque wrench, alternately unscrew the brake release bolts (**1**) outward in 1/2 turn increments until the torque drops off sharply.
11. Again, alternately unscrew the bolts outward until you feel the bolts flange begin to contact against the special screw.
12. Screw the bolts inward (clockwise) 1/4 turn.
13. The parking brake should now be reactivated and the front wheels locked.
14. Remove the blocks from the four tires.
15. Verify that the parking brake works.

Note: *If the parking brake does not work, check all activation operations step by step.*

Section 7
Engine: Deutz TCD 2012

Contents

7.1 INTRODUCTION

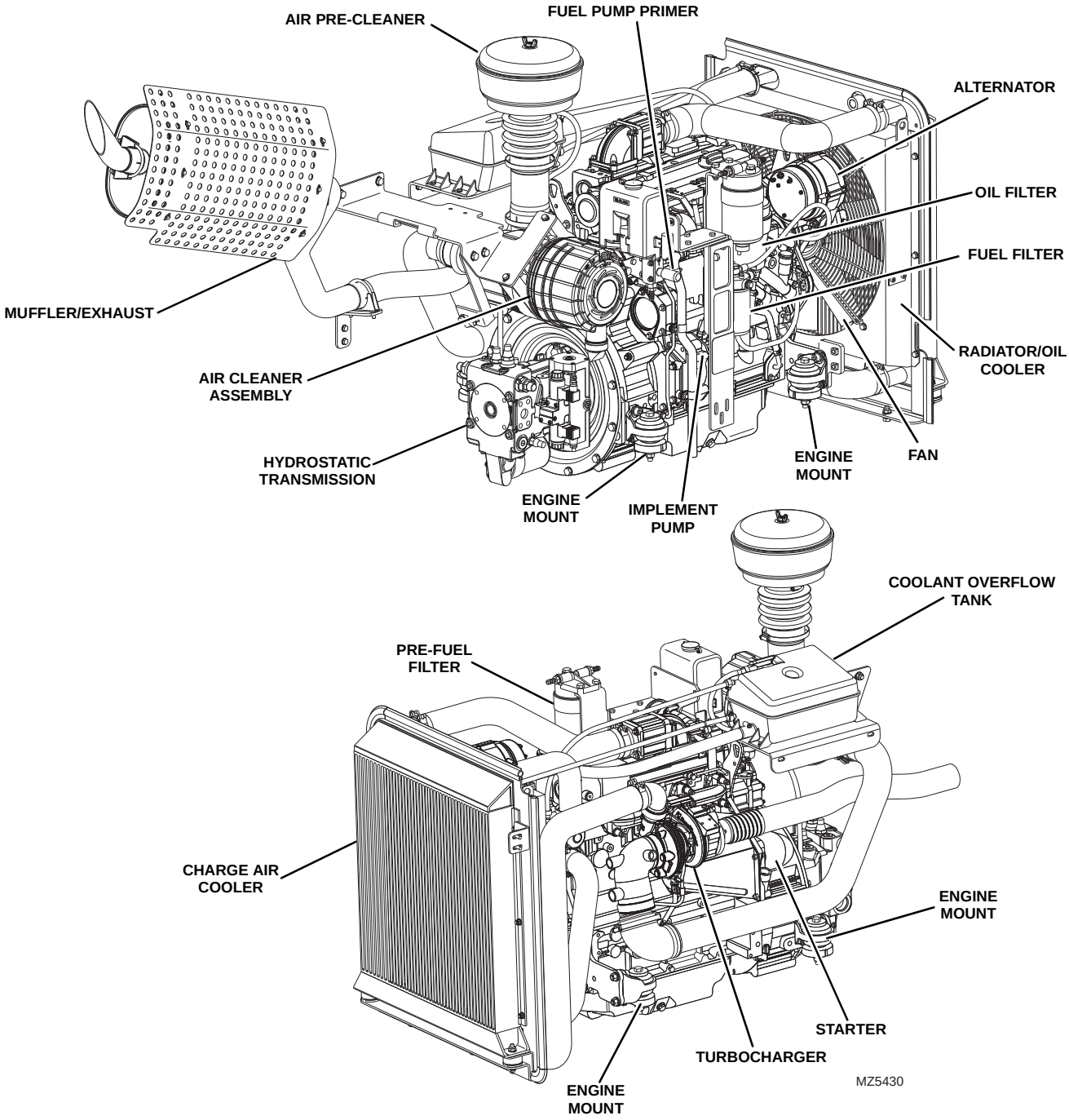
7.1.1 Disclaimer and Scope

These instructions are written for worldwide use. In territories where legal requirements govern engine smoke emission, noise, safety factors, etc., apply all instructions, data and dimensions provided herein in such a way that after maintenance, service and repair of the engine, engine operation does not violate local regulations.

Note: *These instructions cover only the routine maintenance, removal, installation and troubleshooting of the engine. For assistance with comprehensive engine diagnosis, repair and component replacement, contact the local Deutz dealer.*
A gradual running-in (break-in) of a new engine is not necessary. Full load can be applied to a new engine as soon as the engine is put into service and the coolant temperature is at least 60° C (140° F). Extended light-load operation during the early life of the engine is not recommended. ***DO NOT*** *run the engine at high, no-load speeds.* ***DO NOT*** *apply an overload to the engine.*

7.1.2 Component Terminology

To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the engine components. The following illustration identifies the components that are referred to throughout this section.



7.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in the “Safety Practices” section of this manual.

7.3 ENGINE SERIAL NUMBER

The Deutz TCD 2012 serial number is located on a tag on top of the engine. Information contained in the serial number is required in correspondence with the engine manufacturer.

Supply the engine serial number and/or data tag information when communicating about an engine or engine components.

7.4 SPECIFICATIONS AND MAINTENANCE INFORMATION

For engine, coolant and oil specifications, and maintenance information, refer to Section 2, “General Information and Specifications.”

Detailed engine service instructions are provided in the following publication:

- Deutz Engine Operation Manual (P/N 31200638)

7.5 ENGINE COOLING SYSTEM

7.5.1 Radiator Pressure Cap

For a 110° C (230° F) system, use a 95 kPa (13 psi) radiator cap. An incorrect or malfunctioning cap can result in the loss of coolant and a hot-running engine.

7.5.2 Radiator/Oil and Charge Air Cooler Replacement

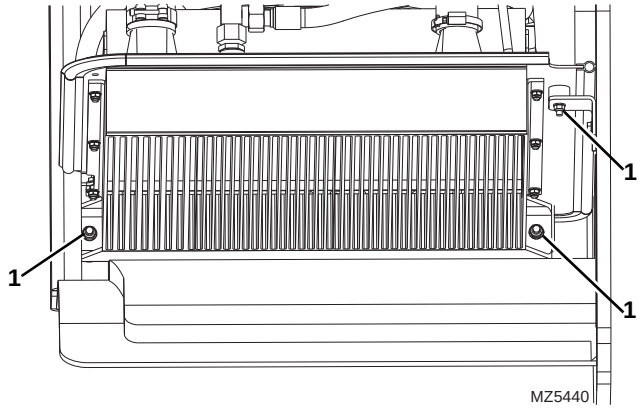
Before considering radiator, oil or charge air cooler replacement for other than obvious damage, conduct a cooling system pressure test check the coolant specific gravity, coolant level, fan belt tension and dash panel temperature indicator.

- If the engine runs hot, check the temperature of the upper radiator hose.
- If the hose is not hot, the thermostat may be stuck in the closed position.
- If the engine has overheated, performance may suffer, indicating other damage including a leaking cylinder head gasket, cracked cylinder head or block, and/or other internal engine damage.

a. Radiator/Oil/Charge Air Cooler Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Thoroughly clean the engine and surrounding area, including all hoses and fittings before proceeding.
5. Properly disconnect the battery.
6. Slowly turn the coolant overflow bottle cap and allow any pressure to escape. Remove the overflow bottle cap.
7. Place a suitable container beneath the radiator petcock.

8. Place a funnel at the base of the radiator to channel the drained coolant into the container. Open the radiator petcock and drain the coolant into the funnel. Transfer the fluid into a properly labeled container. Dispose of properly if coolant needs to be replaced. Close the radiator petcock.
9. Label, disconnect and cap all charge air tubes attached to the radiator. Cap all openings to keep dirt and debris from entering the cooling system.
10. Label, disconnect and cap all coolant hoses attached to the radiator. Cap all fittings and openings to keep dirt and debris from entering the cooling system.
11. Label, disconnect and cap all hydraulic hoses attached to the radiator. Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.
12. Detach the fan safety shroud.



13. Remove the locknuts (**1**) holding the radiator assembly at the side and bottom of the machine.
14. Connect a lifting strap to the radiator/oil cooler and carefully lift the radiator/oil cooler out of the machine.

b. Radiator/Oil Cooler Installation

1. Install the radiator assembly into the machine and secure in place with new locknuts.
2. Be sure the engine fan has clearance in regard to the radiator. Install the engine cover support (**1**) to the frame and radiator.
3. Attach the fan safety shroud.
4. Uncap and reconnect the previously labeled hydraulic hoses to the appropriate locations.
5. Uncap and reconnect all previously labeled coolant hoses to the appropriate locations.
6. Fill the coolant overflow bottle with coolant.
7. Properly connect the battery.
8. Run the engine to operating temperature. Visually check for leaks with the engine running. Check the coolant level in the overflow bottle and fill, or drain, as necessary. Check the hydraulic fluid level in the tank and add fluid as required.
9. Close and secure the engine cover.
10. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

7.6 ENGINE ELECTRICAL SYSTEM

The engine electrical system, including the starter, alternator and primary wiring, is described in Section 9, “Electrical System.”

7.7 FUEL SYSTEM

7.7.1 Diesel Fuel

Fuel represents a major portion of machine operating costs and therefore must be used efficiently. ALWAYS use a premium brand of high-quality, clean diesel fuel. Low cost, inferior fuel can lead to poor performance and expensive engine repair.

NOTICE

Due to the precise tolerances of diesel injection systems, keep the fuel clean, and free of dirt and water. Dirt and water in the fuel system can cause severe damage to both the injection pump and the injection nozzles. Use #2 diesel fuel with a minimum Cetane rating of 40. #2 diesel fuel gives the best economy and performance under most operating conditions. Fuels with Cetane numbers higher than 40 may be needed in high altitudes or extremely low ambient temperatures to help prevent misfiring and excessive smoking.

Inform the owner/operator of the machine to use #2 diesel fuel, unless ambient temperatures are below 0° C (32° F). When temperatures are below 0° C (32° F), a blend of #1 diesel and #2 diesel fuels (known as “winterized” #2 diesel) may be used.

Note: *#1 diesel fuel may be used, however, fuel economy will be reduced.*

Use a low-sulfur content fuel with a cloud point (the temperature at which wax crystals form in diesel fuel) at least 10° below the lowest expected fuel temperature. The viscosity of the fuel must be kept above 1.3 centistokes to provide adequate fuel system lubrication.

Note: *When using diesel fuel with a sulfur content below 1.3 percent, the filter change interval must be reduced by 75 hours. The use of fuel with a sulfur content above 1.3 percent is not recommended.*

7.7.2 Fuel/Hydraulic Oil Tank

a. Cleaning and Drying

If contaminated fuel, hydraulic oil or foreign material is in the tank, the tank can usually be cleaned.

b. If a leak is suspected between the fuel and hydraulic oil tank, contact the local ***JLG*** dealer.

To clean the fuel/hydraulic oil tank:

1. Have a dry chemical (Class B) fire extinguisher near the work area.
2. Depending on which side of the tank is contaminated (fuel or hydraulic oil), remove the fuel or oil tank drain plug, and safely drain any fuel or hydraulic oil into a suitable container. Dispose of fuel or hydraulic oil properly.
3. Clean the fuel/hydraulic oil tank with a high-pressure washer, or flush the tank with hot water for five minutes and drain the water. Dispose of contaminated water properly.
4. For the fuel tank side, add a diesel fuel emulsifying agent to the tank. Refer to the manufacturer’s instructions for the correct emulsifying agent-to-water mixture ratio. Refill the tank with water, and agitate the mixture for 10 minutes. Drain the tank completely. Dispose of contaminated water properly.
5. Refill the fuel tank with water until it overflows. Completely flush the tank with water. Empty the fuel tank, and allow it to dry completely.

c. Inspection

Note: *If a leak is suspected between the fuel and hydraulic oil tank, contact the local **JLG** dealer.*

1. Inspect the fuel/hydraulic oil tank thoroughly for any cracks, slices, leaks or other damage.
2. Plug all openings except one elbow fitting. Install the elbow fitting, and apply approximately 0.07-0.10 bar (1-1.5 psi) of air pressure through the elbow. Check the tank for leaks by applying a soap solution to the exterior and look for bubbles to appear at the cracked or damaged area.

d. Disassembly and Assembly

The fuel/hydraulic oil reservoir is a one piece-unit integral to the chassis frame and cannot be disassembled.

7.7.3 After Fuel System Service

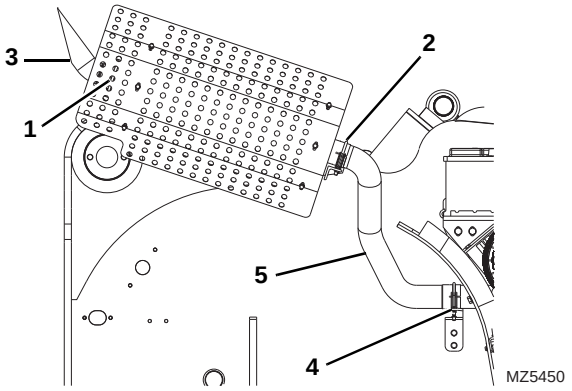
1. Drain and flush the fuel tank if it was contaminated.
2. Fill the fuel tank with fresh, clean diesel fuel as required.

Note: *If bleeding of the fuel system is required, contact the local Deutz dealer.*

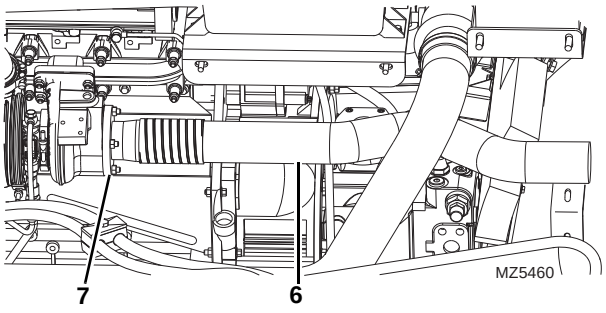
7.8 ENGINE EXHAUST SYSTEM

7.8.1 Exhaust System Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the travel select lever in the (N) NEUTRAL position, engage the parking brake, and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.



5. Loosen and remove the clamp (**1**)(hidden) connecting the muffler and tail pipe from the bracket on the side of the frame.
6. Loosen and remove the clamp (**2**) attaching the rear exhaust pipe section to the muffler.
7. Remove the muffler and tail pipe (**3**).
8. Loosen and remove the clamp (**4**) attaching the rear exhaust pipe section to the frame.
9. Remove the rear exhaust pipe section (**5**) from the front exhaust pipe section (**6**).



10. Loosen and remove the exhaust pipe flange nuts (**7**) at the turbocharger.
11. Remove the front exhaust pipe section (**6**) from the engine.

7.8.2 Exhaust System Installation

Note: *Keep all clamps loosened until entire exhaust system is in place.*

Note: *Replace the nuts and the exhaust studs on the turbocharger if damaged.*

1. Install the front exhaust pipe section (**6**) in place at the turbocharger with the previously used hardware. Torque the flange nuts (**7**) on the turbo charger to 30 ±7 Nm (22 ±5 lb-ft).
2. Install the rear exhaust pipe section (**5**) to the front exhaust pipe section (**6**) with the previously used clamp.
3. Install the muffler and tailpipe (**3**) to the exhaust pipe with the previously used hardware.
4. Install the muffler (**3**) to the frame brackets with the previously used hardware.
5. Adjust the muffler, exhaust and tail pipes for proper clearance then tighten all clamps.
6. Properly connect the battery.
7. Start engine and check for exhaust leaks at all exhaust connections. Adjust or repair as needed.
8. Close and secure the engine cover.
9. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

7.9 AIR CLEANER ASSEMBLY

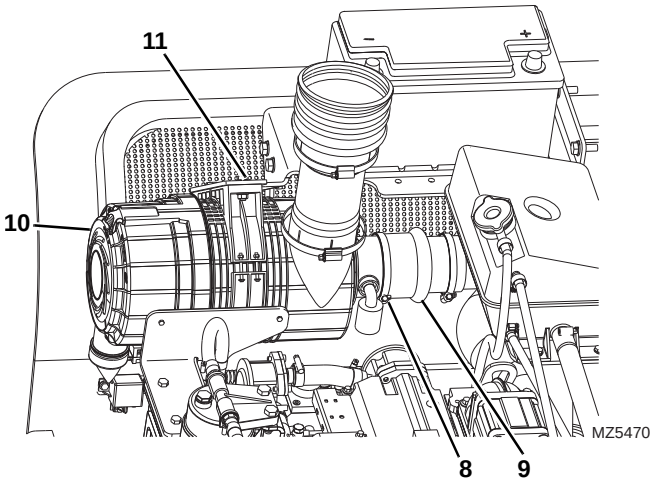
CAUTION

NEVER run the engine with only the inner safety element installed.

Note: *Refer to the Operation & Safety Manual (P/N 31200567) for the correct element change procedure.*

7.9.1 Air Cleaner Assembly Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the travel select lever in the (N) NEUTRAL position, engage the parking brake, and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.



5. Loosen the clamp (**8**) securing the air intake tube (**9**) to the air cleaner assembly (**10**). Pull the air intake elbow off the air cleaner.
6. Remove the hardware (**11**) securing the air cleaner/ bracket to the air cleaner mounting plate. Remove the air cleaner assembly (**10**).

7.9.2 Air Cleaner Assembly Installation

1. Install the air cleaner assembly (**10**) to the air cleaner mounting plate with the previously used hardware (**11**).
2. Place the loosened clamp (**8**) over the air intake tube (**9**) and install elbow on the air cleaner assembly.
3. Adjust and tighten clamps before starting the machine.
4. Properly connect the battery.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

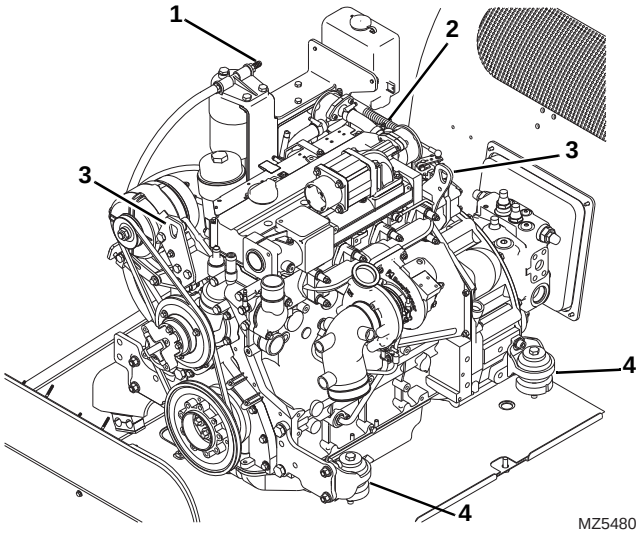
7.10 ENGINE REPLACEMENT

7.10.1 Engine Removal

Note: *If machine is equipped with air conditioning, DO NOT loosen or disconnect any air conditioning hoses until the air conditioning system has been properly drained by the* local ***JLG*** *dealer or certified air conditioning service center*.

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Thoroughly clean the engine and surrounding area, including all hoses and fittings before proceeding.
5. Properly disconnect the battery.
6. Remove the engine cover, radiator cover and engine belly pan.
7. Remove front and rear engine cover supports.
8. Drain hydraulic reservoir. Refer to Section 8.8.2, “Hydraulic Oil Reservoir Draining.”
9. Drain radiator and overflow bottle. Refer to Section 7.5.2, “Radiator/Oil and Charge Air Cooler Replacement.”
10. Label, disconnect and cap all hydraulic hoses attached to engine and radiator, cap all fittings and plug hoses to keep dirt and debris from entering hydraulic system.
11. Label, disconnect and cap both air conditioning hoses.
12. Disconnect the fuel inlet (**1**) and return lines. Install a plug in the end of each line.
13. Remove hydraulic and fuel filters, and filter bracket assembly.

14. Unbolt and remove the fan safety shroud.
15. Remove bolts securing the radiator and lift it clear of engine compartment. Refer to section Section 7.5.2, “Radiator/Oil and Charge Air Cooler Replacement.”
16. Mark the engine fan orientation. Remove the engine fan.



17. Label and disconnect all wire connections on the engine.
18. Mark the location of the throttle cable (**2**) at the engine throttle lever. Disconnect the throttle cable.
19. Detach exhaust and air cleaner hoses from the engine. Cover air inlets to protect from dirt and debris.
20. Remove air cleaner assembly from engine compartment.
21. Completely disconnect exhaust pipe.
22. Remove the hydraulic reservoir fill tube.
23. Secure the engine with a lifting strap or chain from the appropriate lifting points (**3**). Use a suitable hoist or overhead crane.
24. Remove the four motor mount bolts (**4**) that attach the engine to the frame.
25. Carefully lift the engine from the machine. Avoid causing damage to the surrounding parts.
26. Lift the engine clear of the machine, and lower it onto suitable supports or stand. Secure the engine so that it will not move or fall.

7.10.2 Engine Disassembly, Inspection and Service

Engine disassembly, internal inspection, service, repair and assembly procedures are covered in the Deutz TCD 2012 service manual. Several special engine service tools are required to properly service the Deutz engine. Contact the local Deutz dealer for further information.

Note: *If the engine is being replaced, there may be external components that will be required to be transferred from the original engine to the replacement engine depending upon who you purchase the new engine from and the configuration of your replacement engine. Refer to the appropriate Deutz user manual for detailed procedures that cover the transfer of original engine components to the replacement engine.*

7.10.3 Engine Installation

Note: *Refer to Section 2.2, “Torques,” for specific fastener torque specifications.*

1. Position engine in engine compartment being sure to line up the 4 motor mount holes. Replace bolts (**4**) and torque to 97 Nm (71 lb-ft).
2. Connect the hydraulic reservoir fill tube.
3. Connect the exhaust pipe to the engine.
4. Install the air cleaner assembly into the engine compartment and attach hose to air intake.
5. Reconnect throttle cable (**2**) onto the engine, if necessary adjust for full travel.
6. Reattach any previously labeled wire connections on the engine.
7. Attach the engine fan.
8. Reinstall the front and rear engine cover supports.
9. Secure the radiator with the necessary bolts and attach the fan safety shroud. Check that the fan top clearance is adequate with regard to the radiator. Reattach the previously labeled hoses. Refer to Section 7.5.2, “Radiator/Oil and Charge Air Cooler Replacement.” Fill with coolant.
10. Install the filter bracket assembly. Secure the hydraulic and fuel filters.
11. Connect the fuel inlet line to the fuel filter (**1**) and reconnect the return fuel line to the engine.
12. Uncap and reconnect all hydraulic hoses and fittings to the engine and necessary hydraulic elements. Keep hoses free of dirt and debris.
13. Uncap and connect and cap both air conditioning hoses.

14. Refill the hydraulic reservoir (Refer to the appropriate Operation & Safety Manual for information concerning the hydraulic oil and filter change).
15. Reinstall the engine cover and radiator cover.
16. Reconnect the battery terminals, being sure to start with the positive (+) terminal.
17. Check that all hydraulic, electrical, cooling, fuel and exhaust system connections are correct and connected tightly.
18. Recharge the air conditioning system. Refer to Section 4.4.11, “Air Conditioning (If Equipped).”
19. Run engine to normal operating temperature then shut off the engine. While the engine is cooling, check for leaks.
20. Allow the engine to cool. Check the radiator coolant level, and top off with coolant. Replace the radiator cap.
21. Check for leaks from the engine, main hydraulic pump and lines, transmission, hydraulic reservoir and fuel tank. Check the levels of all fluids and lubricants. Fill as required.

NOTICE

During the full throttle check:

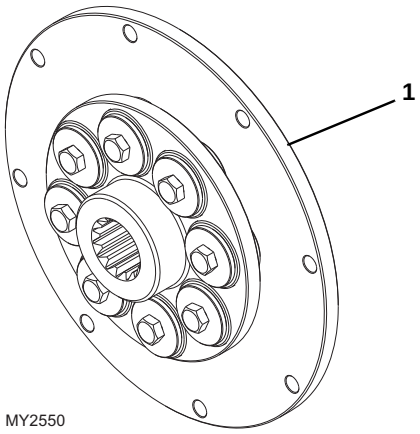
- ***DO NOT*** *operate any hydraulic function.*
- ***DO NOT*** *steer or apply any pressure to the steering wheel.*
- *Keep the transmission in NEUTRAL (N).*

22. Check the engine rpm at high idle. Refer to Section 4.4.5, “Throttle Cable Adjustment,” and Section 4.4.6, “High Idle Adjustment,” for adjustment procedure.
23. Purge the hydraulic system of air by operating all boom functions through their entire range of motion several times. Check the hydraulic oil level.
24. Check for proper operation of all components.
25. Turn the engine OFF.
26. Install the belly pan.
27. Install the engine cover.
28. Close and secure the cover.
29. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

7.11 ENGINE COUPLER

7.11.1 Coupler Removal

1. Remove Hydrostatic transmission. Refer to Section 6.5.1, “Transmission Removal.” Be sure to follow all described safety guidelines.
2. After transmission has been removed, take out the 12 bolts that attach the Flywheel Cover Plate to the engine.
3. Pull off the Flywheel Cover Plate to expose the coupler assembly (**1**).
4. Remove the necessary bolts to detach the coupler assembly.



7.11.2 Coupler Installation

1. Attach the coupler assembly (**3**) using the necessary bolts. Torque to 210 Nm (155 lb-ft).
2. Bolt on the Flywheel Cover Plate over the coupler and flywheel. Torque bolts to 50 Nm (37 lb-ft).
3. Reattach the hydrostatic transmission. Follow all guidelines in Section 6.5.2, “Transmission Installation.”

7.12 TROUBLESHOOTING

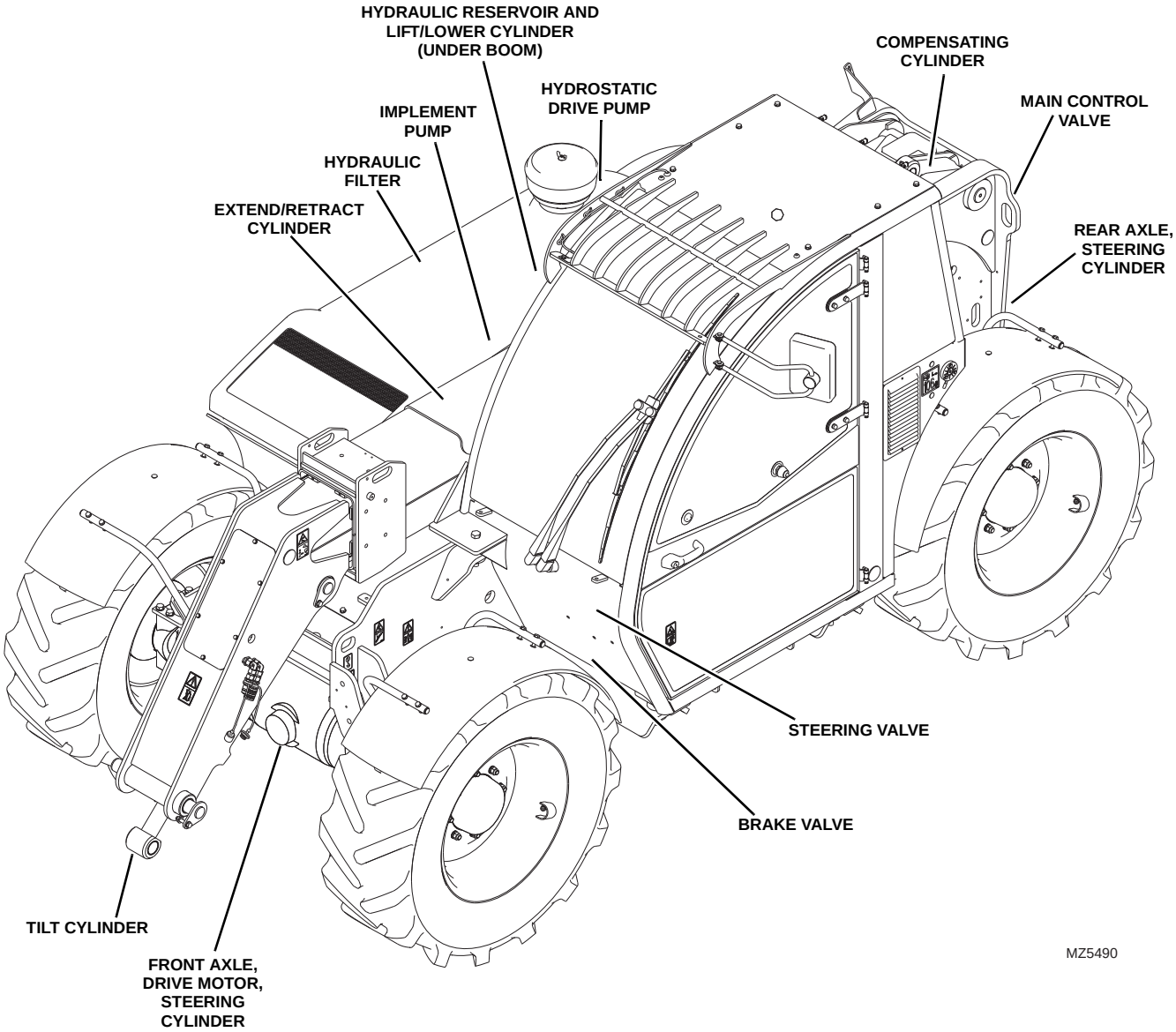
Refer to Section 7.4, “Specifications and Maintenance Information,” for detailed engine service information or contact the local Deutz dealer.

Section 8
Hydraulic System

Contents

8.1 HYDRAULIC COMPONENT TERMINOLOGY

To understand the safety, operation and service information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the hydraulic components of the machine. The following illustration identifies the components that are referred to throughout this section.



8.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in the "Safety Practices" section of this manual.

8.3 GENERAL INFORMATION

Petroleum-based hydraulic oils are used in this machine. The temperature of hydraulic oil increases during the operation of various hydraulic functions. A heated petroleum-based hydraulic oil presents a fire hazard, especially when an ignition source is present.

Accordingly, periodically inspect all hydraulic system components, hoses, tubes, lines, fittings, etc. Carefully examine any deterioration and determine whether any further use of the component would constitute a hazard. If in doubt, replace the component.

Whenever you disconnect a hydraulic line, coupler, fitting or other component, slowly and cautiously loosen the part involved. A hissing sound or slow seepage of hydraulic oil may occur in most cases. After the hissing sound has ceased, continue removing the part. Any escaping oil should be directed into an appropriate container. Cap or otherwise block off the part to prevent further oil seepage.

Hydraulic system maintenance will, at times, require that the engine be operated. Always follow safety precautions.

A major cause of hydraulic component failure is contamination. Keeping the hydraulic oil as clean as possible will help avoid downtime and repairs. Sand, grit and other contaminants can damage the finely machined surfaces within hydraulic components. If operating in an exceptionally dirty environment, change filters and inspect the oil more often. When servicing the system, cap or plug hydraulic fittings, hoses and tube assemblies. Plug all cylinder ports, valves and the hydraulic reservoir, and pump openings until installation occurs. Protect threads from contamination and damage.

Some hydraulic functions are actuated by interfacing with electrical system components (switches, solenoids and sensors). When the hydraulic system is not functioning properly, check the electrical aspect of the malfunctioning circuit also.

8.4 SPECIFICATIONS

Refer to Section 2.3, "Specifications," for hydraulic system specifications.

8.5 HOSES, TUBE LINES, FITTINGS, ETC.

There are numerous hydraulic hoses, tubes, fittings, etc. used on this machine. Periodically inspect all of these and carefully examine any signs of wear, abrasion and/or deterioration. Determine whether any further use of the component would constitute a hazard. If in doubt, replace the component.

8.5.1 Replacement Considerations

Conditions including, but not limited to, the following are sufficient for considering component replacement:

1. Any evidence of hydraulic oil leakage at the surface of a flexible hose or its junction with the metal and couplings.
2. Any blistering or abnormal deformation to the outer covering of a hydraulic hose.
3. Hydraulic oil leakage at any threaded or clamped joint that cannot be eliminated by normal tightening or other recommended procedures.
4. Evidence of excessive abrasion or scrubbing on the outer surface of a hose, rigid tube, or hydraulic fitting. Modification must be made to eliminate the interference of the elements in contact with one another, or to otherwise protect the components from contact with one another. Slightly moving a hose or adjusting a plastic tie wrap may often be all that is necessary to eliminate interference; evaluate each situation and proceed as required by the individual circumstances.

8.5.2 Hose, Tube, Line and Fitting Replacement

Before removing a hydraulic hose or component, always mark or otherwise label the related parts and the exact location of the hose or component to aid in proper reinstallation. Hydraulic oil is a good cleaner and can remove most liquid-ink type markings, so make sure the mark or label will remain intact. Alternative methods to using markers include color-coded tie wraps, number-tag sets, alpha-numeric stampings or markings, and suitably labeled pieces of tape. Select an appropriate marking method for the conditions and proceed accordingly.

NEVER replace a hydraulic hose or other component with a part not specifically designed for this machine. Use only factory approved parts for best performance and safety.

Removal and replacement of hoses, tube lines, fittings, etc. usually involves straightforward procedures. When removing a hydraulic hose or other component, be aware that o-rings are used throughout the hydraulic system. ALWAYS replace a used o-ring with a new part.

Check all routing of hoses, wiring and tubing for sharp bends or interference with any rotating members. Install appropriate protective devices such as tie wraps and conduit to help shield hoses from damage. All tube and hose clamps must be tight.

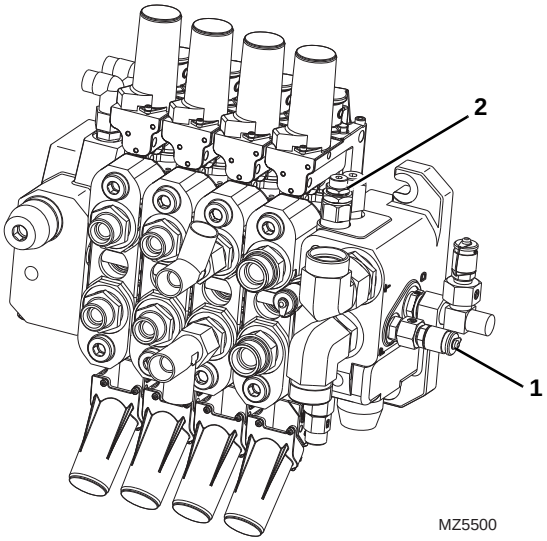
8.6 HYDRAULIC PRESSURE DIAGNOSIS

8.6.1 Pressure Checks and Adjustments

In general, follow the steps below whenever conducting pressure checks and performing adjustments:

1. Park the machine on a firm, level surface. Engage the park brake, place the transmission control lever in (N) NEUTRAL, place the neutral lock lever in the (N) NEUTRAL LOCK position, level the boom and turn the engine OFF.
2. Pressure tee fittings are conveniently located in each hydraulic circuit. Install a pressure gauge capable of measuring at least 10% more pressure than that which the circuit being checked operates under.
3. Start the engine. Operate machine functions several times to allow hydraulic oil to reach operating temperature. The hydraulic oil temperature should be between 38-49° C (100-120° F). If a temperature gauge or thermometer is unavailable, the hydraulic oil reservoir should be warm to the touch.
4. Fully depress the accelerator pedal as required. Place and hold the joystick in the position needed to operate the particular machine function being checked. Continue holding the joystick in position until pressure readings are taken.
5. Check the pressure gauge reading. It should read as described in the appropriate section. If the reading is not as specified, turn the engine OFF and check other components in the system. Verify that all related hydraulic components and electrical switches, sensors, solenoids, etc. are operating correctly.
6. As a last resort, adjust the appropriate relief valve, if applicable. Turning the adjustment screw clockwise will increase the pressure; turning the screw counterclockwise will decrease the pressure.

8.6.2 Main Control Valve Pressure Checking

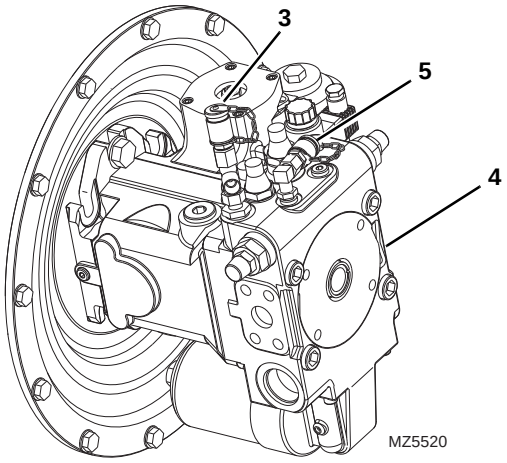


Attach 345 bar (5000 psi) gauge to the test port (**1**) at the rear of the implement pump to check the system pressure. Make sure the gauge is visible from inside the cab.

See Section 8.6, “Hydraulic Pressure Diagnosis,” for start up procedure. Check the main control pressure with the park brake on and the service brake off at full throttle. Retract a boom circuit function until the cylinder bottoms. The main control valve pressure should be 250 ± 2,8 bar (3625 ± 40 psi) at full throttle. Repeat for each boom circuit to verify the correct main control valve pressure.

If a pressure adjustment is required, adjust the main relief cartridge (**2**) on the main control valve. Recheck pressure after any adjustment has been made.

8.6.3 Charge Pressure Checking



Attach a pressure gauge to the test port (**3**) on the hydrostatic transmission (**4**) to check the system pressure. The pressure should be 26,2 ± 2 bar (380 ± 30 psi) with the engine at low idle.

The charge pressure relief valve is preset at the factory and is not adjustable.

8.6.4 Drive Pressure Checking

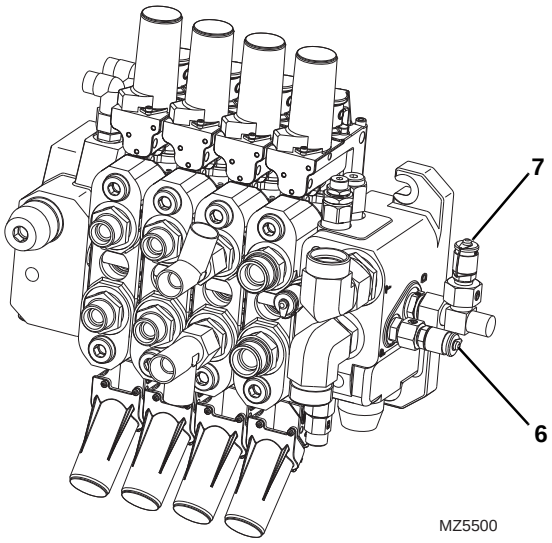
Attach a pressure gauge to the test fitting (**5**) on the hydrostatic transmission (**4**) to check the system pressure.

The following procedure must be performed to verify proper drive pressure:

- Connect a JLG handheld analyzer to the power distribution board (located below the rear cab window).
- Enter service code 01769 for access level 1.
- Navigate to CALIBRATION>TRACTION TEST, select YES. (Note: this mode will return to the default setting NO when the power is cycled.)
- Check the drive pressure with the park brake on, wheels chocked and the service brake off at full throttle. The pressure reading should be 440 to 460 bar (6381 to 6671 psi).

Do **NOT** adjust any relief settings. The unit is preset at the factory and should not be tampered with. If the proper pressure is not read, the unit may be defective.

8.6.5 Boom Function Pressure Checking



Attach 345 bar (5000 psi) gauge to the test port (**6**) at the rear of the main control valve to check the system pressure. Make sure the gauge is visible from inside the cab.

See Section 8.6, “Hydraulic Pressure Diagnosis,” for start up procedure. Check the boom function pressure with the park brake on and the service brake off at full throttle. Retract each boom circuit function until the cylinder bottoms. Each circuit function pressure should be 250 ± 2,8 bar (3625 ± 40 psi) at full throttle.

Note: *With the machine at operating temperature, the* 250 ± 2,8 bar (3625 ± 40 psi) *pressure reading at the main control valve is 13,3 bar (125 psi) HIGHER than the 241 bar ±4 bar (3500 ± 50 psi) of each individual valve section function. DO NOT adjust the main control valve relief pressure below* 250 ± 2,8 bar (3625 ± 40 psi)*. To check individual valve section pressures, install a tee and test port between the cylinder being checked and the corresponding valve section on the main control valve.*

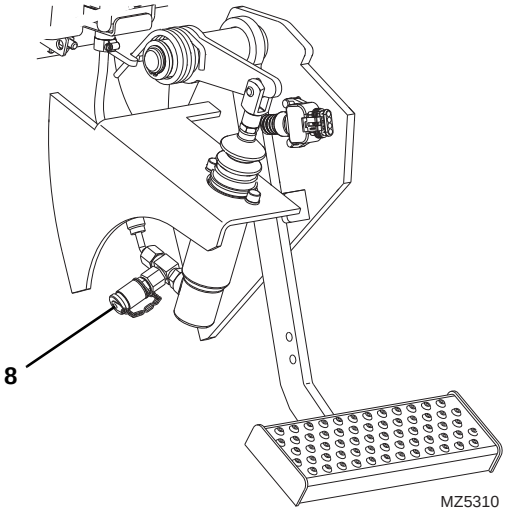
The individual valve section relief valves are preset at the factory and are not adjustable.

8.6.6 Steering Pressure Checking

Attach a pressure gauge to the test fitting (**7**) at the main control valve. The pressure reading should be 186 ± 4 bar (2700 ± 50 psi) with the steering wheel fully turned to the steering stop in one direction.

Do **NOT** adjust any relief settings. The unit is preset at the factory and should not be tampered with. If the proper pressure is not read, the unit may be defective.

8.6.7 Brake Pressure Checking



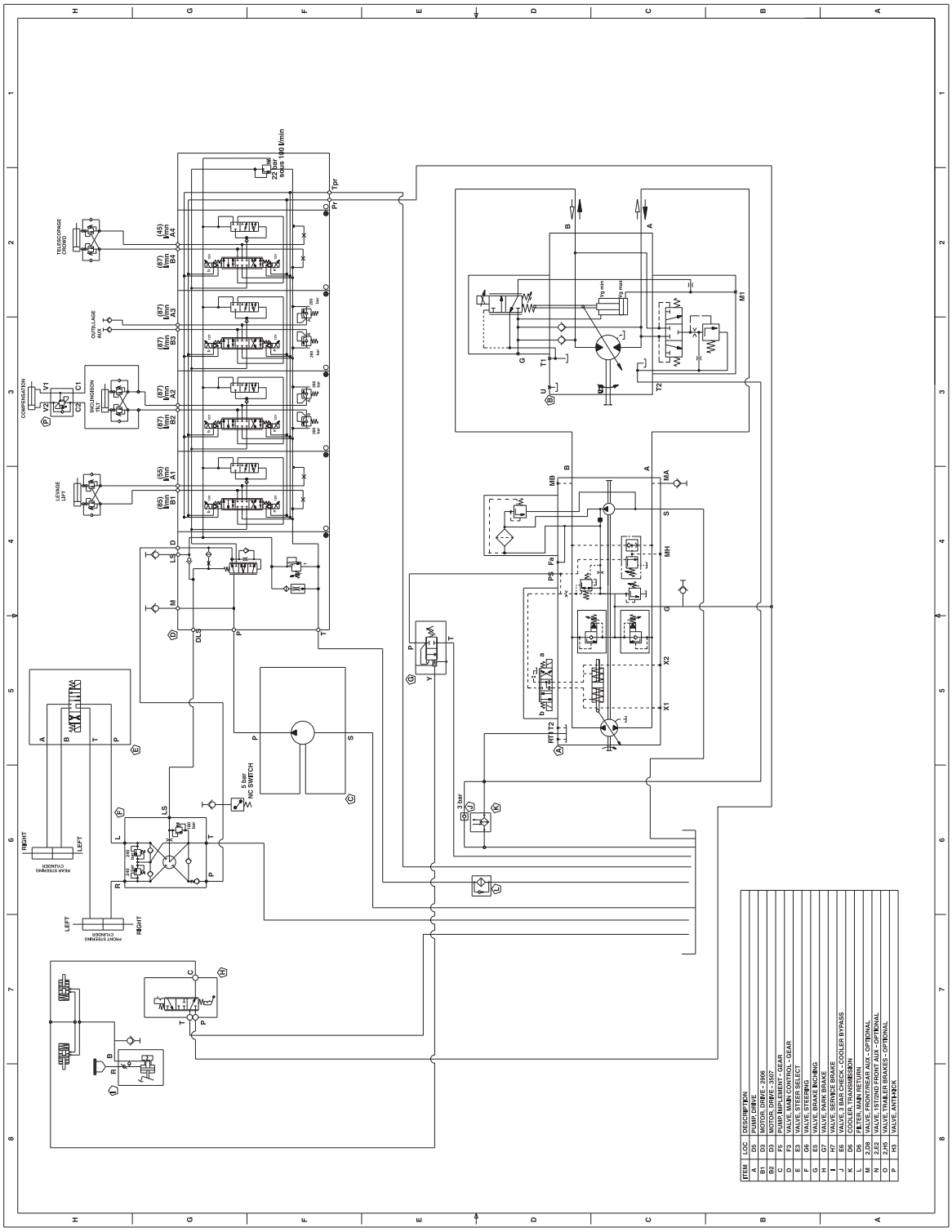
Attach a pressure gauge to the test fitting (**8**) at the brake valve in the cab. The pressure reading should be 30 bar (435 psi) with the brake pedal fully depressed.

Do **NOT** adjust any relief settings. The unit is preset at the factory and should not be tampered with. If the proper pressure is not read, the unit may be defective.

8.7 HYDRAULIC SCHEMATIC

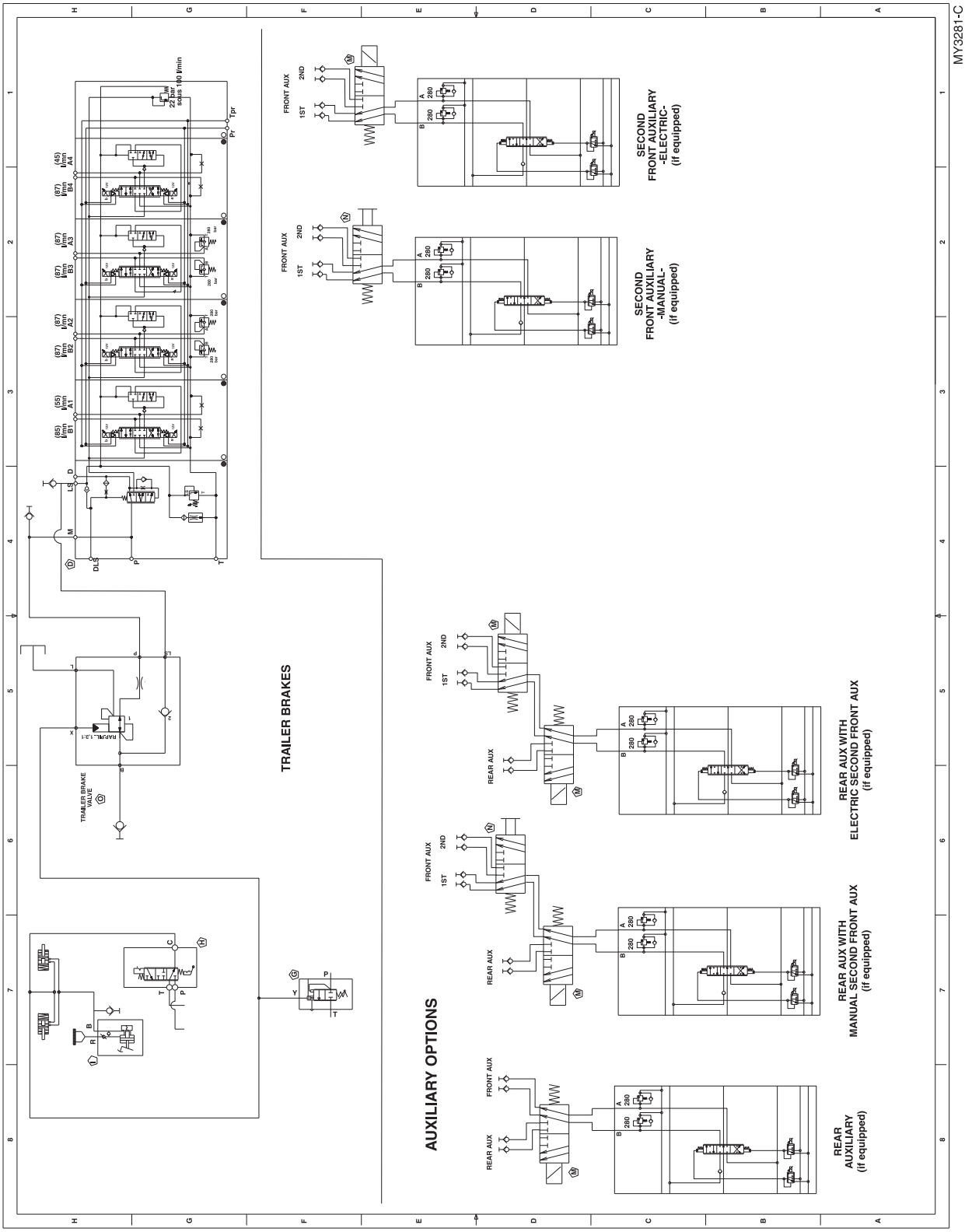
8.7.1 Gear Pump Schematic

(Sheet 1)



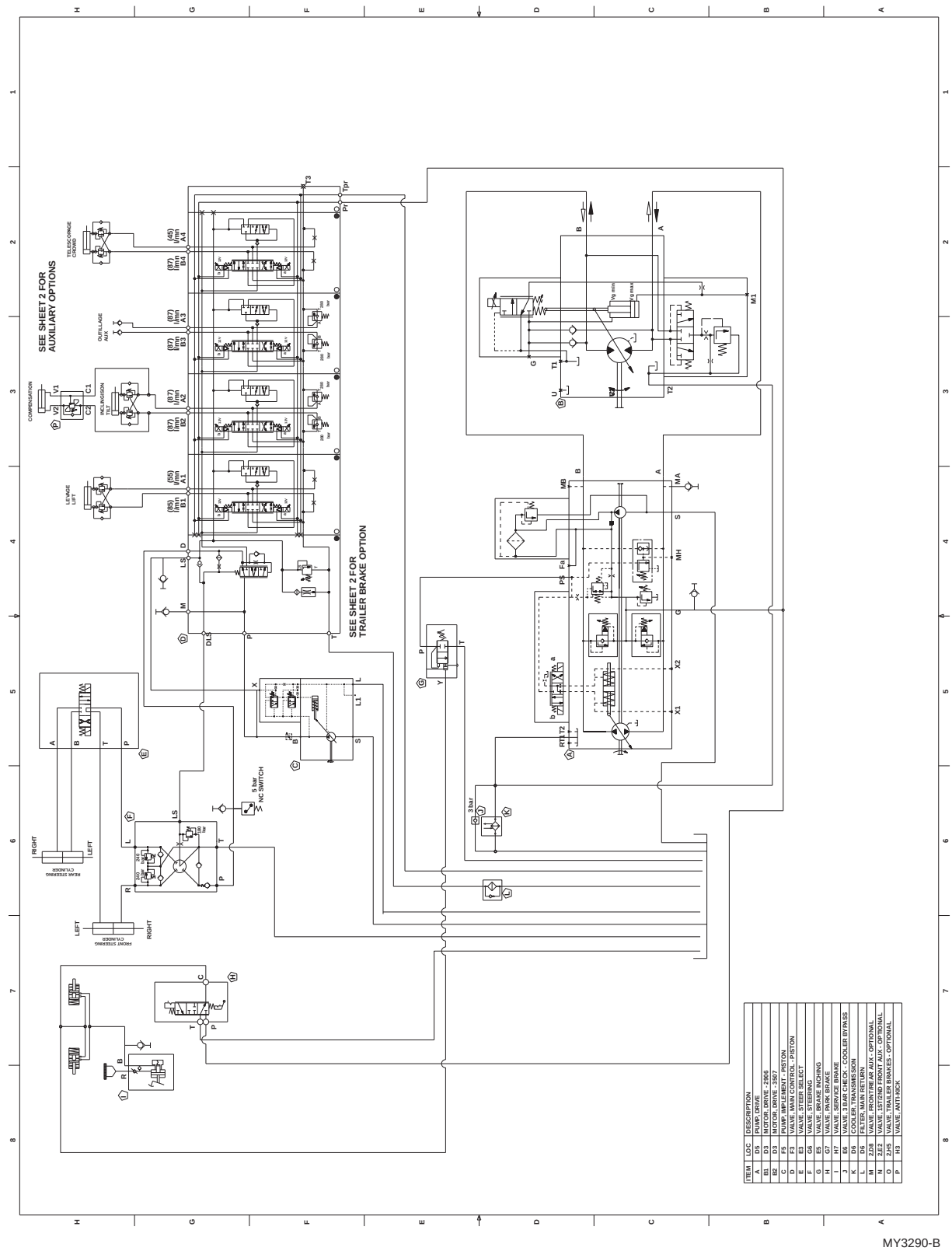
8.7.1 Gear Pump Schematic (Continued)

(Sheet 2)



8.7.2 Piston Pump Schematic

(Sheet 1)



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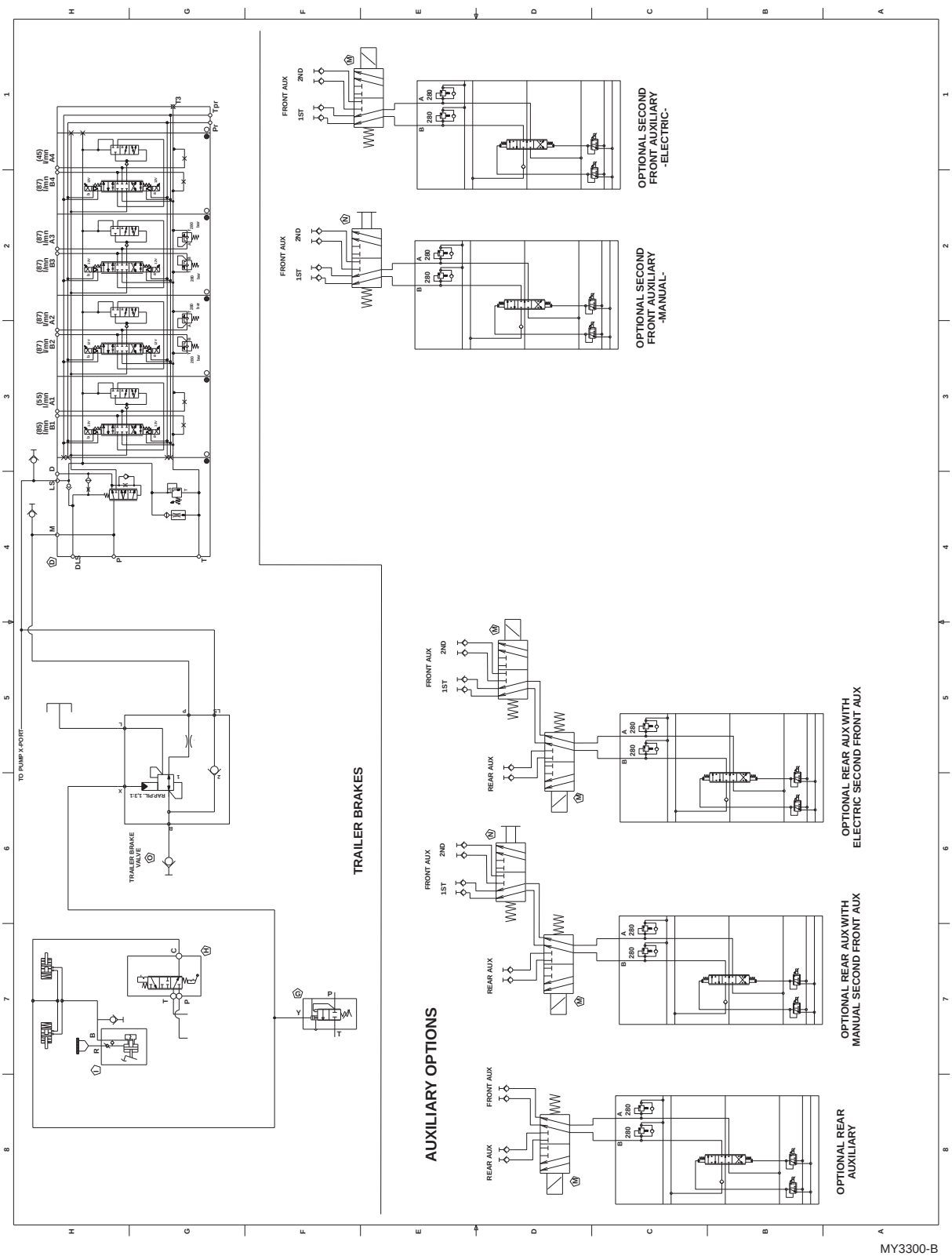
8.7.2 Piston Pump Schematic (Continued)

(Sheet 2)



8.8 HYDRAULIC RESERVOIR

The hydraulic reservoir and fuel tank are part of the frame. For this reason, neither tank can be removed. For cleaning instructions, see Section 7.7.2, “Fuel/Hydraulic Oil Tank.”

Occasionally, oil may seep, leak or be more forcefully expelled from the filter head when system pressure exceeds the rating of the filter head or filler cap. If the return filter becomes plugged, return hydraulic oil will bypass the filter when pressure reaches 1,5 bar (22 psi) and return to the reservoir unfiltered.

Carefully examine oil seepage or leaks from the hydraulic reservoir to determine the exact cause. Clean the reservoir and note where any seepage occurs.

Leaks from a cracked or damaged reservoir require that the reservoir be flushed completely with water and repaired by a certified welder using approved techniques. If these conditions cannot be met, the reservoir must be replaced in its entirety. Contact the local **JLG** dealer should reservoir welding be required.

8.8.1 Pressurized Hydraulic Oil Fill Cap

The fill cap will allow the hydraulic oil reservoir to pressurize to 0,14 bar (2 psi). Inspect the condition of the cap seal to maintain proper reservoir pressure.

8.8.2 Hydraulic Oil Reservoir Draining

1. Park the machine on a firm, level surface, fully retract the boom, support the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Remove the drain plug at the bottom of the hydraulic oil reservoir.
5. Transfer the used hydraulic oil into a suitable, covered container, and label as "Used Oil". Dispose of used oil at an approved recycling facility. Clean and reinstall the drain plug.
6. Wipe up any spilled hydraulic oil.

8.8.3 Hydraulic Oil Reservoir Filling

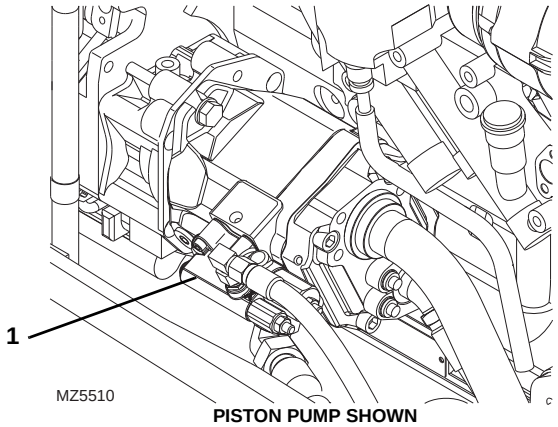
1. Be sure the reservoir is clean and free of all debris.
2. Install new hydraulic oil filters.
3. Fill the reservoir with hydraulic oil. Refer to Section 2.4, “Fluids, Lubricants and Capacities.”
4. Start the machine. Run engine to normal operating temperature. Operate all hydraulic functions.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

8.9 IMPLEMENT PUMP (PISTON OR GEAR)

8.9.1 Implement Pump Replacement

a. Implement Pump Removal

1. Park the machine on a firm, level surface, fully retract the boom, support the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery.
5. Drain the hydraulic oil reservoir. Refer to Section 8.8.2, “Hydraulic Oil Reservoir Draining.”



PISTON PUMP SHOWN

6. Thoroughly clean the pump (**1**) and surrounding area, including all hoses and fittings before proceeding.

7. Label, disconnect and cap all hydraulic hoses attached to the pump, cap all fittings and plug hoses to keep dirt and debris from entering the hydraulic system.
8. Remove the two bolts that hold the pump in place.

b. Implement Pump Installation

1. Position pump in the mounting position.

Note: *Use new o-rings where required. Never reuse o-rings.*

2. Apply Loctite® 243™ to the mounting bolts, secure the pump into place. Torque to 95 Nm (70 lb-ft).
3. Uncap and reconnect previously labeled hydraulic hoses to their proper locations.
4. Fill the hydraulic reservoir with clean, filtered hydraulic oil.
5. Prime the pump by filling the case drain port with fresh, filtered hydraulic oil from a clean container before installing the case drain connector and hose.
6. Check all routing of hoses and tubing for sharp bends or interference with any rotating members. All tube and hose clamps must be tight.
7. Properly connect the battery.
8. Start the engine and run at approximately one-third to one-half throttle for about one minute without moving the machine or operating any hydraulic functions.
9. Inspect for leaks and check all fluid levels.

Note: *Check for leaks and repair as required before continuing.*

10. Close and secure the engine cover.
11. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

c. Pump Test

1. Perform a flow meter test on the pump.
2. Check the system functions.

8.10 FRONT DRIVE MOTOR

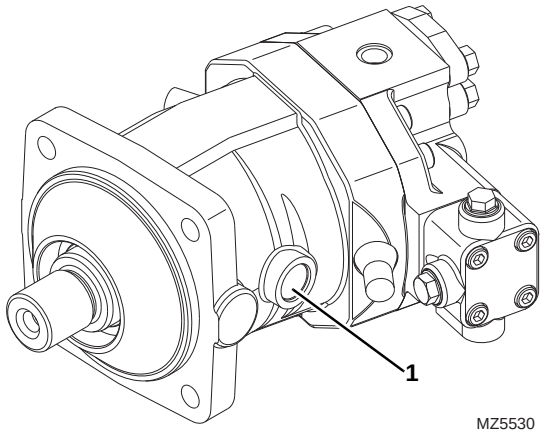
For internal service instructions and detailed specifications, contact the local **JLG** dealer for a copy of the Rexroth Drive Motor Repair Manual (P/N 31200123).

a. Front Drive Motor Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Drain the hydraulic reservoir or attach a vacuum adapter fitting to the reservoir fill tube to reduce oil spillage.
5. Label and disconnect all hydraulic hoses attached to the motor, cap all fittings and plug hoses to keep dirt and debris from entering hydraulic system.
6. Label and disconnect the electrical connection attached to the motor,
7. Support the motor and remove the four bolts attaching the motor to the front axle.

b. Front Drive Motor Installation

1. Install the motor onto the front axle. Torque the four bolts to 241 Nm (178 lb-ft). Use only new seals.
2. Uncap and reconnect the previously labeled hydraulic hoses to their appropriate locations.
3. Connect the electrical connection.

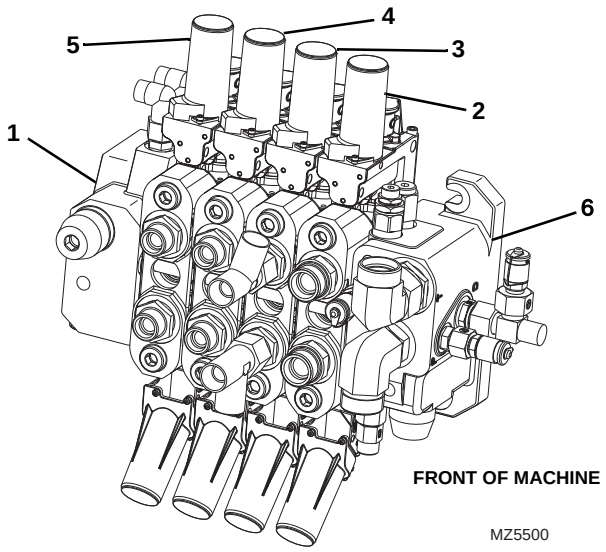


4. Fill the motor with hydraulic oil through the fill plug (**1**) before starting the machine.
5. Refill the hydraulic reservoir and inspect for leaks around the machine.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

8.11 CONTROL VALVES

8.11.1 Main Control Valve

The main control valve is mounted on the rear of the machine behind the rear access panel.



The main control valve assembly consists of various working sections with their own valve assemblies, each providing a specific hydraulic function. The section assemblies are the left-hand end cover (**1**), lift/lower (**2**), tilt (**3**), auxiliary (**4**), crowd (**5**) and right-hand end cover (**6**) sections.

a. Main Control Valve Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Remove the rear panel. Allow the hydraulic oil to cool.
4. Thoroughly clean the main control valve and surrounding area, including all hoses and fittings, before proceeding.
5. Place a suitable container to catch hydraulic oil drainage beneath the frame.
6. Label, disconnect and cap all the hydraulic hoses attached to the main control valve. Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.
7. Wipe up any hydraulic oil spillage in, on, near and around the machine and the work area.
8. Remove the four bolts securing the main control valve to the frame bracket.

b. Main Control Valve Disassembly

1. To disassemble the individual sections of the main control valve, remove the nuts from the end of the tie rods. Pull the tie rods out through the sections.
2. Disassemble each section assembly as required.

Some sections include a pre-adjusted relief valve that regulates pressure in a specific circuit.

NOTICE

DO NOT *adjust any of the relief valve assemblies! Tampering with a relief valve will irrevocably alter pressure in the affected circuit, requiring re calibration or a new relief valve.*

Disassemble each Valve Section

1. Carefully separate the end cover section from the lift/lower section.
2. Remove the o-rings from between the two sections.
3. Carefully separate each remaining section and remove all o-rings and seals.
4. Remove any plugs, check valves, compensator valves, anti-cavitation valves, shock valves or the rectangular hydraulic remote positioners from each individual valve section if equipped.
5. Keep all parts being removed from individual valve sections tagged and kept together.

c. Main Control Valve Parts Cleaning

Clean all components with a suitable cleaner, such as trichlorethylene, before continuing. Blow dry.

d. Main Control Valve Parts Inspection

Inspect all parts and internal passageways for wear, damage, etc. If inner surfaces of any component **DO NOT** display an ultra-smooth, polished finish, or are damaged in any way, replace the damaged part. Often, dirty hydraulic oil causes failure of internal seals, damage to the polished surfaces within the component, and wear of and/or harm to other parts.

e. Main Control Valve Assembly

Note: *ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

Assemble each Valve Section

1. Reassemble any plugs, check valves, compensator valves, anti-cavitation valves, shock valves or hydraulic remote positioners from individual valve sections if equipped.
2. Install the end covers onto Lift/Lower and Crowd sections.

Assemble the Main Control Valve

1. Place all three tie rods with the washers and nuts through the end main control valve section.
2. Stand the end main control valve section on end.
3. Install proper o-rings on the inner face of the end main control valve section. Align the Crowd section over the three tie rods and slide onto the end main control valve section.
4. Using proper o-rings and load sense shuttle, repeat step three for the remaining sections.
5. Install the washers and nuts on the tie rods and torque to 25 Nm (18.5 lb-ft).

f. Main Control Valve Installation

1. Loosely install the four main control valve mounting bolts through bracket on the rear of the machine.
2. Install the main control valve onto the bracket, aligning the bolts with the holes in the end sections of the main control valve. Slide the main control valve into position, and tighten the bolts.
3. Prime the main control valve by filling the inlet openings with fresh, filtered hydraulic oil from a clean container, before attaching the hoses.
4. Use new oiled o-rings as required. Uncap and reattach and secure all hoses, clamps, etc. to the main control valve.
5. Check the routing of all hoses, wiring and tubing for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required. Tighten all tube and hose clamps.
6. Start the engine and run at approximately one-third to one-half throttle for about one minute without moving the machine or operating any hydraulic functions.
7. Inspect for leaks and check the level of the hydraulic oil in the reservoir. Shut the engine OFF.
8. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
9. Install the rear panel.
10. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

g. Main Control Valve Test

Conduct a pressure check of the hydraulic system in its entirety. Adjust pressure(s) as required. Refer to Section 8.6.2, “Main Control Valve Pressure Checking.”

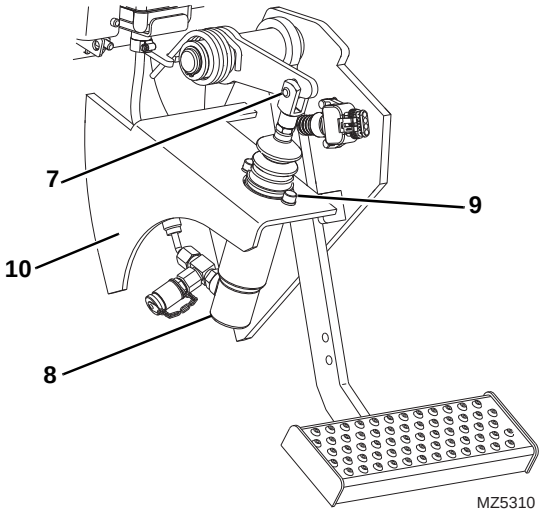
8.11.2 Service Brake Valve

The service brake valve is at the base of the steering column support, concealed by the lower dash cover.

The service brakes themselves are part of the front axle. Refer to Section 5, “Axles, Drive Shafts, Wheels and Tires,” for further information.

a. Service Brake Valve Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Remove the necessary dash panels.
5. Label, disconnect and cap the hydraulic hoses connected to the service brake valve. Cap all fittings and openings to keep dirt and debris from entering the brake system.



6. Remove the cotter key and pin (**7**) from the top of the brake valve (**8**).
7. Remove the bolts (**9**) that mount the service brake valve to the bracket support (**10**).

***Note:** **DO NOT** disassemble the service brake valve. The service brake valve is not serviceable and must be replaced in its entirety, if defective.*

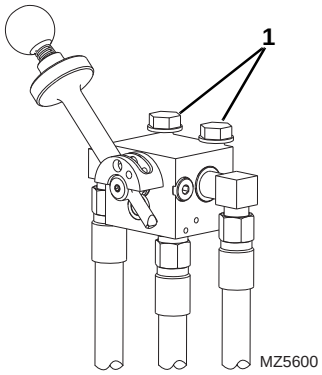
b. Service Brake Valve Installation

1. Install the service brake valve to the steering column support with the necessary hardware.

***Note:** ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

2. Use new oiled o-rings as required. Uncap and reconnect the previously labeled hydraulic hoses to the appropriate locations.
3. Check the routing of all hoses, and tubing for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required. Tighten all tube and hose clamps
4. Start the engine and run at approximately one-third to one-half throttle for about one minute, without moving the machine or operating any hydraulic functions.
5. Inspect the service brake valve and connections for leaks, and check the brake fluid level. Shut the engine OFF.
6. Replace the necessary dash panels.
7. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
8. Close and secure the engine cover.
9. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

8.11.3 Parking Brake



The park brake is secured with two capscrews and lockwashers (**1**) at the left side of the seat base.

a. Park Brake Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Loosen and remove the three bolts and washers holding the park brake valve cover. Remove the cover.
5. Label, disconnect and cap the hydraulic hoses on each side and bottom of the park brake valve. Disconnect and cap all hoses, fittings, etc.
6. Remove the two capscrews, and two lockwashers mounting the park brake valve to the left side of the seat base.

***Note:** **DO NOT** disassemble the park brake valve. The park brake valve is not serviceable and must be replaced in its entirety, if defective.*

b. Park Brake Valve Installation

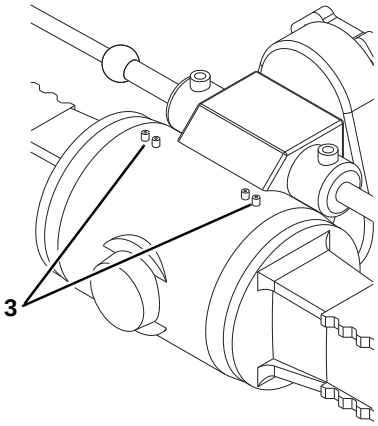
1. Install the park brake valve with the two lockwashers and two capscrews to mount the park brake valve to the left side of the seat base.

Note: *ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

2. Use new oiled o-rings as required. Uncap, reattach and secure the three hoses.
3. Check the routing of all hoses for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required.
4. Start the engine and run at approximately one-third to one-half throttle for about one minute, without moving the machine or operating any hydraulic functions.
5. Inspect the park brake valve and connections for leaks, and check the level of the hydraulic oil in the reservoir. Shut the engine OFF.
6. Replace the brake valve cover.
7. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
8. Close and secure the engine cover.
9. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

Note: *The park brake valve circuit will need to be bled after installation. Refer to Section 8.11.4, "Brake Test."*

8.11.4 Brake Test



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Carefully bleed the brake lines as soon as the brake valve is installed in the machine. Air in the system will not allow the brakes to apply properly. There are four brake bleeder locations (**3**) on the front axle. The outside bleeders are used for the park brake circuit. The inside bleeders are used for the service brake circuit. Work with an assistant to perform this procedure.

1. Place the transmission control lever in (N) NEUTRAL, engage the park brake, and start the engine.
2. Remove the plastic cap from the brake bleeder. Attach one end of a length of transparent tubing over the brake bleeder. Place the other end of this tubing in a suitable transparent container that is partially filled with hydraulic oil. The end of the tubing must be below the oil level in the container.
3. **DO NOT** open the brake bleeder without holding the tubing firmly on the bleeder. There is pressure at the brakes. Carefully open the bleeder with a 12 mm wrench. Have an assistant depress the brake pedal. Close the brake bleeder when air bubbles no longer appear in the oil. Release the brake pedal. Remove the tubing from the brake bleeder.
4. Repeat steps 2 and 3 for the remaining brake bleeder.
5. If bleeding the service brake circuit, install a vacuum pump on the brake reservoir and remove the remainder of the trapped air from the brake system.
6. Check brake fluid level and add fluid if necessary. Refer to Section 2.4, "Fluids, Lubricants and Capacities."
7. Conduct a pressure and function check of the brake.

c. Park Brake Valve Installation

1. Install the park brake valve with the two lockwashers and two capscrews to the cover.

Note: *ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

2. Use new oiled o-rings as required. Uncap, reattach and secure the three hoses.
3. Check the routing of all hoses for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required.
4. Start the engine and run at approximately one-third to one-half throttle for about one minute, without moving the machine or operating any hydraulic functions.
5. Inspect the park brake valve and connections for leaks, and check the level of the hydraulic oil in the reservoir. Shut the engine OFF.
6. Install the park brake/cover with the four capscrews.
7. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.

8. Close and secure the engine cover.
9. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

d. Parking Brake Valve Test.

1. Start the machine and engage the shift lever to the forward position. Slowly depress the throttle to mid idle. The parking brake will not allow the machine to move.
2. If further troubleshooting is required, refer to the Section 8.7, “Hydraulic Schematic,” or Section 9.9, “Electrical System Schematics.”

8.11.5 Steering Orbitrol Valve

Refer to Section 4.4.2, “Steering Column/Valve Replacement,” for details.

8.11.6 Steer Select Valve

The steer select valve is attached to inside the frame near the front drive motor.

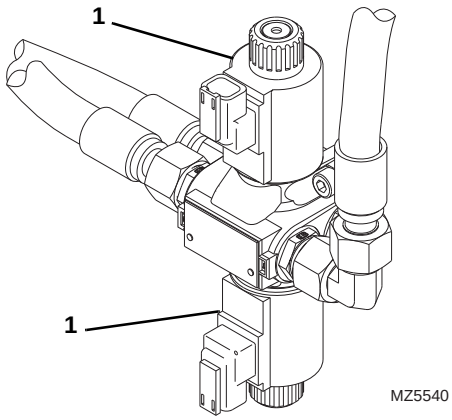
Verify the correct operation of the steer select valve solenoids before considering replacement of the valve. The housing of the steer select valve is not serviceable and must be replaced if defective.

a. Steer Select Manifold and Valve Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Label or otherwise mark the hydraulic hoses in relation to the steer select manifold. Disconnect and cap all hoses, fittings, solenoid wire terminal leads, etc.
5. Remove the capscrews that attach the manifold to the frame.
6. Remove the steer select manifold with attached steer select valve from the machine. Wipe up any hydraulic oil spillage in, on, near and around the machine.

b. Steer Select Valve and Manifold Disassembly, Cleaning, Inspection and Assembly

1. Place the steer select assembly on a suitable work surface.
2. Separate the steer select valve from the manifold by removing the capscrews. Discard the old o-rings.



3. Remove the solenoid valves and cartridges (**1**) from the steer select housing.
4. Clean all components with a suitable cleaner before inspection.
5. Inspect the solenoid cartridges for proper operation. Check by shifting the spool to ensure that it is functioning properly. Check that the spring is intact. Inspect the cartridge interior for contamination.
6. Inspect internal passageways of the steer select manifold and valve for wear, damage, etc. If inner surfaces of the manifold **DO NOT** display an ultra-smooth, polished finish, or components are damaged in any way, replace the manifold or appropriate part. Often, dirty hydraulic oil causes failure of internal seals and damage to the polished surfaces within the unit.

Note: *ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

7. Install the solenoid valves and cartridges in the steer select housing.
8. Attach the steer select valve to the manifold using new, oiled o-rings and socket head capscrews.

c. Steer Select Manifold and Valve Installation

1. Attach the steer select manifold and valve to the mounting plate on the frame using the socket head capscrews.

2. Connect the hydraulic hoses, fittings, solenoid wire terminal leads, etc., to the steer select valve and manifold.
3. Check the routing of all hoses, wiring and tubing for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required. Tighten all tube and hose clamps.
4. Start the engine and run at approximately 1/3-1/2 throttle for about one minute, without moving the machine or operating any hydraulic functions.
5. Inspect for leaks and check the level of the hydraulic oil in the reservoir. Shut the engine OFF.

Note: *Check for leaks and repair as required before continuing. Add hydraulic oil to the reservoir as needed.*

6. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

d. Steering Test

1. Start the machine and select either the 4-wheel steer or the crab steer mode.
2. Turn the steering wheel until the left rear wheel is aligned with the side of the frame.
3. Select the 2-wheel steer mode and turn the steering wheel until the left front wheel is aligned with the frame.
4. With the wheel now aligned, select the desired steer mode.
5. If further troubleshooting is required, refer to Section 8.6.6, “Steering Pressure Checking,” Section 8.7, “Hydraulic Schematic,” or Section 9.9, “Electrical System Schematics.”

8.11.7 Inching Valve

The inching valve is attached at the front of the frame directly above the steer select valve.

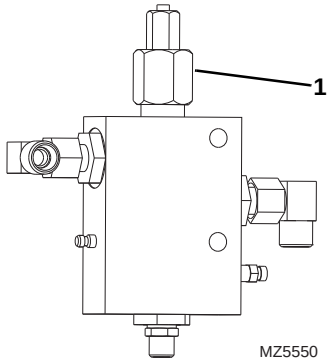
Verify the correct operation of the inching valve before considering replacement of the valve. The housing of the inching valve is not serviceable and must be replaced if defective.

a. Inching Valve Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Label or otherwise mark the hydraulic hoses in relation to the inching valve. Disconnect and cap all hoses, fittings, etc.
5. Remove the capscrews that attach the valve to the frame.
6. Remove the inching valve from the machine. Wipe up any hydraulic oil spillage in, on, near and around the machine.

b. Inching Valve Disassembly, Cleaning, Inspection and Assembly

1. Place the inching valve assembly on a suitable work surface.



2. Remove the cartridge (**1**) from the inching valve housing.
3. Clean all components with a suitable cleaner before inspection.
4. Inspect the cartridge for proper operation. Check by shifting the spool to ensure that it is functioning properly. Check that the spring is intact. Inspect the cartridge interior for contamination.
5. Inspect internal passageways of the inching valve for wear, damage, etc. If inner surfaces of the manifold **DO NOT** display an ultra-smooth, polished finish, or components are damaged in any way, replace the manifold or appropriate part. Often, dirty hydraulic oil causes failure of internal seals and damage to the polished surfaces within the unit.

Note: *ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

6. Install the cartridge in the inching valve housing.

c. Inching Valve Installation

1. Attach the inching valve to the mounting plate on the frame using the socket head capscrews.
2. Connect the hydraulic hoses, fittings, etc., to the inching valve.
3. Check the routing of all hoses and wiring for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required. Tighten all hose clamps.
4. Start the engine and run at approximately 1/3-1/2 throttle for about one minute, without moving the machine or operating any hydraulic functions.
5. Inspect for leaks and check the level of the hydraulic oil in the reservoir. Shut the engine OFF.

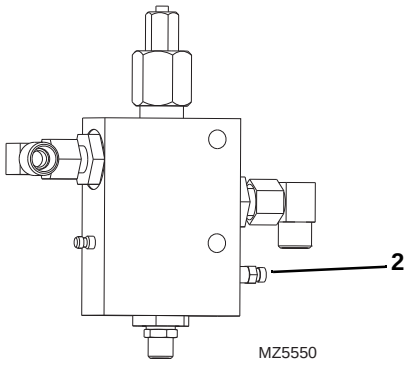
Note: *Check for leaks and repair as required before continuing. Add hydraulic oil to the reservoir as needed.*

6. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

d. Inching Valve Bleeding Procedure

Carefully bleed the inching valve as soon as the inching valve is installed on the machine. Air in the system will not allow the brakes to apply properly. There is one bleeder location on the inching valve. Work with an assistant to perform this procedure.

1. Place the transmission control lever in (N) NEUTRAL, engage the park brake, start the engine and lower the boom. Turn off engine.



2. Remove the plastic cap (**2**) from the inching brake bleeder. Attach one end of a length of transparent tubing over the bleeder. Place the other end of this tubing in a suitable transparent container that is partially filled with hydraulic oil. The end of the tubing must be below the oil level in the container.
3. **DO NOT** open the bleeder without holding the tubing firmly on the bleeder. Have an assistant depress the brake pedal. Carefully open the bleeder with a 10 mm wrench. Close the bleeder when air bubbles no longer appear in the oil. Release the brake pedal. Remove the tubing from the bleeder.
4. If brake system bleeding is required, refer to Section 8.11.2, “Service Brake Valve.”
5. Check brake fluid level and add fluid if necessary. Refer to Section 2.4, “Fluids, Lubricants and Capacities.”

e. Inching Test

1. Start the machine, engage the shift lever to the forward position and release the parking brake. Slowly depress the throttle to 1/2 throttle. Slowly apply the service brake. The machine will slow, but still maintain forward movement. Continuing to depress the service brake will disengage the drive pump and engage the service brakes.
2. If further troubleshooting is required, refer to Section 8.7, “Hydraulic Schematic.”

8.11.8 Anti-Kick Valve

The anti-kick valve is attached at the left rear of the frame directly in front of the main control valve.

Verify the correct operation of the anti-kick valve before considering replacement of the valve. The anti-kick valve must be replaced if defective.

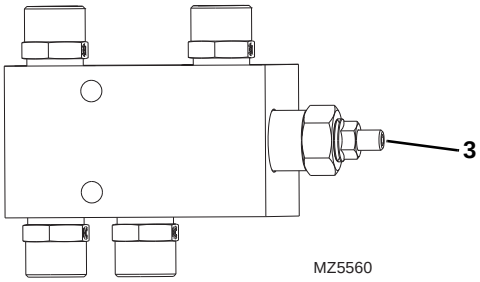
a. Anti-Kick Valve Removal

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the system fluids to cool.
4. Label or otherwise mark the hydraulic hoses in relation to the anti-kick valve. Disconnect and cap all hoses, fittings, etc.
5. Remove the capscrews that attach the valve to the frame.

6. Remove the anti-kick valve from the machine. Wipe up any hydraulic oil spillage in, on, near and around the machine.

b. Anti-Kick Back Disassembly, Cleaning, Inspection and Assembly

1. Place the anti-kick valve assembly on a suitable work surface.



2. Label and remove the relief cartridge (**3**) from the anti-kick valve housing.
3. Clean all components with a suitable cleaner before inspection.

Note: *ALWAYS replace seals, o-rings, gaskets, etc., with new parts to help ensure proper sealing and operation. Lubricate seals and o-rings with clean hydraulic oil.*

4. Install the previously labeled fittings in the anti-kick valve housing.

c. Anti-Kick Back Valve Installation

1. Attach the anti-kick valve to the mounting plate on the frame using the socket head capscrews.
2. Connect the hydraulic hoses, fittings, etc., to the anti-kick valve.
3. Check the routing of all hoses for sharp bends or interference with any rotating members, and install tie wraps and/or protective conduit as required. Tighten all hose clamps.
4. Start the engine and run at approximately 1/3-1/2 throttle for about one minute, without moving the machine or operating any hydraulic functions.
5. Inspect for leaks and check the level of the hydraulic oil in the reservoir. Shut the engine OFF.

Note: *Check for leaks and repair as required before continuing. Add hydraulic oil to the reservoir as needed.*

6. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

d. Anti-Kick Back Test

1. If further troubleshooting is required, refer to Section 8.7, “Hydraulic Schematic.”

8.12 HYDRAULIC CYLINDERS

8.12.1 General Cylinder Removal Instructions

1. Park the machine on a firm, level surface, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Chock the wheels.
3. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
4. Open the engine cover. Allow the system fluids to cool.
5. Label, disconnect and cap hydraulic hoses in relation to the cylinder.
6. Attach a suitable sling to an appropriate lifting device and to the cylinder. Make sure the device used can actually support the cylinder.
7. Remove the lock bolt and/or any retaining clips securing the cylinder pins. Remove the cylinder pins.
8. Remove the cylinder.
9. Wipe up any hydraulic oil spillage in, on, near or around the machine.

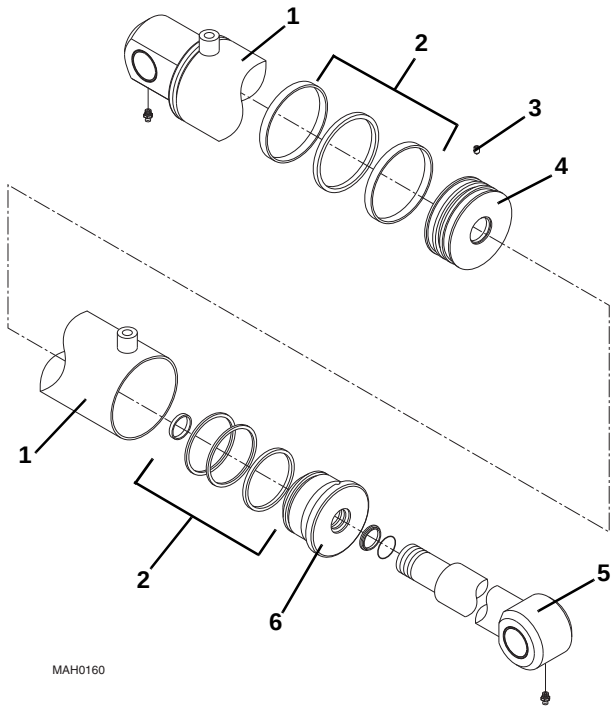
8.12.2 General Cylinder Disassembly

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

NOTICE

Avoid using excessive force when clamping the cylinder in a vise. Apply only enough force to hold the cylinder securely. Excessive force can damage the cylinder tube.

3. If applicable, remove the counterbalance valve from the side of the cylinder barrel.



NOTICE

DO NOT *tamper with or attempt to adjust the counterbalance valve cartridge. If adjustment is necessary, replace the counterbalance valve with a new part.*

4. Extend the rod (**5**) to allow access to the base of the cylinder.

NOTICE

Protect the finish on the rod at all times. Damage to the surface of the rod can cause seal failure.

5. Using a pin spanner wrench, unscrew the head gland (**6**) from the barrel (**1**). A considerable amount of force will be necessary to remove the head gland. Carefully slide the head gland down along the rod toward the rod eye end, away from the cylinder barrel.

NOTICE

When sliding the rod and piston assembly out of the tube, prevent the threaded end of the tube from damaging the piston. Keep the rod centered within the tube to help prevent binding.

6. Carefully pull the rod assembly along with the head gland out of the cylinder barrel.
7. Fasten the rod end in a soft-jawed vise, and put a padded support under and near the threaded end of the rod to help prevent damage to the rod.
8. Remove the set screw (**3**) from the piston (**4**).

Note: *It may be necessary to apply heat to break the bond of the sealant between the piston and the rod before the piston can be removed.*

Some cylinder parts are sealed with a special organic sealant and locking compound. Before attempting to disassemble these parts, remove any accessible seals from the area of the bonded parts. Wipe off any hydraulic oil, then heat the part(s) uniformly to break the bond. A temperature of 149-204° C (300-400° F) will destroy the bond. Avoid overheating, or the parts may become distorted or damaged. Apply sufficient torque for removal while the parts are still hot. The sealant often leaves a white, powdery residue on threads and other parts, which must be removed by brushing with a soft brass wire brush prior to reassembly.

9. Remove the piston head (**4**) from the rod (**5**) and carefully slide the head gland (**6**) off the end of the rod.
10. Remove all seals, back-up rings and o-rings (**2**) from the piston head and all seals, back-up rings and o-rings from the head gland.

Note: *The head gland bearing will need to be inspected to determine if replacement is necessary.*

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

8.12.3 Cylinder Cleaning Instructions

1. Discard all seals, back-up rings and o-rings. Replace with new items from complete seal kits to help ensure proper cylinder function.
2. Clean all metal parts with an approved cleaning solvent such as trichlorethylene. Carefully clean cavities, grooves, threads, etc.

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

8.12.4 Cylinder Inspection

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

8.12.5 General Cylinder Assembly

1. Use the proper tools for specific installation tasks. Clean tools are required for assembly.
2. Install new seals, back-up rings and o-rings (**2**) on the piston (**4**) and the head gland (**6**).

Note: *The Crowd cylinder has a spacer that MUST be installed over the rod AFTER the head gland and BEFORE the piston head.*

3. Fasten the rod eye in a soft-jawed vise, and place a padded support under and near the threaded end of the rod (**5**) to prevent any damage to the rod.

NOTICE

Protect the finish on the rod at all times. Damage to the surface of the rod can cause seal failure.

4. Lubricate and slide the head gland (**6**) over the cylinder rod (**5**). Install the piston head (**4**) on to the end of the cylinder rod. Loctite® 243™ and install the set screw (**3**) in the piston head. Refer to Section 8.12.8, “Hydraulic Cylinder Torque Specifications,” for tightening guidelines for the piston head and the set screw.

NOTICE

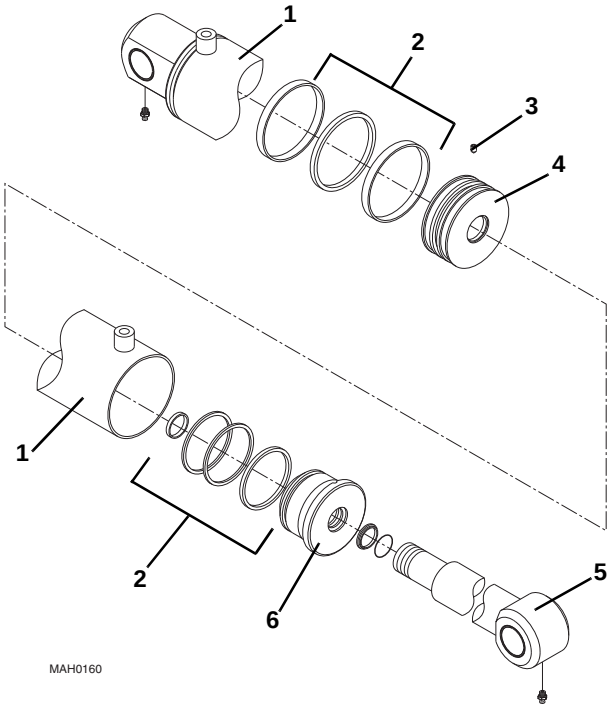
Avoid using excessive force when clamping the cylinder barrel in a vise. Apply only enough force to hold the cylinder barrel securely. Excessive force can damage the cylinder barrel.

5. Place the cylinder barrel (**1**) in a soft-jawed vise or other acceptable holding equipment if possible.

NOTICE

When sliding the rod and piston assembly into the cylinder barrel, prevent the threaded end of the cylinder barrel from damaging the piston head. Keep the cylinder rod centered within the barrel to prevent binding.

6. Carefully insert the cylinder rod assembly into the tube.
7. Screw the head gland (**6**) into the cylinder barrel (**1**) and tighten with a spanner wrench. Refer to Section 8.12.8, “Hydraulic Cylinder Torque Specifications,” for tightening guidelines for the head gland.
8. If applicable, thread the new counterbalance valve into the block on the cylinder barrel.



8.12.6 General Cylinder Installation

1. Grease the bushings at the ends of the hydraulic cylinder. Using an appropriate sling, lift the cylinder into it’s mounting position.
2. Align cylinder bushing and install pin, lock bolt or retaining clip.
3. Uncap and connect the hydraulic hoses in relation to the labels or markings made during removal.
4. Before starting the machine, check the level of the hydraulic oil reservoir and if necessary, fill to full mark with hydraulic oil.
5. Start the machine and run at low idle for about one minute. Slowly activate hydraulic cylinder function in both directions allowing cylinder to fill with hydraulic oil.
6. Inspect for leaks and check level of hydraulic oil in reservoir. Add hydraulic oil if needed.
7. If no leaks are present, operate the hydraulic function at least twenty times at full throttle to bleed any air from the cylinder and hoses.

Note: *To bleed air from the tilt cylinder, operate the tilt function along with the lift cylinder as described above. More operation cycles may be required to clear all air from the system.*

8. Wipe up any hydraulic oil spillage in, on, near and around the machine, work area and tools.
9. Close and secure the engine cover.
10. Remove the Do Not Operate Tags from both the ignition key switch and the steering wheel.

8.12.7 Steering Cylinders

The steering cylinders are attached to each axle center housing. Detailed axle service instructions are provided in the following manuals:

L2906H, 2906H, 29.6 & 619A

Carraro Front Axle Repair Manual (P/N 31200634)
Carraro Rear Axle Repair Manual (P/N 31200635)

3507H, 35.7 & 723A

Carraro Front Axle Repair Manual (P/N 31200636)
Carraro Rear Axle Repair Manual (P/N 31200637)

8.12.8 Hydraulic Cylinder Torque Specifications

Description	L2906H, 2906H, 29.6 & 619A	3507H, 35.7 & 723A
All Cylinder Set Screws	20-25 Nm (15-18 lb-ft)	20-25 Nm (15-18 lb-ft)
Lift/Lower Cylinder		
Head Gland	500-550 Nm (369-406 lb-ft)	700-750 Nm (516-553 lb-ft)
Piston	2160-2210 Nm (1593-1630 lb-ft)	2630-2680 Nm (1940-1977 lb-ft)
Extend/Retract Cylinder		
Head Gland	300-350 Nm (221-258 lb-ft)	300-350 Nm (221-258 lb-ft)
Piston	550-600 Nm (406-443 lb-ft)	550-600 Nm (406-443 lb-ft)
Tilt Cylinder		
Head Gland	400-450 Nm (295-332 lb-ft)	700-750 Nm (516-553 lb-ft)
Piston	1285-1335 Nm (948-985 lb-ft)	2630-2680 Nm (1940-1977 lb-ft)
Compensating Cylinder		
Head Gland	400-450 Nm (295-332 lb-ft)	400-450 Nm (295-332 lb-ft)
Piston	1115-1165 Nm (822-859 lb-ft)	115-1165 Nm (822-859 lb- ft)

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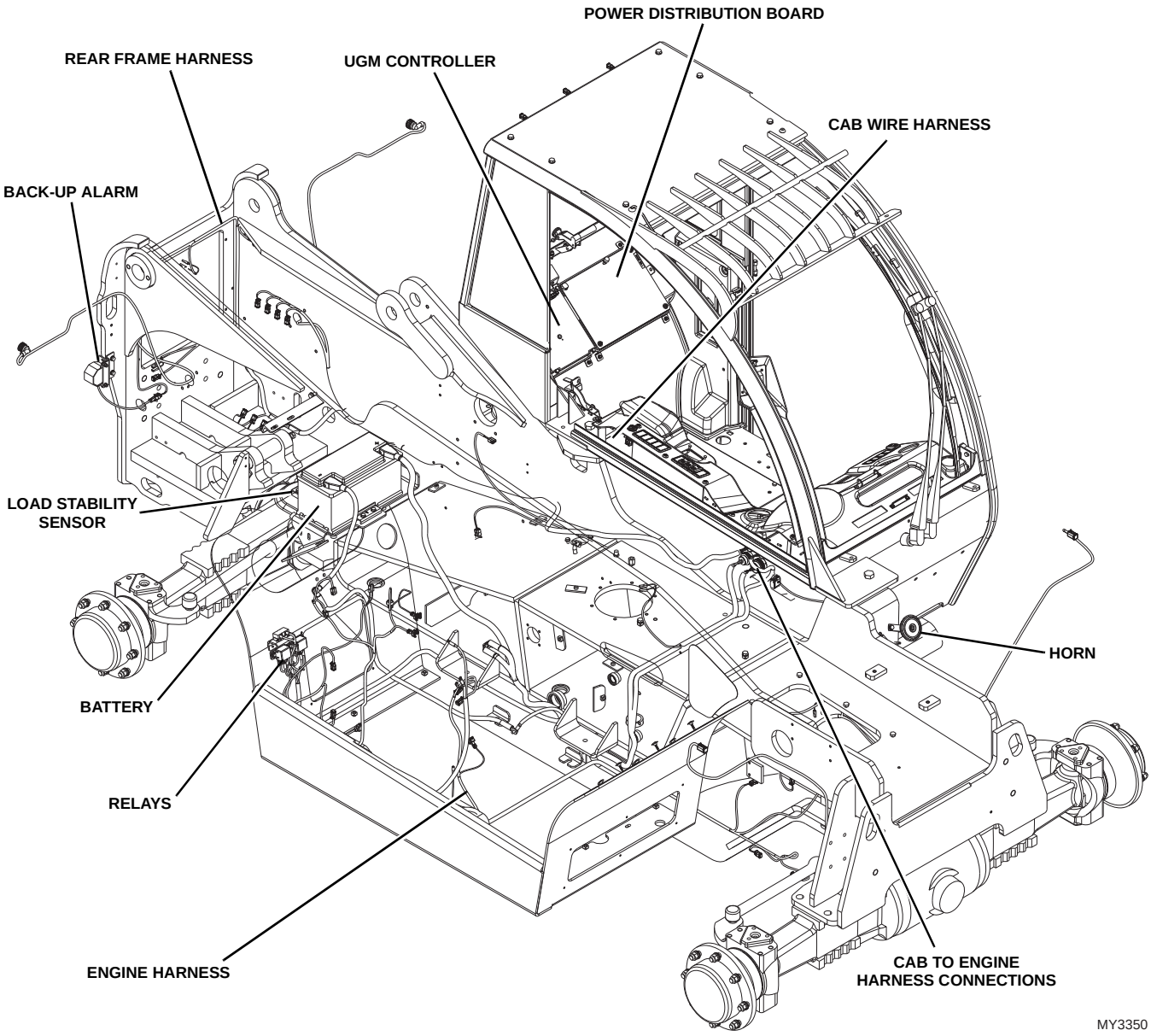
Section 9
Electrical System

Contents

9.1 ELECTRICAL COMPONENT TERMINOLOGY

To understand the safety, operation, and service information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the electrical components of the machine. The following illustration identifies the components that are referred to throughout this section.



9.2 SPECIFICATIONS

Electrical system specifications are listed in Section 2.3, “Specifications.”

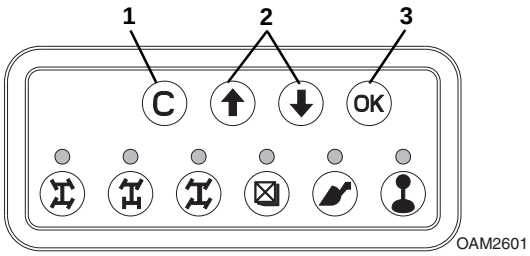
9.3 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in Section 1, “Safety Practices,” of this manual.

9.4 KEYPAD AND DISPLAY SCREEN

9.4.1 Keypad



Depress the C and OK buttons on the keypad to access the menu.

1. C (Clear or Escape): Use in conjunction with display screen. Returns user interface one level during navigation. If at top of the menu, depress and hold for one second to exit.
2. Up/Down Arrows: Use in conjunction with display screen. Navigate menu selections and change adjustable values.
3. OK (Enter): Use in conjunction with display screen. Confirms user interface inputs.

9.4.2 Display Screen

The display screen is located in the center of the instrument panel and can display the following information with activation of the menu screen.

a. Help - Displays active fault code. Depress OK button again and use keypad arrows to cycle through the last 25 fault codes. Active fault codes are denoted with an asterisk. Refer to Section 9.18.2, “Fault Code Table,” for the complete list of codes.

b. Operator Tools - Speed, Temperature and Oil Pressure units, Steer Change Mode and Tires can be modified by the operator. Customer or Service level access code is required to modify additional items.
   - Machine Speed - Select Units (km/h or m/h) to be displayed.
   - Engine Temperature - Select units (Celsius or Fahrenheit) to be displayed.
   - Steering Alignment Mode - Select mode (manual, rear wheel assisted or all wheel assisted, if equipped) to be used when changing steering mode.
   - Tires - Select tire size installed on machine.

c. Personalities - View performance parameters, Customer or Service level access code required to modify parameters.

d. Access Level - Code entry determines access level.
   - Operator (Level 3) - No code required.
   - Customer (Level 2) - Refer to Section 9.5, “Software Level 2 Accessibility.”
   - Service (Level 1) - Manufacturer service representative only.

e. Diagnostics - View diagnostic information.

f. System Test - Performs test of all system inputs and outputs.

g. Machine Setup - View machine configurations. Service level access code required to modify configurations.

h. Calibrations - Customer or Service level access code required.

9.5 SOFTWARE LEVEL 2 ACCESSIBILITY

The following parameters can be altered in the 2nd level of access to the machine's software.

Refer to Section 9.17.2, "Analyzer Software - Version 3.5,"for detailed software information.

9.5.1 Operator Tools

Function	Description
Change Anti Theft Code	Allows the owner to change the Anti Theft Code
Perform Hardware Exchange	Allows the owner to restore machine data (anti theft code, engine hours, machine personalities, etc.) in the event that the machine controller or display/cluster gauge has been replaced
Confirm Machine Service	Allows the owner to turn off the Service Required Warning lamp when service is performed
Review Service History	Allows the owner to see the last 15 times the Service Required Warning lamp was reset
Set Service Interval	Allows the owner to modify the default service interval of 100 hours
Cabin Joystick Telescope: X-Axis/ Roller	Allows the owner to change/swap operation of the joystick Telescope and Fork Tilt functions.

9.5.2 Personalities

Function	Description	Default Value
Main Lift	Allows the owner to adjust the Max Lift Up & Max Lift Down function speeds	1400 mA
Soft Lift	Allows the owner to adjust the derate value when the boom enters the soft lift zone	40%
Telescope	Allows the owner to adjust the Max Tele In & Max Tele Out function speeds	1450 mA (out) 1350 mA (in)
Fork Tilt	Allows the owner to adjust the Max Fork Tilt Up & Max Fork Tilt Down function speeds	1350 mA (up) 1450 mA (down)
Aux. Function	Allows the owner to adjust the Accel, Decel, and Max Function A & Max Function B function speeds	1550 mA
Aux. Momentary	Allows the owner to adjust the Max Momentary Aux A & Max Momentary Aux B function speeds	1100 mA
Bucket Mode	Allows the owner to adjust the Max Bucket Up & Max Bucket Down function speeds	65 mA

9.5.3 Calibrations

Function	Description
Boom Angle	Allows the owner to calibrate the boom angle sensor if it is replaced. Refer to Section 9.14.10, "Boom Angle Sensor."

9.6 OPERATOR TOOLS

9.6.1 Resetting the Anti theft Code

To reset the anti theft code:

1. Turn the engine to the ON position.
2. Press the "C" and "OK" buttons on the dash simultaneously to enter the analyzer mode.
3. Scroll to "Access Level Code". Enter the code "33271" to go into access level 2.
4. Scroll to and select the "Operator Tools" screen.
5. Scroll to and select the "Change Anti Theft Code" screen.
6. Enter the current anti theft code.

Note: *If a machine does not have an anti theft code set, the default code is "00000".*

7. Enter the new code.

9.6.2 Hardware Exchange

After the replacement of either the display or UGM (Controller) the machine software will indicate a Hardware Exchange fault. To correct this fault:

1. Turn the engine to the ON position.
2. Press the "C" and "OK" buttons on the dash simultaneously to enter the analyzer mode.
3. Scroll to "Access Level Code". Enter the code "33271" to go into access level 2.
4. Scroll to and select the "Operator Tools" screen.
5. Scroll to and select the "Perform Hardware Exchange" screen.
6. Scroll to and select the proper screen for hardware exchange. The screen will show either "DISPLAY -> UGM" or "UGM -> DISPLAY". The new component should be listed second.

9.6.3 Confirm Machine Service

To log the machine service into the software:

1. Turn the engine to the ON position.
2. Press the "C" and "OK" buttons on the dash simultaneously to enter the analyzer mode.
3. Scroll to "Access Level Code". Enter the code "33271" to go into access level 2.
4. Scroll to and select the "Operator Tools" screen.
5. Scroll to and select the "Confirm Machine Service" screen.
6. If service is complete, press ENTER for YES. Otherwise, press ESC for NO.

9.6.4 Review Service History

To view the last 15 machine service instances:

1. Turn the engine to the ON position.
2. Press the "C" and "OK" buttons on the dash simultaneously to enter the analyzer mode.
3. Scroll to "Access Level Code". Enter the code "33271" to go into access level 2.
4. Scroll to and select the "Operator Tools" screen.
5. Scroll to and select the "Review Service History" screen.
6. Scroll through the screens to view the last 15 times the machine was serviced.

9.6.5 Set Service Interval

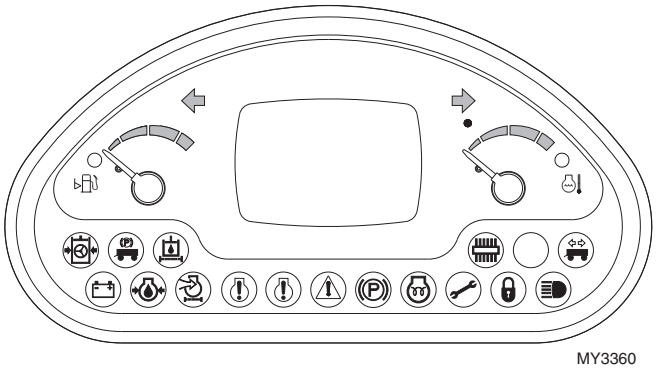
To set the machine recommended service interval:

1. Turn the engine to the ON position.
2. Press the "C" and "OK" buttons on the dash simultaneously to enter the analyzer mode.
3. Scroll to "Access Level Code". Enter the code "33271" to go into access level 2.
4. Scroll to and select the "Operator Tools" screen.
5. Scroll to and select the "Set Service Interval" screen.
6. Enter a new service interval.Cabin Joystick Telescope: X-Axis/Roller

To change the joystick telescope function on the joystick:

1. Turn the engine to the ON position.
2. Press the "C" and "OK" buttons on the dash simultaneously to enter the analyzer mode.
3. Scroll to "Access Level Code". Enter the code "33271" to go into access level 2.
4. Scroll to and select the "Operator Tools" screen.
5. Scroll to and select the "Cabin Joystick Telescope" screen.
6. Select either X-AXIS or ROLLER.

9.7 INSTRUMENT PANEL



a. Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Remove the instrument panel from the dash. The instrument panel is held in place with clips.
6. Slide the instrument panel out of the operator console.
7. Disconnect the wiring harnesses.

NOTICE

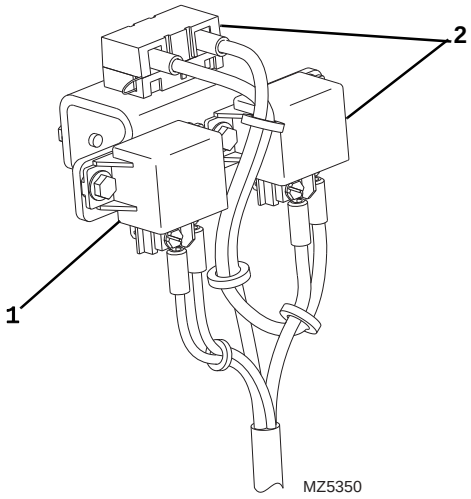
Static electricity can cause damage to the operator's instrument cluster. Avoid any manner of touching (hands, tools, etc.) the printed circuit boards and terminals. Disconnect the battery negative (-) cable at its battery terminal before beginning this procedure. Failure to comply can result in damage to the operator's instrument cluster and malfunction of the instruments and indicator lights.

b. Installation

1. Connect the instrument panel wiring harnesses.
2. Position the instrument panel in the operator console.
3. Secure the instrument panel to the dash.
4. Properly connect the battery.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

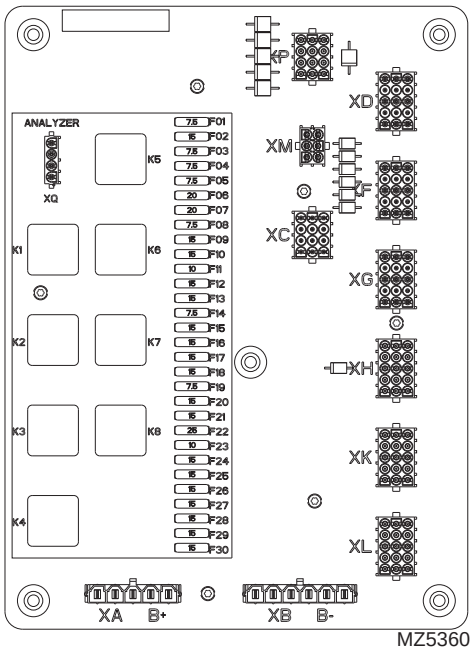
9.8 FUSES AND RELAYS

9.8.1 Engine Compartment Relays and Fuses



There are three relays located on the frame, below the battery. The relays control the starter (**1**) and engine preheat (**2**).

9.8.2 Power Distribution Module



MZ5360

Fuse/Relay	Function	Amp Rating
F01	Right Headlight Low	7.5
F02	Rear Wiper	15
F03	Right Headlight High	7.5
F04	Left Headlight Low	7.5
F05	Left Headlight High	7.5
F06	Fan	20
F07	Front Wiper	25
F08	A/C	7.5
F09	Key 2	15
F10	Key 1	15
F11	Radio	10
F12	Lights Bat 1	15
F13	Lights Bat 2	15
F14	Left Marker Lights	7.5
F15	Boom Worklights	15
F16	Brake Lights	15
F17	Front Worklights	15
F18	Flasher	15
F19	Right Marker Lights	7.5

Fuse/Relay	Function	Amp Rating
F20	Beacon	15
F21	Rear Worklights	15
F22	Controller	25
F23	Display/Joystick	10
F24	Fuel	15
F25	Socket	15
F26	Seat	15
F27	Key Bat	15
F28	Spare Bat	15
F29	Shift/Steer	15
F30	Spare Key	15
K1	Reverse Travel	
K2	1/2 Aux	
K3	Flasher	
K4	Ignition Power 1	
K5	Ignition Power 2	
K6	Work Lights	
K7	Ignition Power 3	
K8	Fuel	

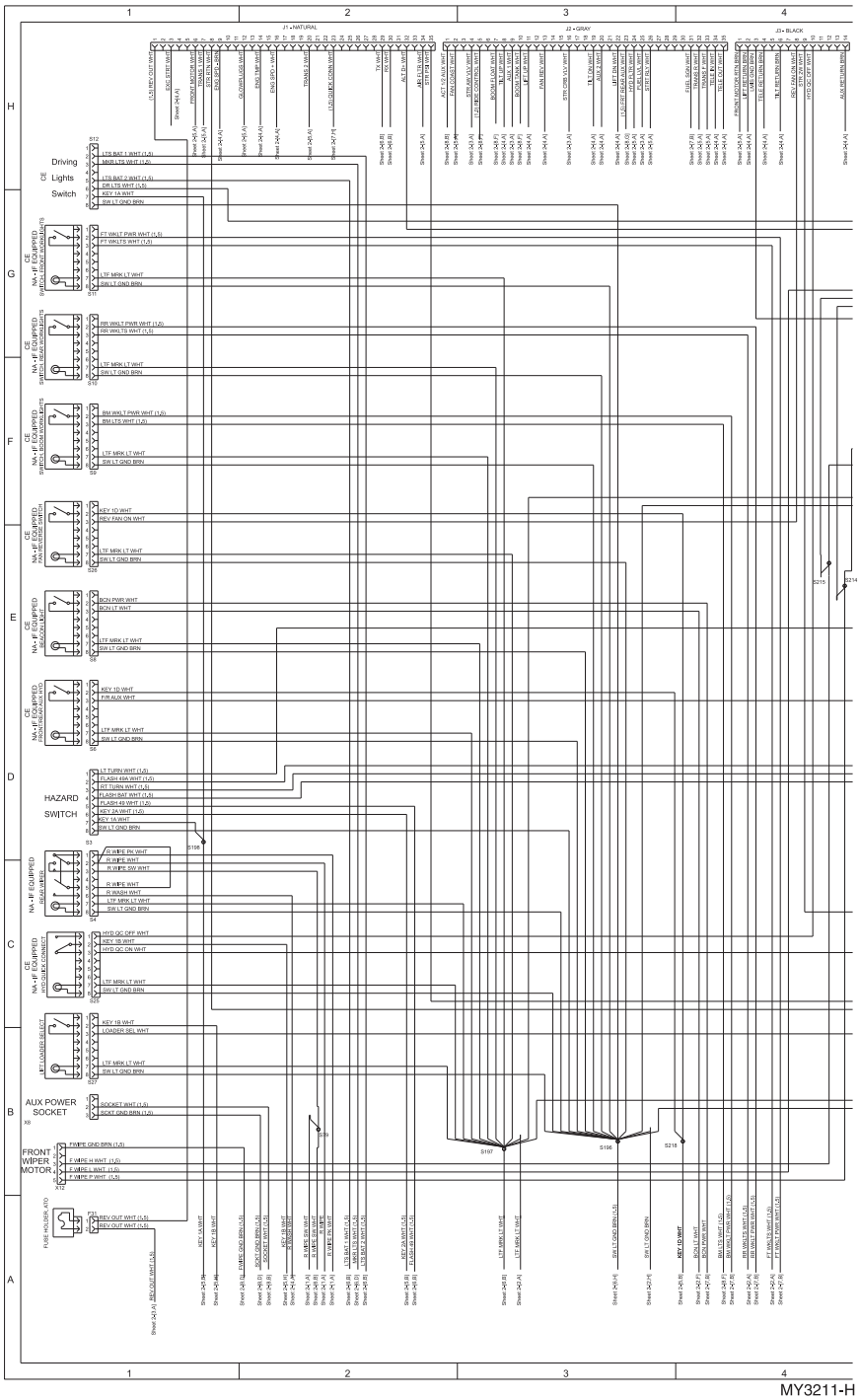
9.9 ELECTRICAL SYSTEM SCHEMATICS

For more detailed schematics, contact your local authorized service distributor.

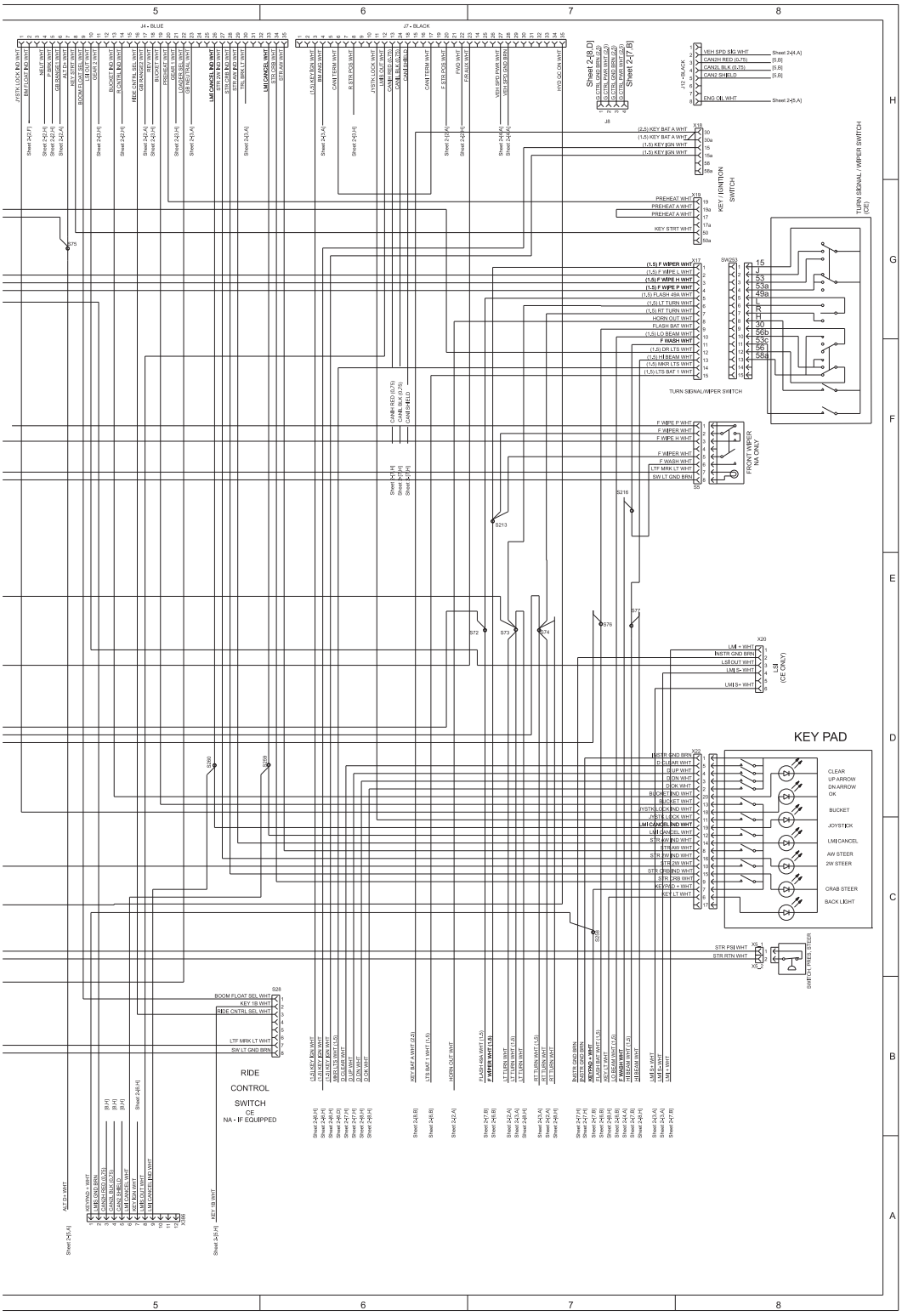
9.9.1 Cab Harness Electrical Schematic 1 of 2

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 2)

Note: *Sheet 1 of 7 not included in electrical schematic intentionally.*

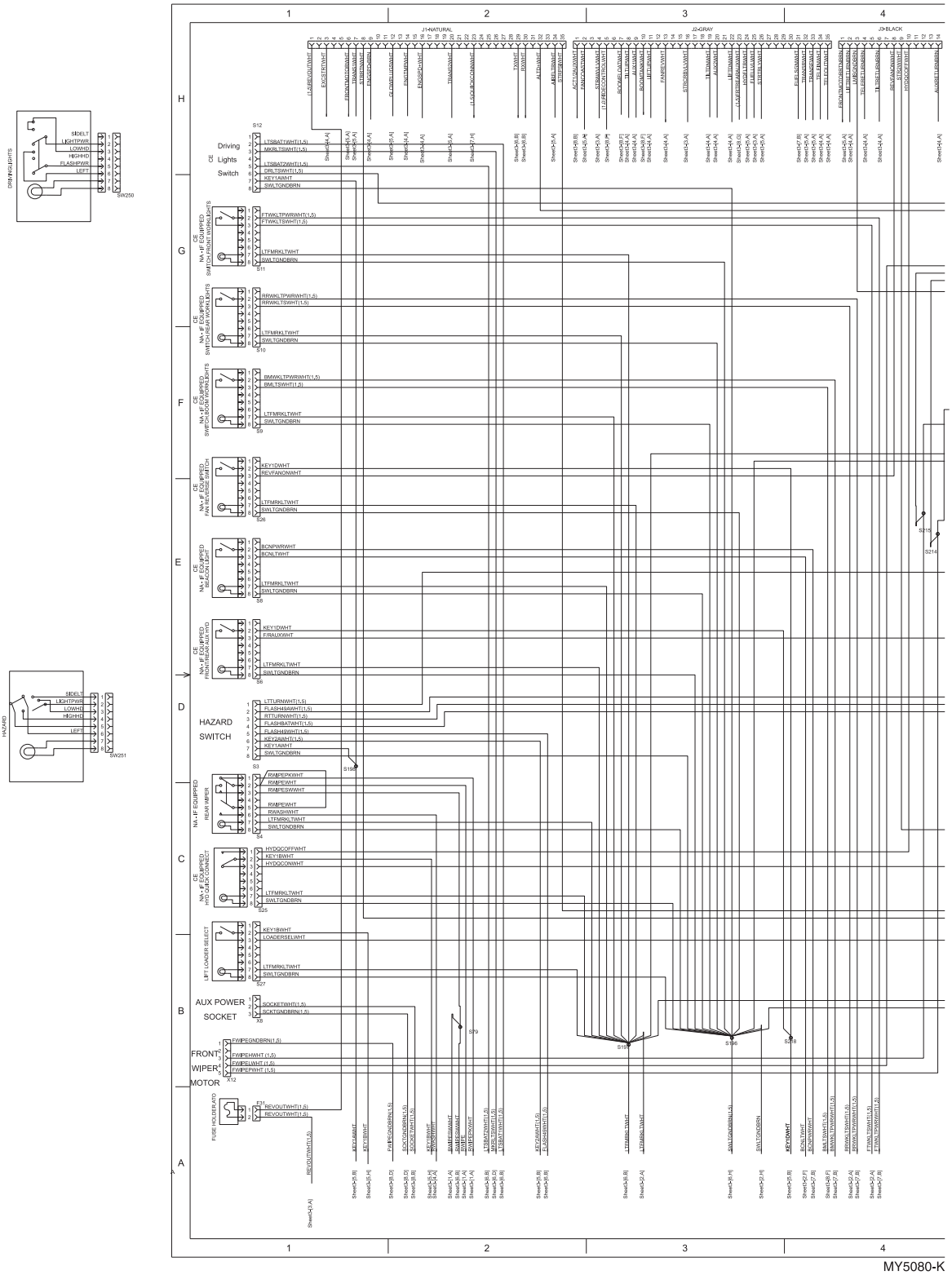


Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 2 - Continued)

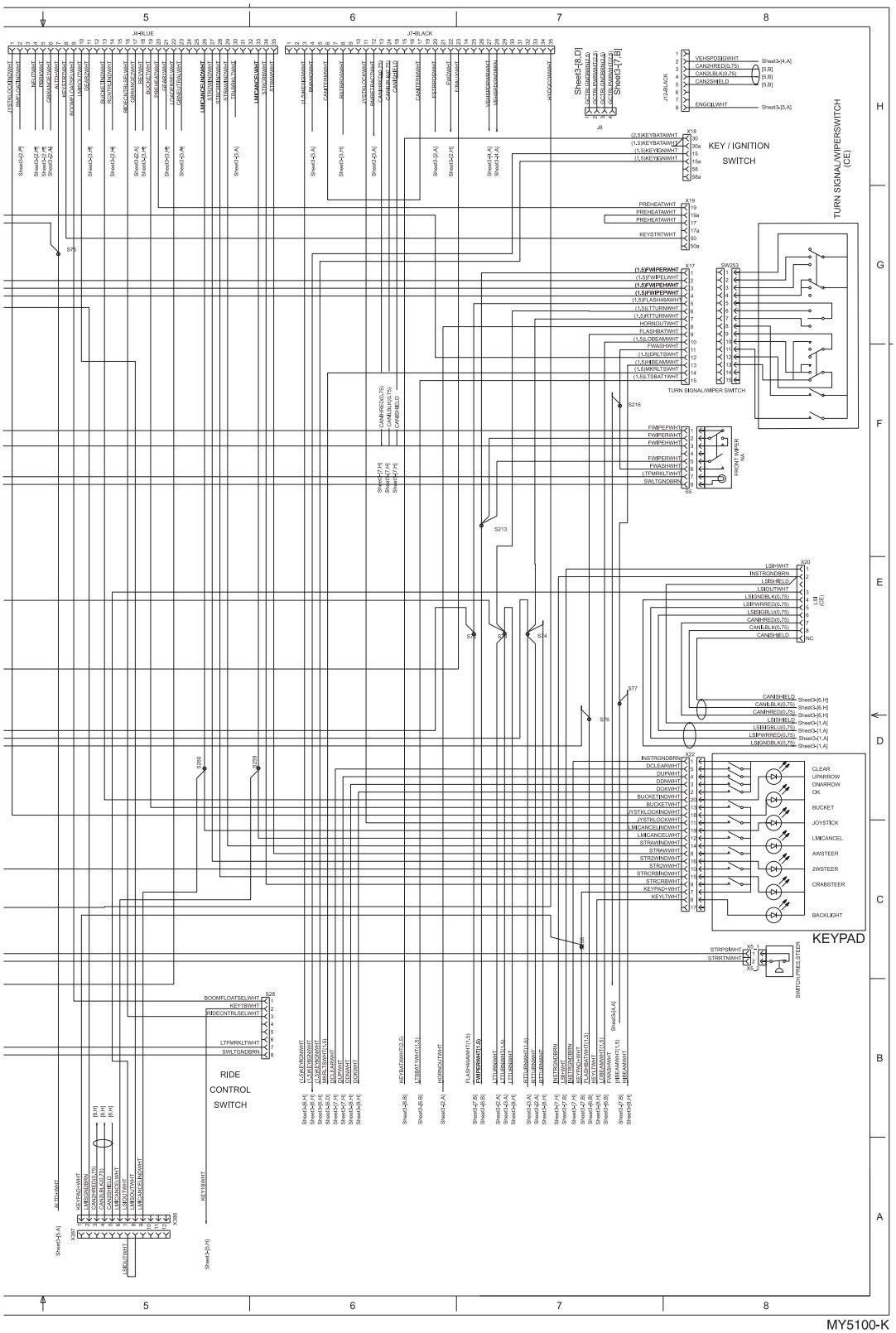


S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 2)

Note: *Sheet 1 of 7 not included in electrical schematic intentionally.*

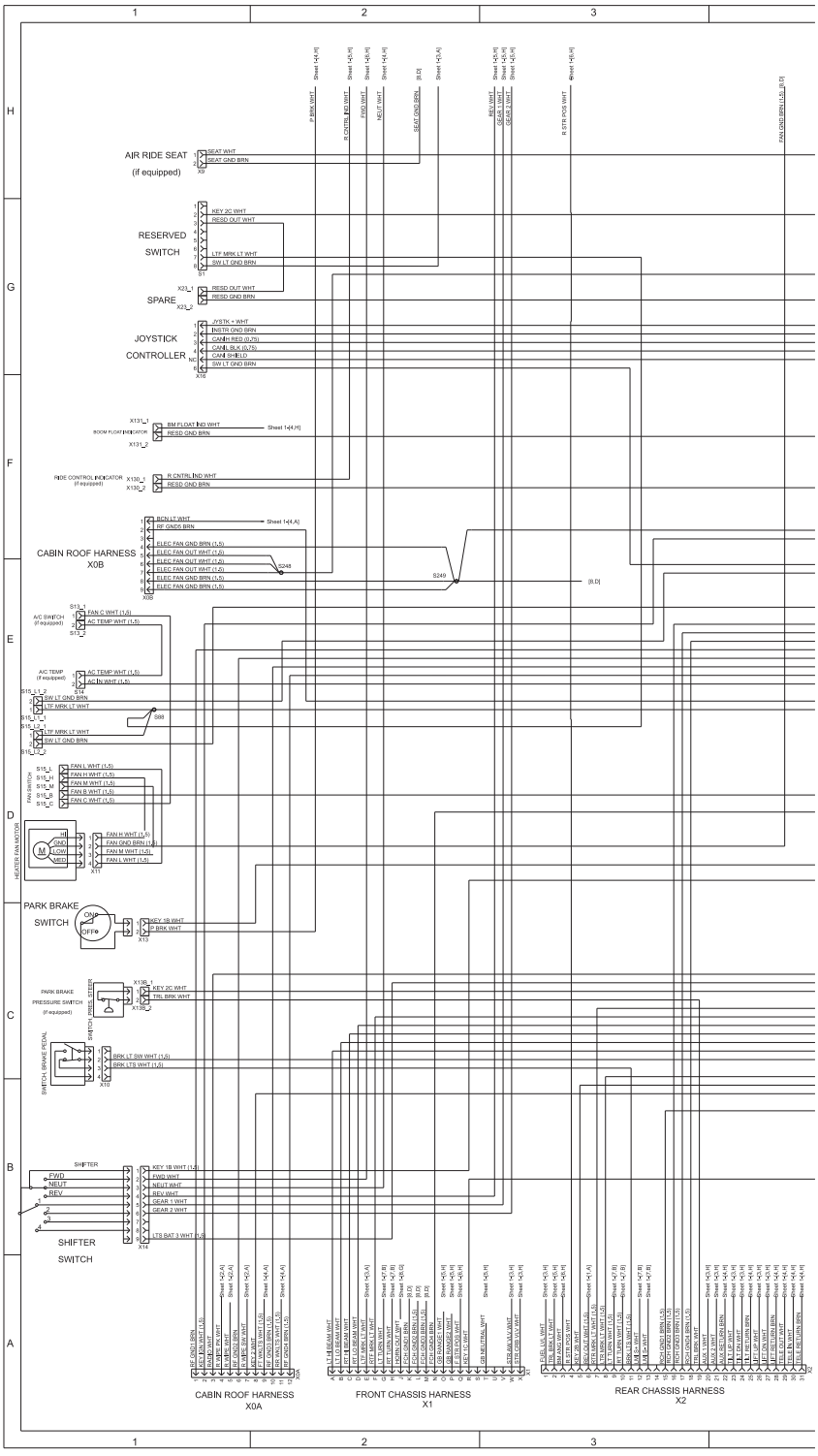


S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 2 - Continued)



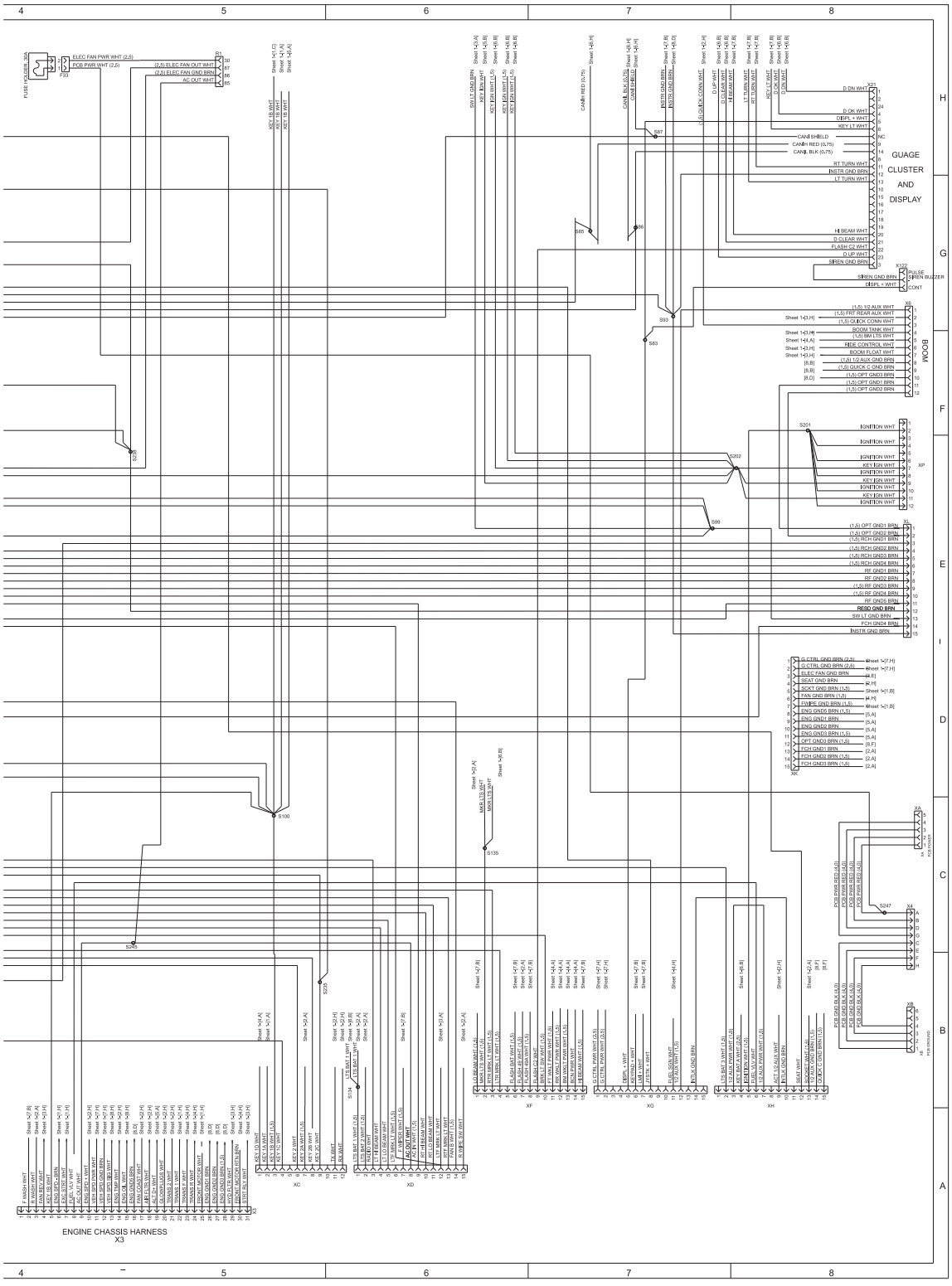
9.9.2 Cab Harness Electrical Schematic 2 of 2

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 3)

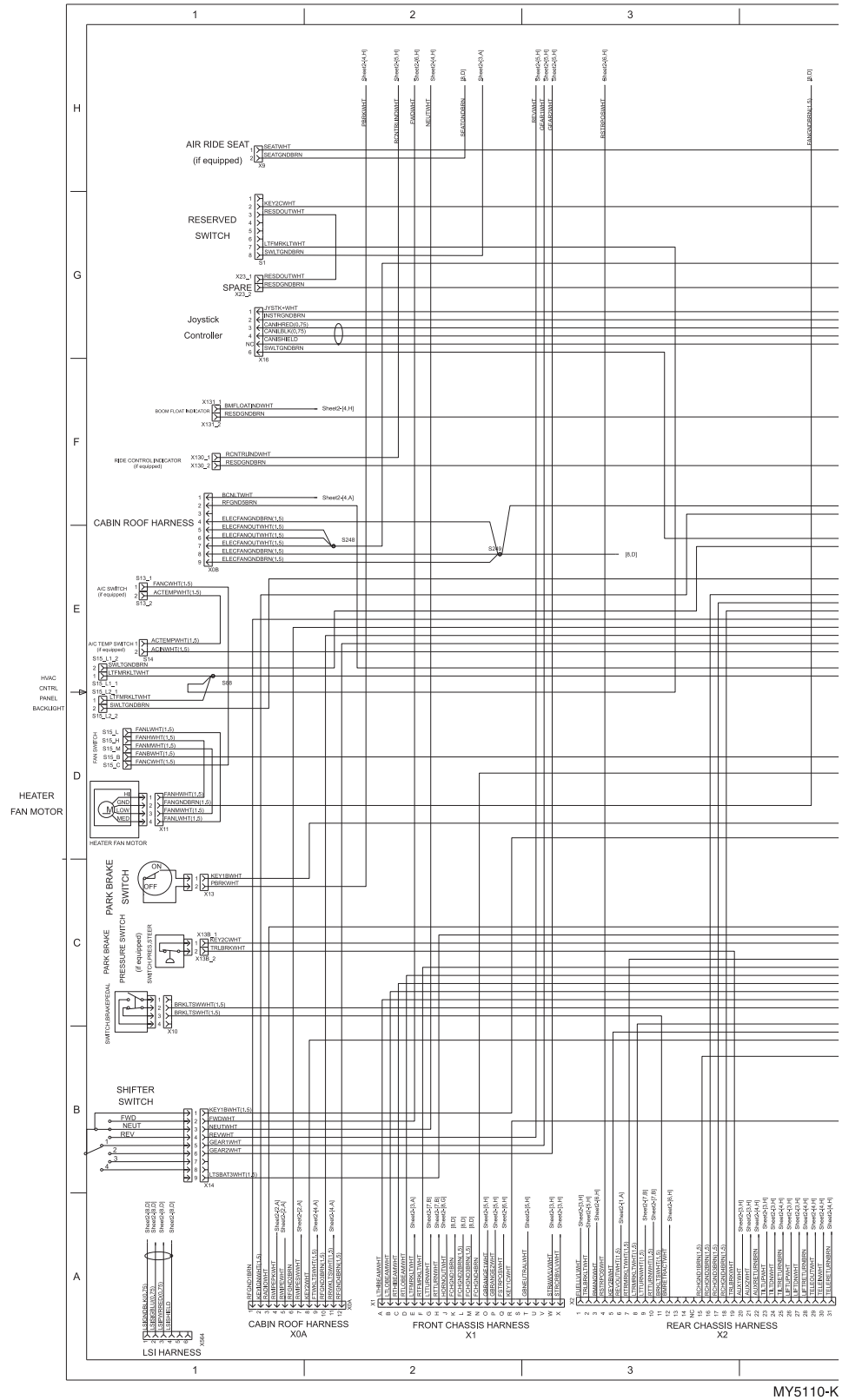


MY3221-H

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 3 - Continued)

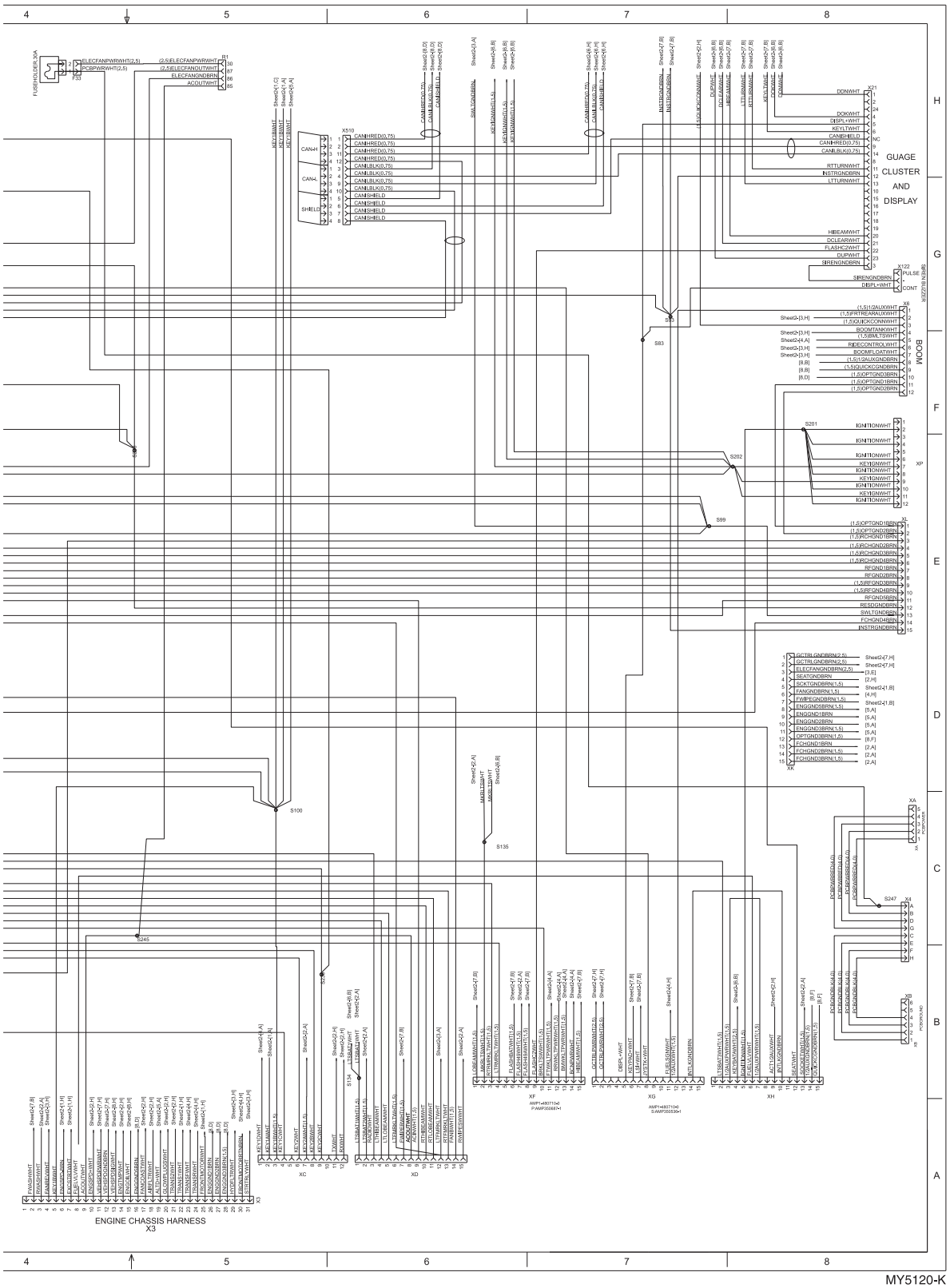


S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 3)



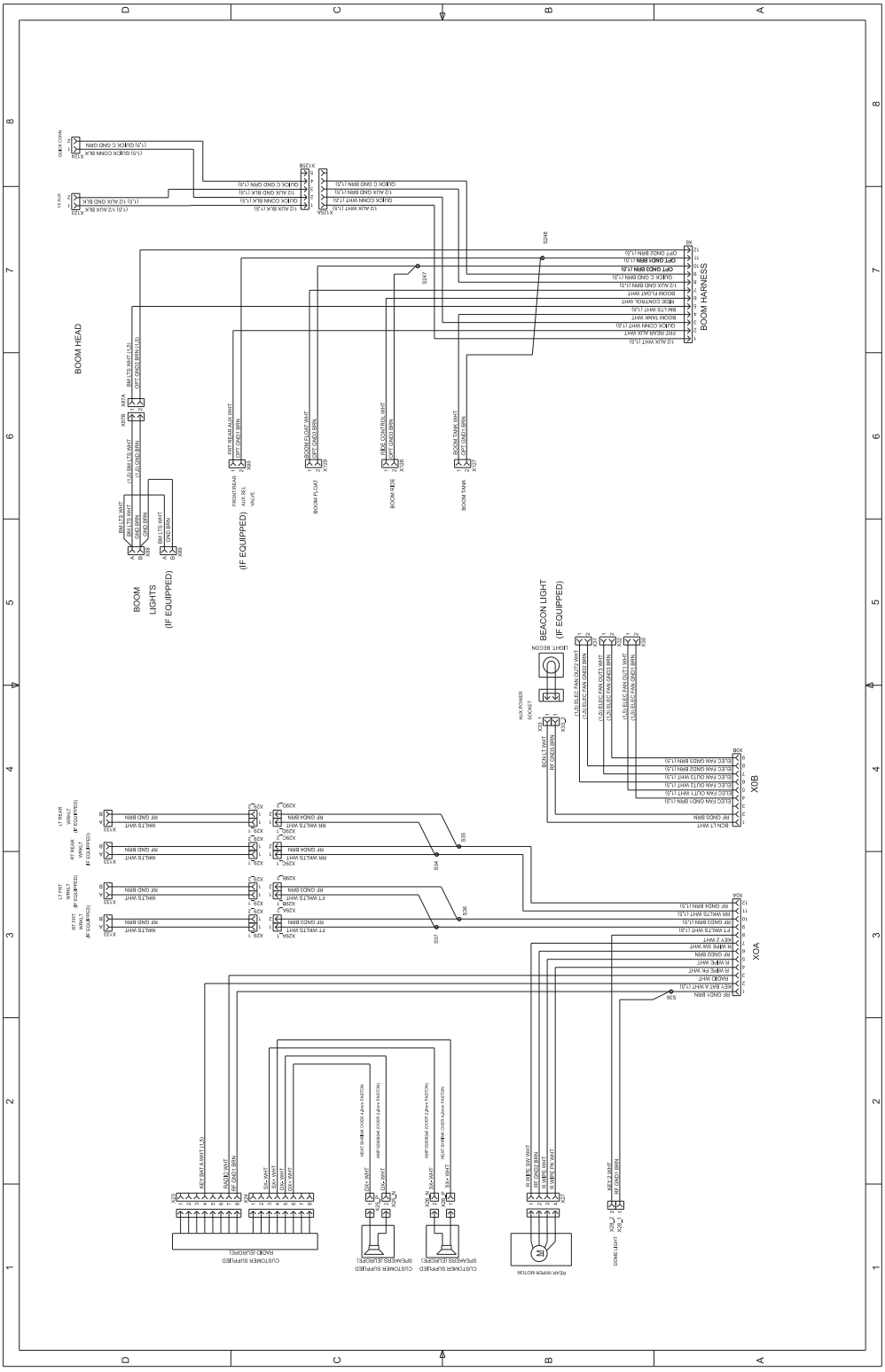
MY5110-K

S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 3 - Continued)



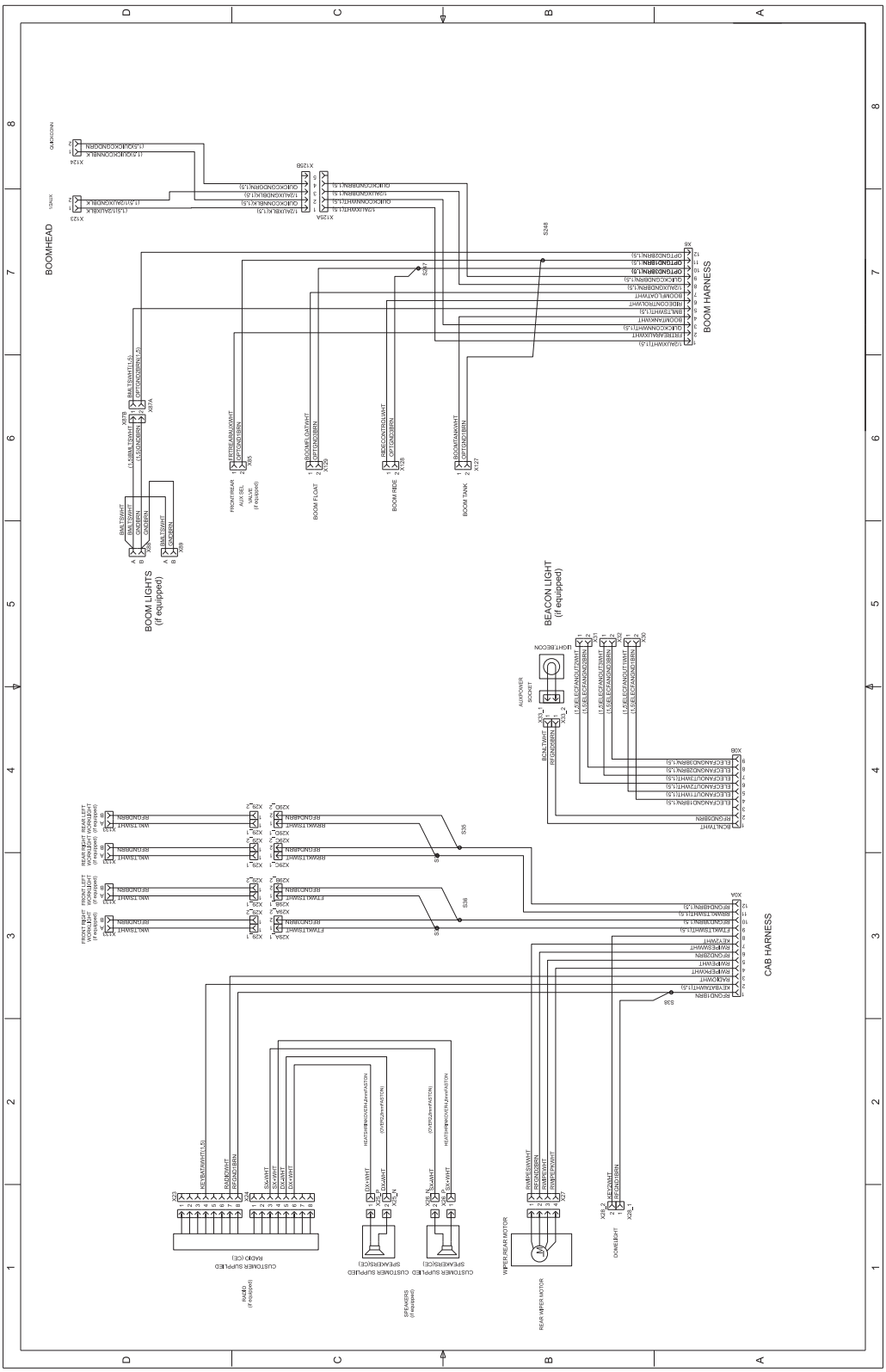
9.9.3 Cab Roof and Boom Schematic

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 4)



MY3230-H

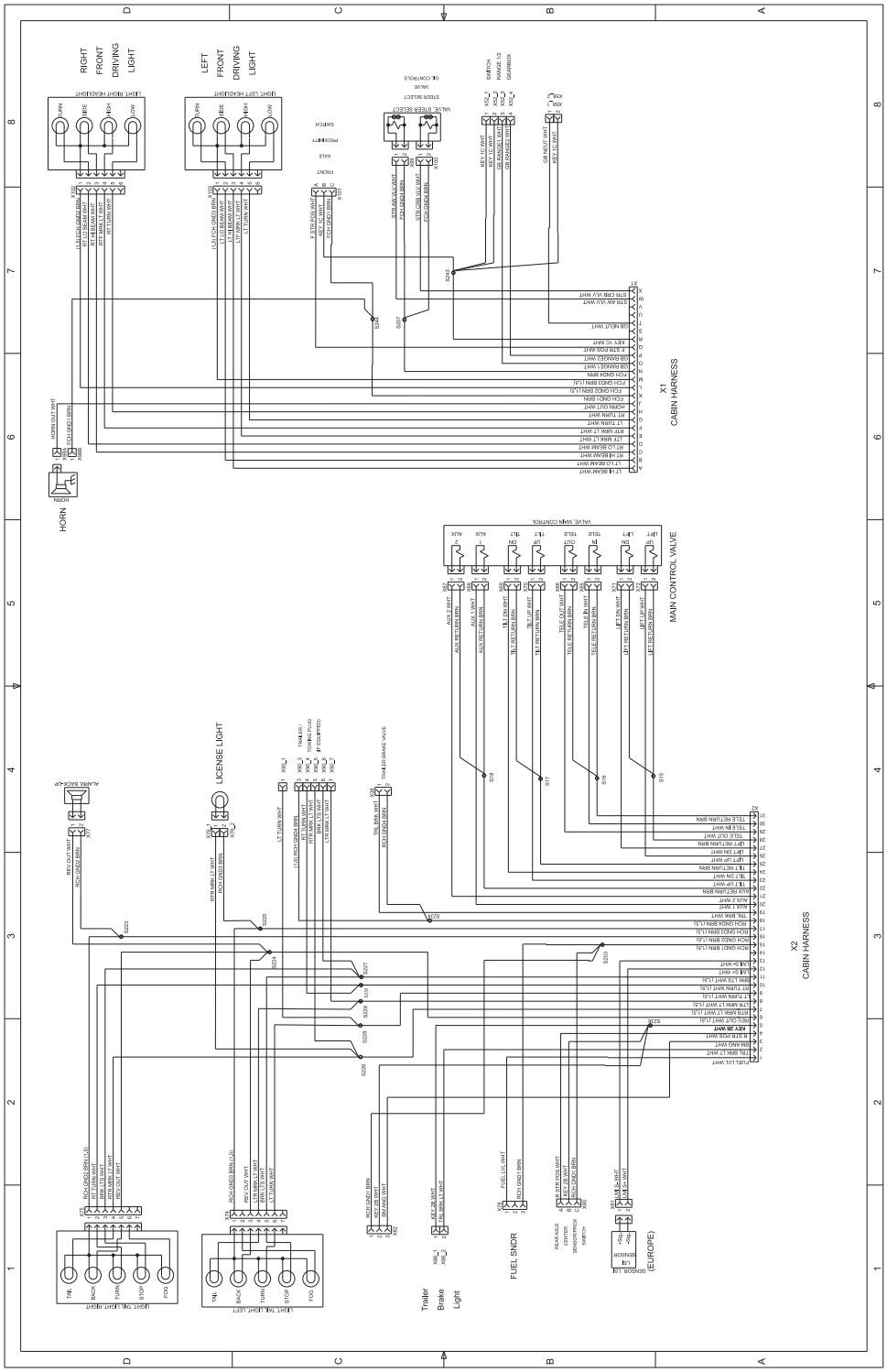
S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 4)



MY5130-K

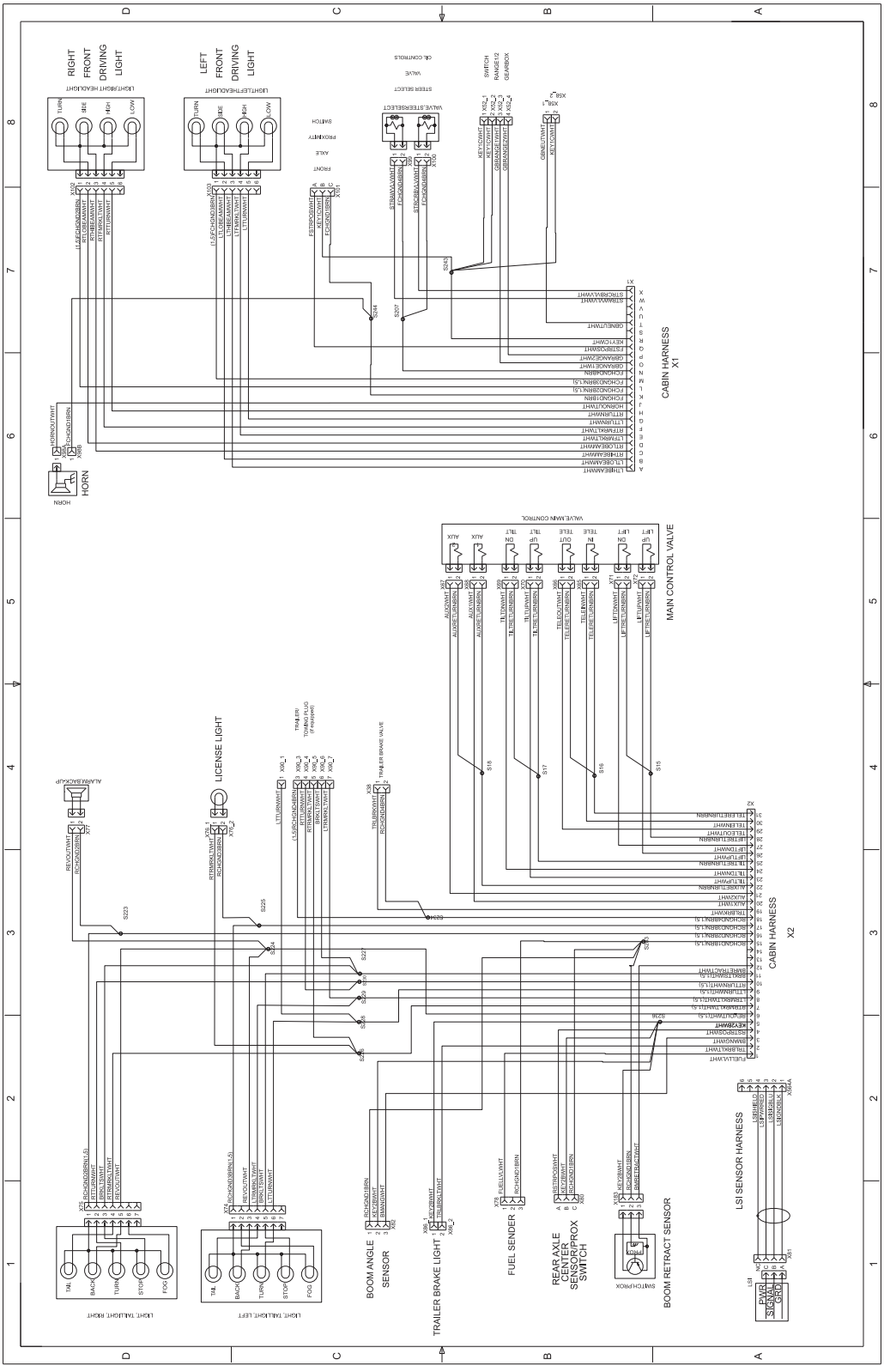
9.9.4 Front and Rear Frame Schematic

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 5)



MY3340-H

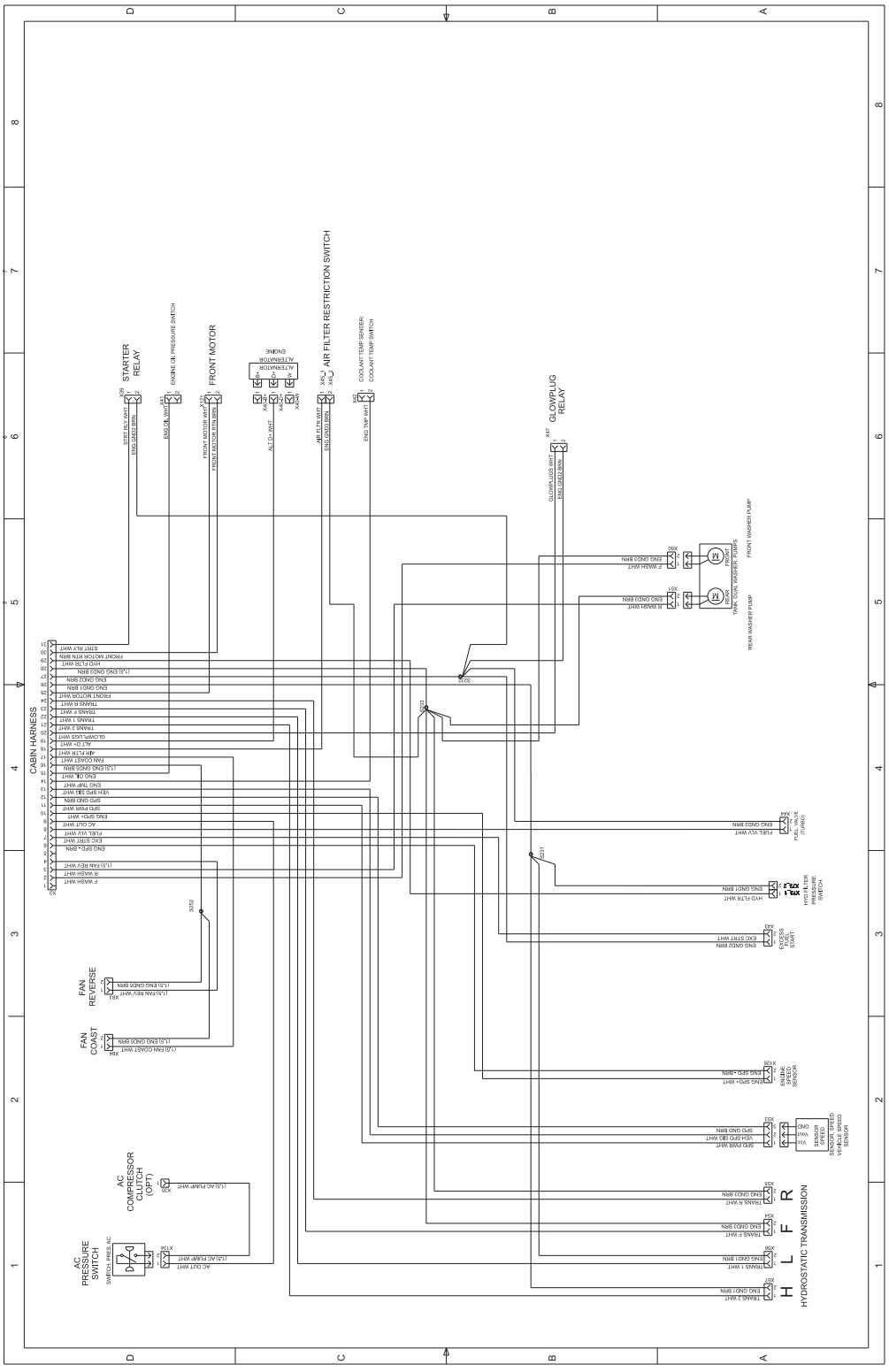
S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 5)



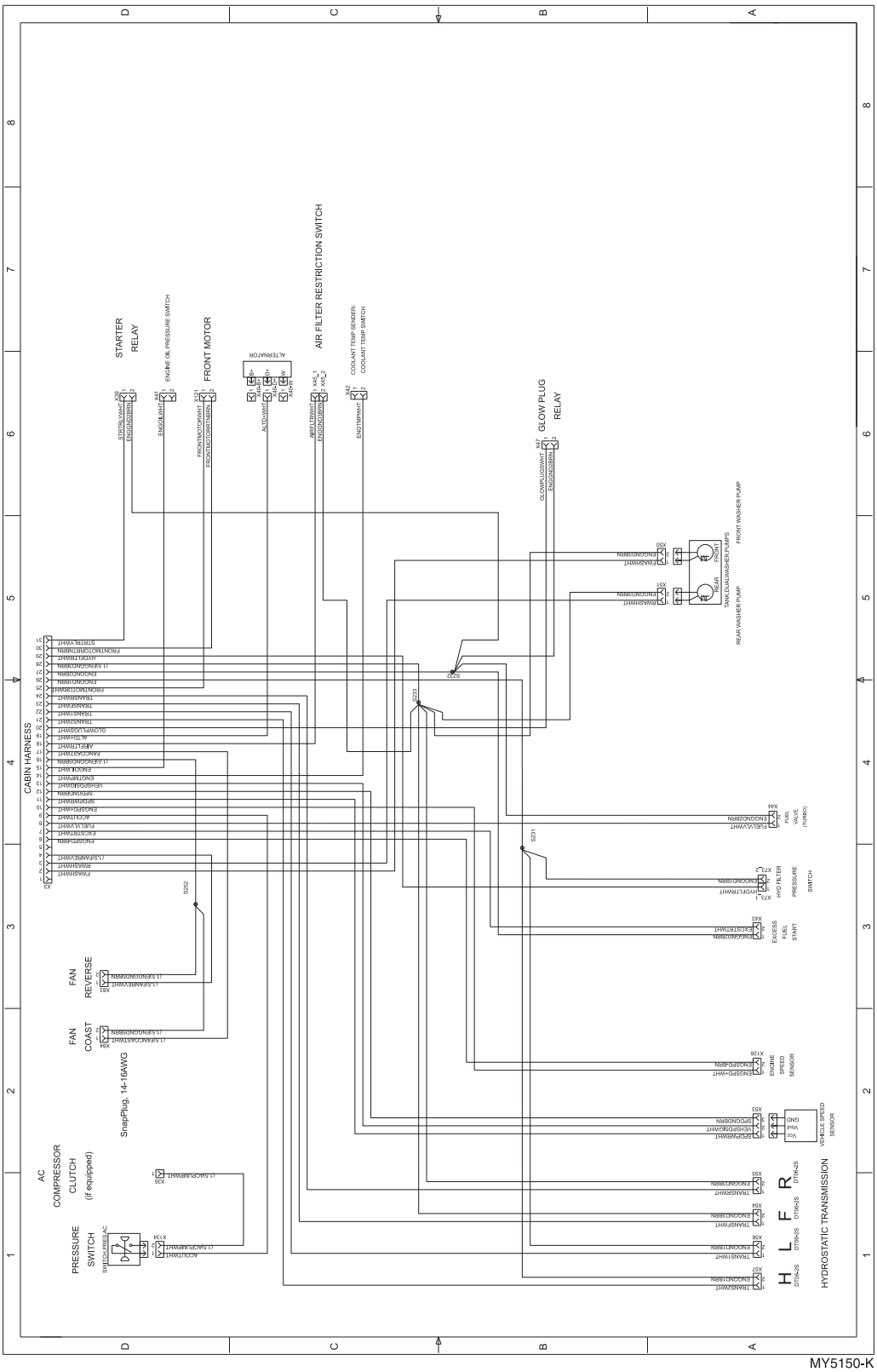
MY5140-K

9.9.5 Engine Compartment Schematic

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 6)



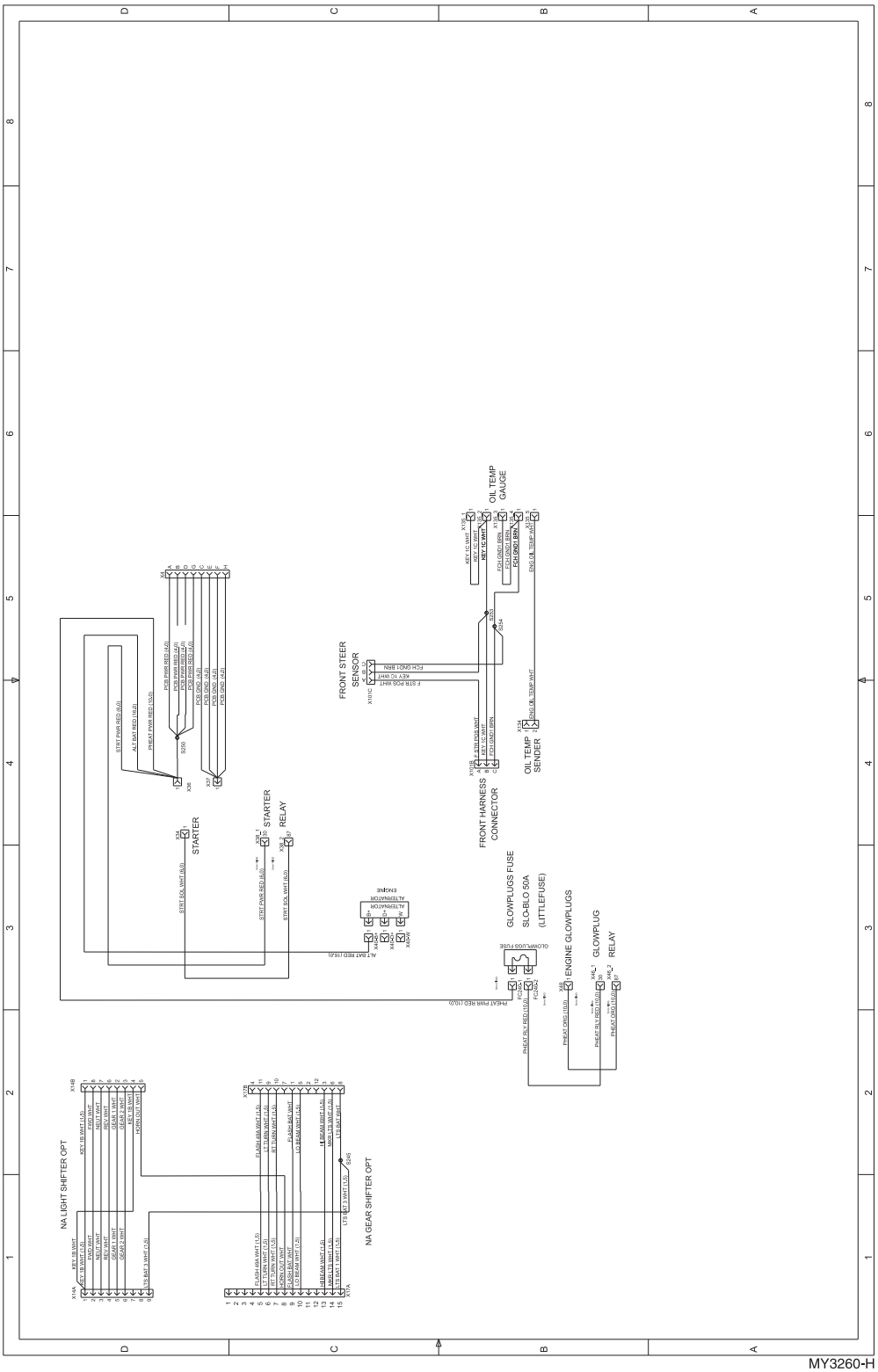
S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 6)



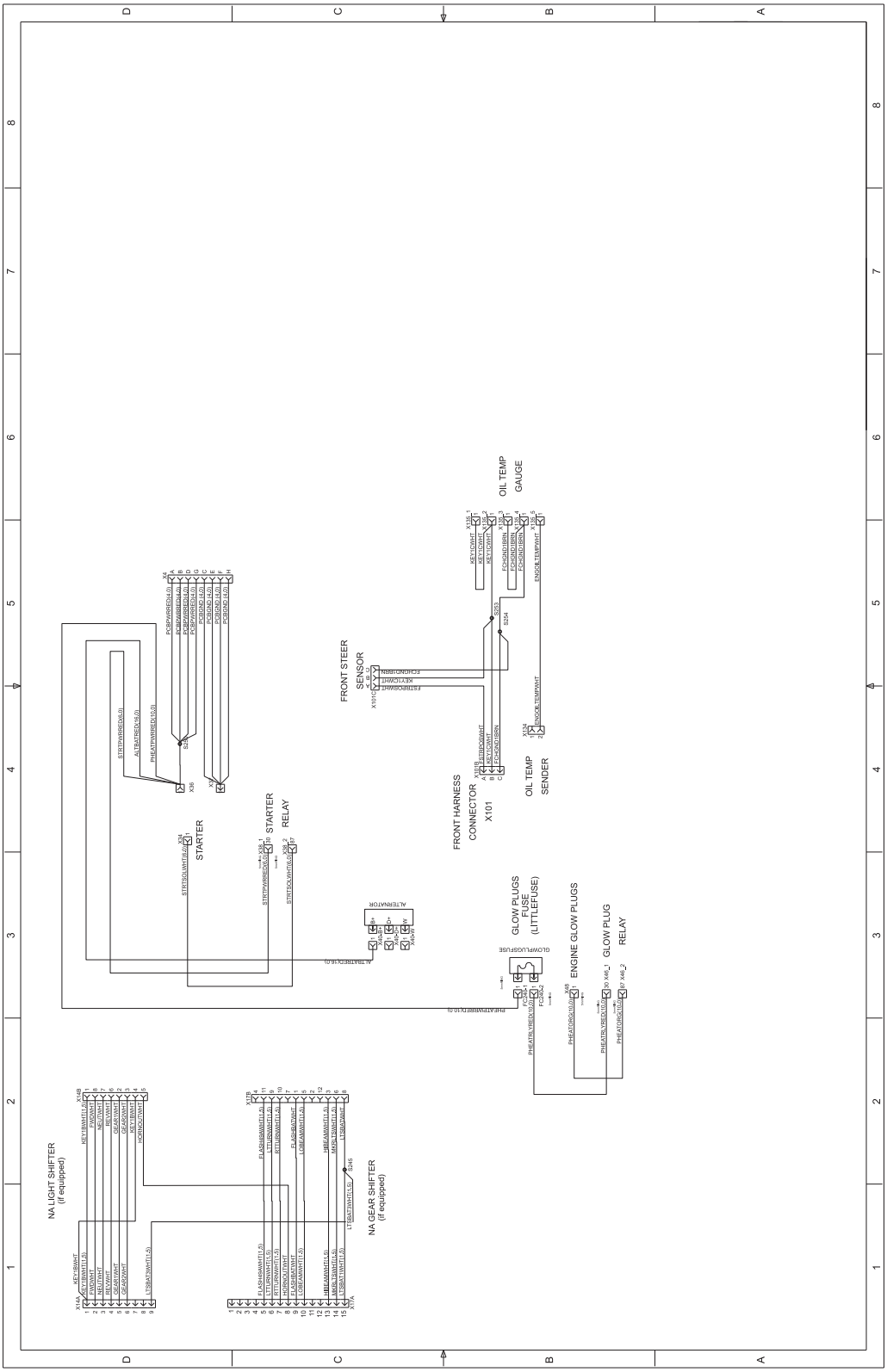
MY5150-K

9.9.6 Power Ground, ANSI Shifter and Oil Gauge Schematic

Before S/N 1160005989 excluding 116005189, 1160005314 & 1160005414 (Sheet 7)



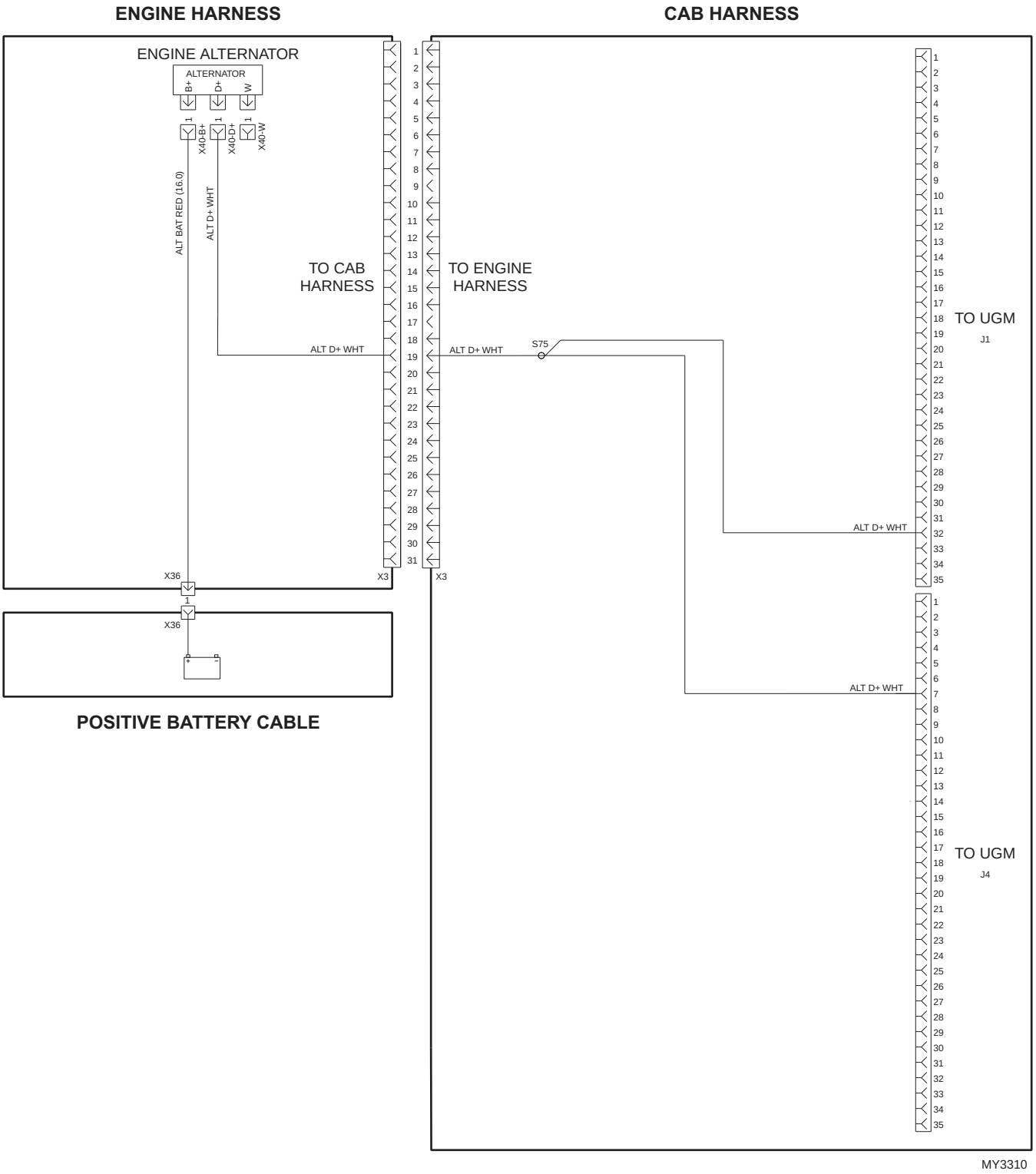
S/N 1160005989 & After including 116005189, 1160005314 & 1160005414 (Sheet 7)



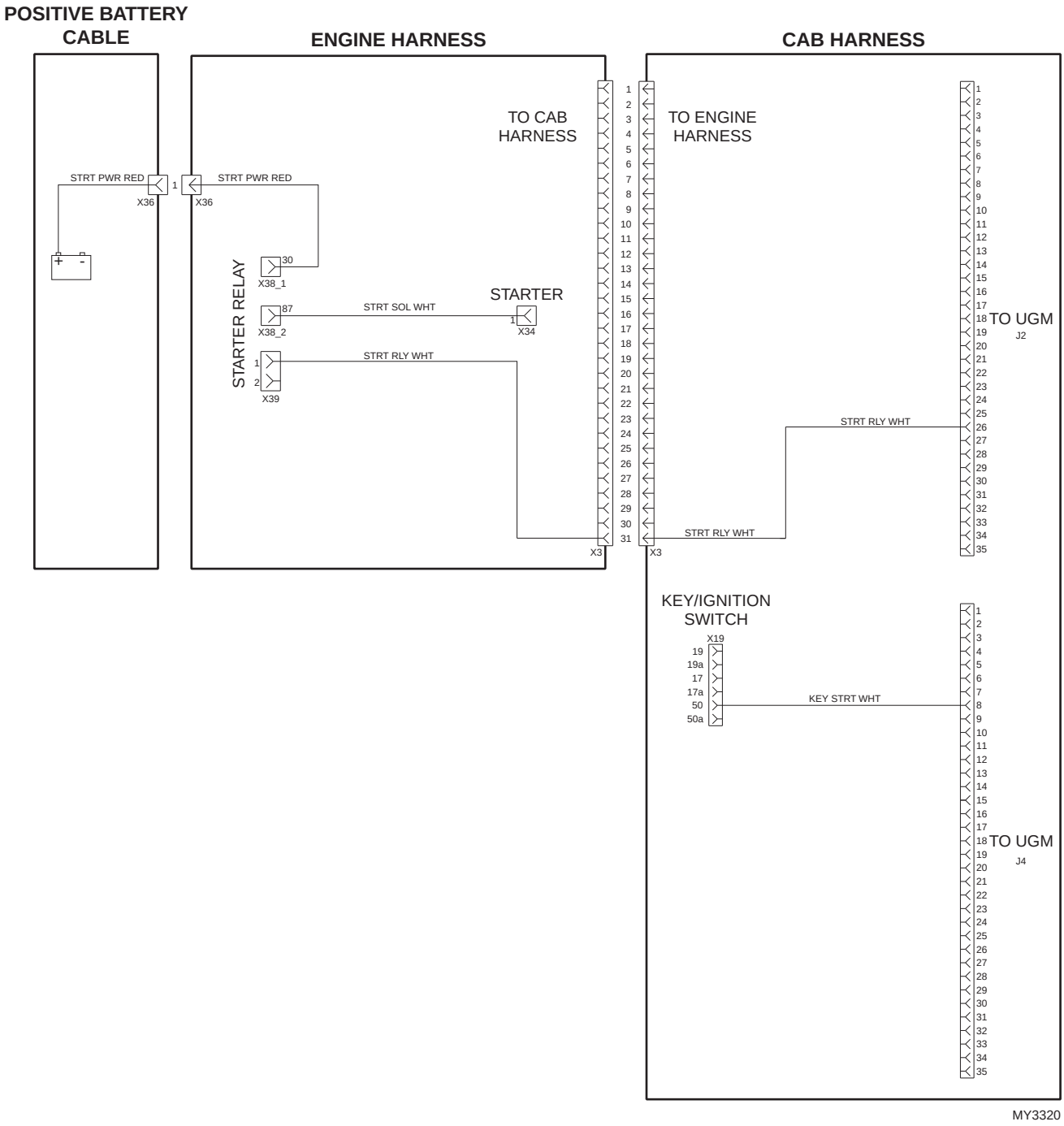
MY5160-K

9.10 CIRCUIT BREAKDOWNS

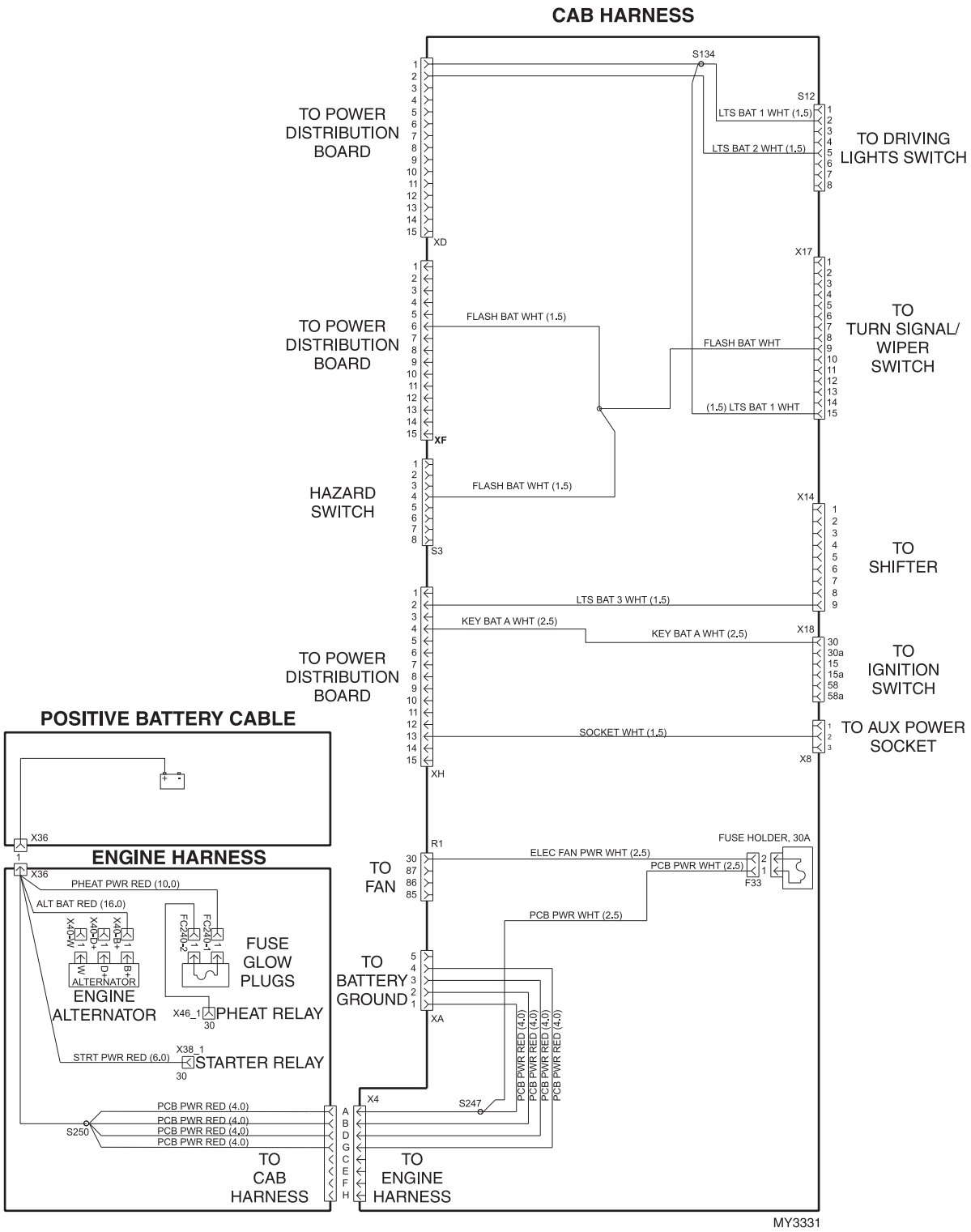
9.10.1 Alternator Charge Circuit



9.10.2 Starter Circuit

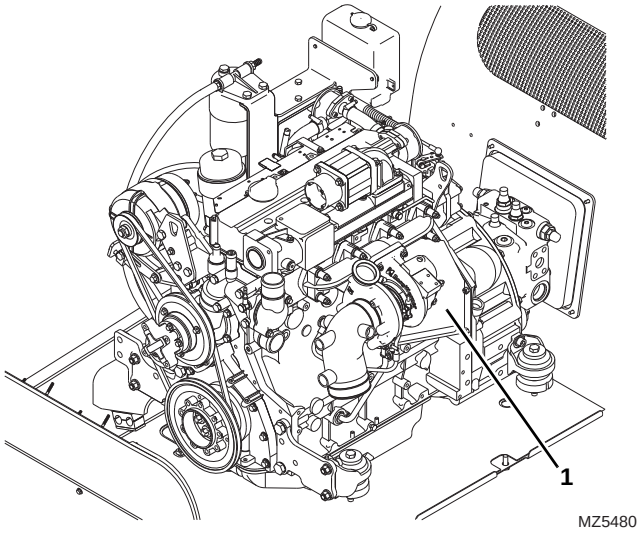


9.10.3 Constant Power Circuit



9.11 ENGINE ELECTRICAL COMPONENTS

9.11.1 Starter



The starter (**1**) is located on the left side of the engine attached to the bell housing.

a. Testing the Starter on the Engine

If the starter does not engage when the ignition key switch is turned, check the following:

1. The transmission control lever is in (N) NEUTRAL and the park brake is engaged.
2. The main fuse may be blown, requiring replacement. Check for the cause of the blown fuse.
3. There may be a defect in the ignition key switch, ignition wiring or starter solenoid.
4. Check battery condition. Clean the battery posts and the connectors at each end of the battery cables.
5. Check for broken wiring and damaged insulation on the wiring. Replace all broken or damaged wiring.
6. Check all connections at the starter solenoid, key switch and wiring harness plugs. Clean and tighten all connections.
7. If the starter still does not operate after these checks have been performed, check the starting circuit.

b. Starter Circuit Checks

1. Check wires and connections for looseness, corrosion, damage, etc.
2. If a “whirring” noise is heard but the engine does not turn over, the starter is spinning but not engaging the flywheel. The starter drive or solenoid that pushes the drive forward to engage the flywheel may be defective. Missing or damaged teeth on the flywheel can also prevent the starter from cranking the engine.
3. If the starter only “clicks” it may indicate that the battery is discharged, or that there is a loose or corroded battery cable connection. Check the battery state of charge and battery condition first, then check the cables and cable connections.
4. For additional information on the starting circuit, refer to Section 9.9.4, “Front and Rear Frame Schematic.”

c. Starter Removal

Remove the starter only if it fails. To remove the starter:

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Remove the wires from the solenoid stud. Remove the red, positive (+) battery cable from the starter. Label and disconnect the wire from the starter solenoid housing stud. Record how the wires are installed to ensure correct installation later.
6. Loosen, but **DO NOT** remove, the fasteners securing the starter to the flywheel housing. Support the starter securely, as it is relatively heavy and will fall if not supported.
7. Support the starter and remove the fasteners securing the starter to the engine. Remove the negative (-) ground cable from its starter mounting bolt.
8. Remove the starter (**1**) from the machine.

d. Starter Cleaning and Drying

1. While the starter is being removed, wipe away any grease or dirt that has accumulated around the starter mounting opening.
2. If reinstalling the starter, clean the exterior of the starter with an approved solvent. **DO NOT** submerse the starter or allow the solvent to contact the starter bushings.
3. Dry the starter with a clean, lint-free cloth.

e. Starter Periodic Maintenance

A starter requires no routine maintenance beyond the occasional inspection of the electrical connections, which must be clean and tight.

Note: ***DO NOT*** *disassemble the starter. The starter is not serviceable and must be replaced in its entirety, if defective.*

f. Starter Installation

1. Position the starter in its mounting opening on the flywheel housing. Position the ground cable over the correct starter mounting bolt. Secure the starter with fasteners. Torque fasteners to 43 Nm (32 lb-ft).
2. Connect the positive (+) battery cable to the upper solenoid stud. Install the wires to the upper solenoid stud, and secure with lockwasher and nut.
3. Connect the wire to the solenoid mounting stud.
4. Properly connect the battery.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.11.2 Alternator

Before using a battery charger, an attempt can be made to recharge the battery by jump-starting the machine. (Refer to the appropriate Operation & Safety Manual.) Allow the engine to run, which will enable the alternator to charge the battery.

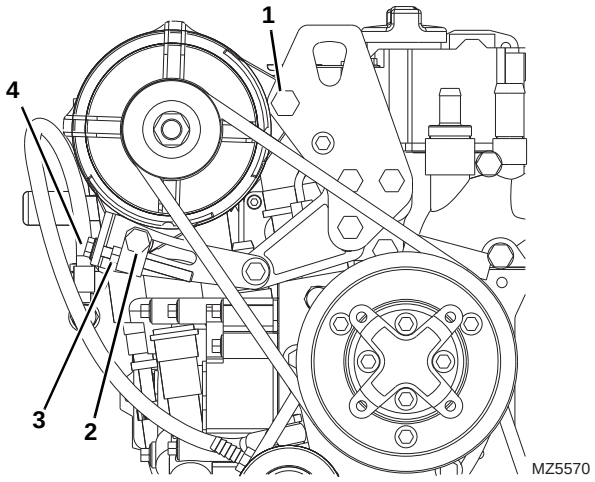
If the engine alternator charging warning indicator illuminates, perform the following checks:

1. Check the all battery cable connections at the battery, and verify that they are clean and tight.
2. Check the external alternator wiring and connections, and verify that they are in good condition.
3. Check the fan belt condition and tension.
4. Verify that the alternator mounting hardware is tight.
5. Run the engine and check the alternator for noise. A loose drive pulley, loose mounting hardware, worn or dirty internal alternator bearings, a defective stator or defective diodes can cause noise. Replace a worn or defective alternator.

a. Alternator Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Label and disconnect the wires attached to the alternator.

Note: *Record how the alternator is installed to ensure correct installation later.*



6. Loosen the top alternator mounting bolt (**1**) and lower alternator mounting bolt (**2**).
7. Loosen the jam nut (**3**) on the belt tensioning adjustment bolt (**4**) at the bottom of the alternator.
8. Turn the belt tensioning adjustment bolt (**4**) counter clockwise to loosen the fan drive belt.
9. Remove the fan drive belt from the alternator.
10. Remove the lower mounting capscrew securing the alternator to the lower mounting hole on the engine.
11. While supporting the alternator with one hand, remove the upper mounting hardware from the upper alternator mount. Remove the alternator from the machine.

b. Alternator Installation

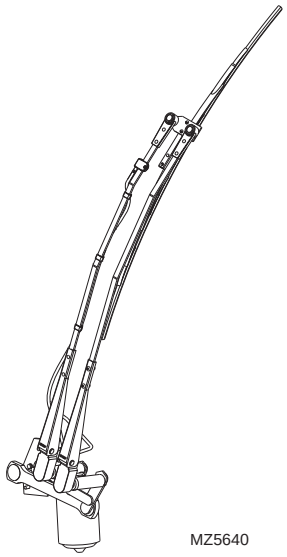
1. Position the alternator and align with the upper alternator mount on the engine bracket. Insert the upper mounting hardware (**1**) through the alternator mount. **DO NOT** tighten completely at this time.
2. Align the lower alternator mount hole with the lower mounting bracket on the engine, and insert the lower mounting hardware (**2**) through the alternator mount. **DO NOT** tighten completely at this time.
3. Attach the fan drive belt to the alternator.
4. Turn the belt tensioning adjustment bolt (**4**) clockwise to loosen the fan drive belt. Check for proper fan belt deflection.
5. Tighten the belt tensioning adjustment bolt jam nut (**3**).
6. Reattach the previously labeled electrical wires to the alternator.
7. Properly connect the battery.
8. Close and secure the engine cover.
9. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.12 WINDOW WIPER/WASHER

9.12.1 Windshield Wiper Motor (if equipped)

a. Removal

Note: *It may be necessary to remove several hydraulic hoses from under the dash in order to remove and install the wiper motor housing.*



MZ5640

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Remove the lower access panel below the instrument panel.
6. Disconnect the right side defroster hose from dash panel hose connector.
7. Disconnect the cab harness connectors from the wiper motor.
8. Remove the linkage attached to the wiper motor.
9. Loosen and remove the four bolts holding the wiper motor to the mounting bracket.

Note: *Retain all hardware removed from the wiper assembly for possible reuse on the replacement motor housing.*

10. Remove the motor from the inside of the cab.

b. Disassembly

DO NOT disassemble the motor. The motor is not serviceable. Replace motor if found to be defective.

c. Inspection and Replacement

Inspect the motor terminals for continuity. Replace motor if continuity is not found.

d. Installation and Testing

1. Install all required hardware to the motor assembly.
2. Align motor with the mounting holes and bolt the motor to the mounting bracket.
3. Connect the wiper linkage to the wiper motor shaft.

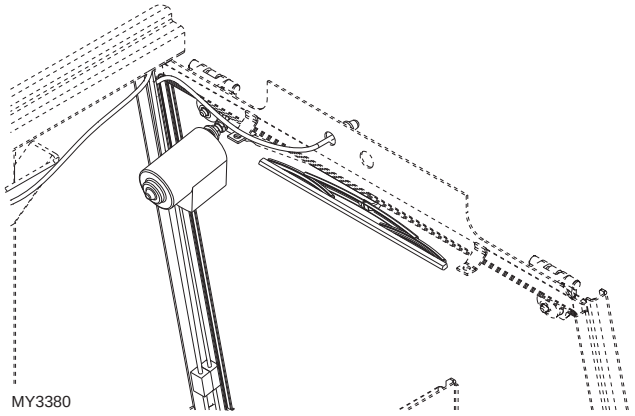
Note: *Align the wiper linkage arm with the flat on the motor shaft to ensure wiper stroke covers window area, and it does not swipe past the glass area.*

4. Connect the cab harness connectors to windshield wiper motor connectors.
5. Properly connect the battery.
6. Close and secure the engine cover.

7. Turn ignition key switch to the RUN position, and operate windshield wiper in both LOW and HIGH speeds to ensure proper operation and that correct wiper travel is achieved.
8. Install right side defroster hose to the dash panel hose connector.
9. If previously removed, install hydraulic hoses under the dash.
10. Install the lower dash panel.
11. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.12.2 Rear Window Wiper Motor (if equipped)

a. Removal


MY3380

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Loosen and remove the rear wiper cover.
6. Disconnect the cab harness connectors from the wiper motor.
7. Remove the wiper motor in question.

Note: *Retain all hardware removed from the wiper assembly for possible reuse on the replacement motor housing.*

b. Disassembly

DO NOT disassemble the motor. The motor is not serviceable. Replace motor if found to be defective.

c. Inspection and Replacement

Inspect the motor terminals for continuity. Replace motor if continuity is not found.

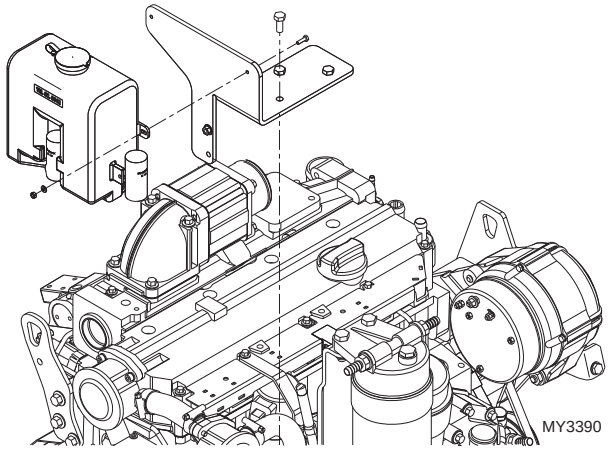
d. Installation and Testing

1. Install all required hardware to the motor assembly.
2. Align motor with the mounting holes and bolt the motor to the proper location.

Note: *Align the wiper to ensure wiper stroke covers window area, and it does not swipe past the glass area.*

3. Connect the cab harness connectors to wiper motor connectors.
4. Install rear wiper cover.
5. Install wiper arm assembly.
6. Properly connect the battery.
7. Close and secure the engine cover.
8. Turn ignition key switch to the RUN position, and operate wiper to ensure proper operation and that correct wiper travel is achieved.
9. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.12.3 Windshield Washer Reservoir and Pump


MY3390

The washer reservoir/motor is located in the engine compartment as a unit and cannot be serviced separately.

a. Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Remove the nuts and the lockwashers from the washer mounting studs.
6. Pull the washer reservoir out and away from the mounting studs.
7. Rotate the washer reservoir, label and remove the cab harness connectors from the washer reservoir connectors.
8. Remove the windshield washer hoses from the reservoir.

b. Disassembly

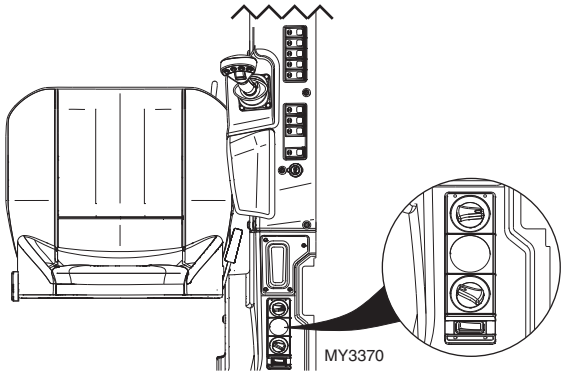
DO NOT disassemble the pump. The pump is not serviceable. Replace pump if found to be defective.

c. Installation and Testing

1. Connect the windshield washer hoses to the reservoir.
2. Connect the cab wiring harness connectors to the reservoir connectors.
3. Install the reservoir tank onto the mounting studs.
4. Install the lockwashers and nuts and secure.
5. Fill the washer fluid reservoir with washer fluid.
6. Properly connect the battery.
7. Close and secure the engine cover.
8. Turn the ignition key switch to the RUN position and press the washer switch. Verify that fluid is sprayed on the windshield.
9. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.13 CAB HEATER AND FAN

9.13.1 Cab Heater/Air Conditioning Controls



Note: *If the suspect component is found to be within the heater box, the heater box must be removed as a complete unit and replaced. For additional information on the removal and installation of the heater box, refer to Section 4.4.10, a. "Heater Assembly Removal."*

The cab heater controls are located to the right of the seat. The control panel consists of a variable speed fan control knob and a temperature control knob.

a. Cab Heater Controls Removal

Note: *After determining which control knob is not functioning, remove only the suspect control knob. In order to remove either knob, the cab heater and fan control panel must be removed from the dash panel.*

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Remove the screws and backing locknuts from the cab heater and fan control panel.
6. Pull the control panel out from the dash panel, and if removing variable speed fan control, remove the cab harness connector.
7. If removing the temperature control knob, disconnect the cable connector and remove control knob.
8. Remove the setscrew from the variable speed fan control knob or temperature control knob.

9. Remove the hex locknut from the suspect control shaft.
10. Remove the control from the panel.

b. Disassembly

DO NOT disassemble the cab heater and fan controls. The controls are not serviceable. Replace controls if found to be defective.

c. Installation and Testing

1. Check that the variable speed fan control is in the OFF position.
2. If installing the temperature control, attach the cable connector to the back of the control.
3. Insert the control shaft through the panel, ensuring that the knob is in the VERTICAL position.
4. Install the hex locknut on the shaft and tighten.
5. Connect the cab harness connector to the variable speed fan control.
6. Install the control panel screws.
7. Install the setscrew, securing the knob to the control.
8. Properly connect the battery.
9. Close and secure the engine cover.
10. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14 SOLENOIDS, SENSORS AND SENDERS

9.14.1 Ignition Key Switch

a. Ignition Switch Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Remove lower dash panel.
6. Remove the hex nut securing the ignition key switch to the dash.
7. Reach up under the dash to work the ignition switch and wiring out of the mounting hole.
8. Disconnect the ignition switch connectors from the cab harness connectors, and remove the switch from the machine.

b. Disassembly

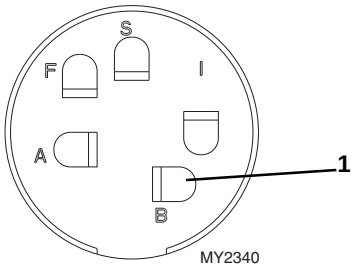
DO NOT disassemble the ignition switch. Replace a defective switch with a new part.

c. Inspection and Replacement

To determine the proper operation of the ignition key switch, test the wires on the back of the switch for continuity with an ohmmeter.

Test the ignition key switch for continuity, by checking from the BAT terminal (**1**) to each of the remaining terminals in their corresponding switch position.

If all terminals do not show proper continuity, replace the ignition switch.



d. Ignition Switch Installation

1. Connect the ignition key switch to the cab harness connectors.
2. Reach up and under the dash to work the ignition switch into the ignition switch-mounting hole on the lower right side of the dash.
3. Align the ignition switch so that when it is in the OFF position, the key slot is positioned vertically (straight up and down). Install the hex nut securing the ignition switch to the dash. **DO NOT** overtighten.
4. Install the lower dash panel.
5. Properly connect the battery.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14.2 Dash Switches

a. Switch Removal

1. Open the engine cover.
2. Disconnect the battery negative (-) cable at the battery negative (-) terminal.
3. Pull the frame out of the dash, disconnect the harness connector to the switch in question and push the switch out of the frame.

b. Disassembly

DO NOT disassemble the dash switch. Replace a defective switch with a new part.

c. Inspection and Replacement

Inspect the switch terminals for continuity in both the engaged and disengaged positions. Replace a defective or faulty switch with a new switch.

d. Switch Installation

1. Connect the switch to the cab harness connector.
2. Position the switch over the rectangular switch bezel and snap into position.
3. Replace the frame into the dash.
4. Properly connect the battery.
5. Close and secure the engine cover.
6. Start the machine and check the replaced switch for proper function.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14.3 Fuel Level Indicator and Fuel Level Sender

a. Fuel Level Indicator Testing

1. The fuel level sender wiring harness leads can be accessed from the top of the fuel tank. Disconnect the fuel level sender wiring harness leads. With the help of an assistant, touch both harness leads together.
2. From the operator cab, have the assistant turn the ignition key switch to the RUN position. **DO NOT** start the engine. Observe the fuel level indicator needle on the operator instrument cluster.
3. Turn the ignition key switch to the OFF position. The fuel level indicator needle should return to the EMPTY position.

b. Fuel Level Circuit Tests

If the fuel level indicator is suspected of giving a false reading, perform the following checks:

1. If the fuel level indicator needle does not move, check the fuel tank for fuel.
2. Check for loose or defective wiring, faulty ground connections or corrosion on the fuel tank sender and wiring lead.
3. If the fuel level indicator needle does not move after the ignition key switch is turned to the RUN position, verify whether current is flowing from the ignition switch to the fuel level sender.
4. If the fuel level indicator does not move and a faulty or defective fuel level sender in the fuel tank has been ruled out and in addition, wiring and connectors have been checked and ruled out, the fuel level indicator is defective and the instrument cluster must be replaced.
5. Check that the ignition terminal has current and that the fuse in the fuse panel is not blown.
6. Check for broken, shorted, frayed, disconnected or damaged wiring between the fuel level indicator wiring at the cab, fuse and relay panel, ignition key switch and from the fuel level sender on the fuel tank through the wiring in the cab.

7. Check the fuel level sender. The resistance of the fuel level sender are:

Fuel Tank Capacity	L2906H, 2906H, 29.6 & 619A	3507H, 35.7 & 714A
100%	4 ohms	10 ohms
50%	162 ohms	185 ohms
0%	314 ohms	297 ohms

8. A defective fuel level sender in the fuel tank may also prevent the fuel level indicator from moving.

9.14.4 Hourmeter

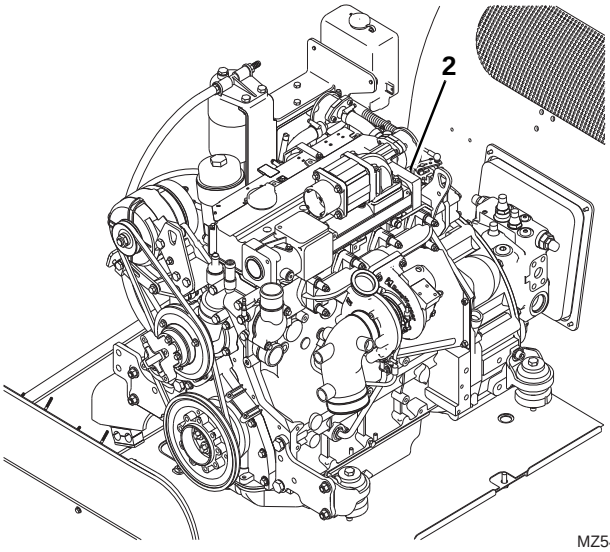
The hourmeter is a non-repairable instrument that records hours of machine engine operation in tenth of an hour increments and is located in the instrument panel.

The hourmeter is an analog device, similar to an odometer, and will display 99,999.9 hours before resetting to zero.

If trouble is suspected, time the hourmeter for six minutes to verify that a tenth of an hour has been recorded.

The hourmeter is built into the instrument panel and cannot be repaired. If the hourmeter is suspect, replace the instrument panel.

9.14.5 Coolant Temperature Sender



The coolant temperature sender (**2**) is located the rear of the engine below the cylinder head.

a. Coolant Temperature Sender Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Disconnect the wiring connector at the coolant temperature sender lead.
6. The coolant temperature sender is threaded into the engine block. Remove the sender.

b. Coolant Temperature Sender Inspection and Replacement

Inspect the sender and the wiring harness connector terminals for continuity. Replace a defective or faulty sender with a new part.

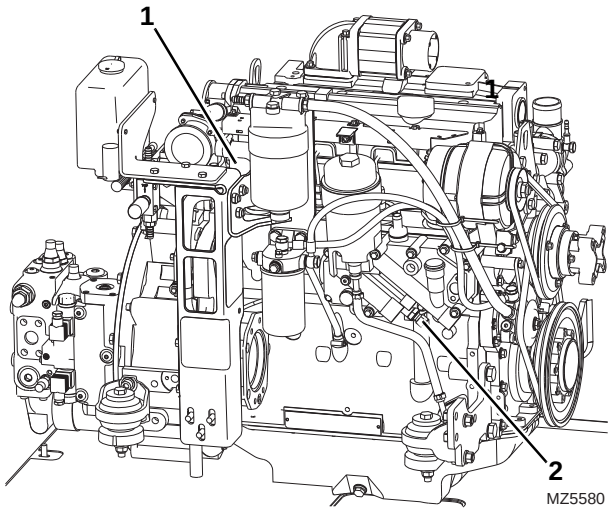
c. Coolant Temperature Sender Installation and Testing

1. Thread the coolant temperature sender into the engine housing snugly, then connect the sender connector to the wiring harness connector.
2. Properly connect the battery.
3. Check for proper fluid level.
4. Check the coolant temperature sender. The resistance of the coolant temperature sender are:

Temperature	Resistance (ohms)
130°C (266°F)	28.9 ±1.5
120°C (248°F)	36.8 ±2.2
90°C (194°F)	83.3 ±6.9
60°C (140°F)	222.5 ±22.9
20°C (68°F)	1138.3 ±140.8

5. Start the engine, allow it to reach operating temperature and observe the operator instrument cluster for warning indication. If the sender is not defective, the problem could be elsewhere; possibly in a shorted wire, improper-running engine, improper or low coolant, obstructed or faulty radiator, coolant pump, loose fan belt, defective instrument display, etc.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14.6 Fuel Shut-off Solenoid



The fuel shut-off solenoid (**1**) is located on the top of the engine injector pump.

a. Fuel Shut-off Solenoid Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Disconnect the wiring connector at the fuel shut-off solenoid lead.
6. Remove the fuel shut-off solenoid from the engine.

b. Fuel Shut-off Solenoid Disassembly

DO NOT disassemble a fuel shut-off solenoid. Replace a defective fuel shut-off solenoid with a new part.

c. Fuel Shut-off Solenoid Inspection and Replacement

Use a 12-volt DC source and ground to test the solenoid. Energize the solenoid, and watch for the plunger to retract. If the plunger does not retract, replace the fuel shut-off solenoid with a new solenoid.

d. Fuel Shut-off Solenoid Installation

1. Clean the exterior of the fuel shut-off solenoid engine location.
2. Install the fuel shut-off solenoid on the engine. **Do Not Over Tighten**.
3. Connect the wiring connector at the fuel shut-off solenoid lead.
4. Properly connect the battery.
5. Start the engine. If the engine starts, the fuel shutoff solenoid is functioning. If the engine fails to start, the fuel shut-off solenoid may have a poor ground connection. Visually check the wiring at the fuel shutoff solenoid leads and/or check for continuity with a voltmeter as required.
6. Check for fuel and/or oil leakage around the solenoid.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14.7 Oil Pressure Sender

The oil pressure sender (**2**) is located on the engine near the oil filter.

a. Oil Pressure Sender Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Disconnect the wiring connector at the oil pressure sender lead.
6. The oil pressure sender is threaded into the engine. Remove the sender.

b. Oil Pressure Sender Inspection and Replacement

Inspect the sender and the wiring harness connector terminals for continuity. Replace a defective or faulty sender with a new part.

c. Oil Pressure Sender Installation and Testing

1. Thread the oil pressure sender into the engine housing snugly, then connect the sender connector to the wiring harness connector.
2. Properly connect the battery.
3. Check for proper fluid level.

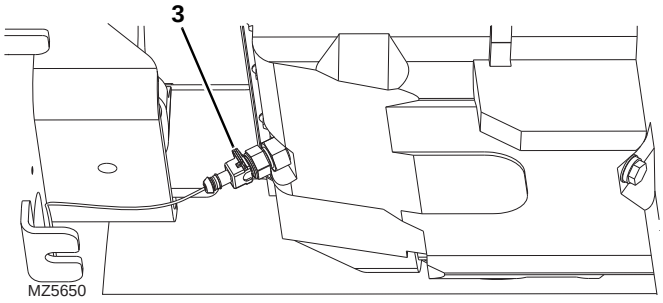
4. Start the engine, and observe the operator's display for warning indication. If the sender is not defective, the problem could be elsewhere; possibly in a shorted wire, improper-running engine, low oil, obstructed or faulty oil pump, defective instrument display.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14.8 Oil Temperature Sensor

The oil pressure sensor is located on the side of the engine oil pan.

a. Oil Temperature Sensor Removal

1. Park the machine on a firm, level surface with the machine level, retract and level the boom. Place the transmission control lever in the (N) NEUTRAL position and engage the parking brake. Shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery.
5. Disconnect the wiring connector at the oil pressure sensor lead.



6. Remove the sensor (**3**) from the adaptor on the side of the oil pan.

b. Oil Temperature Sensor Inspection and Replacement

Inspect the sensor and the wiring harness connector terminals for continuity. Replace a defective or faulty sender with a new part.

c. Oil Temperature Sensor Installation and Testing

1. Install the oil temperature sensor into the adaptor on the side of the engine oil pan and tighten.
2. Connect the wiring harness connector to the sensor.
3. Properly connect the battery.
4. Check for proper oil level.
5. Start the engine, and observe the operator's display for warning indication. If the sensor is not defective, the problem could be elsewhere; possibly in a shorted wire, improper-running engine, low oil, obstructed or faulty oil pump, defective instrument display.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.14.9 Back-up Alarm

The back-up alarm is located at the rear of the machine.

When the park brake is released and the transmission shift control switch (transmission control lever) is shifted to the (R) REVERSE position, the back-up alarm will automatically sound.

Place the transmission control lever in (R) REVERSE to test the back-up alarm. The back-up alarm must not sound when the transmission control lever is in (N) NEUTRAL or (F) FORWARD. Also, with the ignition key switch in the RUN position, the back-up alarm will sound when the transmission control lever is shifted into the (R) REVERSE position.

a. Disassembly

DO NOT disassemble the back-up alarm. Replace a defective or faulty alarm with a new part.

b. Inspection and Replacement

Inspect the wiring harness connector and alarm terminals for continuity and shorting. Test the alarm by turning the ignition key switch to the RUN position and shifting the transmission control lever into the REVERSE position. The alarm should sound.

Replace a defective or faulty alarm with a new part.

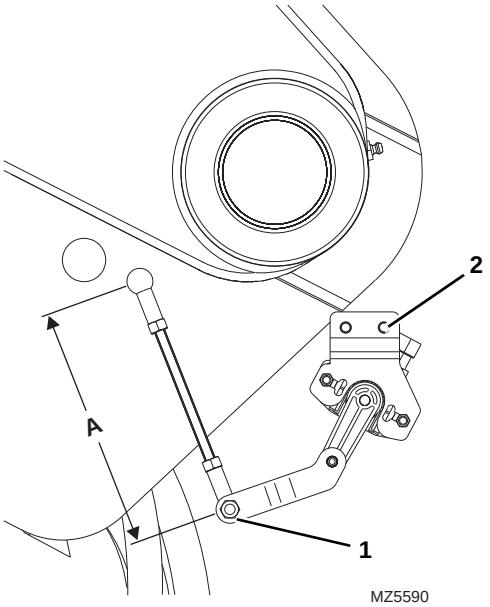
9.14.10 Boom Angle Sensor

The boom angle sensor is located at the top left inside rear of the boom.

a. Boom Angle Sensor Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the engine to cool.
4. Properly disconnect the battery.
5. Disconnect the boom angle sensor electrical connector.

2906H SHOWN



SHOWN AT BOOM MID-TRAVEL POSITION

6. Loosen and remove the nut holding the rod assembly (**1**) to the sensor arm.
7. Loosen and remove the two bolts (**2**) holding the sensor to the sensor bracket.
8. Remove the sensor assembly.
9. If necessary, remove the sensor bracket.

b. Boom Angle Sensor Inspection and Replacement

Inspect the sensor and the wiring harness connector terminals for continuity. Replace a defective or faulty sensor with a new sensor.

c. Boom Angle Sensor Installation

1. If necessary, install the sensor bracket.
2. Install the sensor assembly to the sensor seat and tighten both bolts.
3. Install the rod end to the sensor arm and tighten nut.
4. If necessary, measure and set the rod length as required.

Machine	Rod Length (A)
L2906H, 2906H, 29.6 & 619A	141,6 ±0,5 mm (5.57 ± 0.02 in)
3507H, 35.7 & 723A	196,1 ±1 mm (7.72 ± 0.02 in)

5. Plug the electrical connector into the sensor assembly.
6. Properly connect the battery.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

d. Boom Angle Sensor Adjustment

1. Access Level 2 can be reached by pressing buttons **C** and **OK** at the same time.
2. Enter Access Level 2 password 33271.
3. Choose Calibration menu and select “Boom Angle”.
4. Press **OK** button when asked “Calibrate Boom Angle Sensor?”.
5. Follow prompts. First move boom to lowest position, press **OK** button.
6. Follow prompts. Move boom to highest position, press **OK** button.
7. If calibration is successful, Analyzer will indicate “Calibration: Complete”.
   If calibration fails, Analyzer will indicate “Calibration Failed”. The boom angle sensor position may need to be adjusted or the boom sensor rod may need adjusted.

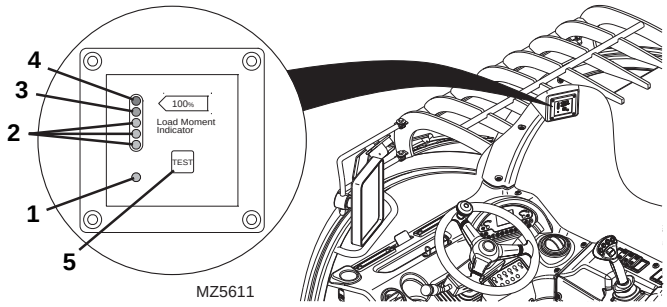
9.15 LOAD STABILITY INDICATOR - LSI L2906H, 2906H, 3507H, 29.6LP, 29.6 & 35.7 (Before S/N 1160005993 excluding 1160005943, 1160005945 & 1160005414)

9.15.1 Load Stability Indicator

WARNING

TIP OVER HAZARD. The LSI considers only longitudinal stability limitations, observe all operating parameters. Failure to follow operating parameters of the telehandler could damage the equipment and/or cause tip over.

Note: *The Load Stability Indicator is NOT a serviceable item. The LSI must be inspected and/or replaced by a qualified dealer or a JLG technician.*



The LSI provides visual and audible indication of forward stability limitations when machine is static on firm, level surface.

- Green LED (**1**) will illuminate when LSI power is on.
- When approaching forward stability limitations LEDs progressively illuminate, green (**2**), then yellow (**3**) and finally red (**4**).
- The warning buzzer sounds as the first red LED illuminates.
- As the telehandler reaches forward stability limitations and the second red LED illuminates, the automatic function cut-out is activated. Certain functions are disabled (i.e. boom lift, extend, etc). Retract boom to re-enable functions.
- Press button (**5**) to disable the warning buzzer. When disabled, yellow LED (**3**) will illuminate. If last red LED illuminates, disable button is overridden and warning buzzer sounds.

Test the LSI at the beginning of each work shift.

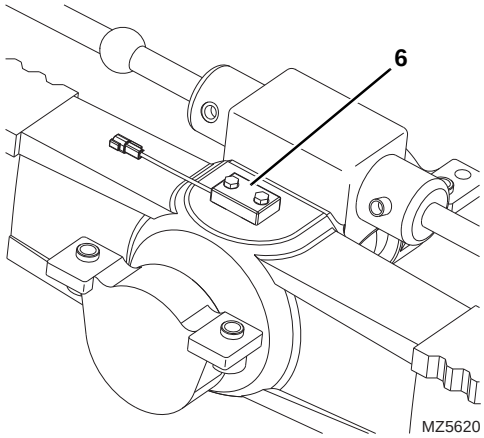
1. Fully retract and level the boom, with no load. Do not raise the boom during this test.
2. Level frame using level in cab.
3. Press the test button on the LSI display. This will cause all LEDs to flash on and an audible warning to sound. This indicates that the system is functioning properly. If the test gives a different result, the system is not functioning properly and the machine must be removed from service and repaired before continued operation.

WARNING

TIP OVER HAZARD. If the green, orange and red LEDs flash and warning buzzer sounds, retract and lower boom immediately. Determine cause and correct before continued use.

9.15.2 LSI Sensor

Note: *If the rear axle is removed or replaced, the LSI Sensor must be installed AFTER the rear axle is installed and setting on all four wheels.*



The LSI sensor (**6**) is bolted on the top center of the rear axle.

a. LSI Sensor Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the engine to cool.
4. Properly disconnect the battery.
5. Disconnect the LSI electrical connector.
6. Loosen, remove and discard the two bolts holding the LSI assembly to the rear axle.
7. Remove and discard the sensor assembly.

b. LSI Sensor Installation

1. Ensure threads of both bolt holes are clean and free from rust, water and debris.
2. Clean the bare metal with a degreasing agent, Loctite® 7063™.
3. Remove any excessive degreasing agent and allow to dry.
4. Apply a thin film of Loctite® 330™ adhesive to the flat metal surface of the sensor, ensuring the adhesive is spread evenly over the entire surface.
5. Apply a layer of Loctite® 7386™ to the mounting surface of the axle, ensuring the activator is spread evenly over the entire surface.

Note: *Follow all adhesive manufacturer's recommendations including storage life.*

6. Fit the sensor, ensuring the lead exits in the corner direction. If the existing bolts are not available, use M10 x 40mm bolts with a minimum tensile strength of 10.9.

Note: *It is important to prevent distortion of the sensor element, therefore tighten each bolt finger tight. Alternately tighten each bolt to 35 Nm (26 lb-ft) and finally to 70-80 Nm (52-59 lb-ft).*

7. Leave the machine undisturbed with NO load for a minimum of 6 hours before moving.
8. Plug the electrical connector into the sensor assembly.
9. Properly connect the battery.
10. Close and secure the engine cover.
11. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.
12. Calibrate the LSI system, refer to Section 9.15.3, "LSI System Calibration."

9.15.3 LSI System Calibration

a. Standard Calibration

To calibrate the LSI, certain conditions must be met:

- The sensor must be installed according to Section 9.15.2, “LSI Sensor.”
- The machine control system must be powered on for at least 10 minutes before calibration.
- The calibration shall be conducted with the standard carriage and forks attached for the machine and weights as necessary.
- The machine must be on a level surface with the wheels steered straight, park brake OFF and ignition turned ON.
- Access to the calibration mode requires the use of a magnetic key.

Calibration procedure:

Calibration of the LSI requires the setting up of two reference points, 0% and 100% Safe Work Load (SWL).

1. With the ignition key in ON position, press and hold TEST button on LSI display. Place the magnetic key in position; level with and just to the right of the TEST button. The display will show all LEDs flashing and buzzer on. The correct position is indicated when the buzzer stops and all LEDs stay on.
2. The lower green LED of the scale should be on constant. Position the machine with empty attachment with boom level and fully retracted, forks level (not contacting the ground).
3. Keep holding the TEST button and MAGNET in place until the display changes to display the red LED only. This indicates that the system is now in the calibration mode and waiting for the first reference point.
4. Release the TEST button and remove the MAGNET. The display will emit short intermittent beeps to remind the operator that the calibration is in progress.

Note: *If the TEST button or MAGNET is released to early, the display will revert back to normal operation with the previous calibration settings.*

5. The system allows FIVE minutes for each part of the calibration procedure to be completed. If a part of the calibration procedure is not completed within the FIVE minutes allowed, the system will revert to normal operation with the previous calibration settings.
6. If the ignition is switched OFF during calibration the system will automatically revert to the previous calibration settings.
7. **Set 0% SWL**- Position the machine on level ground in the 0% calibration mode (boom fully retracted, forks lowered but not resting on the ground and no load on forks).
8. Press the TEST button once. The system will give a single, short beep indicating that the 0% point is set. The display will change to show the red and amber LEDs lit (with continuing intermittent beeps), indicating that the system is ready and waiting for the 100% reference.

Note: *If a long beep is emitted from the buzzer during calibration, this indicates a fault condition (see Section b, “Error Conditions.”).*

9. **Set 100% SWL**- Pick up the calibrated (maximum capacity)100% load and extend the boom to the pre-determined, normal 100% point.

Model	Weight on Rear Axle
L2906, 2906H, 29.6LP & 29.6	650 kg (1433 lb)
3507H & 35.7	800 kg (1764 lb)

10. Press the TEST button once to set the 100% reference. The display will now change back to normal operation and show 100% (all green and amber LEDs are lit and flashing).
11. Turn the ignition key to OFF. LSI is now calibrated.

b. Error Conditions

1. Sensor signal out of range - Red and 1st Green LED.
2. Calibration Error - Red and 2nd Green LED.
3. Display Circuit Fault - Red, 2nd and 3rd Green LED.
4. Calibration Required Error - Red and 3rd Green LED.

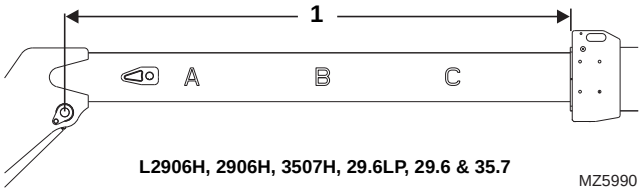
c. Field Calibration

To calibrate the LSI, certain conditions must be met:

- The sensor must be installed according to Section 9.15.2, “LSI Sensor.”
- The test weight matches the model being calibrated in the table shown below.
- The calibration shall be conducted with standard carriage and forks attached to the machine.
- While utilizing the LSI override button, 10 times lift and lower the boom stopping suddenly to induce the rear axle to bounce.

Note: *If the test weight is not known, follow steps 1 & 2.*

Model	Test Weight (W)	Xtip (1)	Xcal (2)
L2906H, 29.6LP	2100 kg (4630 lb)	1256 mm (49 in)	698 mm (27 in)
2906H, 29.6	2100 kg (4630 lb)	1256 mm (49 in)	698 mm (27 in)
3507H, 35.7	2100 kg (4630 lb)	1758 mm (69 in)	1043 mm (41 in)



L2906H, 2906H, 3507H, 29.6LP, 29.6 & 35.7

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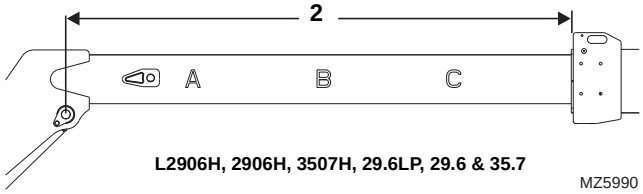
1. With the estimated test weight on the forks, start the machine and extend the boom horizontally until the machine starts to tip. This point should be at an extension of Xtip (**1**) of the second boom section. If the machine is not tipping at this extension, weight needs to be added or removed from the forks.
2. By confirming that the machine tips at this point, the correct amount of weight is now on the forks.
3. The machine control system must be powered on for at least 10 minutes before calibration.
4. The machine must be on a level surface with the wheels steered straight and park brake OFF. Drive the machine forward over a distance of at least 2 m (6.5 ft) before entering a calibration point.
5. Place test weight on ground, apply park brake and shut engine OFF. Do Not move machine.

Field Calibration Procedure:

Note: *The following procedure must be completed within 30 minutes of starting the procedure.*

1. With ignition key in OFF position, press and hold SYSTEM CHECK button on LSI display and turn ignition key to engine START position. Release the ignition key when engine start is achieved, but continue to hold SYSTEM CHECK button on LSI display until the orange LED on LSI display goes out and buzzer sounds (approximately 3 seconds). Release SYSTEM CHECK button.
2. The LEDs will perform a sequence. When only the third green LED illuminates, press the SYSTEM CHECK button.
3. The first green LED then illuminates. With no attachment and boom retracted, lift boom fully.
4. Press the SYSTEM CHECK button on the LSI display and release. The first 3 green LEDs will illuminate. The third then second green LEDs will go out as the calibration point is recorded.
5. The first green LED goes out and buzzer sounds then the red LED illuminates.
6. Lower boom and without moving the machine, pick up the proper test weight (**W**) listed in the table.



L2906H, 2906H, 3507H, 29.6LP, 29.6 & 35.7

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7. With the boom horizontal, slowly extend the boom to the distance of Xcal (**2**). The proper calibration weight is now on the rear axle and the LSI can now be calibrated.
8. Press the SYSTEM CHECK button on the LSI display and release. As the calibration point is recorded, buzzer sounds and the LEDs will flash and perform a sequence until all are flashing.
9. Turn the ignition key to OFF. LSI is now calibrated.

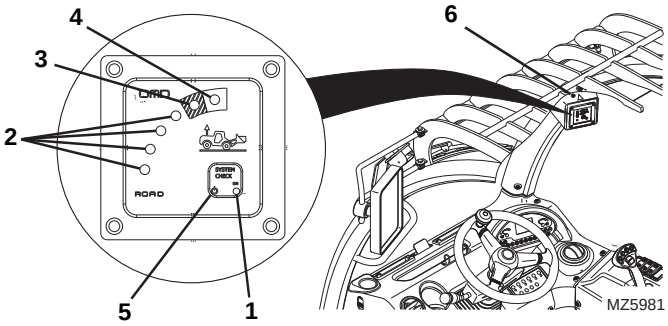
9.16 LOAD STABILITY INDICATOR - LSI L2906H, 2906H, 3507H, 29.6LP, 29.6 & 35.7 (S/N 1160005993 & After including 1160005943, 1160005945 & 1160005414)

9.16.1 Load Stability Indicator

WARNING

TIP OVER HAZARD. The LSI considers only longitudinal stability limitations, observe all operating parameters. Failure to follow operating parameters of the telehandler could damage the equipment and/or cause tip over.

Note: *The Load Stability Indicator is NOT a serviceable item. The LSI must be inspected and/or replaced by a qualified dealer or a JLG technician.*



The LSI provides visual and audible indication of forward stability limitations when machine is static on firm, level surface.

- Green LED (**1**) will illuminate when LSI power is on.
- When approaching forward stability limitations LEDs progressively illuminate, green (**2**), then orange (**3**) and finally red (**4**).
- If the red LED illuminates the warning buzzer also sounds.

The LSI has two modes:

Active Mode

- As the telehandler reaches forward stability limitations and the red LED (**4**) illuminates, the automatic function cut-out is activated. All boom, frame level and outrigger functions are disabled except for boom retract (CE & AUS) and boom lift (CE). Retract boom to re-enable functions.
- In some instances the LSI system may slow down or stop boom functions if operated close to forward stability limitations. When LEDs begin to flash, certain functions can not be operated. Retract boom and/or return the joystick to neutral position for a short period to allow system to reset and LEDs to stop flashing before proceeding with operation.

Passive Mode

- The orange LED (**6**) illuminates when either of the following occurs:
  - The boom is fully retracted.
  - The park brake is not applied and transmission control lever is in the forward or reverse position.
- When approaching forward stability limitations, visual and audible indication is provided and the automatic function cut-out and/or slow down feature is disabled.

WARNING

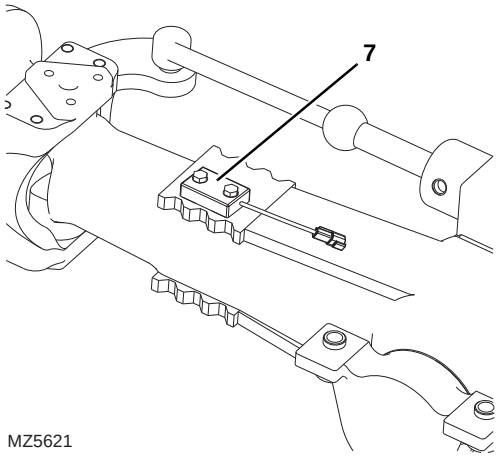
TIP OVER HAZARD. If the green, orange and red LEDs flash and warning buzzer sounds, retract and lower boom immediately. Determine cause and correct before continued use.

Test the LSI at the beginning of each work shift.

1. Fully retract and level the boom, with no load. Do not raise the boom during this test.
2. Level frame using level in cab.
3. Press the system check button (**5**) on the LSI display. This will cause all LEDs to flash on and an audible warning to sound. This indicates that the system is functioning properly. If the test gives a different result, the system is not functioning properly and the machine must be removed from service and repaired before continued operation.

9.16.2 LSI Sensor

Note: *If the rear axle is removed or replaced, the LSI Sensor must be installed AFTER the rear axle is installed and setting on all four wheels.*



The LSI sensor (**7**) is bolted on the top left of the rear axle.

a. LSI Sensor Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission control lever in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the engine to cool.
4. Properly disconnect the battery.
5. Disconnect the LSI electrical connector.
6. Loosen, remove and discard the two bolts holding the LSI assembly to the rear axle.
7. Remove and discard the sensor assembly.

b. LSI Sensor Installation

1. Ensure threads of both bolt holes are clean and free from rust, water and debris.
2. Clean the bare metal with a degreasing agent, Loctite® 7063™.
3. Remove any excessive degreasing agent and allow to dry.
4. Apply a thin film of Loctite® 638™ adhesive to the flat metal surface of the sensor, ensuring the adhesive is spread evenly over the entire surface.

Note: *Follow all adhesive manufacturer's recommendations including storage life.*

5. Fit the sensor, ensuring the lead exits in the corner direction. Secure with two bolts - Socket HD Capscrew M10x35x1.5, Grade 12.9.

Note: *It is important to prevent distortion of the sensor element, therefore tighten each bolt finger tight. Alternately tighten each bolt to 35 Nm (26 lb-ft) and finally to 70-80 Nm (52-59 lb-ft).*

6. Permanently mark position of bolt head and sensor body.
7. Leave the machine undisturbed for a minimum of 6 hours before moving.
8. Plug the electrical connector into the sensor assembly.
9. Properly connect the battery.
10. Close and secure the engine cover.
11. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.
12. Calibrate the LSI system, refer to Section 9.15.3, "LSI System Calibration."

9.16.3 LSI System Calibration

a. Standard Calibration

To calibrate the LSI, certain conditions must be met:

- The sensor must be installed according to Section 9.15.2, “LSI Sensor.”
- The machine control system must be powered on for at least 10 minutes before calibration.
- The operator must remain in the cab.
- The calibration shall be conducted with the standard carriage and forks attached and weights as necessary (a range of 60-80% of maximum weight capacity).
- The machine must be on a level surface with the wheels steered straight and park brake off, with straight driving over a distance of at least 2 m (6.5 ft) being the last movement before entering a calibration point.
- While utilizing the LSI override button, 10 times lift and lower the boom stopping suddenly to induce the rear axle to bounce.
- Position the rear tires centrally on the scales.
- The calibration must be completed within 30 minutes after starting procedure.

Calibration Procedure:

1. Start and position the machine to perform the calibration procedure.
2. Remove the standard carriage and weight assembly.
3. Fully retract the boom and if equipped, lower the outriggers. Shut the machine OFF.
4. With ignition key in OFF position, press and hold SYSTEM CHECK button on LSI display and turn ignition key to engine START position. Release the ignition key when engine start is achieved, but continue to hold SYSTEM CHECK button on LSI display until the orange LED on LSI display goes out and buzzer sounds (approximately 3 seconds). Release SYSTEM CHECK button.
5. The LEDs will perform a rolling sequence. When only the third green LED illuminates, press the SYSTEM CHECK button.
6. The first green LED then illuminates. With no attachment, outriggers down (if equipped) and boom retracted, lift boom to maximum boom angle.
7. Press the SYSTEM CHECK button on the LSI display and release. The first 3 green LEDs will illuminate. The third then second green LEDs will go out as the calibration point is recorded.
8. The first green LED goes out and buzzer sounds then the red LED illuminates.
9. Lower boom until level. If equipped, fully raise the outriggers. Pressing the LMI Override button may be required to lower the boom.
10. Attach the previously removed standard carriage, forks and weight.
11. Slowly extend the boom until the rear axle weight in the following table is achieved.

Model	Weight on Rear Axle
L2906, 2906H, 3507H, 29.6LP, 29.6 & 35.7	750 kg (1653 lb)

12. Press the SYSTEM CHECK button on the LSI display and release. As the calibration point is recorded, buzzer sounds and the LEDs will flash and perform a sequence until all are flashing.
13. Turn the ignition key to OFF. LSI is now calibrated.
14. Perform the LSI-CAN PT Check. Refer to Section 9.16.4, “LSI-CAN Check PT.”

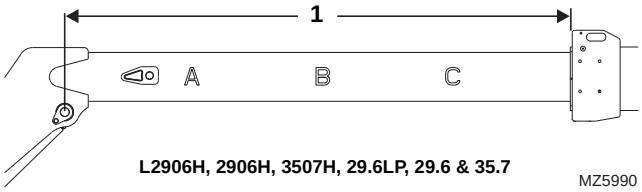
b. Field Calibration

To calibrate the LSI, certain conditions must be met:

- The sensor must be installed according to Section 9.15.2, “LSI Sensor.”
- The test weight matches the model being calibrated in the table shown below.
- The calibration shall be conducted with standard carriage and forks attached to the machine.
- While utilizing the LSI override button, 10 times lift and lower the boom stopping suddenly to induce the rear axle to bounce.

Note: *If the test weight is not known, follow steps 1 & 2.*

Model	Test Weight (W)	Xtip (1)	Xcal (2)
L2906H, 29.6LP	2100 kg (4630 lb)	1256 mm (49 in)	610 mm (24 in)
2906H, 29.6	2100 kg (4630 lb)	1256 mm (49 in)	610 mm (24 in)
3507H, 35.7	2100 kg (4630 lb)	1758 mm (69 in)	1090 mm (43 in)



L2906H, 2906H, 3507H, 29.6LP, 29.6 & 35.7

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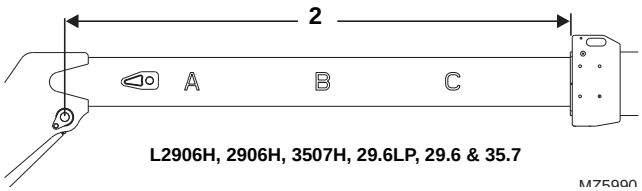
1. With the estimated test weight on the forks, start the machine and extend the boom horizontally until the machine starts to tip. This point should be at an extension of Xtip (**1**) of the second boom section. If the machine is not tipping at this extension, weight needs to be added or removed from the forks.
2. By confirming that the machine tips at this point, the correct amount of weight is now on the forks.
3. The machine control system must be powered on for at least 10 minutes before calibration.
4. The machine must be on a level surface with the wheels steered straight and park brake OFF. Drive the machine forward over a distance of at least 2 m (6.5 ft) before entering a calibration point.
5. Lower outriggers (if equipped), place test weight on ground, apply park brake and shut engine OFF. Do Not move machine.

Field Calibration Procedure:

Note: *The following procedure must be completed within 30 minutes of starting the procedure.*

1. With ignition key in OFF position, press and hold SYSTEM CHECK button on LSI display and turn ignition key to engine START position. Release the ignition key when engine start is achieved, but continue to hold SYSTEM CHECK button on LSI display until the orange LED on LSI display goes out and buzzer sounds (approximately 3 seconds). Release SYSTEM CHECK button.
2. The LEDs will perform a sequence. When only the third green LED illuminates, press the SYSTEM CHECK button.
3. The first green LED then illuminates. With no attachment, outriggers down (if equipped), and boom fully retracted, lift boom to maximum boom angle.
4. Press the SYSTEM CHECK button on the LSI display and release. The first 3 green LEDs will illuminate. The third then second green LEDs will go out as the calibration point is recorded.
5. The first green LED goes out and buzzer sounds then the red LED illuminates.
6. Lower boom and without moving the machine, pick up the proper test weight (**W**) listed in the table. Pressing the LMI Override button may be required to lower the boom.



L2906H, 2906H, 3507H, 29.6LP, 29.6 & 35.7

MZ5990

7. With the boom horizontal, slowly extend the boom to the distance of Xcal (**2**). The proper calibration weight is now on the rear axle and the LSI can now be calibrated.
8. Press the SYSTEM CHECK button on the LSI display and release. As the calibration point is recorded, buzzer sounds and the LEDs will flash and perform a sequence until all are flashing.
9. Turn the ignition key to OFF. LSI is now calibrated.
10. Perform the LSI-CAN PT Check. Refer to Section 9.16.4, “LSI-CAN Check PT.”

Note: *The following procedure MUST be performed before the calibration is finalized.*

9.16.4 LSI-CAN Check PT

With the LSI calibrated, the UGM also need it’s “LSI_CAN CHECK PT” calibrated and verified.

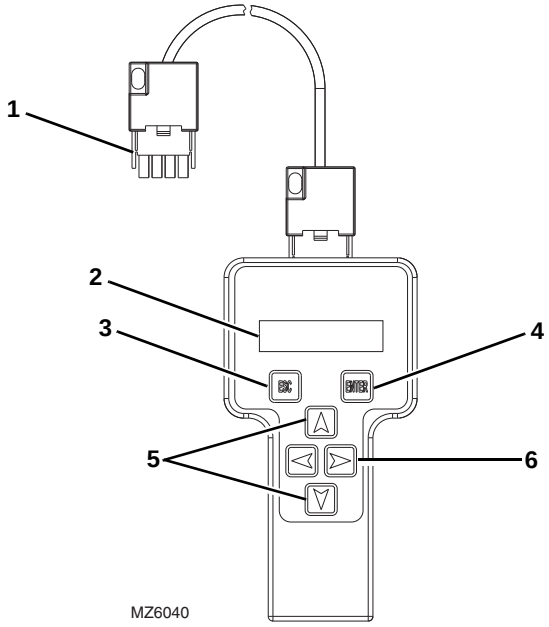
1. Start the machine.
2. Press the “C” and “OK” buttons simultaneously on the keypad or the analyzer.
3. Go to “ACCESS LEVEL 3” and press “OK”.
4. Enter the proper access code and press “OK”.
5. “ACCESS LEVEL 2 is now visible.
6. Go to “CALIBRATIONS” menu, press “OK”.
7. Scroll to “LSI_CAN CHECK PT”.
8. “SET LSI_CAN CHECK POINT”, use the arrow keys to change “NO” to “YES”.
9. Follow the screen instructions:
   a. “Remove Weights and Attachments”, press “OK”.
   b. “TELESCOPE IN and FULLY LIFT UP”, press “OK”.
   c. “STOP, WAIT ONE MINUTE”, press “OK”.
   d. “PRESS ENTER TO SET CHECK POINT”, press “OK”
   e. Screen defaults back to Calibrations Menu.

9.16.5 500 Hour - LSI CAN SYSTEM CHECK

1. Start machine
2. Press the “C” and “OK” buttons simultaneously on the keypad or the analyzer.
3. Go to “ACCESS LEVEL 2 or 1” and press “OK”.
4. Enter the proper access code and press “OK”.
5. Go to “OPERATOR TOOLS” menu, press “OK”.
6. Scroll to “LSI_CAN SYSTEM CHECK”.
7. “PERFORM LSI_CAN SYSTEM CHECK?”, use the arrow keys to change “NO” to “YES”.
8. Follow the screen instructions as follows:
   a. “Remove Weights and Attachments”, press “OK”.
   b. “TELESCOPE IN and FULLY LIFT UP”, press “OK”.
   c. “STOP, WAIT ONE MINUTE”, press “OK”.
   d. “PRESS ENTER TO START TEST”
   e. “PASS or “FAIL”, press “ESC”. Must receive a “PASS”.
   f. “LSI CAN SYSTEM CHECK”, press “ESC” to return to menu.
9. Cycle power.Turn machine OFF - ON.
10. Install the previously removed carriage assembly.

9.17 HAND HELD ANALYZER

The hand held analyzer can be used in place of the cab display panel.



1. Cable Connector.
2. Analyzer Display Screen.
3. Escape Key: To return home or access previous menu.
4. Enter Key: Stores and selects Top Level, Sub Level and Items Menus.
5. Up/Down Arrow Keys: Change adjustable values.
6. Left and Right Arrow Keys: Used to move between Top Level, Sub Levels and Item Menus.

9.17.1 Analyzer Usage

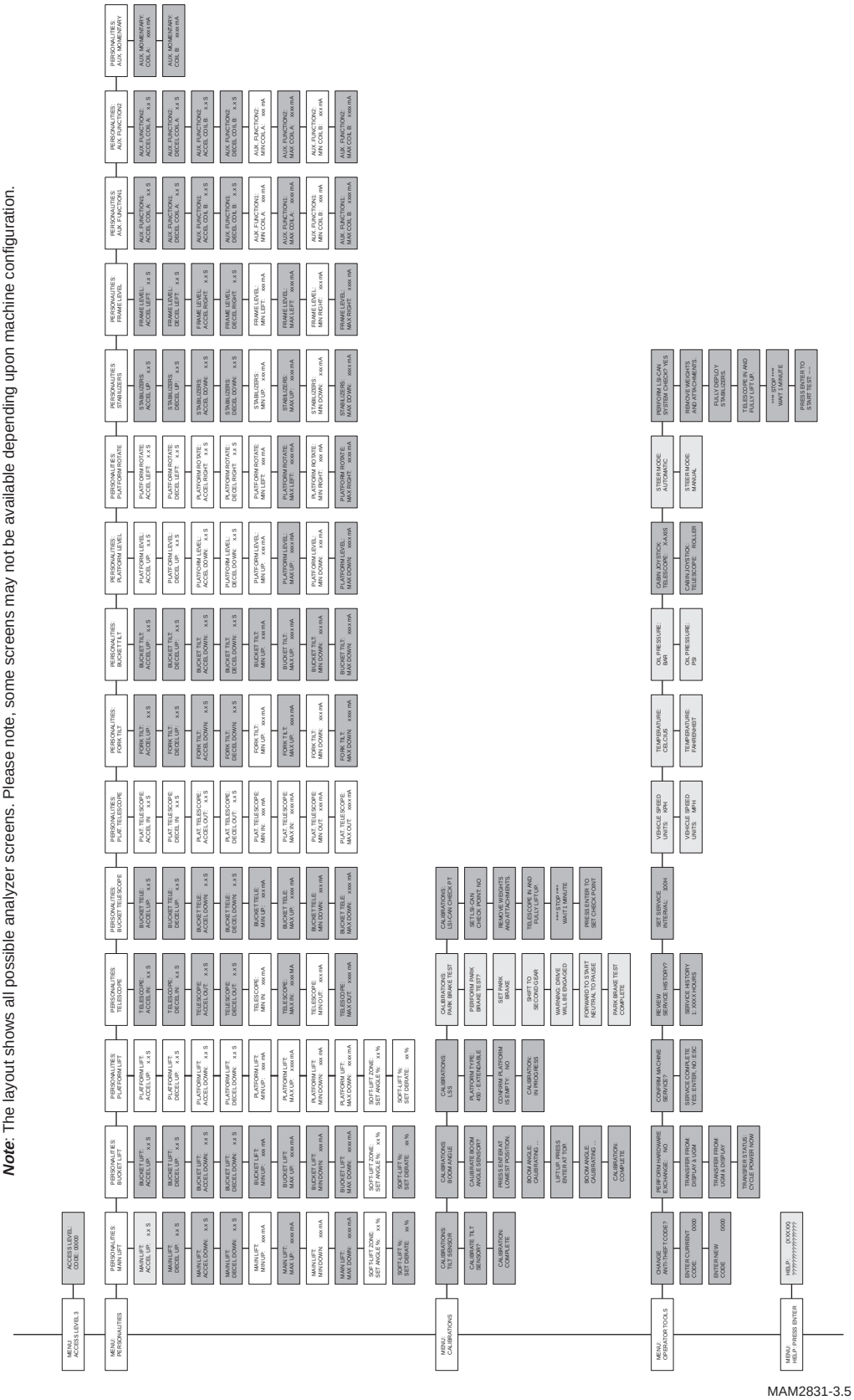
Help messages can be viewed using the Analyzer (P/N 1001103758). The Help messages can be accessed by pressing the ENTER key while viewing the current Help message. The Help message shall be EVERYTHING OK when no fault is present. The Analyzer cable plugs into the XQ connector of the PCB board located beside the operator’s seat.

For more information, contact the local JLG dealer.

9.17.2 Analyzer Software - Version 3.5 (Sheet 1 of 2)

- Not ACCESSABLE
- Requires ACCESS LEVEL 3, 2, 1 and 0
- Requires ACCESS LEVEL 2, 1 and 0

Note: The layout shows all possible analyzer screens. Please note, some screens may not be available depending upon machine configuration.



(Sheet 2 of 2)

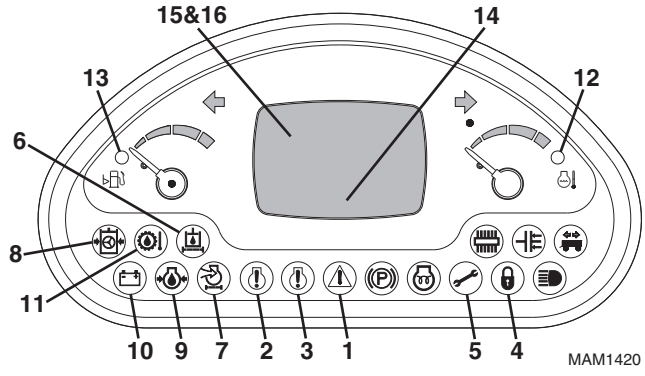
Note: The layout shows all possible analyzer screens. Please note, some screens may not be available depending upon machine configuration.

9.18 FAULT CODES

Active faults and fault memory will be displayed at the operator level of access. Active faults will also be displayed as a blink code at the controller on-board LED. The 25 previous faults are logged in fault memory, which can be accessed by choosing ENTER while viewing active fault messages.

9.18.1 Indicator Cross Reference Table

Indicator	Assignment
1	Machine System Distress
2	Engine Fault Warning
3	Engine Fault Critical
4	Machine Locked
5	Service
6	Hydraulic Filter Restriction
7	Air Filter Restriction
8	Low Steer Pressure
9	Low Engine Oil Pressure
10	Battery Low or Not Charging
11	High Transmission Oil Temperature
12	High Engine Coolant Temperature
13	Low Fuel Level
14	Platform Overloaded
15	Outriggers Not Deployed (Platform)
16	Chassis Not Level



9.18.2 Fault Code Table

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
HELP COMMENT	00XXX				
EVERYTHING OK	001			The system detects no problems exist.	
POWER UP	21XXX				
POWER CYCLE	211			Power was cycled ON.	
FUNCTION ENABLE INPUTS – INVALID SIGNAL STATES	214	1	Ignore and inhibit all function requests from the platform station. Output J2-19 Function Enable Relay of the platform module will be deactivated. Output J2-26 Engage Starter will be deactivated and inhibited from the platform.	If both J7-15 of the UGM and J7-8 of the platform module are simultaneously HIGH or LOW for a period of 1 second after the Function Enable Relay power-up check have been successfully completed or J7-15 is HIGH and J7-8 is LOW after the Function Enable Relay power-up check have been successfully completed and the PLATFORM STATION is active and a valid PLATFORM MODE exists.	Power cycled.
JOYSTICK AXES NOT IN NEUTRAL POSITION AT POWER UP	215	1	Ignore command signals from the joystick regarding the X axis and Y axis.	At system power-up, if the one of the two axes are not in the neutral position, the UGM will report and log a “JOYSTICK AXES NOT IN NEUTRAL POSITION AT POWER-UP” fault.	A CAN message is received indicating the X axis and Y axis are in the neutral position.
JOYSTICK ROLLER NOT IN NEUTRAL POSITION AT POWER UP	216	1	Ignore command signals from the joystick regarding the roller.	At system power-up, if the roller is not in the neutral position on JLG models only.	A CAN message is received indicating the roller is in the neutral position.
JOYSTICK S1 BUTTON ACTIVE AT POWER UP	217	1	Ignore command signals from the joystick S1 button that was active during the power-up.	At system power-up, if the S1 button is activated.	A CAN message is received indicating the joystick S1 button is not activated.
JOYSTICK S2 BUTTON ACTIVE AT POWER UP	218	1	Ignore command signals from the joystick S2 button that was active during the power-up.	At system power-up, if the S2 button is activated on JLG models only.	A CAN message is received indicating the joystick S2 button is not activated.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
JOYSTICK S3 BUTTON ACTIVE AT POWER UP	219	1	Ignore command signals from the joystick S3 button that was active during the power-up.	At system power-up, if the S3 button is activated on JLG models only.	A CAN message is received indicating the joystick S3 button is not activated.
JOYSTICK S4 BUTTON ACTIVE AT POWER UP	2110	1	Ignore command signals from the joystick S4 button that was active during the power-up.	At system power-up, if the S4 button is activated on JLG models only.	A CAN message is received indicating the joystick S4 button is not activated.
ENGINE START PREVENTED – PLATFORM START SWITCH HIGH AT POWER UP	2111	1	The engine start signal will be ignored. J2-26 Engage Starter will be deactivated and inhibited.	If a LOW on J1-14 of the platform module and the PLATFORM STATION is active at system power up.	Power cycled.
PLATFORM ROTATE LEFT PREVENTED – INPUT HIGH AT POWER UP	2112	1	Ignore platform rotate left function request.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and a HIGH is detected at the platform station on the platform rotate left input at system power up.	The input goes LOW for a period of at least 1 second.
PLATFORM ROTATE RIGHT PREVENTED – INPUT HIGH AT POWER UP	2113	1	Ignore platform rotate right function request.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and a HIGH is detected at the platform station on the platform rotate right input at system power up.	The input goes LOW for a period of at least 1 second.
PLATFORM LEVEL UP PREVENTED – INPUT HIGH AT POWER UP	2114	1	Ignore platform level up function request.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and a HIGH is detected at the platform station on the platform level up input at system power up.	The input goes LOW for a period of at least 1 second.
PLATFORM LEVEL DOWN PREVENTED – INPUT HIGH AT POWER UP	2115	1	Ignore platform level down function request.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and a HIGH is detected at the platform station on the platform level down input at system power up.	The input goes LOW for a period of at least 1 second.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
APU SWITCH INPUT INVALID – INPUT HIGH AT POWER UP	2116	1	Still allow APU function request. If J7-4 Boom Angle reading is less than 10° and the J3-8 Boom Retracted input is HIGH, cutout the Main Lift Up and Telescope Out functions.	If a platform is configured as ENABLED and the UGM detects J4-16 Auxiliary Power Unit (APU) Enable is HIGH at system power up.	The input goes LOW for a period of at least 1 second.
PLATFORM JOYSTICK NOT IN NEUTRAL POSITION AT POWER UP	2117	1	Ignore platform lift and telescope function requests from the platform joystick.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and the platform joystick is not detected to be in the neutral position at system power up.	Joystick is detected to be in neutral position.
ENGINE PRE-HEAT PREVENTED – INPUT HIGH AT POWER UP	2118	1	Ignore engine pre-heat function request.	If the UGM detects J4-20 Engine Pre-Heat or the platform module input J1-23 Engine Pre-heat is HIGH at system power up.	The input goes LOW for a period of at least 1 second.
FRAME LEVEL RIGHT INPUT – INVALID SIGNAL	2119	1	Deactivate and inhibit J2-5 Frame Level Right Valve. Deactivate and inhibit J2-7 Frame Level Left Valve. Deactivate and inhibit J1-3 Stabilizer and Frame Level Speed Valve (if applicable) as it relates to frame leveling functions only.	If J4-17 Frame Leveling Right is HIGH at power up.	Power cycled.
FRAME LEVEL LEFT INPUT – INVALID SIGNAL	2120	1	Deactivate and inhibit J2-5 Frame Level Right Valve. Deactivate and inhibit J2-7 Frame Level Left Valve. Deactivate and inhibit J1-3 Stabilizer and Frame Level Speed Valve (if applicable) as it relates to frame leveling functions only.	If J4-9 Frame Leveling Left is HIGH at power up.	Power cycled.
HYDRAULIC QUICK CONNECT INPUT – INVALID SIGNAL	2121	1	Deactivate output J1-23 Hydraulic Quick Connect Valve. Ignore hydraulic quick connect function requests. Deactivate output J2-9 Auxiliary Function-A Valve until the cabin's joystick is in the neutral position and the S4 switch is OFF and J1-23 is confirmed to be deactivated. Deactivate output J2-20 Auxiliary Function-B Valve until the cabin's joystick is in the neutral position and the S4 switch is OFF and J1-23 is confirmed to be deactivated.	If hydraulic quick connect feature is configured in the MACHINE SETUP menu and J7-35 Hydraulic Quick Connect ON is HIGH at power up or J3-10 Hydraulic Quick Connect OFF is LOW at power up or J7-35 matches the state of input J3-10 for 0.5 seconds.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
CONTINUOUS AUXILIARY HYDRAULICS SWITCH HIGH AT POWER UP	2122	1	Inhibit operation of the Continuous Auxiliary Hydraulics feature/logic.	The UGM has detected the Continuous Auxiliary Hydraulics switch is HIGH at system power up.	The input goes LOW for a period of at least 1 second.
JOYSTICK TRIGGER SWITCH ACTIVE AT POWER UP	2123	1	Ignore command signals from the joystick trigger switch that was active during the power-up.	At system power-up, if the joystick trigger switch is activated on CAT models only.	A CAN message is received indicating the joystick trigger switch is not activated.
JOYSTICK LEFT ROLLER NOT IN THE NEUTRAL POSITION AT POWER UP	2124	1	Ignore command signals from the joystick regarding the left roller.	At system power-up, if the left roller of the joystick is not in the neutral position on CAT models only.	Latch fault until a joystick CAN message is received indicating the roller is in the neutral position.
JOYSTICK RIGHT ROLLER NOT IN THE NEUTRAL POSITION AT POWER UP	2125	1	Ignore command signals from the joystick regarding the right roller.	At system power-up, if the right roller of the joystick is not in the neutral position on CAT models only.	Latch fault until a joystick CAN message is received indicating the roller is in the neutral position.
BOOM RIDE ENABLE SWITCH NOT IN THE OFF POSITION AT POWER UP	2130	1	Ignore signal from the Boom Ride Enable Switch.	At system power-up, the Boom Ride/Boom Float module has detected the Boom Ride Enable Switch is engaged.	Boom Ride Enable Switch is detected in its OFF position.
PLATFORM CONTROLS	22XXX				
PLATFORM LEVEL – CONFLICTING INPUT SIGNALS	2225	1	Not acknowledge either platform level function request messages.	If the UGM receives CAN2 messages that indicate both J1-9 and J1-10 inputs to the platform controller are HIGH together.	Power cycled.
PLATFORM ROTATE – CONFLICTING INPUT SIGNALS	2226	1	Not acknowledge either platform rotate function request messages.	If the UGM receives CAN2 messages that indicate both J1-7 and J1-8 inputs to the platform controller are HIGH together.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
FUNCTION ENABLE INTERLOCK – ENABLE SWITCH NOT SELECTED FIRST	2227	1	The requested function will be ignored.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and a hydraulic function request is detect at the platform station before the function enable signal was received.	The hydraulic function request is no longer active.
FUNCTION ENABLE INTERLOCK – NOT SELECTED IN TIME	2228	1	Turn OFF the functions enabled indicator at the platform station. Ignore all function requests from the platform station while the FUNCTIONS ENABLED state is active.	If the PLATFORM STATION is active and a platform is configured as ENABLED and a platform is detected as attached and if a function request is not received within the 7 second period from the time the FUNCTION ENABLE state is activated.	The function enable switch is released.
ENGINE START PREVENTED – FUNCTION ENABLE SWITCH ENGAGED	2229	1	The engine start signal will be ignored. J2-26 Engage Starter will be deactivated and inhibited.	When the PLATFORM STATION is active and the engine start signal is detected at the platform and the UGM detects the function enable switch is engaged.	The function enable switch is released.
PLATFORM JOYSTICK – OUT OF RANGE HIGH	2230	1	Hydraulic functions (Lift and Telescope) associated to the dual-axis platform joystick are inhibited.	The platform module detects the input voltage for dual-axis joystick is out of range on the high side and reports the issue to the UGM.	Power cycle.
PLATFORM JOYSTICK – CENTER TAP BAD	2231	1	Hydraulic functions (Lift and Telescope) associated to the dual-axis platform joystick are inhibited.	The platform module detects center tap dual-axis joystick voltage is out of range and reports the issue to the UGM.	Power cycle.
FUNCTION ENABLE RELAY – INVALID SIGNAL	2233	1	Deactivate and inhibit platform module output J2-19 Function Enable Relay. Deactivate and inhibit UGM output J2-26 Engage Starter. Suppress the “FUNCTION ENABLE INPUTS – INVALID SIGNAL STATES” fault.	J7-2 of the platform module is HIGH and J2-4 Function Enable Integrity Signal does not change states from HIGH to LOW during the power-up test sequence.	Power cycle.
GROUND CONTROLS	23XXX				
OPERATING MODE INTERLOCK – SHIFTER NOT IN NEUTRAL	239	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted.	The PLATFORM STATION is active and CABIN MODE was the last valid operating mode and a platform is detected as attached and the drive direction inputs are not detected as follows: (J4-4 Neutral-HIGH, J7-22 Forward-LOW, J4-18 LOW).	A valid drive direction of Neutral exists (J4-4 is the only HIGH shifter input).

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
PLATFORM OPTION NOT CONFIGURED	2311	1	The UGM will also disregard all commands from the platform station. The UGM will use the platform attached response curves.	If the PLATFORM ATTACHED option has not been configured in the MACHINE SETUP menu and a platform attached state is detected or the UGM detects a HIGH on J7-1 or J7-2.	Power cycle.
STABILIZERS NOT CONFIGURED	2312	1	The UGM will ignore all stabilizer function requests from the joystick.	If the S1 button on the cabin's joystick is activated and the STABILIZERS option has not been configured in the MACHINE SETUP menu and STABILIZERS are a configurable for the selected MODEL.	The S1 button on the cabin joystick is released.
FRAME LEVEL NOT CONFIGURED	2313	1	The UGM will ignore all frame level function requests on UGM inputs J4-17 and J4-9.	If J4-17 Frame Leveling Right or J4-9 Frame Leveling Left inputs are HIGH and the FRAME LEVEL option has not been configured in the MACHINE SETUP menu.	J4-17 or J4-9 goes LOW.
OPERATING STATION SELECTION INVALID	2314	1	The directional symbol "N" will be displayed in the operator's cabin display LCD. The transmission will be commanded to neutral and drive will not be permitted. Immediately deactivate and inhibit all hydraulic function operation.	If UGM inputs J7-3 Ground Mode and J7-2 Platform Mode both are HIGH during operation.	Power cycle.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
OPERATING MODE INTERLOCK - STABILIZERS NOT DEPLOYED	2315	1, 15	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. If PLAFORM MODE is already the valid operating state and the UGM has not detected any chassis tilt condition, then inhibit the Lift function until the Boom Retracted switch is HIGH. Once the Boom Retracted switch is HIGH, the UGM will permit the Lift Down Function to operate and inhibit the Telescope Out function. Once the UGM detects the boom angle is below 10°, the Telescope Out function will be permitted and the Lift function permitted up to a boom angle of 10°. If the UGM detects a chassis tilt condition with a tilt sensor angle reading of ABSOLUTE TRIP POINT 1 or higher but less than ABSOLUTE TRIP POINT 2, the above retrieval sequence will be permitted at derated function speeds. If the UGM detects a chassis tilt condition with a tilt sensor angle reading of ABSOLUTE TRIP POINT 2 or higher, Telescope Out will be immediately inhibited.	The PLATFORM STATION is active and one or both inputs J7-7 and J7-20 are LOW.	J7-7 and J7-20 become HIGH.
OPERATING MODE INTERLOCK - PLATFORM NOT ATTACHED	2316	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. If PLATFORM MODE is the last valid operating mode, the UGM will assume the platform is attached.	The PLATFORM STATION is active and the UGM has not detected the platform electrically attached.	The UGM detects the platform as electrically attached.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
OPERATING MODE INTERLOCK - CHASSIS NOT LEVEL	2317	1, 16	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. If PLATFORM MODE is already the valid operating state and a chassis tilted condition occurs from a tilt sensor angle reading of ABSOLUTE TRIP POINT 1or higher but less than ABSOLUTE TRIP POINT 2, the Lift and Telescope function speeds will be derated if an ENGINE RUNNING condition exists and APU operation will be permitted if an ENGINE STOPPED condition exists. If PLATFORM MODE is already the valid operating state and a chassis tilted condition occurs from a tilt sensor angle reading of ABSOLUTE TRIP POINT 2 or higher, telescope out will be inhibited.	The PLATFORM STATION is active and the UGM has detected the machine's chassis is not sufficiently level for platform operation.	The UGM detects the machine's chassis tilt level is within range.
OPERATING MODE INTERLOCK - BOOM ANGLE TOO HIGH	2318	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. Changeover to CABIN MODE will not be permitted.	CABIN MODE was the last valid operating mode and the PLAFORM STATION is currently active and the UGM has detected the boom angle is 10°. PLATFORM MODE was the last valid operating mode and the CABIN STATION is currently active and the UGM has detected the boom angle is 10°.	The UGM has detected the boom angle is 10°.
OPERATING MODE INTERLOCK - BOOM NOT FULLY RETRACTED	2319	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. Changeover to CABIN MODE will not be permitted.	CABIN MODE was the last valid operating mode and the PLAFORM STATION is currently active and the UGM has detected J3-8 Boom Retracted is LOW. PLATFORM MODE was the last valid operating mode and the CABIN STATION is currently active and the UGM has detected J3-8 Boom Retracted is LOW.	The UGM has detected J3-8 Boom Retracted is HIGH.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
OPERATING MODE INTERLOCK - PARK BRAKE NOT SET	2320	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. Changeover to CABIN MODE will not be permitted. All hydraulic function requests from the platform station will be ignored.	The PLATFORM STATION or CABIN STATION is active and the UGM has detected J4-5 Park Brake is LOW (not set) during a MODE changeover situation or during PLATFORM MODE.	J4-5 Park Brake is HIGH (set).
ERRATIC PLATFORM ATTACHED SIGNAL	2321	1	The platform will be considered attached. Display the platform attached screen on the cabin's LCD.	The UGM detects three signal transitions on J1-21 within a 5 second period.	Power cycled.
CONFLICTING FRAME LEVEL SIGNALS	2322	1	Deactivate and inhibit J2-5 Frame Level Right Valve. Deactivate and inhibit J2-7 Frame Level Left Valve. Deactivate and inhibit J1-3 Stabilizer and Frame Level Speed Valve (if applicable) as it relates to frame leveling functions only.	J4-17 Frame Leveling Right and J4-9 Frame Leveling Left inputs are both HIGH simultaneously.	Power cycled.
CABIN JOYSTICK – X AXIS FAULT	2323	1	X-axis function requests will be ignored by the UGM.	The cabin joystick detects a fault on the X-axis of the joystick.	Power cycled.
CABIN JOYSTICK – Y AXIS FAULT	2324	1	Y-axis function requests will be ignored by the UGM.	The cabin joystick detects a fault on the Y-axis of the joystick.	Power cycled.
CABIN JOYSTICK – ROLLER FAULT	2325	1	Roller function requests will be ignored by the UGM.	The JLG cabin joystick detects a fault with the roller on the joystick.	Power cycled.
CABIN JOYSTICK – S1 BUTTON FAULT	2326	1	S1 button function requests will be ignored by the UGM.	The cabin joystick detects a fault with the S1 button on the joystick.	Power cycled.
CABIN JOYSTICK – S2 BUTTON FAULT	2327	1	S2 button function requests will be ignored by the UGM.	The JLG cabin joystick detects a fault with the S2 button on the joystick.	Power cycled.
CABIN JOYSTICK – S3 BUTTON FAULT	2328	1	S3 button function requests will be ignored by the UGM.	The JLG cabin joystick detects a fault with the S3 button on the joystick.	Power cycled.
CABIN JOYSTICK – S4 BUTTON FAULT	2329	1	S4 button function requests will be ignored by the UGM.	The JLG cabin joystick detects a fault with the S4 button on the joystick.	Power cycled.
CABIN JOYSTICK – S SWITCH FAULT	2330	1	S switch function requests will be ignored by the UGM.	The cabin joystick detects a fault with the S switch.	Power cycled.
CABIN JOYSTICK – T SWITCH FAULT	2331	1	T switch function requests will be ignored by the UGM.	The cabin joystick detects a fault with the T switch.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
HYDRAULIC FILTER RESTRICTION	2332	1, 6	N/A	J2-24 Hydraulic Filter Restriction input is HIGH for a period of 3 seconds or more after system power has been ON for at least 10 minutes.	J2-24 Hydraulic Filter Restriction input is LOW for 1 second.
ALL WHEEL STEER INPUT – INVALID SIGNAL	2333	1	Not recognize any steer mode requests on input J4-35 All Wheel Steer. Flash the All-Wheel Steer Mode Indicator at a frequency of 5 Hz.	J4-35 All Wheel Steer input is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
CRAB STEER INPUT – INVALID SIGNAL	2334	1	Not recognize any steer mode requests on input J4-34 Crab Steer. Flash the Crab Steer Mode Indicator at a frequency of 5 Hz.	J4-34 Crab Steer input is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
JOYSTICK LOCK INPUT – INVALID SIGNAL	2335	1	Deactivate the Joystick Lock feature if the CABIN STATION is active. Activate J4-1 Joystick Function Indicator to flash at a frequency of 5 Hz.	J7-11 Joystick Lock input is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
LOAD MOMENT SHUTOFF INPUT – INVALID SIGNAL	2336	1	Disregard a HIGH on input J4-33. If the CABIN STATION is active, monitor and immediately react to the signal at J4-10; otherwise, disregard the signal at J4-10. If the CABIN STATION is active, flash J4-26 Load Moment Shutoff Indicator at a frequency of 5Hz; otherwise, activate J4-26. If the CABIN STATION is active, set the Load Moment Shutoff state to active; otherwise, set the Load Moment Shutoff state to inactive.	J4-33 Load Moment Shutoff input is HIGH at power up or for a period of 40 seconds or longer.	Power cycled.
BUCKET MODE INPUT – INVALID SIGNAL	2337	1	Discard the fork tilt response curves for bucket mode. Activate J4-13 Bucket Mode Indicator to flash at a frequency of 5 Hz. Apply the proper fork tilt response curves for the new active mode when the cabin's joystick X and Y and roller(s) axes are in neutral.	J4-19 Bucket Mode input is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
2–WHEEL STEER INPUT – INVALID SIGNAL	2338	1	Not recognize any steer mode requests on input J3-9 2-Wheel Steer. Flash the 2-Wheel Steer Mode Indicator at a frequency of 5 Hz.	J3-9 2-Wheel Steer input is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
KEYPAD OK BUTTON – INVALID SIGNAL	2339	1	Disregard all signal changes until switch state transitions to LOW.	The UGM detects the keypad OK button is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
KEYPAD CANCEL BUTTON – INVALID SIGNAL	2340	1	Disregard all signal changes until switch state transitions to LOW.	The UGM detects the keypad CANCEL button is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
KEYPAD UP BUTTON – INVALID SIGNAL	2341	1	Disregard all signal changes until switch state transitions to LOW.	The UGM detects the keypad UP button is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
KEYPAD DOWN BUTTON – INVALID SIGNAL	2342	1	Disregard all signal changes until switch state transitions to LOW.	The UGM detects the keypad DOWN button is HIGH at power up or for a period of 7 seconds or longer.	Power cycled.
BOOM ANGLE SENSOR – NOT CALIBRATED	2343	1	Assign a fixed boom angle value of 99×, as other functions will then fault to safe conditions. Display the fixed boom angle value of '99' on the operator's cabin display. Derate the MAX LIFT UP in the PERSONALITIES menu screen by the LIFT UP DERATE value in the Constant Data tables. Ignore all hydraulic function requests from the platform module.	The UGM detects no calibration has been completed.	A valid boom angle sensor calibration is completed.
BOOM ANGLE SENSOR – OUT OF RANGE HIGH	2344	1	Display the fixed boom angle value of '99' on the operator's cabin display. Temporarily assign a fixed boom angle value of 99×. If a calibration is in progress, fail boom angle sensor calibration ("CALIBRATION: SENSOR FAULT"). Derate the MAX LIFT UP in the PERSONALITIES menu screen by the LIFT UP DERATE value in the Constant Data tables. Ignore all hydraulic function requests from the platform module.	During operation or calibration, the UGM detects a value at this input of more than 4.4V.	Power cycled.
BOOM ANGLE SENSOR – OUT OF RANGE LOW	2345	1	Display the fixed boom angle value of '99' on the operator's cabin display. Temporarily assign a fixed boom angle value of 99×. If a calibration is in progress, fail boom angle sensor calibration ("CALIBRATION: SENSOR FAULT"). Derate the MAX LIFT UP in the PERSONALITIES menu screen by the LIFT UP DERATE value in the Constant Data tables. [2]Ignore all hydraulic function requests from the platform module.	During operation or calibration, the UGM detects a value at this input of less than 0.6V.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
BOOM ANGLE SENSOR – NOT RESPONDING	2346	1	Display the fixed boom angle value of '99' on the operator's cabin display. Temporarily assign a fixed boom angle value of 99×. Disallow boom angle sensor calibration ("BOOM ANGLE: CALIBRATION FAIL"). Ignore all hydraulic function requests from the platform module. Deactivate and inhibit the Lift Up output if the platform is detected as attached or PLATFORM MODE is the current active mode; otherwise, derate the MAX LIFT UP in the PERSONALITIES menu screen by the LIFT UP DERATE value in the Constant Data tables.	J2-11 Main Lift Up Valve or J2-22 Main Lift Down Valve are active operating at a current of at least 900 mA for a period of 4 seconds with an ENGINE RUNNING condition and no appreciable change set at 0.5 degrees (adjustable in Constant Data) in the value at this input. (Note, this fault will not be report during boom angle sensor calibration.)	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
SYSTEM INTERLOCK – SET JOYSTICK INPUTS TO NEUTRAL	2347	1	Deactivate and inhibit all joystick functionality.	The UGM has detected one of the following conditions: The hydraulic quick connect switch is activated when any of the other auxiliary hydraulics functions is active. If the joystick roller(s) and/or X-axis and/or Y-axis are not in the neutral or centered position when the hydraulic quick connect switch is released. When the hydraulic quick connect switch is activated and the S4 button activation is not the next detected operator action. If the joystick roller(s) and/or X-axis and/or Y-axis are not in the neutral or centered position when the 'S' switch activation cause the Auxiliary Hydraulics Release feature to engage. If the Auxiliary Hydraulics Release feature is active and the platform becomes detected as attached. When the hydraulic quick connect switch is activated and the S4 button activated, but then released. When the Quick Connect feature is active and the S4 button is released. If the platform is detected as attached with bucket mode active. If the roller(s) and/or X-axis and/or Y-axis are not in the neutral or centered position or one of the S1-S4 buttons are engaged or the trigger switch is engaged and the Joystick Lock feature is enabled. The S4 button is engaged when the joystick roller and/or X-axis and/or Y-axis are not in the neutral or centered position. The Auxiliary Hydraulics Release feature will suppress this fault when active.	Joystick inputs are in the neutral position.
ENGINE START INPUT – INVALID SIGNAL	2348	1	N/A	If a HIGH is detected on J4-8 Engine Start and an ENGINE RUNNING condition has existed for 7 seconds	J4-8 Engine Start goes LOW for 1 second.
LIFT ANGLE DERATED – STABILIZERS NOT DEPLOYED	2349	1	N/A	A MODEL configuration of 4017 is selected and the stabilizers are not deployed and a platform is not attached and a valid Lift function is engaged and a boom angle sensor reading equals the 4017-ANGLE LIMIT parameter.	Inputs J7-7 and J7-20 indicate the stabilizers are deployed.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
CABIN JOYSTICK – LEFT ROLLER FAULT	2350	1	Left roller function requests will be ignored by the UGM.	The CAT cabin joystick detects a fault with the left roller on the joystick.	Power cycled.
CABIN JOYSTICK – RIGHT ROLLER FAULT	2351	1	Right roller function requests will be ignored by the UGM.	The CAT cabin joystick detects a fault with the right roller on the joystick.	Power cycled.
CABIN JOYSTICK – TRIGGER SWITCH FAULT	2352	1	Trigger switch requests will be ignored by the UGM.	The CAT cabin joystick detects a fault with the trigger switch on the joystick.	Power cycled.
BOOM ANGLE SENSOR – INTERNAL FAILURE	2353	1	Display the fixed boom angle value of '99' on the operator's cabin display. Temporarily assign a fixed boom angle value of 99×. Disallow boom angle sensor calibration ("BOOM ANGLE: CALIBRATION FAIL"). Ignore all hydraulic function requests from the platform module. Deactivate and inhibit the Lift Up output if the platform is detected as attached or PLATFORM MODE is the current active mode; otherwise, derate the MAX LIFT UP in the PERSONALITIES menu screen by the LIFT UP DERATE value in the Constant Data tables.	The UGM or platform module has detected one of the following internal failures of the CAN based boom angle sensor: A difference of more than 7 counts (2.5°) for 1 second between the 2 angle readings. A CAN bus message indicating a boom angle value out of range of the calibration, i.e. more than 250 counts.	Power cycled.
OPERATING INTERLOCK – ATTACHMENT COUPLING PIN NOT ENGAGED	2354	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. If the PLATFORM MODE is the valid operating mode, Lift and Telescope functions will be derated to the LIFT UP DERATE and TELE DERATE values in Constant Data.	The platform module has detected J1-1 of the platform module is LOW and the PLATFORM STATION is active and a platform is detected as attached and CAN communications exist between the UGM and platform module.	J1-1 of the platform module goes HIGH for a period of 3 seconds.
OPERATING INTERLOCK – PLATFORM NOT COUPLED	2384	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted if the PLATFORM STATION is active and CABIN MODE was the last valid operating mode. Changeover to PLATFORM MODE will not be permitted. If PLATFORM MODE is the last valid operating mode, the UGM will assume the platform is attached.	The PLATFORM STATION is active and a MARKET configuration of AUSTRAILIA exists and the UGM has not detected the platform coupled signal on input J3-13 (LOW).	The UGM detects the platform as coupled for 2 seconds.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
ERRATIC PLATFORM COUPLED SIGNAL	2385	1	The platform will be considered coupled.	The UGM detects three signal transitions on J3-13 within a 5 second period.	Power cycled.
LOSS OF PLATFORM COUPLED SIGNAL	2386	1	N/A	The CABIN STATION is active and a MARKET configuration of AUSTRALIA exists and J3-13 Platform Coupled input is LOW and J1-21 Platform Attached input is LOW or valid platform module CAN bus messages are being continuously received by the UGM or “ERRACTIC PLATFORM ATTACHED SIGNAL” fault exists.	Power cycled.
FUNCTION PREVENTED	25XXX				
MODEL CHANGED – HYDRAULICS SUSPENDED – CYCLE EMS	259	1	Deactivate and inhibit all hydraulic function operation. J2-26 Engage Starter output will be deactivated and engine start will not be permitted.	The MODEL selection on the Analyzer was changed from its previous setting.	Power cycled.
FUNCTIONS LOCKED OUT – CONSTANT DATA VERSION IMPROPER	2520	1	Deactivate and inhibit all hydraulic function operation. J2-26 Engage Starter output will be deactivated and engine start will not be permitted.	The Constant Data code version is not up to date / compatible with the current machine Application code.	Proper Constant Version is loaded and power is cycled.
ENGINE START PREVENTED – PARK BRAKE NOT SET	2525	1	J2-26 Engage Starter output will be deactivated and engine start will not be permitted.	The CABIN STATION is active and J4-8 Engine Start input is HIGH and J4-5 Park Brake is LOW (not set).	J4-5 Park Brake is HIGH (set).
BOOM EXTENDED SWITCH – CONFLICTING STATE	2526	1	N/A	J7-8 Boom Extension Limit input is LOW, the feature is enabled in the MACHINE SETUP menu, and the J3-8 Boom Retracted input is HIGH.	Power cycled.
EXCESSIVE BOOM ANGLE FOR HYDRAULIC QUICK CONNECT OPERATION	2527	1	Not activate outputs J2-9 Auxiliary Function-A Valve or J2-20 Auxiliary Function-B Valve.	If hydraulic quick connect feature is configured in the MACHINE SETUP menu and the boom angle sensor reading is 10° and the boom angle sensor has successfully completed a calibration and a hydraulic quick connect function request is detected.	J7-35 Hydraulic Quick Connect ON is LOW and J3-10 Hydraulic Quick Connect OFF is HIGH.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
PLATFORM ATTACHED - HYDRAULIC QUICK CONNECT CUTOUT	2528	1	Deactivate output J1-23 Hydraulic Quick Connect. Ignore auxiliary hydraulic requests when the S4 button is engaged on the cabin's joystick.	If hydraulic quick connect feature is configured in the MACHINE SETUP menu and the platform attached conditions have been met and J7-35 is HIGH and J3-10 is LOW and the CABIN STATION is active.	J7-35 Hydraulic Quick Connect ON is LOW and J3-10 Hydraulic Quick Connect OFF is HIGH.
ENGINE START PREVENTED – SHIFT LEVER NOT IN NEUTRAL	2529	1	J2-26 Engage Starter output is inhibited.	If the drive direction signal is not in neutral (i.e. – J7-22 Forward HIGH and/or J4-18 Reverse HIGH).	Shift lever is in neutral position.
PLATFORM ATTACHED ANGLE LIMIT EXCEEDED	2533	1	Report the condition to the UGM. Deactivate platform module output J2-19 Function Enable Relay (which deactivates the dump valve) with any Main Lift Up hydraulic request from the platform station. The UGM will inhibit activation of J2-11 Main Lift Up Valve.	The platform option is configured and a platform is detected as attached and the platform module is detecting the "PLATFORM ATTACHED BOOM ANGLE OVERSHOOT POINT" has been reached and faults 2343, 2353, and 6621 are not active.	The UGM and platform module confirm the boom angle sensor reading is less than the "PLATFORM ATTACHED BOOM ANGLE CUT-OUT POINT" for at least 1 second.
BOOM EXTENSION LIMIT SWITCHES – CONFLICTING STATES	2557	1	Illuminate the vehicle system distress indicator in the cabin's display. Activate the buzzer for a period of 5 seconds in the cabin's display. Illuminate the vehicle system distress indicator at the platform station. Activate the buzzer for a period of 5 seconds at the platform station. Illuminate the Envelope Control indicator at the platform station. If a prohibited function is engaged, the Envelope Control indicator will instead flash at a 10Hz rate. J2-35 Main Telescope Out Valve will be inhibited. J2-22 Main Lift Down Valve will be inhibited; allow Telescope In function until a J3-8 Boom Retracted input state changes occurs from LOW to HIGH. Only permit J2-22 Main Lift Down once J3-8 state change has been seen as HIGH.	If a platform is detected as attached and AM J1-4 is LOW and J7-8 is HIGH or Visa Versa for more than 500ms when a telescope function is active.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
TELESCOPE POSITION SWITCHES – CONFLICTING STATES	2558	1	Illuminate the vehicle system distress indicator in the cabin's display. Activate the buzzer for a period of 5 seconds in the cabin's display. Illuminate the vehicle system distress indicator at the platform station. Activate the buzzer for a period of 5 seconds at the platform station.	If a platform is detected as attached and both AM J1-4 and J7-8 are LOW and the J3-8 Boom Retracted input is HIGH.	Power cycled.
BOOM RETRACTED SENSOR FAULTY – SENSING INVALID	2560	1	Consider any information on input J3-8 Boom Retracted invalid. Set the system as if the boom is always extended.	The UGM has detected one of the following failures of the boom retracted sensor when configured for LSI-CAN or LSI-CAN + LMI: With no telescope functions active, a boom retracted sensor state changes occur. With Telescope In active, a boom retracted sensor transition of HIGH to LOW occurs. With Telescope Out active, a boom retracted sensor transition of LOW to HIGH occurs. With Telescope Out active, the boom retracted sensor has not HIGH for a period of 5 seconds with at least 950mA commanded on the function AND the Load Moment Warning Point has been met or exceeded.	Power cycled.
UGM OUTPUT DRIVERS	33XXX				
MAIN LIFT UP VALVE – OPEN CIRCUIT	33181	1	Deactivate output J2-11 Main Lift Up Valve.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
MAIN LIFT VALVES – SHORT TO BATTERY	33182	1	Deactivate output J2-11 Main Lift Up Valve. Deactivate output J2-22 Main Lift Down Valve. Decouple/disable current feedback input J3-2 Lift Return (Disables Lift Up and Down).	The UGM detects a short to battery at this output.	Power cycled.
MAIN LIFT UP VALVE – SHORT TO GROUND	33183	1	Deactivate output J2-11 Main Lift Up Valve. Decouple/disable current feedback input J3-2 Lift Return (Disables Lift Up and Down).	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
MAIN LIFT DOWN VALVE – OPEN CIRCUIT	33184	1	Deactivate output J2-22 Main Lift Down Valve.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
MAIN LIFT DOWN VALVE – SHORT TO GROUND	33185	1	Deactivate output J2-22 Main Lift Down Valve. Decouple/disable current feedback input J3-2 Lift Return (Disables Lift Up and Down).	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
MAIN TELESCOPE OUT VALVE – OPEN CIRCUIT	33186	1	Deactivate output J2-35 Main Telescope Out Valve.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason why.	Power cycled.
MAIN TELESCOPE VALVES – SHORT TO BATTERY	33187	1	Deactivate output J2-35 Main Telescope Out Valve. Deactivate output J2-34 Main Telescope In Valve. Decouple/disable current feedback input J3-4 Telescope Return (Disables Telescope Out and In).	The UGM detects a short to battery at this output.	Power cycled.
MAIN TELESCOPE OUT VALVE – SHORT TO GROUND	33188	1	Deactivate output J2-35 Main Telescope Out Valve. Decouple/disable current feedback input J3-4 Telescope Return (Disables Telescope Out and In).	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
MAIN TELESCOPE IN VALVE – OPEN CIRCUIT	33189	1	Deactivate output J2-34 Main Telescope In Valve.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
MAIN TELESCOPE IN VALVE – SHORT TO GROUND	33190	1	Deactivate output J2-34 Main Telescope In Valve. Decouple/disable current feedback input J3-4 Telescope Return (Disables Telescope Out and In).	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
FORK TILT UP VALVE – OPEN CIRCUIT	33191	1	Deactivate output J2-8 Fork Tilt Up Valve.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
FORK TILT VALVES – SHORT TO BATTERY	33192	1	Deactivate output J2-8 Fork Tilt Up Valve. Deactivate output J2-19 Fork Tilt Down Valve. Decouple/disable current feedback input J3-6 Tilt Return (Disables Fork Tilt Up and Down).	The UGM detects a short to battery at this output.	Power cycled.
FORK TILT UP VALVE – SHORT TO GROUND	33193	1	Deactivate output J2-8 Fork Tilt Up Valve. Decouple/disable current feedback input J3-6 Tilt Return (Disables Fork Tilt Up and Down).	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
FORK TILT DOWN VALVE – OPEN CIRCUIT	33194	1	Deactivate output J2-19 Fork Tilt Down Valve.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
FORK TILT DOWN VALVE – SHORT TO GROUND	33195	1	Deactivate output J2-19 Fork Tilt Down Valve. Decouple/disable current feedback input J3-6 Tilt Return (Disables Fork Tilt Up and Down).	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
AUXILIARY FUNC-TION-A VALVE – OPEN CIRCUIT	33196	1	Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate and inhibit the Continuous Auxiliary Hydraulics feature. Turn OFF the Continuous Auxiliary Hydraulics indicator.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
AUXILIARY FUNCTIO-A/B VALVES – SHORT TO BATTERY	33197	1	Deactivate output J2-9 Auxiliary Function-A Valve. Decouple/disable current feedback input J3-14 Aux Return (Disables Auxiliary Function-A and Function-B). Deactivate and inhibit the Continuous Auxiliary Hydraulics feature. Turn OFF the Continuous Auxiliary Hydraulics indicator.	The UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
AUXILIARY FUNCTION-A VALVE– SHORT TO GROUND	33198	1	Deactivate output J2-9 Auxiliary Function-A Valve. Decouple/disable current feedback input J3-14 Aux Return (Disables Auxiliary Function-A and Function-B). Deactivate and inhibit the Continuous Auxiliary Hydraulics feature. Turn OFF the Continuous Auxiliary Hydraulics indicator.	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
AUXILIARY FUNCTION-B VALVE – OPEN CIRCUIT	33199	1	Deactivate output J2-20 Auxiliary Function-B Valve. Deactivate and inhibit the Continuous Auxiliary Hydraulics feature. Turn OFF the Continuous Auxiliary Hydraulics indicator.	The UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
AUXILIARY FUNCTION-B VALVE – SHORT TO GROUND	33200	1	Deactivate output J2-20 Auxiliary Function-B Valve. Decouple/disable current feedback input J3-14 Aux Return (Disables Auxiliary Function-A and Function-B). Deactivate and inhibit the Continuous Auxiliary Hydraulics feature. Turn OFF the Continuous Auxiliary Hydraulics indicator.	The UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
STABILIZER/FRAME LEVEL SPEED VALVE – OPEN CIRCUIT	33201	1	Deactivate output J1-3 Stabilizer and Frame Level Speed Valve.	The UGM is not configured for a 3508, 3509, 4008, or 4009 and the UGM detects an open circuit at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.
STABILIZER/FRAME LEVEL SPEED VALVE – SHORT TO BATTERY	33202	1	Deactivate output J1-3 Stabilizer and Frame Level Speed Valve. Decouple/disable current feedback input J3-5 Stabilizer – Frame Level Return (Disables Stabilizers and Frame Leveling functions).	The UGM is not configured for a 3508, 3509, 4008, or 4009 and the UGM detects a short to battery at this output.	Power cycled.
STABILIZER/FRAME LEVEL SPEED VALVE – SHORT TO GROUND	33203	1	Deactivate output J1-3 Stabilizer and Frame Level Speed Valve. Decouple/disable current feedback input J3-5 Stabilizer – Frame Level Return (Disables Stabilizers and Frame Leveling functions).	The UGM is not configured for a 3508, 3509, 4008, or 4009 and the UGM detects a short to ground at this output or the UGM detects a CURRENT FEEDBACK LOST condition and sets an internal flag to determine if this fault condition is the reason for the fault.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
HYDRAULIC QUICK CONNECT SELECT – OPEN CIRCUIT	33204	1	Deactivate output J1-23 Hydraulic Quick Connect Select.	If hydraulic quick connect feature is configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
HYDRAULIC QUICK CONNECT SELECT – SHORT TO BATTERY	33205	1	Deactivate output J1-23 Hydraulic Quick Connect Select. Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate output J2-20 Auxiliary Function-B Valve.	If hydraulic quick connect feature is configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.
HYDRAULIC QUICK CONNECT SELECT – SHORT TO GROUND	33206	1	Deactivate output J1-23 Hydraulic Quick Connect Select. Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate output J2-20 Auxiliary Function-B Valve.	If hydraulic quick connect feature is configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
HORN – OPEN CIRCUIT	33207	1	Deactivate output J2-2 Horn.	The UGM detects an open circuit at this output.	Power cycled.
HORN – SHORT TO BATTERY	33208	1	Deactivate output J2-2 Horn.	The UGM detects a short to battery at this output.	Power cycled.
HORN – SHORT TO GROUND	33209	1	Deactivate output J2-2 Horn.	The UGM detects a short to ground at this output.	Power cycled.
REVERSE ALARM AND LIGHTS – OPEN CIRCUIT	33210	1	Deactivate output J1-1 Reverse Alarm and Lights.	The UGM detects an open circuit at this output.	Power cycled.
REVERSE ALARM AND LIGHTS – SHORT TO BATTERY	33211	1	Deactivate output J1-1 Reverse Alarm and Lights.	The UGM detects a short to battery at this output.	Power cycled.
REVERSE ALARM AND LIGHTS – SHORT TO GROUND	33212	1	Deactivate output J1-1 Reverse Alarm and Lights.	The UGM detects a short to ground at this output.	Power cycled.
DUMP VALVE – OPEN CIRCUIT	33213	1	Deactivate output J2-13 Dump Valve.	The platform option is configured and the UGM detects an open circuit at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
DUMP VALVE – SHORT TO BATTERY	33214	1	Deactivate output J2-13 Dump Valve. Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-5 Frame Level Right Valve. Deactivate output J2-7 Frame Level Left Valve. Deactivate output J2-8 Fork Tilt Up Valve. Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-11 Main Lift Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-19 Fork Tilt Down Valve. Deactivate output J2-20 Auxiliary Function-B Valve. Deactivate output J2-21 Left Stabilizer Down Valve. Deactivate output J2-22 Main Lift Down Valve. Deactivate output J2-34 Main Telescope In Valve. Deactivate output J2-35 Main Telescope Out Valve. Deactivate output J1-3 Stabilizer and Frame Level Speed Valve (if applicable).	The platform option is configured and the UGM detects a short to battery at this output.	Power cycled.
DUMP VALVE – SHORT TO GROUND	33215	1	Deactivate output J2-13 Dump Valve.	The platform option is configured and the UGM detects a short to ground at this output.	Power cycled.
AUXILIARY FUNCTION SELECT – OPEN CIRCUIT	33216	1	Deactivate output J2-1 Auxiliary Function Select.	The CAT brand is configured for the UGM, the PLATFORM STATION is not active, and the UGM detects an open circuit at this output.	Power cycled.
AUXILIARY FUNCTION SELECT – SHORT TO BATTERY	33217	1	Deactivate output J2-1 Auxiliary Function Select. Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate output J2-20 Auxiliary Function-B Valve.	The CAT brand is configured for the UGM and the UGM detects a short to battery at this output.	Power cycled.
AUXILIARY FUNCTION SELECT – SHORT TO GROUND	33218	1	Deactivate output J2-1 Auxiliary Function Select. Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate output J2-20 Auxiliary Function-B Valve.	The CAT brand is configured for the UGM and the UGM detects a short to ground at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
AUXILIARY ELECTRICS – OPEN CIRCUIT	33219	1	Deactivate output J2-1 Auxiliary Electrics.	The JLG brand is configured for the UGM, the PLATFORM STATION is not active, and the UGM detects an open circuit at this output.	Power cycled.
AUXILIARY ELECTRICS – SHORT TO BATTERY	33220	1	Deactivate output J2-1 Auxiliary Electrics.	The JLG brand is configured for the UGM and the UGM detects a short to battery at this output.	Power cycled.
AUXILIARY ELECTRICS – SHORT TO GROUND	33221	1	Deactivate output J2-1 Auxiliary Electrics.	The JLG brand is configured for the UGM and the PLATFORM STATION is not active and the UGM detects a short to ground at this output.	Power cycled.
LEFT STABILIZER DOWN VALVE – OPEN CIRCUIT	33222	1	Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
LEFT STABILIZER DOWN VALVE – SHORT TO BATTERY	33223	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve. Deactivate and inhibit output J1-3, (Frame Leveling and Stabilizers will be cutout).	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.
LEFT STABILIZER DOWN VALVE – SHORT TO GROUND	33224	1	Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
LEFT STABILIZER UP VALVE – OPEN CIRCUIT	33225	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
LEFT STABILIZER UP VALVE – SHORT TO BATTERY	33226	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve. Deactivate and inhibit output J1-3, (Frame Leveling and Stabilizers will be cutout).	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LEFT STABILIZER UP VALVE – SHORT TO GROUND	33227	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
RIGHT STABILIZER DOWN VALVE – OPEN CIRCUIT	33228	1	Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
RIGHT STABILIZER DOWN VALVE – SHORT TO BATTERY	33229	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve. Deactivate and inhibit output J1-3 (Frame Leveling and Stabilizers will be cutout).	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.
RIGHT STABILIZER DOWN VALVE – SHORT TO GROUND	33230	1	Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
RIGHT STABILIZER UP VALVE – OPEN CIRCUIT	33231	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
RIGHT STABILIZER UP VALVE – SHORT TO BATTERY	33232	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve. Deactivate and inhibit output (Frame Leveling and Stabilizers will be cutout).	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
RIGHT STABILIZER UP VALVE – SHORT TO GROUND	33233	1	Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve.	The stabilizers are configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
FRAME LEVEL LEFT VALVE – OPEN CIRCUIT	33234	1	Deactivate output J2-7.	Frame leveling is configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
FRAME LEVEL LEFT VALVE – SHORT TO BATTERY	33235	1	Deactivate output J2-7. Deactivate and inhibit output J1-3 Frame Leveling and Stabilizers Speed Valve (if applicable).	Frame leveling is configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.
FRAME LEVEL LEFT VALVE – SHORT TO GROUND	33236	1	Deactivate output J2-7.	Frame leveling is configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
FRAME LEVEL RIGHT VALVE – OPEN CIRCUIT	33237	1	Deactivate output J2-5.	Frame leveling is configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
FRAME LEVEL RIGHT VALVE – SHORT TO BATTERY	33238	1	Deactivate output J2-5. Deactivate and inhibit output J1-3 Frame Leveling and Stabilizers Speed Valve (if applicable).	Frame leveling is configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.
FRAME LEVEL RIGHT VALVE – SHORT TO GROUND	33239	1	Deactivate output J2-5.	Frame leveling is configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION C COIL – OPEN CIRCUIT	33240	1	Deactivate output J1-10 Transmission C Control Coil (Gear will not be available for selection). 3rd, 2nd, and 1st will be the only available gear selections. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and a GEAR SELECTION of 4F/3R is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION C COIL – SHORT TO BATTERY	33241	1	Deactivate output J1-10 Transmission C Control Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and a GEAR SELECTION of 4F/3R is configured and the UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
TRANSMISSION C COIL – SHORT TO GROUND	33242	1	Deactivate output J1-10 Transmission C Control Coil. 3rd, 2nd, and 1st will be the only available gear selections. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and a GEAR SELECTION of 4F/3R is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION B COIL – OPEN CIRCUIT	33243	1	Deactivate output J2-32 Transmission B Control Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION B COIL – SHORT TO BATTERY	33244	1	Deactivate output J2-32 Transmission B Control Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to battery at this output.	Power cycled.
TRANSMISSION B COIL – SHORT TO GROUND	33245	1	Deactivate output J2-32 Transmission B Control Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION REVERSE COIL – OPEN CIRCUIT	33246	1	Deactivate output J2-32 Transmission Reverse Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION REVERSE COIL – SHORT TO BATTERY	33247	1	Deactivate output J2-32 Transmission Reverse Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to battery at this output.	Power cycled.
TRANSMISSION REVERSE COIL – SHORT TO GROUND	33248	1	Deactivate output J2-32 Transmission Reverse Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION A COIL – OPEN CIRCUIT	33249	1	Deactivate output J2-33 Transmission A Control Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION A COIL – SHORT TO BATTERY	33250	1	Deactivate output J2-33 Transmission A Control Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
TRANSMISSION A COIL – SHORT TO GROUND	33251	1	Deactivate output J2-33 Transmission A Control Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION FORWARD COIL – OPEN CIRCUIT	33252	1	Deactivate output J2-33 Transmission Forward Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION FORWARD COIL – SHORT TO BATTERY	33253	1	Deactivate output J2-33 Transmission Forward Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to battery at this output.	Power cycled.
TRANSMISSION FORWARD COIL – SHORT TO GROUND	33254	1	Deactivate output J2-33 Transmission Forward Coil. Flash the “Gear Selection” and the “Drive Direction” symbols on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION E COIL – OPEN CIRCUIT	33255	1	Deactivate output J1-7 Transmission E Control Coil (Gear will not be available for selection). 3rd and 4th will be the only available gear selections. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION E COIL – SHORT TO BATTERY	33256	1	Deactivate output J1-7 Transmission E Control Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to battery at this output.	Power cycled.
TRANSMISSION E COIL – SHORT TO GROUND	33257	1	Deactivate output J1-7 Transmission E Control Coil. 3rd and 4th will be the only available gear selections. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION 1 COIL – OPEN CIRCUIT	33258	1	Deactivate output J1-7 Transmission 1 Coil. Maintain the last valid gear selection. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION 1 COIL – SHORT TO BATTERY	33259	1	Deactivate output J1-7 Transmission 1 Coil. Deactivate and inhibit activation of J1-20 Transmission 2 Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
TRANSMISSION 1 COIL – SHORT TO GROUND	33260	1	Deactivate output J1-7 Transmission 1 Coil. Deactivate and inhibit activation of J1-20 Transmission 2 Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION D COIL – OPEN CIRCUIT	33261	1	Deactivate output J1-20 Transmission D Control Coil (Gear will not be available for selection). 2^{nd}, 3^{rd}, and 4^{th} will be the only available gear selections. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION D COIL – SHORT TO BATTERY	33262	1	Deactivate output J1-20 Transmission D Control Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to battery at this output.	Power cycled.
TRANSMISSION D COIL – SHORT TO GROUND	33263	1	Deactivate output J1-20 Transmission D Control Coil. 2^{nd}, 3^{rd}, and 4^{th} will be the only available gear selections. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of POWERSHIFT is configured and the UGM detects a short to ground at this output.	Power cycled.
TRANSMISSION 2 COIL – OPEN CIRCUIT	33264	1	Deactivate output J1-20 Transmission 2 Coil. Deactivate and inhibit activation of J1-7 Transmission 1 Coil. Maintain the last valid gear selection. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects an open circuit at this output.	Power cycled.
TRANSMISSION 2 COIL – SHORT TO BATTERY	33265	1	Deactivate output J1-20 Transmission 2 Coil. Deactivate and inhibit activation of J1-7 Transmission 1 Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to battery at this output.	Power cycled.
TRANSMISSION 2 COIL – SHORT TO GROUND	33266	1	Deactivate output J1-20 Transmission 2 Coil. Deactivate and inhibit activation of J1-7 Transmission 1 Coil. Flash the “Gear Selection” symbol on the LCD of the cabin’s display.	A TRANSMISSION configuration of HYDROSTATIC is configured and the UGM detects a short to ground at this output.	Power cycled.
ENGINE FUEL RELAY – OPEN CIRCUIT	33267	1	Deactivate output J2-31 Engine Fuel Relay. Deactivate and inhibit output J2-26 Engage Starter.	The UGM detects an open circuit at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
ENGINE FUEL RELAY – SHORT TO BATTERY	33268	1	Deactivate output J2-31 Engine Fuel Relay. Deactivate and inhibit output J2-26 Engage Starter.	The UGM detects a short to battery at this output.	Power cycled.
ENGINE FUEL RELAY – SHORT TO GROUND	33269	1	Deactivate output J2-31 Engine Fuel Relay. Deactivate and inhibit output J2-26 Engage Starter.	The UGM detects a short to ground at this output.	Power cycled.
CRAB STEER VALVE – OPEN CIRCUIT	33270	1	Deactivate output J2-16 Crab Steer Valve. Try to complete any pending steer mode changes. Display the “Steer Valve Failure” screen on the LCD of the cabin’s display.	The UGM detects an open circuit at this output.	Power cycled.
CRAB STEER VALVE – SHORT TO BATTERY	33271	1	Deactivate output J2-16 Crab Steer Valve. Try to complete any pending steer mode changes and prohibit any new steer mode requests. Display the “Steer Valve Failure” screen on the LCD of the cabin’s display.	The UGM detects a short to battery at this output.	Power cycled.
CRAB STEER VALVE – SHORT TO GROUND	33272	1	Deactivate output J2-16 Crab Steer Valve. Try to complete any pending steer mode changes. Display the “Steer Valve Failure” screen on the LCD of the cabin’s display.	The UGM detects a short to ground at this output.	Power cycled.
ALL WHEEL STEER VALVE – OPEN CIRCUIT	33273	1	Deactivate output J2-4 All Wheel Steer Valve. Try to complete any pending steer mode changes. Display the “Steer Valve Failure” screen on the LCD of the cabin’s display.	The UGM detects an open circuit at this output.	Power cycled.
ALL WHEEL STEER VALVE – SHORT TO BATTERY	33274	1	Deactivate output J2-4 All Wheel Steer Valve. Try to complete any pending steer mode changes and prohibit any new steer mode requests. Display the “Steer Valve Failure” screen on the LCD of the cabin’s display.	The UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
ALL WHEEL STEER VALVE – SHORT TO GROUND	33275	1	Deactivate output J2-4 All Wheel Steer Valve. Try to complete any pending steer mode changes. Display the “Steer Valve Failure” screen on the LCD of the cabin’s display.	The UGM detects a short to ground at this output.	Power cycled.
APU PUMP RELAY – OPEN CIRCUIT	33276	1	Inhibit operation of J1-13 APU Pump Relay.	The platform option is configured and the UGM detects an open circuit at this output.	Power cycled.
APU PUMP RELAY – SHORT TO BATTERY	33277	1	Inhibit operation of J1-13 APU Pump Relay.	The platform option is configured and the UGM detects a short to battery at this output.	Power cycled.
APU PUMP RELAY – SHORT TO GROUND	33278	1	Inhibit operation of J1-13 APU Pump Relay.	The platform option is configured and the UGM detects a short to ground at this output.	Power cycled.
GLOWPLUGS – OPEN CIRCUIT	33279	1, 2	Deactivate output J1-12 Glow-plugs.	The UGM detects an open circuit at this output.	Power cycled.
GLOWPLUGS – SHORT TO BATTERY	33280	1, 2	Deactivate output J1-12 Glow-plugs.	The UGM detects a short to battery at this output.	Power cycled.
GLOWPLUGS - SHORT TO GROUND	33281	1, 2	Deactivate output J1-12 Glow-plugs.	The UGM detects a short to ground at this output.	Power cycled.
ENGAGE STARTER OUTPUT – OPEN CIRCUIT	33282	1	Deactivate output J2-26 Engage Starter.	The UGM detects an open circuit at this output.	Power cycled.
ENGAGE STARTER OUTPUT – SHORT TO BATTERY	33283	1	Deactivate output J2-26 Engage Starter. Activate output J2-31 Fuel Enable Signal.	The UGM detects a short to battery at this output.	Power cycled.
ENGAGE STARTER OUTPUT – SHORT TO GROUND	33284	1	Deactivate output J2-26 Engage Starter.	The UGM detects a short to ground at this output.	Power cycled.
ALTERNATOR EXCITATION LINE – SHORT TO BATTERY	33285	1, 2, 10	J1-32 Alternator Excitation output will be deactivated.	J1-32-Alternator Excite (and thus J4-7 Alternator D+) is HIGH for a period of 2 seconds or more and an ENGINE STOPPED state is detected.	Power cycled.
FRONT MOTOR – CURRENT FEEDBACK READING TOO LOW	33286	1	N/A	The UGM detects the actual current has deviated more than 250 mA from the commanded current for more than 1 second.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LIFT – CURRENT FEEDBACK READING TOO LOW	33287	1	Do not detect or report the BOOM ANGLE SENSOR – NOT RESPONDING fault.	The UGM detects the actual current has deviated more than 250 mA from the commanded current for more than 1 second.	Power cycled.
TELESCOPE – CURRENT FEEDBACK READING TOO LOW	33288	1	N/A	The UGM detects the actual current has deviated more than 250 mA from the commanded current for more than 1 second.	Power cycled.
STABILIZERS/ FRAME LEVEL – CURRENT FEEDBACK READING TOO LOW	33289	1	N/A	The UGM detects the actual current has deviated more than 250 mA from the commanded current for more than 1 second.	Power cycled.
FORK TILT – CURRENT FEEDBACK READING TOO LOW	33290	1	N/A	The UGM detects the actual current has deviated more than 250 mA from the commanded current for more than 1 second.	Power cycled.
AUXILIARY HYDRAULICS – CURRENT FEEDBACK READING TOO LOW	33291	1	N/A	The UGM detects the actual current has deviated more than 250 mA from the commanded current for more than 1 second.	Power cycled.
FRONT MOTOR SWIVEL ANGLE – OPEN CIRCUIT	33292	1	Deactivate output J1-6 Front Motor Swivel.	The UGM detects an open circuit at this output.	Power cycled.
FRONT MOTOR SWIVEL ANGLE – SHORT TO BATTERY	33293	1	Deactivate output J1-6 Front Motor Swivel.	The UGM detects a short to battery at this output.	Power cycled.
FRONT MOTOR SWIVEL ANGLE – SHORT TO GROUND	33294	1	Deactivate output J1-6 Front Motor Swivel.	The UGM detects a short to ground at this output.	Power cycled.
REAR AUXILIARY HYDRAULICS VALVE – OPEN CIRCUIT	33326	1	Deactivate output J2-23 Rear Auxiliary Hydraulics Valve.	If the rear auxiliary hydraulics feature is configured in the MACHINE SETUP menu and the UGM detects an open circuit at this output.	Power cycled.
REAR AUXILIARY HYDRAULICS VALVE – SHORT TO BATTERY	33327	1	Deactivate output J2-23 Rear Auxiliary Hydraulics Valve. Deactivate output J2-9 Auxiliary Function-A Valve. Deactivate output J2-20 Auxiliary Function-B Valve.	If the rear auxiliary hydraulics feature is configured in the MACHINE SETUP menu and the UGM detects a short to battery at this output.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
REAR AUXILIARY HYDRAULICS VALVE – SHORT TO GROUND	33328	1	Deactivate output J2-23 Rear Auxiliary Hydraulics Valve. Deactivate output J2-9 Auxiliary Function-A Valve until input J7-23 is LOW. Deactivate output J2-20 Auxiliary Function-B Valve until input J7-23 is LOW.	If the rear auxiliary hydraulics feature is configured in the MACHINE SETUP menu and the UGM detects a short to ground at this output.	Power cycled.
BOOM RIDE VALVE – SHORT TO BATTERY OR OPEN CIRCUIT	33369	1	The Boom Ride feature will be deactivated and inhibited.	If the Boom Ride feature is configured and the Boom Ride/ Boom Float Module detects a short to battery or open circuit at this output.	Power cycled.
BOOM RIDE VALVE – SHORT TO GROUND	33338	1	The Boom Ride feature will be deactivated and inhibited.	If the Boom Ride feature is configured and the Boom Ride/ Boom Float Module detects a short to ground at this output.	Power cycled.
BOOM FLOAT VALVE – SHORT TO BATTERY OR OPEN CIRCUIT	33370	1	The Boom Float feature will be deactivated and inhibited. The Boom Ride feature will be deactivated and inhibited. J2-11 Main Lift Up Valve will be inhibited.	If the Boom Float feature is configured and the Boom Ride/ Boom Float Module detects a short to battery or open circuit at this output.	Power cycled.
BOOM FLOAT VALVE – SHORT TO GROUND	33341	1	The Boom Float feature will be deactivated and inhibited. J2-11 Main Lift Up Valve will be inhibited.	If the Boom Float feature is configured and the Boom Ride/ Boom Float Module detects a short to ground at this output.	Power cycled.
BOOM TANK VALVE – SHORT TO BATTERY OR OPEN CIRCUIT	33371	1	The Boom Ride feature will be deactivated and inhibited. The Boom Float feature will be deactivated and inhibited. J2-11 Main Lift Up Valve will be inhibited.	If the Boom Ride or Boom Float feature is configured and the Boom Ride/Boom Float Module detects a short to battery or open circuit at this output.	Power cycled.
BOOM TANK VALVE – SHORT TO GROUND	33344	1	The Boom Ride feature will be deactivated and inhibited. The Boom Float feature will be deactivated and inhibited.	If the Boom Ride or Boom Float feature is configured and the Boom Ride/Boom Float Module detects a short to ground at this output.	Power cycled.
ENGINE	43XXX				

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
ENGINE TROUBLE CODE: (SPN):(FMI)	437	1, 2, 3*	(ECM will determine the proper action to take.) * - The UGM will illuminate just the engine warning fault indicator if the DM1 message indicates a warning or derate condition. The UGM will illuminate the engine warning and engine critical fault indicators if the DM1 message indicates a critical (shutdown) condition. In the event a transfer protocol message is received with multiple faults, a fault indicating a critical (shutdown) fault will receive priority when the UGM determines what indicators to turn ON.	The ECM detects a fault condition (not defined in this SRD).	Power cycled
WRONG ENGINE SELECTED – ECM DETECTED	4314	1, 2	J2-26 Engage Starter will be deactivated and inhibited.	The ENGINE CONTROL configuration is MECHANICAL and the UGM detects CAN messages from an ECM.	Power cycled.
HIGH ENGINE COOLANT TEMPERATURE WARNING	4316	1, 2, 12	(For ECM controlled engines, the ECM may also derate the engine.)	MECHANICAL: The engine coolant temperature reaches 113×C or more for a period of at least 10 seconds and an ENGINE RUNNING state exists. ELECTRONIC: The ECM detects the engine coolant temperature has reached 113×C or more, the ECM will transmit a J1939 CAN bus DM1 message, or use the J1939 Transfer Protocol in the event multiple engine faults exist, on CAN1 to communicate an engine coolant temperature warning (SPN:FMI 110:15 or 110:16).	MECHANIAL: The engine coolant temperature reaches 110×C. ELETRONIC: The ECM no longer transmits the condition as an active fault.
HIGH ENGINE COOLANT TEMPERATURE CRITICAL	4317	1, 2, 3, 12	(For ECM controlled engines, the ECM may also derate the engine.)	MECHANCIAL: The engine coolant temperature reaches 118×C or more for a period of at least 10 seconds and an ENGINE RUNNING state exists. ELECTRONIC: The engine coolant temperature reaches 118×C or more, the ECM will transmit a J1939 CAN bus DM1 message, or use the J1939 Transfer Protocol in the event multiple engine faults exist, on CAN1 to communicate an engine coolant temperature critical (SPN:FMI 110:0).	MECHANIAL: The engine coolant temperature reaches 115×C. ELETRONIC: The ECM no longer transmits the condition as an active fault.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LOW ENGINE OIL PRESSURE WARNING	4318	1, 2, 9	N/A	The ECM detects the engine oil pressure is getting low, the ECM will transmit a J1939 CAN bus DM1 message, or use the J1939 Transfer Protocol in the event multiple engine faults exist, on CAN1 to communicate low engine oil pressure (SPN:FMI 100:17 or 100:18).	Power cycled.
LOW ENGINE OIL PRESSURE CRITICAL	4319	1, 2, 3, 9	N/A	MECHANICAL: The UGM detects input J12-8 Engine Oil Pressure is LOW for 3 seconds and an ENGINE RUNNING state exists for a period of 5 seconds. ELECTRONIC: The engine oil pressure reaches its critical low oil pressure value, which is based on engine speed, the ECM will transmit a J1939 CAN bus DM1 message, or use the J1939 Transfer Protocol in the event multiple engine faults exist, on CAN1 at a rate of 1 second to communicate low engine oil pressure (SPN:FMI 100:1).	Power cycled.
ALTERNATOR CHARGING FAILURE	4320	1, 2, 10	N/A	Once an ENGINE RUNNING state exists for a period of 3 seconds or more, J4-7 Alternator D+ input will be LOW for a period of 500ms.	J4-7 Alternator D+ is continuously HIGH for a period of 3 seconds.
AIR FILTER RESTRICTION	4321	1, 2, 7	N/A	J1-34 Air Filter Restriction input is LOW and an ENGINE RUNNING state exists for a period of 3 seconds or more or 10 seconds after a system power up.	J1-34 Air Filter Restriction input is HIGH for 1 second.
LOSS OF ENGINE SPEED SIGNAL	4322	1, 2	Deactivate J2-26 Engage Starter. Ignore the above-mentioned interlock for disabling the Continuous Auxiliary Hydraulics function when engine speed is 600 RPM. Ignore the prevent engine stall logic.	MECHANICAL: J4-7 Alternator D+ is HIGH and J12-8 is HIGH and no impulses are received at J1-16 Engine Speed. ELECTRONIC: The TCM or ECM will report the fault using J1939 CAN protocol to the UGM.	Power cycled.
CONFLICTING OPERATING ENGINE STATE	4324	1, 2	N/A	J4-8 Engine Start has been engaged during the active power cycle, an ENGINE STOPPED condition exists, and one of the three ENGINE RUNNING conditions is true	Power cycled.
BATTERY SUPPLY	44XXX				

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	441	1	Inhibit all output drivers except engine start.	The UGM or platform module has detected the battery voltage is at or below 9V.	Power cycled. (Replace/fix battery.)
BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	442	1	Inhibit all output drivers.	The UGM or platform module has detected the battery voltage is at or above 16V.	Power cycled. (Fix supply voltage.)
LSS BATTERY VOLTAGE TOO HIGH	443	1	UGM assumes a platform overloaded condition.	The LSS module detects its supply voltage is too high and reports the issue to the UGM.	Power cycled. (Fix supply voltage.)
LSS BATTERY VOLTAGE TOO LOW	444	1	UGM assumes a platform overloaded condition.	The LSS module detects its supply voltage is too low and reports the issue to the UGM.	Power cycled. (Replace/fix battery.)
BATTERY VOLTAGE LOW	445	1	J1-12 Glow-plugs will be inhibited.	The UGM has detected the battery voltage below 11V for a period of 3 seconds or more and an ENGINE RUNNING state exists.	The UGM detects the battery voltage higher than 11V for a period of 10 seconds or power cycled.
REFERENCE VOLTAGE OUT OF RANGE – GROUND	447	1	Inhibit all hydraulic functions.	The UGM has detected its reference voltage is too high or low.	Power cycled.
TRANSMISSION & DRIVE SYSTEM	46XXX				
HIGH TRANSMISSION OIL TEMPERATURE CRITICAL	461	1, 11	N/A	UGM input J3-11 Transmission Oil Temperature is LOW when a TRANSMISSION configuration of POWERSHIFT or POWERSYNCRO is selected.	Power cycled.
CONFLICTING DRIVE DIRECTION SIGNALS	462	1	Command an 'N' in the cabin's display. Broadcast the TC1 J1939 CAN message on CAN1 to command the TCM to the neutral gear selection if MODELS: TH336, TH337, TH406, TH407, TH414, TH417, TH515 are configured. Deactivate and inhibit output J2-33 Transmission Forward. Deactivate and inhibit output J2-32 Transmission Reverse. Deactivate and inhibit output J1-1 Reversing Alarm and Lights.	A HIGH signal is detected on more than one of drive direction inputs (J4-4 Neutral / J7-22 Forward / J4-18 Reverse) at the same time for a period of 3 seconds or more.	Only input J4-4 Neutral is HIGH.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
DRIVE DIRECTION SIGNAL LOST	463	1	Command an 'N' in the cabin's display. Broadcast the TC1 J1939 CAN message on CAN1 to command the TCM to the neutral gear selection if MODELS: TH336, TH337, TH406, TH407, TH414, TH417, TH515 are configured. Deactivate and inhibit output J2-33 Transmission Forward. Deactivate and inhibit output J2-32 Transmission Reverse. Deactivate and inhibit output J1-1 Reversing Alarm and Lights.	J4-4 Neutral and J7-22 Forward and J4-18 Reverse are simultaneously LOW for a period of 3 seconds or more	Only input J4-4 Neutral is HIGH.
CONFLICTING GEAR SELECTION SIGNALS	464	1	Maintain the output of the last valid gear selected or 3rd Gear if the fault is present at startup for POWERSHIFT and POWERSYNCRO transmissions or 2nd Gear if the fault is present at startup for a HYDROSTATIC transmission. Transmission drive direction signals will still be acknowledged in this case. Flash last valid gear selection or flash 3rd Gear if the fault is present at startup for POWERSHIFT and POWERSYNCRO transmissions or 2nd Gear if the fault is present at startup for a HYDROSTATIC transmission on the LCD of the cabin's display.	If more than one of the gear selection inputs, J4-21 1st Gear / J4-11 2nd Gear / J4-22 3rd Gear / J4-23 4th Gear, are HIGH simultaneously for a period of 3 seconds.	J4-5 Park Brake is HIGH and issue cleared or power cycled.
GEAR SELECTION SIGNAL LOST	465	1	Maintain the output of the last valid gear selected or 3rd Gear if the fault is present at startup for POWERSHIFT and POWERSYNCRO transmissions or 2nd Gear if the fault is present at startup for a HYDROSTATIC transmission. Transmission drive direction signals will still be acknowledged in this case. Flash last valid gear selection or flash 3rd Gear if the fault is present at startup for POWERSHIFT and POWERSYNCRO transmissions or 2nd Gear if the fault is present at startup for a HYDROSTATIC transmission on the LCD of the cabin's display.	If J4-21 1st Gear and J4-11 2nd Gear and J4-22 3rd Gear and J4-23 4th Gear are simultaneously LOW for a period of 3 seconds or more.	J4-5 Park Brake is HIGH and issue cleared or power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
INVALID TRANSMISSION CONFIGURATION	466	1	Deactivate output J1-20 Transmission D / 2 Coil. Deactivate output J1-7 Transmission E / 1 Coil. Deactivate output J2-33 Transmission A / Forward Coil. Deactivate output J2-32 Transmission B / Reverse Coil. Deactivate output J1-10 Transmission C Coil. Deactivate output J2-5 Frame Leveling Right Valve. Deactivate output J2-7 Frame Leveling Left Valve. Deactivate output J2-3 Right Stabilizer Up Valve. Deactivate output J2-15 Right Stabilizer Down Valve. Deactivate output J2-10 Left Stabilizer Up Valve. Deactivate output J2-21 Left Stabilizer Down Valve. Deactivate output J2-13 Dump Valve. Deactivate output J1-3 Stabilizer and Frame Level Speed Valve (if applicable). Deactivate output J2-11 Main Lift Up Valve. Deactivate output J2-22 Main Lift Down Valve. Deactivate output J2-35 Main Telescope Out Valve. Deactivate output J2-34 Main Telescope In Valve. Deactivate output J2-8 Fork Tilt Up Valve. Deactivate output J2-19 Fork Tilt Down Valve. Deactivate output J2-9 Auxiliary Hydraulics 1 Valve. Deactivate output J2-20 Auxiliary Hydraulics 2 Valve.	J4-22 3rd Gear or J4-23 4th Gear are LOW and a TRANSMISSION selection of HYDROSTATIC is configured.	The configuration is corrected and power is cycled.
TRANSMISSION TROUBLE CODE: (SPN):(FMI)	467	1	(TCM will determine the proper action to take.) Flash the current drive direction and gear selection on the cabin's display.	The TCM detects a fault condition (not defined in this SRD).	Power cycled
VEHICLE SPEED SENSOR – NOT RESPONDING	468	1	Broadcast a proprietary B CAN message on CAN1 to display a value of '99' on the cabin's LCD display. Disable the drive direction interlock and allow drive direction to be changed at any point in time. Boom Ride feature will be inhibited if configured.	VEHICLE SPEED is configured in the MACHINE SETUP menu and the transmission is not in neutral and the service brake is not engaged and the park brake is not engaged and Engine RPM is 1200 RPM and no VEHICLE SPEED signal is measured for a period 3 seconds or more.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
COMMUNICATIONS	66XXX				
CANBUS FAILURE – PLATFORM MODULE	662	1	Disregard any CAN messages with the platform module source addresses.	The PLATFORM OPTION is configured as ENABLED and a platform is detected as attached and the UGM does not detect the platform module on the CAN bus for a period of 250msec.	Power cycled.
CANBUS FAILURE – LOAD SENSING SYSTEM MODULE	663	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD. Disregard any CAN messages with platform module source addresses.	The PLATFORM STATION is active and the PLATFORM OPTION is configured as ENABLED and a platform is detected as attached and the LOAD SENSING menu screen is not configured as NONE and the UGM does not detect the LSS module on the CAN bus.	Power cycled.
CANBUS FAILURE – ENGINE CONTROLLER	666	1, 3	Deactivate and inhibit output J2-26 Engage Starter.	The ENGINE CONTROL menu is configured as ELECTRONIC and the UGM does not detect the ECM on the CAN bus.	Power cycled.
CANBUS FAILURE – EXCESSIVE CANBUS ERRORS	6613	1	N/A	The UGM detects more than 500 Bus Off or more than 500 Bus Passive conditions during a power cycle or the UGM detects more than 22 Bus Off or more than 22 Bus Passive conditions during a period of 1 second.	Power cycled.
CANBUS FAILURE – TRANSMISSION CONTROLLER	6616	1	Only transmit messages that keep the transmission in neutral.	The UGM does not detect the TCM on the CAN bus when a POWERSYNCRO transmission is configured and an ENGINE STOPPED or ENGINE RUNNING state exists for a period of one second.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
CANBUS FAILURE – CABIN JOYSTICK	6617	1	Disregard any CAN messages with the cabin joystick source addresses. Deactivate and inhibit all hydraulic functions.	The UGM does not detect the cabin's joystick on the CAN bus for a period of 250msec and an ENGINE STOPPED or ENGINE RUNNING state exists for a period of one second.	Valid CAN bus communication is re-established with the joystick.
CANBUS FAILURE – CABIN DISPLAY	6618	1		The UGM does not detect the cabin's display on the CAN bus.	Power cycled.
CANBUS FAILURE – UNKNOWN TROUBLE CODE: (SPN):(FMI)	6619	1	N/A	The UGM has detected an unknown module reporting a DM1 or transfer protocol message.	Power cycled.
CANBUS FAILURE – BOOM ANGLE SENSOR	6621	1	Display the fixed boom angle value of '99' on the operator's cabin display. Temporarily assign a fixed boom angle value of 99×. Disallow boom angle sensor calibration ("BOOM ANGLE: CALIBRATION FAIL"). Ignore any hydraulic function requests from the platform station. Deactivate and inhibit the Lift Up output if the platform is detected as attached or PLATFORM MODE is the current active mode; otherwise, derate the MAX LIFT UP in the PERSONALITIES menu screen by the LIFT UP DERATE value in the Constant Data tables.	The UGM or platform module has lost communications with the Boom Angle Sensor.	Power cycled.
CANBUS FAILURE - TCU MODULE	6622	1		CAN Communications has been lost with the TCU module for 30 seconds or more. Only reported if the telematics machine configuration digit is enabled.	Valid CAN bus communications is re-established with the telematics module
CANBUS FAILURE - GATEWAY MODULE	6623	1		CAN Communications has been lost with the gateway module for 30 seconds or more. Only reported if the telematics machine configuration digit is enabled.	Valid CAN bus communications is re-established with the gateway module
CANBUS FAILURE - TELEMATICS CAN-BUS LOADING TOO HIGH	6629	1	If this fault has been detected, the CANBUS FAILURE TCU COMUNICATIONS LOST fault will be suppressed.		Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
CANBUS FAILURE – BOOM RIDE/BOOM FLOAT MODULE	6631	1	If active, deactivate and then inhibit operation of Boom Ride Valve, Boom Float Valve, and Boom Tank Valve.	The UGM has lost communications with the Boom Ride/Boom Float (Accessory) Module.	Power cycled.
CANBUS FAILURE - BOOM EXTENSION LIMIT MODULE	6637	1		The UGM has lost communications with the Accessory Module.	Power cycled.
CANBUS FAILURE - LSI	6638	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached (regardless of the state of input J4-10) and react accordingly depending on the MARKET configuration.	The UGM has lost communications with the LSI system for 1000 milliseconds.	Power cycled.
TILT SENSOR	81XXX				
CHASSIS TILT SENSOR NOT CALIBRATED	813	1	The UGM will not permit PLATFORM MODE operation.	The PLAFORM OPTION is configured as ENABLED and the UGM detects its on-board tilt sensor has not been calibrated.	Successful tilt calibration has been completed.
CHASSIS TILT SENSOR OUT OF RANGE	814	1	The UGM will not permit PLATFORM MODE operation.	The PLAFORM OPTION is configured as ENABLED and the UGM detects a platform is attached and the UGM detects the tilt sensor reading is more than 19° for 4 seconds and the PLATFORM STATION is active or the CABIN STATION is active with one or more stabilizer deployed.	Power cycle. (Replace board)
CHASSIS TILT SENSOR DISAGREEMENT	815	1	The UGM will not permit PLATFORM MODE operation.	The PLATFORM OPTION is configured as ENABLED and the UGM detects a platform is attached and the UGM detects the machine is driving and a 3° difference between tilt sensor for 5 seconds or the UGM detects the machine is not driving and a 1° difference between tilt sensor for 2 seconds.	Power cycle. (Replace board)
PLATFORM LOAD SENSE	82XXX				

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LSS CELL #1 ERROR	821	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD.	The UGM has detected the PLATFORM STATION is active and the PLATFORM OPTION is ENABLED and a platform is detected as attached and the LSS module is reporting a error with regard to load cell #1.	Power cycled.
LSS CELL #2 ERROR	822	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD.	The UGM has detected the PLATFORM STATION is active and the PLATFORM OPTION is ENABLED and a platform is detected as attached and the LSS module is reporting a error with regard to load cell #2.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LSS CELL #3 ERROR	823	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD.	The UGM has detected the PLATFORM STATION is active and the PLATFORM OPTION is ENABLED and a platform is detected as attached and the LSS module is reporting a error with regard to load cell #3.	Power cycled.
LSS CELL #4 ERROR	824	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD.	The UGM has detected the PLATFORM STATION is active and the PLATFORM OPTION is ENABLED and a platform is detected as attached and the LSS module is reporting a error with regard to load cell #4.	Power cycled.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LSS HAS NOT BEEN CALIBRATED	825	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD.	The UGM has detected the PLATFORM STATION is active and the PLATFORM OPTION is ENABLED and a platform is detected as attached and the LSS module calibration has not been completed.	A valid calibration of the LSS module is completed or the LOAD SENSING menu screen is configured to NONE and power is cycled.
PLATFORM FUNC-TIONS CUTOUT – PLATFORM OVERLOADED	829	1, 14	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay when platform module detects condition if the UGM fails to report the condition in 1 second. Display the platform overloaded screen on the cabin's LCD.	When the UGM or platform module detects an overloaded platform condition at 110% rated load and the PLATFORM STATION is selected and a platform is detected as attached and the LOAD SENSING menu screen is configured as PLATFORM CUTOUT.	When a rated load of less than 110% is detected for a period of at least 3 seconds. (The system will then re-enable J2-19 Function Enable Relay and verify the platform function enable switch is not engaged before operation is allowed.)
LOAD MOMENT	85XXX				
LSI NOT CALIBRATED	8514	1	Set CAN message bit to permit LSI System display control of its alarm.	Within 1500ms of system power ON, the UGM reads a CAN message from the LSI System indicating calibration has not occurred.	The LSI System CAN message which indicates the calibration mode status changes to OFF.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LSI DETECTED BUT NOT CONFIGURED	8515	1	Inhibit all hydraulic functions. Set CAN message bit to permit LSI System display control of its alarm.	The UGM has detected the CAN bus LSI system is present on the machine; however it has not been configured properly in the MACHINE SETUP - LOAD MOMENT menu selection.	Use analyzer and correct parameter that is improperly configured.
LSI LOAD CELL A – OUT OF RANGE	8516	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The LSI System has detected that Load Cell A is out of range and is providing a CAN bus message notification to the UGM.	Power cycle.
LSI LOAD CELL B – OUT OF RANGE	8517	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The LSI System has detected that Load Cell B is out of range and is providing a CAN bus message notification to the UGM.	Power cycle.
LSI CUTOUT OUTPUT – SHORT TO BATTERY OR OPEN CIRCUIT	8518	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The LSI System has detected that its 100% Cutout digital output has an short to battery or open circuit condition and is providing a CAN bus message notification to the UGM.	Power cycle.
LSI OUT OF CALIBRATION	8519	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The UGM LSI-CAN system check has been performed and the actual load cell raw counts are not within +/- 10 counts of the logged calibrated counts.	The LSI-CAN system check is performed and is completed with a pass condition.
STEERING	86XXX				
LOW STEERING PRESSURE	8638	1, 8	N/A	J1-35 Steering Pressure is HIGH for a period of 3 seconds or more and an ENGINE RUNNING state must be detected for at least 5 seconds.	Until steer pressure is re-estab-lished (i.e. J1-35 is LOW for a period of 3 seconds).
HARDWARE	99XXX				
LSS WATCHDOG RESET	991	1			Power cycle. (Replace board)

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
LSS EEPROM ERROR	992	1			Power cycle. (Replace board)
LSS INTERNAL ERROR – PIN EXCITATION	993	1			Power cycle. (Replace board)
LSS INTERNAL ERROR – DRDY MISSING FROM A/D	994	1			Power cycle. (Replace board)
EEPROM FAILURE – CHECK ALL SETTINGS	998	1	Suspend all hydraulic function, engine, and transmission operation.	The UGM has detected an anomaly in EEPROM.	Power cycle. (Replace board)
FUNCTION LOCKED OUT – PLATFORM MODULE SOFTWARE VERSION IMPROPER	9910	1	Suspend all hydraulic function, engine, and transmission operation from platform station only. (CABIN STATION operation is permitted.)	The UGM has detected the platform module software major revision # is not compatible.	Reprogram board and power cycle. (Replace board)
FUNCTION LOCKED OUT – LSS MODULE SOFTWARE VERSION IMPROPER	9911	1	Suspend all hydraulic functions, prevent engine start, and transmission operation from platform station only. (CABIN STATION operation is permitted.)	The UGM has detected the LSS module software revision # is not compatible (if major version is 7, then minor will be checked to be 17 or higher; otherwise major version higher than 7 will pass).	Reprogram board and power cycle. (Replace board)
CHASSIS TILT SENSOR NOT GAIN CALIBRATED	9915	1	The UGM will not permit PLATFORM MODE operation.	The PLATFORM OPTION is configured as ENABLED and the UGM detects the tilt gain values necessary for calculating chassis have been lost.	Power cycle. (Replace board)
GROUND MODULE FAILURE – HIGH SIDE DRIVER CUTOUT FAULTY	9921	1	Suspend all hydraulics.	The UGM detects a internal hardware failure on J2-1, J2-13, and/or J1-23.	Power cycle.
FUNCTIONS LOCKED OUT – MACHINE NOT CONFIGURED	9924	1	The UGM will not permit engine start. The UGM will not permit any hydraulic function operation.	The UGM detects the MACHINE SETUP menu has never been entered, which is noted by the MODEL menu screen being configured to "??????????????" (i.e. it is the first time the board was powered ON).	The MACHINE SETUP menu has been accessed and power is cycled.
CURRENT FEEDBACK GAINS OUT OF RANGE	9944	1	The UGM will not permit engine start. The UGM will not permit any hydraulic function operation.	The UGM has detected the current feedback gain calibrations have been lost.	Power cycle. (Replace board)

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
CURRENT FEED-BACK CALIBRATION CHECKSUM INCORRECT	9945	1	The UGM will not permit engine start. The UGM will not permit any hydraulic function operation.	The UGM has detected the current feedback calibration checksum is incorrect.	Power cycle. (Replace board)
CABIN DISPLAY EEPROM WRITE FAILURE	9946	1	N/A	The UGM was not able to write/ reprogram the cabin display's EEPROM.	Power cycle.
HARDWARE EXCHANGE REQUIRED	9947	1	Enter analyzer mode and take the user directly to the "PERFORM HARDWARE EXCHANGE?" menu.	The UGM has detected a data mismatch between itself and the cabin's display.	Complete a hardware exchange and cycle power.
PLATFORM MODULE HARDWARE FAILURE	9948	1	The UGM will not permit engine start from the platform. The UGM will not permit any hydraulic function operation from the platform.	The platform module has detected the cleaning current FET has failed.	Power cycle.
MACHINE CONFIGURATION OUT OF RANGE – CHECK ALL SETTINGS	9949	1	Suspend all hydraulic function, engine, and transmission operation.	The UGM has detected an anomaly in the EEPROM.	Use analyzer and correct parameter that is out of range.
CABIN JOYSTICK - INTERNAL FAILURE	9976	1	The UGM will not permit any hydraulic function operation.	The ITT cabin joystick reports has an internal problem. (Reference ITT SRD)	Power cycle.
LSS CORRUPT EEPROM	9977	1	Deactivate and inhibit the Lift Up output. Deactivate and inhibit the Lift Down output. Deactivate and inhibit the Telescope Out output. Deactivate and inhibit the Telescope In output. Deactivate and inhibit the Platform Rotate Left output. Deactivate and inhibit the Platform Rotate Right output. Deactivate and inhibit the Platform Level Up output. Deactivate and inhibit the Platform Level Down output. Deactivate platform module output J2-19 Function Enable Relay. Display the platform overloaded screen on the cabin's LCD.	At power-up or immediately thereafter, if the PLATFORM STATION is active and the platform module and UGM will check the consistency of the redundantly stored Platform Unloaded Weight and the Platform Maximum Allowed Load values.	Power cycle
EEPROM VALUE – OUT OF RANGE	9978	1	Suspend all hydraulic function and engine operation, and command the transmission to neutral.	The UGM has detected an anomaly in the EEPROM.	Use analyzer and correct parameter that is out of range.

Message	Fault Code	Indicators	Other Actions Taken	Trigger for Fault	Latch Until
GROUND MODULE VLOW FET FAILURE	9986	1	Suspend all hydraulic function and engine operation, and command the transmission to neutral.	The UGM has detected an anomaly in a mosfet.	Power cycle. (Replace board)
FUNCTIONS LOCKED OUT – LSI SOFTWARE VERSION IMPROPER	99151	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The UGM has detected the LSI module software revision # is not compatible [(Major version 0, minor 11) OR (Major version 1).	Power cycle. (Install proper LSI)
LSI FAULTY – SYSTEM FLASH CRC ERROR	99152	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The LSI System has detected a checksum error with its system flash and is reporting the issue on a CAN bus message to UGM.	Power cycle. (Replace LSI)
LSI FAULTY – DATA FLASH CRC ERROR	99153	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The LSI System has detected a checksum error with its data flash and is reporting the issue on a CAN bus message to UGM.	Power cycle. (Replace LSI)
LSI FAULTY – LOAD CELLS A AND B DISAGREEMENT	99154	1	If active, the control system will respond as if the Load Moment Cutout % parameter has been reached and react accordingly depending on the MARKET configuration. Set CAN message bit to permit LSI System display control of its alarm.	The LSI System has detected a unacceptable variance in the readings between Load Cell A and Load Cell B and is reporting the issue on a CAN bus message to UGM.	Power cycle. (Recalibrate or replace LSI sensor)

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