Service Manual

Models
832
925

PVC 1911
PVC 2005

31211472

February 01, 2021 - Rev C

An Oshkosh Corporation Company

EFFECTIVITY PAGE

DATE	REVISION	DESCRIPTION
February 6, 2020	A	Original Issue Of Manual
July 03, 2020	B	Revised 2-7, 2-9, 2-10, 2-26, 2-30 thru 2-39, 2-56 thru 2-59, 2-66 thru 2-69, 2-74, 5-3, 6-3, 8-28, 9-50 thru 9-56, 9-58, 9-61 thru 9-75, 9-85, 9-98 thru 9-100, 9-131 thru 9-138, 9-142 thru 9-143, 9-189, 9-193, 9-212 thru 9-213.
February 01, 2021	C	Revised 2-5, 6-3, 8-7, 8-17, 8-23, 9-19 thru 9-29, 9-50 thru 9-81, 9-83 thru 9-221, Added pages 9-57, 9-5, 9-67, 9-68, 9-71, 9-219 thru 9-221.

READ THIS FIRST

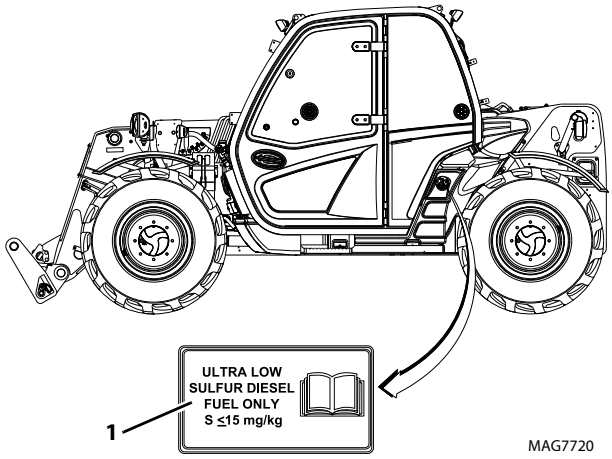
Modifications

Modifications to this machine may affect compliance with Industry Standards and/or Governmental Regulations. Any modification must be approved by JLG.

Machine Configuration

Two configurations of each machine are included in this manual. Determine if machine is equipped with Ultra Low Sulfur Fuel Decal (**1**) as indicated below.

- If equipped with the Ultra Low Sulfur decal, all specific references to this machine configuration will be referred to as Ultra Low Sulfur (**ULS**) from this point forward.
- If **not** equipped with the Ultra Low Sulfur decal, all specific references to this machine configuration will be referred to as Low Sulfur (**LS**) from this point forward.



SECTION CONTENTS

Section	Subject	Page
Section 1		
Safety Practices		**1-1**
1.1	Introduction	1-2
1.2	Disclaimer	1-2
1.3	Operation & Safety Manual	1-2
1.4	Do Not Operate Tags	1-2
1.5	Safety Information	1-2
1.6	Safety Instructions	1-3
1.7	Safety Decals	1-4
Section 2		
General Information and Specifications		**2-1**
2.1	Replacement Parts and Warranty Information	2-3
2.2	Specifications	2-4
2.3	Fluid and Lubricant Capacities	2-7
2.4	Service and Maintenance Schedules	2-11
2.5	Lubrication Schedule	2-14
2.6	Thread Locking Compound	2-15
2.7	Torque Charts	2-16
2.8	Hydraulic Connection Assembly and Torque Specification	2-26
Section 3		
Boom		**3-1**
3.1	Boom System Component Terminology	3-2
3.2	Boom System	3-4
3.3	Boom Removal/Installation	3-4
3.4	Boom Assembly Maintenance - 925	3-7
3.5	Boom Assembly Maintenance - 832	3-11
3.6	Third Boom Section Removal/Installation Only - 832	3-16
3.7	Boom Wear Pads	3-19
3.8	Quick Coupler	3-20
3.9	Forks	3-22
3.10	Boom Prop (If Equipped)	3-23
3.11	Emergency Boom Lowering Procedure	3-24
3.12	Troubleshooting	3-26
Section 4		
Cab		**4-1**
4.1	Operator Cab Component Terminology	4-2
4.2	Operator Cab	4-3
4.3	Cab Components	4-3
4.4	Cab Removal	4-11
4.5	Cab Installation	4-13

Section	Subject	Page
Section 5		
Axles, Drive Shafts, Wheels and Tires		**5-1**
5.1	Axle, Drive Shaft and Wheel Component Terminology	5-2
5.2	Axle Serial Number	5-3
5.3	Axle Specifications and Maintenance Information	5-3
5.4	Axle Replacement	5-3
5.5	Brake Inspection	5-6
5.6	Steering Angle Adjustment	5-6
5.7	Axle Assembly and Drive Shaft Troubleshooting	5-7
5.8	Drive Shafts	5-10
5.9	Wheels and Tires	5-11
5.10	Towing a Disabled Machine	5-12
Section 6		
Transmission		**6-1**
6.1	Transmission Assembly Component Terminology	6-2
6.2	Transmission Serial Number	6-3
6.3	Specifications and Maintenance Information	6-3
6.4	Transmission Replacement	6-3
6.5	Transmission Fluid/Filter Replacement	6-5
6.6	Transmission Fluid Level Check	6-5
6.7	Torque Converter Diaphragm	6-6
Section 7		
Engine		**7-1**
7.1	Introduction	7-2
7.2	Engine Serial Number	7-5
7.3	Specifications and Maintenance Information	7-5
7.4	Engine Cooling System	7-5
7.5	Engine Electrical System	7-7
7.6	Fuel System	7-7
7.7	Engine Exhaust System	7-14
7.8	Air Cleaner Assembly	7-17
7.9	Engine Replacement	7-18
7.10	Troubleshooting	7-20
Section 8		
Hydraulic System		**8-1**
8.1	Hydraulic Component Terminology	8-2
8.2	Safety Information	8-4
8.3	Specifications	8-4
8.4	Hydraulic Pressure Diagnosis	8-5
8.5	Hydraulic Circuits	8-5
8.6	Hydraulic Schematic	8-9
8.7	Hydraulic Reservoir	8-12
8.8	Implement Pump	8-16
8.9	Control Valves	8-17
8.10	Boom Ride Control (If Equipped)	8-25
8.11	Hydraulic Cylinders	8-27

Section 9
Electrical System 9-1

9.1 Electrical Component Terminology 9-4
9.2 Specifications 9-5
9.3 Safety Information 9-5
9.4 Power Distribution Boards 9-6
9.5 Electrical System Schematic 9-19
9.6 Dielectric Grease Application 9-30
9.7 Engine Start Circuit 9-32
9.8 Battery 9-34
9.9 Electrical Master Switch 9-36
9.10 Window Wiper System (if equipped) 9-37
9.11 Cab Heater and A/C (if equipped) 9-41
9.12 Solenoids, Sensors and Senders 9-42
9.13 Dash Switches 9-47
9.14 Machine Data 9-48
9.15 Analyzer Software Accessibility 9-58
9.16 Load Stability Indicator (LSI) (if equipped) 9-82
9.17 Fault Codes 9-86
9.18 Machine Fault Codes 9-87
9.19 Engine Diagnostic 9-222

Section	Subject	Page

Section 1
Safety Practices
Contents

PARAGRAPH		TITLE	PAGE
1.1		**Introduction**	**1-2**
1.2		**Disclaimer**	**1-2**
1.3		**Operation & Safety Manual**	**1-2**
1.4		**Do Not Operate Tags**	**1-2**
1.5		**Safety Information**	**1-2**
	1.5.1	Safety Alert System and Signal Words	1-2
1.6		**Safety Instructions**	**1-3**
	1.6.1	Personal Hazards	1-3
	1.6.2	Equipment Hazards	1-3
	1.6.3	General Hazards	1-3
	1.6.4	Operational Hazards	1-4
1.7		**Safety Decals**	**1-4**

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 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 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, JLG recommends a maximum pressure of 52 bar (750 psi) at a minimum distance of 12 in (30,5 cm) 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 fluid and diesel fuel leaking under pressure can penetrate the skin, cause infection, gangrene and other serious personal injury.

Engine fuel lines are pressurized. **DO NOT** attempt repairs unless specific training has been completed. Refer to the engine manufacturers' manual for specific details concerning the fuel system.

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.

COOLANT SYSTEM CAP: The cooling system is under pressure, and escaping coolant can cause severe burns and eye injury. To prevent personal injury, **NEVER** remove the coolant system cap while the cooling system is hot. Wear safety glasses. Turn the coolant system 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.

Properly disconnect battery(s) prior to service the fuel or hydraulic systems.

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 fluid 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

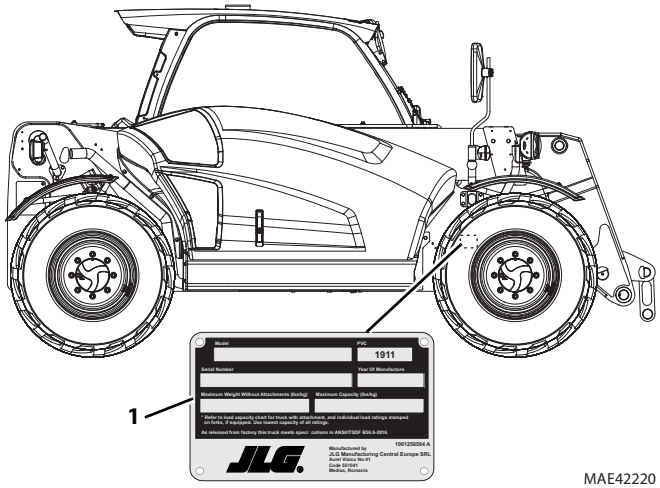
Check that all safety decals are present and readable on the machine. Refer to the Operation & Safety Manual supplied with machine for information.

Section 2
General Information and Specifications
Contents

PARAGRAPH		TITLE	PAGE
2.1		**Replacement Parts and Warranty Information**	**2-3**
2.2		**Specifications**	**2-4**
	2.2.1	Travel Speed	2-4
	2.2.2	Hydraulic Cylinder Performance	2-4
	2.2.3	Cylinder Drift	2-5
	2.2.4	Electrical System	2-5
	2.2.5	Engine Performance Specifications	2-5
	2.2.7	Steering Angle Specification	2-6
	2.2.8	Tires	2-6
2.3		**Fluid and Lubricant Capacities**	**2-7**
	2.3.1	Fluids (if equipped for ULS)	2-7
	2.3.2	Fluids (if equipped for LS)	2-9
	2.3.3	Capacities	2-10
2.4		**Service and Maintenance Schedules**	**2-11**
	2.4.1	Every 10 Hours	2-11
	2.4.2	First 50 Hours	2-11
	2.4.3	Every 50 Hours	2-11
	2.4.4	First 250 Hours	2-11
	2.4.5	Every 250 Hours	2-12
	2.4.6	Every 500 Hours	2-12
	2.4.7	Every 750 Hours	2-12
	2.4.8	Every 1000 Hours	2-13
	2.4.9	Every 1500 Hours	2-13
	2.4.10	Every 2000 Hours	2-13
	2.4.11	Every 3000 Hours	2-13
	2.4.11	Every 3000 Hours	2-13
2.5		**Lubrication Schedule**	**2-14**
	2.5.1	50 & 250 Hour	2-14
2.6		**Thread Locking Compound**	**2-15**
2.7		**Torque Charts**	**2-16**
	2.7.1	SAE Fastener Torque Chart	2-16
	2.7.2	Metric Fastener Torque Chart	2-22

2.8 Hydraulic Connection Assembly and Torque Specification 2-26
2.8.1 Definitions 2-26
2.8.2 Assembly Instructions for American Standard Pipe Thread Tapered Connections 2-30
2.8.3 Assembly Instructions for British Standard Pipe Thread Tapered Connections. 2-31
2.8.4 Assembly Instructions for 37° (JIC) Flare Fittings 2-32
2.8.5 Assembly Instructions for 45° SAE Flare Fittings 2-36
2.8.6 Assembly Instructions for O-Ring Face Seal (ORFS) Fittings..... 2-38
2.8.7 Assembly Instructions for DIN 24° Flare Bite Type Fittings (MBTL and MBTS) .. 2-40
2.8.8 Assembly Instructions for Bulkhead (BH) Fittings 2-42
2.8.9 Assembly Instructions for O-Ring Boss (ORB) Fittings 2-46
2.8.10 Assembly Instructions for Adjustable Port End Metric Fittings..... 2-54
2.8.11 Assembly Instructions for Metric ISO 6149 Port Assembly Stud Ends 2-62
2.8.12 Assembly Instructions for Adjustable Port End (BSPP) Fittings..... 2-64
2.8.13 Assembly Instructions for Flange Connections (FL61 and FL62) 2-72
2.8.14 Double Wrench Method 2-75
2.8.15 FFWR and TFFT Methods 2-76
2.8.16 Adjustable Stud End Assembly..... 2-76

2.1 REPLACEMENT PARTS AND WARRANTY INFORMATION



MAE42220

Before ordering parts or initiating service inquiries, make note of the machine serial number. The machine serial number plate (**1**) is located on the frame behind the left front tire.

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.
Registration activates the warranty period and helps to assure that warranty claims are promptly processed to guarantee full warranty service.

2.2 SPECIFICATIONS

2.2.1 Travel Speed

TRANSMISSION	AVERAGE MAXIMUM SPEED- FORWARD		AVERAGE MAXIMUM SPEED- REVERSE	
	90 kW	100 kW	90 kW	100 kW
First Gear	3.6 mph (5,8 kph)	3.6 mph (5,8 kph)	3.6 mph (5,8 kph)	3.6 mph (5,8 kph)
Second Gear	5.34 mph (8,6 kph)	5.4 mph (8,7 kph)	7.02 mph (11,3 kph)	7.08 mph (11,4 kph)
Third Gear	7.02 mph (11,3 kph)	7.08 mph (11,4 kph)	15.78 mph (25,4 kph)	16.15 mph (26 kph)
Fourth Gear	10.37 mph (16,7 kph)	10.5 mph (16,9 kph)	-	-
Fifth Gear	15.78 mph (25,4 kph)	16.15 mph (26 kph)	-	-
Sixth Gear	22.6 mph (36,4 kph)	23.67 mph (38,1 kph)	-	-

2.2.2 Hydraulic Cylinder Performance

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

FUNCTION	APPROXIMATE TIMES (seconds)	
	832	925
Boom Extend (Boom Level)	9.9 - 11.6	5.7 - 6.6
Boom Retract (Boom Level)	9.5 - 11.0	5.2 - 6.1
Boom Lift	7.1 - 8.3	6.6 - 7.7
Boom Lower	5.7 - 6.6	5.2 - 6.1
Attachment Tilt Forward	2.8 - 3.3	2.8 - 3.3
Attachment Tilt Rearward	2.8 - 3.3	2.8 - 3.3

2.2.3 Cylinder Drift

Cylinder	Average Rod Travel (loaded or unloaded)
Lift/Lower Cylinder	N/A
Extend/Retract Cylinder	N/A
Attachment Tilt Cylinder	N/A

2.2.4 Electrical System

Description	Standard	Dual
Battery		
Type, Rating	12 V, Negative (-) Ground, Tapered Top Post, Maintenance Free	12 V, Negative (-) Ground, Tapered Top Post, Threaded Side Terminal Maintenance Free
Quantity	1	2
Reserve Capacity Minutes @ 80°F (27° C)	205	110
Cold Cranking Amps @ 0°F (-18° C)	950	815
Group/Series	BCI Group 31	BCI Group 31
Alternator	12V, 150 Amps	12V, 150 Amps
Starter	12V, 4.0 KW	12V, 4.0 KW

2.2.5 Engine Performance Specifications

Description	Specifications	
	121 HP (90 kW)	134 HP (100 kW)
Engine Make/Model	Deutz AG - TCD 3.6 L4	Deutz AG - TCD 3.6 L4
Displacement	221 in^3 (3,6 liters)	221 in^3 (3,6 liters)
Low Idle	910* rpm	910* rpm
High Idle	2310 ± 25 rpm	2310 ± 25rpm
Horsepower	121 HP(90 kW) @ 2200 rpm	134 HP (100 kW) @ 2200 rpm
Peak Torque	354 lb-ft (480 Nm) @ 1600 rpm	368.78 lb-ft (500 Nm)@ 1600 rpm
Fuel Delivery	Fuel Injection	Fuel Injection
Air Cleaner	Dry Type, Replaceable Primary and Safety Elements	Dry Type, Replaceable Primary and Safety Elements
* Actual Low idle Speed including Droop and parasitic loads is 950 ±15 rpm		

2.2.6 Transmission Performance Specifications

Engine	kW (Horsepower)	Transmission	Stall Speed	
Deutz AG - TCD 3.6L4	121 HP (90 kW)	6 Speed	2030 rpm	2150 rpm
Deutz AG - TCD 3.6L4	134 HP (100 kW)	6 Speed	1981 rpm	2051 rpm

2.2.7 Steering Angle Specification

Angle (in Degrees)	45

2.2.8 Tires

Note: *Wheel lug nut torque is 325-355 lb-ft (440-480 Nm).*

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

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
15.5/80-24	TR01	16 Ply	Pneumatic	62 psi (4,25 Bar)
15.5 R25	XHA	16 Ply	Pneumatic	62 psi (4,25 Bar)
460/70 R24	XMCL	12 Ply	Pneumatic	58 psi (4,0 Bar)
500/70 R24	XMCL	14 Ply	Pneumatic	44 psi (3,0 Bar)
440/80-24	POWER CL	16 Ply	Pneumatic	51 psi (3,5 Bar)
400/80-24	POWER CL	16 Ply	Pneumatic	51 psi (3,5 Bar)
370/75-28	DuraForce MH	14 Ply	Pneumatic	76 psi (5,25 Bar)
460/70 R24	BIBLOAD	16 Ply	Pneumatic	58 psi (4,0 Bar)

2.3 FLUID AND LUBRICANT CAPACITIES

2.3.1 Fluids (if equipped for ULS)

Compartment or System	Type and Classification	Viscosities	Ambient Temperature Range			
			°F		°C	
			Min	Max	Min	Max
Engine Crankcase	Deutz DQC III-10 LA or Deutz DQC IV-10 LA	SAE 0W-40	-40	104	-40	40
		SAE 0W-30	-40	86	-40	30
		SAE 5W-30	-22	86	-30	30
		SAE 5W-40	-22	86	-30	30
		SAE 10W-30	-4	86	-20	30
		SAE 10W-40	-4	114	-20	45
		SAE 15W-40	6	114	-14	45
		SAE 20W-50	24	122	-5	50
Transmission and Transfer Case	Shell Donax TA		-4	104	-20	40
		SAE 10W	-4	104	-20	40
	Mobilfluid 424	SAE 0W-20	-40	95	-40	35
		10W-30	-4	122	-20	50
		SAE 30	32	95	0	35
		SAE 50	50	122	10	50
	Mobilfluid LT*	75W-80	-40	0	-40	-18
Axle Differential and Wheel End	API GL5 with LS Additives	80W-90 LS 85W-90 LS	-4	118	-20	48
		75W-90 LS	-40	118	-40	48
Hydraulic System	Mobilfluid 424	10W-30	6	122	-14	50
	Exxon Univis HVI		-40	100	-40	38
Boom Wear Pad Grease	Extreme Pressure Grease	NLGI Grade 000	-31	122	-35	50
Grease Fittings	Extreme Pressure Grease	NLGI Grade 2 EP or NLGI Grade 3 EP with Moly Additive	5	122	-15	50
Engine Coolant**	DQC CA-14 DQC CB-14 DQC CC-14	50% Ethylene Glycol and 50% Water	-40	122	-40	50

Compartment or System	Type and Classification	Viscosities	Ambient Temperature Range			
			°F		°C	
			Min	Max	Min	Max
Fuel	EN590 ASTM D975 Grade 2-D ASTM D975 Grade1-D (Maximum B5 Biodiesel)	Ultra Low Sulfur (S ≤15mg/kg)				
Diesel Exhaust Fluid	ISO22241-1	32.5% Urea				
Brake Fluid	Mobil ATF 220		-40	122	-40	50
Air Conditioning	Refrigerant R-134-a	Tetrafluoroethane				

Note: **Friction Modifier may be added to axle differentials, see Section 2.3.3, "Capacities".*
***Do not mix coolants from different specifications.*

2.3.2 Fluids (if equipped for LS)

Compartment or System	Type and Classification	Viscosities	Ambient Temperature Range			
			°F		°C	
			Min	Max	Min	Max
Engine Crankcase	Deutz DQC III-10 or Deutz DQC IV-10	SAE 0W-40	-40	104	-40	40
		SAE 0W-30	-40	86	-40	30
		SAE 5W-30	-22	86	-30	30
		SAE 5W-40	-22	86	-30	30
		SAE 10W-30	-4	86	-20	30
		SAE 10W-40	-4	114	-20	45
		SAE 15W-40	6	114	-14	45
		SAE 20W-50	24	122	-5	50
Transmission and Transfer Case	Shell Donax TA		-4	104	-20	40
		SAE 10W	-4	104	-20	40
	Mobilfluid 424	SAE 0W - 20	-40	95	-40	35
		10W-30	-4	122	-20	50
		SAE 30	32	95	0	35
		SAE 50	50	122	10	50
	Mobilfluid LT*	75W-80	-40	0	-40	-18
Axle Differential and Wheel End	API GL5 with LS Additives	80W-90 LS 85W-90 LS	-4	118	-20	48
		75W-90 LS	-40	118	-40	48
Hydraulic System	Mobilfluid 424	10W-30	6	122	-14	50
	Exxon Univis HVI		-40	100	-40	38
Boom Wear Pad Grease	Extreme Pressure Grease	NLGI Grade 000	-31	122	-35	50
Grease Fittings	Extreme Pressure Grease	NLGI Grade 2 EP or NLGI Grade 3 EP with Moly	5	122	-15	50
Engine Coolant**	DQC CA-14 DQC CB-14 DQC CC-14	50% Ethylene Glycol and 50% Water	-40	122	-40	50
Fuel	EN 590 ASTM D975 Grade 2-D ASTM D975 Grade 1-D	Low Sulfur ($S \leq 500$ mg/kg)				
Brake Fluid	Mobil ATF 220		-40	122	-40	50
Air Conditioning	Refrigerant R-134-a	Tetrafluoroethane				

Note: **Friction Modifier may be added to axle differentials, see Section 2.3.3, "Capacities".*
***Do not mix coolants from different specifications.*

2.3.3 Capacities

Engine Crankcase Oil	
Capacity with Filter Change	8.5 quarts (8,0 liters)
Fuel Tank	
Capacity	39 gallons (148 liters)
Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS)	
Capacity	5.3 gallons (20.25 liters)
Cooling System	
System Capacity	20 quarts (19 liters)
Hydraulic System	
System Capacity	31.7 gallons (120 liters)
Reservoir Capacity to Full Mark	25.6 gallons (97 liters)
Transmission System	
Capacity with Filter Change	19 quarts (18 liters)
Transfer Case	
Capacity	3 quarts (2,8 liters)
Axles	
Differential Housing Capacity Front Axle Rear Axle	 6.5 quarts (6,15 liters) 7.9 quarts (7,5 liters)
Wheel End Capacity Front Axle Rear Axle	 1.7 quarts (1,6 liters) or 3.4 quarts (3,2 liters) 1.5 quarts (1,4 liters) or 2.9 quarts (2,8 liters)
Air Conditioning System (if equipped)	
System Capacity	2.65 lb (1,2 kilogram)
Brake Fluid	
Capacity	0.5 quarts (0,5 liters)

2.4 SERVICE AND MAINTENANCE SCHEDULES

2.4.1 Every 10 Hours

Check Fuel Level

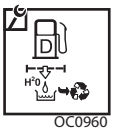
Check Tire Condition and Pressure

Check Brake Fluid Level

Check Engine Oil Level

Check Hydraulic Oil Level

Check Transmission Oil Level



Drain Fuel/Water Separator

Check DEF Level

Check Air Filter

Check Engine Coolant Level

2.4.2 First 50 Hours

Check Wheel Lug Nut Torque

2.4.3 Every 50 Hours

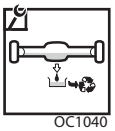
Lubrication Schedule

Check Washer Fluid

Check Cab Filter

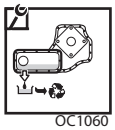
Check LSI System

2.4.4 First 250 Hours



Change Axle Oil

Change Wheel End Oil

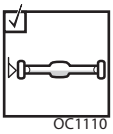


Change Transfer Case Fluid

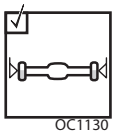
Change Transmission Fluid and Filter

2.4.5 Every 250 Hours

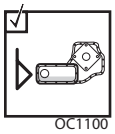
Lubrication Schedule



Check Axle Oil Level



Check Wheel End Oil Level



Check Transfer Case Fluid Level

Check Boom Wear Pads

2.4.6 Every 500 Hours

Check Battery

Check V-Belt

Check Wheel Lug Nut Torque

Change Engine Oil and Filter

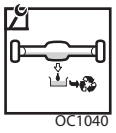
Check Engine Coolant Quality

2.4.7 Every 750 Hours

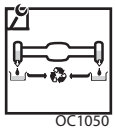
Change Hydraulic Tank Breather

Change Hydraulic Filters

2.4.8 Every 1000 Hours



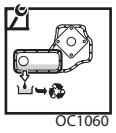
Change Axle Oil



Change Wheel End Oil

Check Air Intake System

Check Park Brake



Change Transfer Case Fluid

Change Transmission Fluid and Filter

Change V-Belt

Change Fuel Filters

Change DEF Pump Filter

Check LSI Calibration

2.4.9 Every 1500 Hours

Change Hydraulic Fluid and Filters

2.4.10 Every 2000 Hours

Change DEF Tank Filter

Change Air Filter Elements

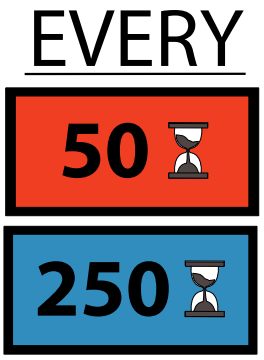
2.4.11 Every 3000 Hours

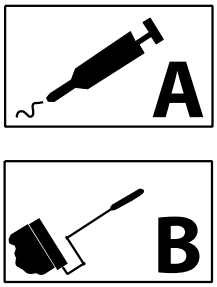
Change Engine Coolant (See Note)

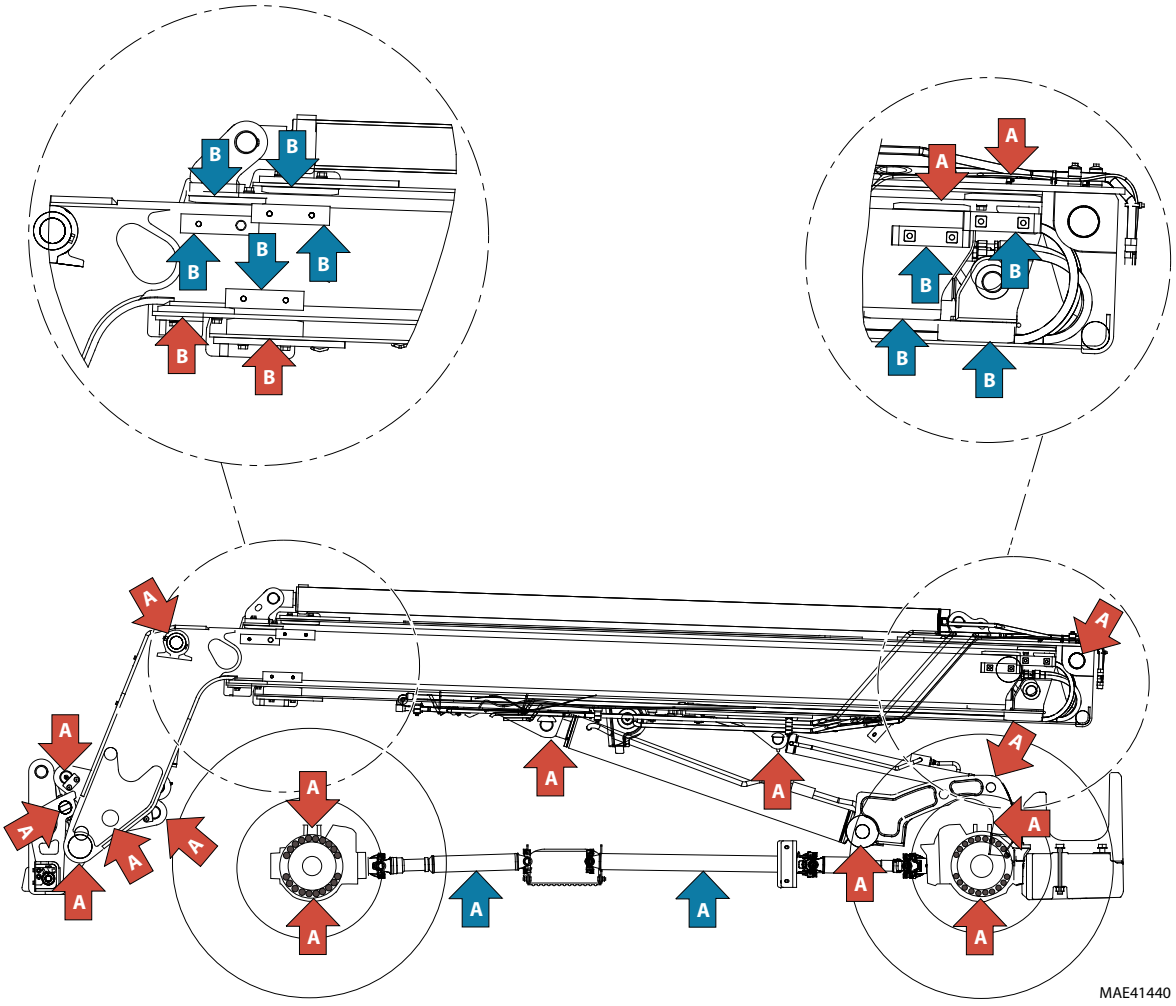
Note: *For first engine coolant change or if using DQC CA-14 engine coolant, change intervals are 3,000 hours or 2 years. If using DQC CB-14 or DQC CC-14 engine coolant, all subsequent change intervals are 6,000 hours or 4 years.*

2.5 LUBRICATION SCHEDULE

2.5.1 50 & 250 Hour







2.6 THREAD LOCKING COMPOUND

JLG PN	Loctite®	ND Industries	Description
0100011	242™	Vibra-TITE™ 121	Medium Strength (Blue)
1001095650	243™	Vibra-TITE™ 122	Medium Strength (Blue)
0100019	271™	Vibra-TITE™ 140	High Strength (Red)
0100071	262™	Vibra-TITE™ 131	Medium - High Strength (Red)

Note: *Loctite® 243™ can be substituted in place of Loctite® 242™. Vibra-TITE™ 122 can be substituted in place of Vibra-TITE™ 121.*

2.7 TORQUE CHARTS

2.7.1 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

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

2.7.1 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=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	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

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

2.7.1 SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SAE GRADE 5 BOLTS & GRADE 2 NUTS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry) K=0.17		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		In	Sq In	LB	IN-LB	[N.m]	IN-LB	[N.m]	IN-LB	[N.m]
4	40	0.1120	0.00604	380	7	0.8				
	48	0.1120	0.00661	420	8	0.9				
6	32	0.1380	0.00909	580	14	1.5				
	40	0.1380	0.01015	610	14	1.6				
8	32	0.1640	0.01400	900	25	2.8				
	36	0.1640	0.01474	940	26	2.9				
10	24	0.1900	0.01750	1120	36	4.1				
	32	0.1900	0.02000	1285	42	4.7				
1/4	20	0.2500	0.0318	2020	86	9.7	80	9		
	28	0.2500	0.0364	2320	99	11.1	95	11		
		In	Sq In	LB	FT-LB	[N.m]	FT-LB	[N.m]	FT-LB	[N.m]
5/16	18	0.3125	0.0524	3340	15	20	14	19	15	20
	24	0.3125	0.0580	3700	15	20	15	21	15	20
3/8	16	0.3750	0.0775	4940	25	35	25	34	25	34
	24	0.3750	0.0878	5600	30	40	28	38	25	34
7/16	14	0.4375	0.1063	6800	40	55	40	54	35	48
	20	0.4375	0.1187	7550	45	60	44	60	40	54
1/2	13	0.5000	0.1419	9050	65	90	60	82	55	75
	20	0.5000	0.1599	10700	75	100	71	97	65	88
9/16	12	0.5625	0.1820	11600	90	120	87	118	80	109
	18	0.5625	0.2030	12950	105	145	97	132	90	122
5/8	11	0.6250	0.2260	14400	130	175	120	163	115	156
	18	0.6250	0.2560	16300	145	195	136	185	125	170
3/4	10	0.7500	0.3340	21300	225	305	213	290	200	272
	16	0.7500	0.3730	23800	255	345	238	324	225	306
7/8	9	0.8750	0.4620	29400	365	495	343	466	320	435
	14	0.8750	0.5090	32400	400	545	378	514	355	483
1	8	1.0000	0.6060	38600	545	740	515	700	480	653
	12	1.0000	0.6630	42200	600	815	563	765	530	721
1 1/8	7	1.1250	0.7630	42300	675	920	635	863	595	809
	12	1.1250	0.8560	47500	755	1025	713	969	670	911
1 1/4	7	1.2500	0.9690	53800	955	1300	897	1219	840	1142
	12	1.2500	1.0730	59600	1055	1435	993	1351	930	1265
1 3/8	6	1.3750	1.1550	64100	1250	1700	1175	1598	1100	1496
	12	1.3750	1.3150	73000	1420	1930	1338	1820	1255	1707
1 1/2	6	1.5000	1.4050	78000	1660	2260	1560	2122	1465	1992
	12	1.5000	1.5800	87700	1865	2535	1754	2385	1645	2237

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

2.7.1 SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SAE GRADE 8 (HEX HD) BOLTS & GRADE 8 NUTS*										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load	Torque (Dry or Loctite® 263) K=0.17		Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.16		Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15	
		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	37	4				
10	24	0.1900	0.01750	1580	51	6				
	32	0.1900	0.02000	1800	58	7				
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

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

2.7.1 SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SOCKET HEAD CAP SCREWS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K=0.17		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	415	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

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

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

2.7.1 SAE Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*										
SOCKET HEAD CAP SCREWS										
Size	TPI	Bolt Dia	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry) K=0.17		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	415	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

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

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.

2.7.2 Metric Fastener Torque Chart

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*							
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS							
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™)	Torque (Lube)	Torque (Loctite® 262™ or 271™ or Vibra-TITE™ 131)	Torque (Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 141)
		Sq mm	KN	[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

NOTES: 1. THESE TORQUE VALUES DO NOT APPLY TO CADMIUM PLATED FASTENERS 5000059K

2. ALL TORQUE VALUES ARE STATIC TORQUE MEASURED PER STANDARD AUDIT METHODS TOLERANCE = ±10%

3. * ASSEMBLY USES HARDENED WASHER

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.

2.7.2 Metric Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS, CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAP SCREWS M3 - M5*						
Size	**Pitch**	**Tensile Stress Area**	**Clamp Load See Note 4**	**Torque (Dry or Loctite® 263™) K=0.20**	**Torque (Lube 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	23	19
8	1.25	36.60	22.8	37	33	27
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

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
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.

5000059K

2.7.2 Metric Fastener Torque Chart (Continued)

Values for Magni Coated Fasteners (Ref 4150701)*						
CLASS 8.8 METRIC (HEX/SOCKET HEAD) BOLTS CLASS 8 METRIC NUTS						
Size	Pitch	Tensile Stress Area	Clamp Load See Note 4	Torque (Dry or Loctite® 263™) K=0.17	Torque (Lube or Loctite® 242™ or 271™ or Vibra-TITE™ 111 or 140) K=0.16	Torque (Loctite® 262™ or Vibra-TITE™ 131) K=0.15
		Sq mm	KN	[N.m]	[N.m]	[N.m]
3	0.5	5.03	2.19	1.1	1.1	1.0
3.5	0.6	6.78	2.95	1.8	1.7	1.5
4	0.7	8.78	3.82	2.6	2.4	2.3
5	0.8	14.20	6.18	5.3	4.9	4.6
6	1	20.10	8.74	9	8.4	7.9
7	1	28.90	12.6	15	14	13
8	1.25	36.60	15.9	22	20	19
10	1.5	58.00	25.2	43	40	38
12	1.75	84.30	36.7	75	70	66
14	2	115	50.0	119	110	105
16	2	157	68.3	186	175	165
18	2.5	192	83.5	256	240	225
20	2.5	245	106.5	362	340	320
22	2.5	303	132.0	494	465	435
24	3	353	153.5	627	590	555
27	3	459	199.5	916	860	810
30	3.5	561	244.0	1245	1170	1100
33	3.5	694	302.0	1694	1595	1495
36	4	817	355.5	2176	2050	1920
42	4.5	1120	487.0	3477	3275	3070

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
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.

5000059K

2.7.2 Metric Fastener Torque Chart (Continued)

Values for Magni Coated Fasteners (Ref 4150701)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS CLASS 10 METRIC NUTS, CLASS 12.9 SOCKET HEAD CAP SCREWS M6 AND ABOVE*						
Size	**Pitch**	**Tensile Stress Area**	**Clamp Load See Note 4**	**Torque (Dry or Loctite® 263™) K=0.17**	**Torque (Lube 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	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	55
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	222.0	905	850	800
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

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
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.

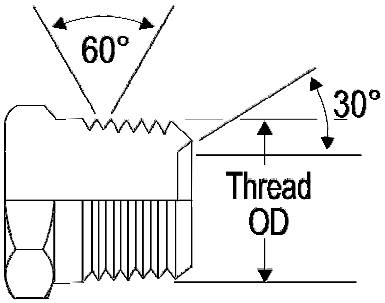
5000059K

2.8 HYDRAULIC CONNECTION ASSEMBLY AND TORQUE SPECIFICATION

2.8.1 Definitions

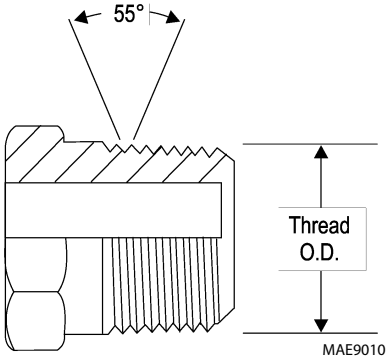
a. Tapered Thread Types

NPTF *- National tapered fuel (dry seal) per SAE J476/J512*



MAE9000

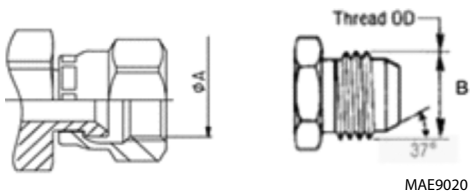
BSPT *- British standard pipe tapered per ISO7-1*



MAE9010

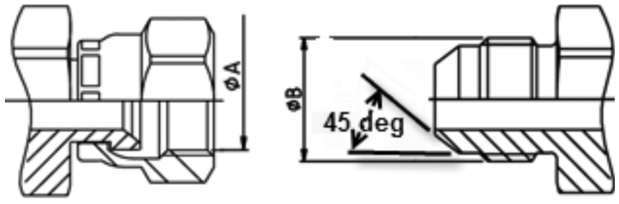
b. Straight Thread Types, Tube and Hose Connections

JIC *- 37° flare per SAE J514*



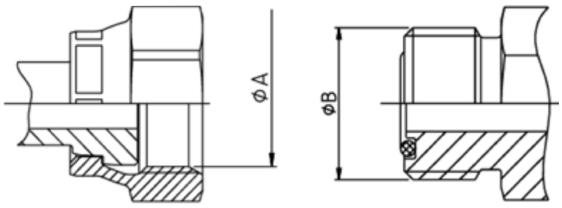
MAE9020

SAE *- 45° flare per SAE J512*



MAE9030

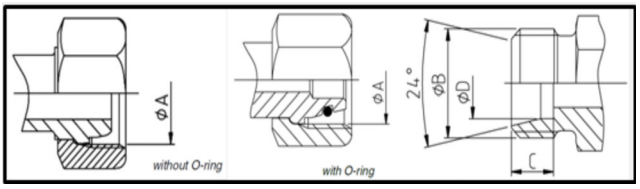
ORFS *- O-ring face seal per SAE J1453*



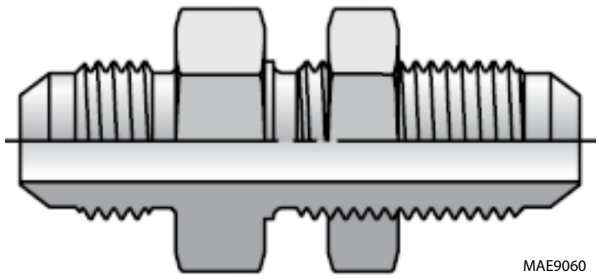
MAE9050

MBTL *- Metric flareless bite type fitting, pressure rating L (medium) per ISO 8434, DIN 2353*

MBTS *- Metric flareless bite type fitting, pressure rating S (high) per ISO 8434, DIN 2353*



BH *- Bulkhead connection – JIC, ORFS, MBTL, or MBTS types*

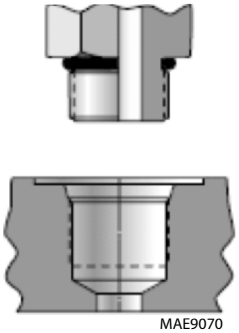


MAE9060

c. Straight Thread Types, Port Connections

ORB *- O-ring boss per SAE J1926, ISO 11926*

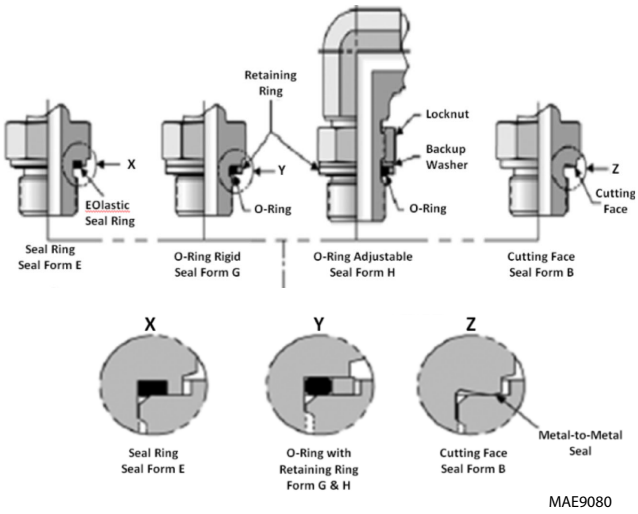
MPP *- Metric pipe parallel o-ring boss per SAE J2244, ISO 6149, DIN 3852*



MAE9070

MFF *- Metric flat face port per ISO 9974-1*

BSPP *- British standard parallel pipe per ISO 1179-1, DIN 3852-2*

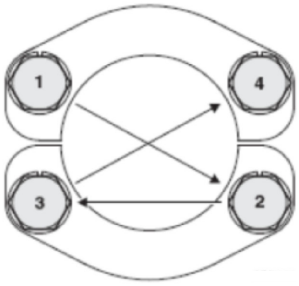


MAE9080

d. Flange Connection Types

FL61 *- Code 61 flange per SAE J518, ISO 6162*

FL62 *- Code 62 flange per SAE J518, ISO 6162*



MAE9090

e. Tightening Methods

Torque - Application of a twisting force to the applicable connection by use of a precise measurement instrument (i.e. torque wrench).

Finger Tight (Hand Tight) - The point where the connector will no longer thread onto the mating part when tightened by hand or fingers. Finger Tight is relative to user strength and will have some variance. The average torque applied by this method is 3 ft-lb (4 Nm).

TFFT - Turns From Finger Tight; Application of a preload to a connection by first tightening the connection by hand (fingers) and applying an additional rotation counted by a defined number of turns by use of a tool.

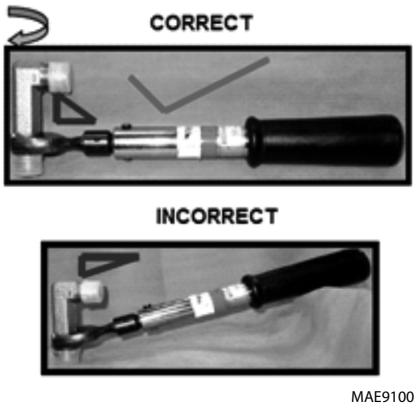
FFWR (Flat method) - Flats From Wrench Resistance; Application of a preload to a connection by tightening to the point of initial wrench resistance and turning the nut a described number of flats. A flat is one side of the hexagonal tube nut and equates to 1/6 of a turn.

f. Assembly and Torque Specifications

Prior to selecting the appropriate torque from the tables within this section, it is necessary to properly identify the connector being installed.

g. General Tube Type Fitting Assembly Instructions

1. Take precautions to ensure that fittings and mating components are not damaged during storage, handling or assembly. Nicks and scratches in sealing surfaces can create a path for leaks which could lead to component contamination and/or failure.
2. When making a connection to tubing, compression or flare, inspect the tube in the area of the fitting attachment to ensure that the tube has not been damaged.
3. The assembly process is one of the leading causes for contamination in air and hydraulic systems. Contamination can prevent proper tightening of fittings and adapters from occurring.
   a. Avoid using dirty or oily rags when handling fittings.
   b. If fittings are disassembled, they should be cleaned and inspected for damage. Replace fittings as necessary before reinstalling.
   c. Sealing compounds should be applied where specified; however, care should be taken not to introduce sealant into the system.
   d. Avoid applying sealant to the area of the threads where the sealant will be forced into the system. This is generally the first two threads of a fitting.
   e. Sealant should only be applied to the male threads.
   f. Straight thread fittings do not require sealants. O-rings or washers are provided for sealing.
   g. When replacing or installing an o-ring, care is to be taken while transferring the o-ring over the threads as it may become nicked or torn. When replacing an o-ring on a fitting, the use of a thread protector is recommended.
   h. When installing fittings with o-rings, lubrication shall be used to prevent scuffing or tearing of the o-ring. Refer to Section g, "Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.", for procedure.
4. Take care to identify the material of parts to apply the correct torque values.
   a. Verify the material designation in the table headings
   b. If specifications are given only for steel fittings and components, the values for alternate materials shall be as follows:
   Aluminum and Brass - reduce steel values by 35%
   Stainless Steel - Use the upper limit for steel.
5. To achieve the specified torque, the torque wrench is to be held perpendicular to the axis of rotation.



MAE9100

6. Refer to the appropriate section in this manual for more specific instructions and procedures for each type of fitting connection.

2.8.2 Assembly Instructions for American Standard Pipe Thread Tapered Connections

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply high temperature thread sealant with PTFE, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female

NOTICE

Over tightening may cause deformation of the pipe fitting and damage to the joining fitting, flange or component may occur.

NOTICE

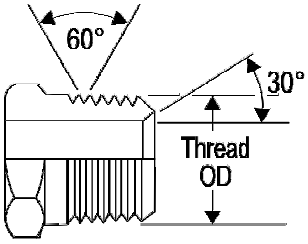
Never back off (loosen) pipe threaded connectors to achieve alignment. Meet the minimum required turns and use the last turn for alignment.

5. Rotate male fitting the number of turns as per below mentioned table. Refer to Section 2.8.15, "FFWR and TFFT Methods", for procedure.

Note: *TFFT values provided in below mentioned table are applicable for the following material configurations:*

a. Steel fittings with steel mating components
b. Steel fittings with aluminum or brass mating components
c. Aluminum or brass fittings with steel mating components
d. Aluminum or brass fittings with aluminum or brass mating components.

a. NPTF Pipe Thread



ØA dimension is measured on the 4th pitch of the thread

MAE9110

TYPE/FITTING IDENTIFICATION					Turns From Finger Tight (TFFT)**
Material	Dash Size	Thread Size	ØA*		
		(UNF)	(in)	(mm)	
STEEL, ALUMINUM, OR BRASS FITTINGS WITH STEEL, ALUMINUM, OR BRASS MATING COMPONENTS	2	1/8 - 27	0.40	10.24	2 to 3
	4	1/4 - 18	0.54	13.61	2 to 3
	6	3/8 - 18	0.67	17.05	2 to 3
	8	1/2 - 14	0.84	21.22	2 to 3
	12	3/4 - 14	1.05	26.56	2 to 3
	16	1 - 11 1/2	1.31	33.22	1.5 to 2.5
	20	1 1/4 - 11 1/2	1.65	41.98	1.5 to 2.5
	24	1 1/2 - 11 1/2	1.89	48.05	1.5 to 2.5
	32	2 - 11 1/2	2.37	60.09	1.5 to 2.5

NOTE:

* ØA thread dimension for reference only.

** Refer to Section 2.8.15, "FFWR and TFFT Methods", for TFFT procedure requirements.

2.8.3 Assembly Instructions for British Standard Pipe Thread Tapered Connections

1. Inspect components to ensure male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Apply high temperature thread sealant with PTFE, to the male pipe threads if not already applied. Ensure the first 1 to 2 threads are uncovered to prevent system contamination.
3. Assemble connection hand tight.
4. Mark fittings, male and female.

NOTICE

Over tightening may cause deformation of the pipe fitting and damage to the joining fitting, flange or component may occur.

NOTICE

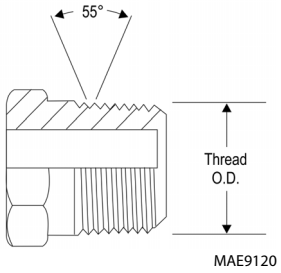
Never back off (loosen) pipe threaded connectors to achieve alignment. Meet the minimum required turns and use the last turn for alignment.

5. Rotate male fitting the number of turns as per below mention table.

Note: *TFFT values provided in below table are applicable for the following material configurations:*

a. Steel fittings with steel mating components
b. Steel fittings with aluminum or brass mating components
c. Aluminum or brass fittings with steel mating components
d. Aluminum or brass fittings with aluminum or brass mating components.

a. BSPT Pipe Thread



TYPE/FITTING IDENTIFICATION					Turns From Finger Tight (TFFT)**
Material	Dash Size	Thread Size	ØA*		
		(BSPT)	(in)	(mm)	
STEEL, ALUMINUM, OR BRASS FITTINGS WITH STEEL, ALUMINUM, OR BRASS MATING COMPONENTS	2	1/8 - 28	0.38	9.73	2 to 3
	4	1/4 - 19	0.52	13.16	2 to 3
	6	3/8 - 19	0.66	16.66	2 to 3
	8	1/2 - 14	0.83	20.96	2 to 3
	12	3/4 - 14	1.04	26.44	2 to 3
	16	1 - 11	1.31	33.25	1.5 to 2.5
	20	1 1/4 - 11	1.65	41.91	1.5 to 2.5
	24	1 1/2 - 11	1.88	47.80	1.5 to 2.5
	32	2 - 11	2.35	59.61	1.5 to 2.5

NOTE:

* ØA thread dimension for reference only.

** Refer to Section 2.8.15, "FFWR and TFFT Methods", for TFFT procedure requirements.

2.8.4 Assembly Instructions for 37° (JIC) Flare Fittings

1. Inspect the flare for obvious visual squareness
2. and concentricity issues with the tube OD. Ensure that surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary, replace fitting or adapter.

NOTICE

DO NOT force a misaligned or short hose/tube into alignment. It puts undesirable strain onto the joint eventually leading to leakage.

3. Align tube to fitting and start threads by hand.

NOTICE

The torque method should NOT be used on lubricated or oily fittings. No lubrication or sealant is required. The lubrication would cause increased clamping force and cause fitting damage.

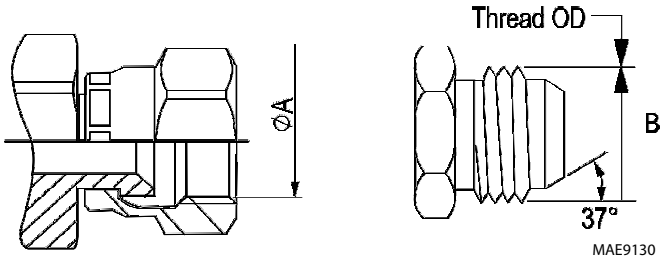
4. Torque assembly to value listed in below mentioned table while using the Double Wrench Method.

Note: *Torque values provided in below table are segregated based on the material configuration of the connection.*

ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS' indicate either the following material configurations:

a. Steel fittings with steel mating components
b. STEEL fittings with ALUMINUM or BRASS mating components
c. ALUMINUM or BRASS fittings with STEEL mating components
d. ALUMINUM or BRASS fittings with ALUMINUM or BRASS mating components.

a. 37° Flare (JIC) Thread - Steel



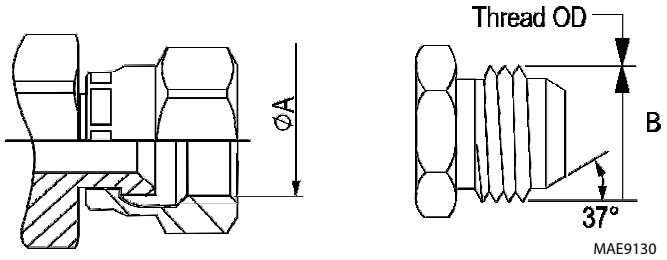
TYPE/FITTING IDENTIFICATION													Flats From Wrench Resistance (F.F.W.R)**
Material	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[Nm]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	6	7	7	8	9	10	--
	3	3/8-24	0.34	8.60	0.37	9.50	8	9	10	11	12	14	--
	4	7/16-20	0.39	10.00	0.44	11.10	13	14	14	18	19	19	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	14	15	15	19	20	21	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	22	23	24	30	31	33	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	42	44	46	57	60	63	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	60	63	66	81	85	89	1 to 1-1/2
	12	1 1/16-12	0.97	24.60	1.06	27.00	84	88	92	114	120	125	1 to 1-1/2
	14	1 3/16-12	1.11	28.30	1.19	30.10	100	105	110	136	142	149	1 to 1-1/2
	16	1 5/16-12	1.23	31.30	1.31	33.30	118	124	130	160	168	176	3/4 to 1
	20	1 5/8-12	1.54	39.20	1.63	41.30	168	176	185	228	239	251	3/4 to 1
	24	1 7/8-12	1.80	45.60	1.87	47.60	195	205	215	264	278	291	3/4 to 1
	32	2 1/2-12	2.42	61.50	2.50	63.50	265	278	292	359	377	395	3/4 to 1

NOTE:

* ØA and ØB thread dimensions for reference only.

** Refer to Section 2.8.15, "FFWR and TFFT Methods", for FFWR procedure requirements.

b. 37° Flare (JIC) Thread - Aluminum Brass



TYPE/FITTING IDENTIFICATION													Flats From Wrench Resistance (F.F.W.R)**
Material	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[Nm]			
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max	
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	0.31	7.75	4	4	5	5	6	7	--
	3	3/8-24	0.34	8.60	0.37	9.50	5	6	7	7	8	9	--
	4	7/16-20	0.39	10.00	0.44	11.10	8	9	9	11	12	13	1-1/2 to 1-3/4
	5	1/2-20	0.46	11.60	0.50	12.70	9	10	10	12	13	14	1 to 1-1/2
	6	9/16-18	0.51	13.00	0.56	14.30	14	15	16	19	20	21	1 to 1-1/2
	8	3/4-16	0.69	17.60	0.75	19.10	27	29	30	37	39	41	1-1/2 to 1-3/4
	10	7/8-14	0.81	20.50	0.87	22.20	39	41	43	53	56	58	1 to 1-1/2
	12	1 1/16-12	0.97	24.60	1.06	27.00	55	57	60	74	78	81	1 to 1-1/2
	14	1 3/16-12	1.11	28.30	1.19	30.10	65	68	72	88	93	97	1 to 1-1/2
	16	1 5/16-12	1.23	31.30	1.31	33.30	77	81	84	104	109	114	3/4 to 1
	20	1 5/8-12	1.54	39.20	1.63	41.30	109	115	120	148	155	163	3/4 to 1
	24	1 7/8-12	1.80	45.60	1.87	47.60	127	133	139	172	180	189	3/4 to 1
	32	2 1/2-12	2.42	61.50	2.50	63.50	172	181	189	234	245	257	3/4 to 1

NOTE:

* ØA and ØB thread dimensions for reference only.

** Refer to Section 2.8.15, "FFWR and TFFT Methods", for FFWR procedure requirements.

2.8.5 Assembly Instructions for 45° SAE Flare Fittings

1. Inspect the flare for obvious visual squareness and concentricity issues with the tube OD. Ensure that surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary, replace fitting or adapter.

NOTICE

DO NOT force a misaligned or short hose/tube into alignment. It puts undesirable strain onto the joint eventually leading to leakage.

2. Align tube to fitting.
3. Tighten fitting by hand until hand tight.

NOTICE

The torque method should NOT be used on lubricated or oily fittings. No lubrication or sealant is required. The lubrication would cause increased clamping force and cause fitting damage.

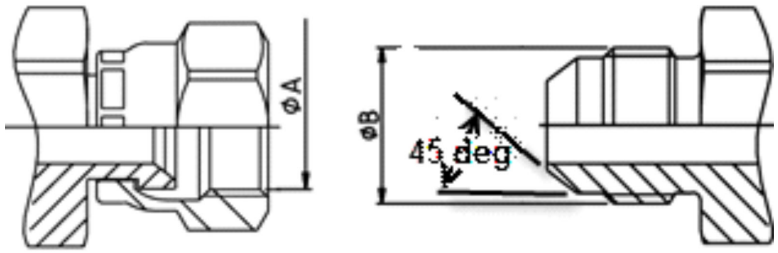
Torque fitting to value listed in below table while using the Double Wrench Method outlined in this section.

Note: *Torque values provided in below table are segregated based on the material configuration of the connection.*

'Aluminum/brass fittings or aluminum/brass mating components' indicate either the following material configurations:

a. Steel fittings with steel mating components
b. Steel fittings with aluminum or brass mating components
c. Aluminum or brass fittings with steel mating components
d. Aluminum or brass fittings with aluminum or brass mating components.

a. 45° Flare (SAE)



MAE9140

STEEL

TYPE/FITTING IDENTIFICATION							TORQUE					
Material	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	13	14	14	18	19	19
	6	5/8-18	0.56	14.30	0.63	15.90	22	23	24	30	31	33
	8	3/4-16	0.69	17.50	0.75	19.10	42	44	46	57	60	62
	10	7/8-14	0.81	20.60	0.87	22.20	60	63	66	81	85	89
	12	1 1/16-14	0.98	25.00	1.06	27.00	84	88	92	114	119	125

NOTE: * ØA and ØB thread dimensions for reference only.

ALUMINUM BRASS

TYPE/FITTING IDENTIFICATION							TORQUE					
Material	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	4	7/16-20	0.39	9.90	0.44	11.10	8	9	9	11	12	12
	6	5/8-18	0.56	14.30	0.63	15.90	14	15	15	19	20	20
	8	3/4-16	0.69	17.50	0.75	19.10	27	29	30	37	39	41
	10	7/8-14	0.81	20.60	0.87	22.20	39	41	43	53	56	58
	12	1 1/16-14	0.98	25.00	1.06	27.00	55	58	61	75	79	83

NOTE: * ØA and ØB thread dimensions for reference only.

2.8.6 Assembly Instructions for O-Ring Face Seal (ORFS) Fittings

1. Ensure proper o-ring is installed. If o-ring is missing install per o-ring Installation (replacement). Refer to Section g, "Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.", for procedure.
2. Ensure that surface is smooth, free of rust, weld and brazing splatter, splits, dirt, foreign matter, or burrs. If necessary, replace fitting or adapter.

NOTICE

Care to be taken when lubricating o-ring. Avoid adding oil to the threaded connection of the fitting. The lubrication would cause increased clamping force and cause fitting damage.

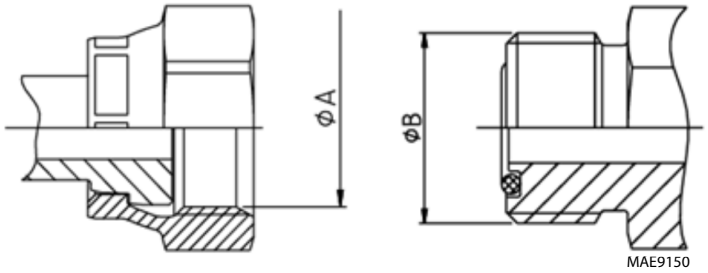
3. Pre-lubricate the o-ring with hydraulic oil.
4. Place the tube assembly against the fitting body so that the flat face comes in contact with the o-ring. Hand thread the nut onto the fitting body.
5. Torque nut to value listed in below mentioned table while using the Double Wrench Method. Refer to Section 2.8.15, "FFWR and TFFT Methods", for procedure if using the FFWR method.

Note: *Torque values provided in below table are segregated based on the material configuration of the connection.*

Aluminum/brass fittings or aluminum/brass mating components' indicate either the following material configurations:

a. Steel fittings with aluminum or brass mating components
b. Aluminum or brass fittings with steel mating components
c. Aluminum or brass fittings with aluminum or brass mating components.

a. O-ring Face Seal (ORFS)



STEEL

TYPE/FITTING IDENTIFICATION							TORQUE							
Material	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[Nm]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18	0.51	13.00	0.56	14.20	18	19	20	25	26	27	1/4 to 1/2	1/2 to 3/4
	6	11/16-16	0.63	15.90	0.69	17.50	30	32	33	40	43	45	1/4 to 1/2	1/2 to 3/4
	8	13/16-16	0.75	19.10	0.81	20.60	40	42	44	55	57	60	1/4 to 1/2	1/2 to 3/4
	10	1-14	0.94	23.80	1.00	25.40	60	63	66	81	85	89	1/4 to 1/2	1/2 to 3/4
	12	1 3/16-12	1.11	28.20	1.19	30.10	85	90	94	115	122	127	1/4 to 1/2	1/2 to 3/4
	16	1 7/16-12	1.34	34.15	1.44	36.50	110	116	121	149	157	164	1/4 to 1/2	1/2 to 3/4
	20	1 11/16-12	1.59	40.50	1.69	42.90	150	158	165	203	214	224	1/4 to 1/2	1/2 to 3/4
	24	2-12	1.92	48.80	2.00	50.80	230	242	253	312	328	343	1/4 to 1/2	1/2 to 3/4
	32	2 1/2-12	2.43	61.67	2.50	63.50	375	394	413	508	534	560	1/4 to 1/2	1/2 to 3/4

NOTE: * ØA and ØB thread dimensions for reference only.

ALUMINUM/BRASS

TYPE/FITTING IDENTIFICATION							TORQUE						FLATS FROM WRENCH RESISTANCE (F.F.W.R)**	
Material	Dash Size	Thread Size	ØA*		ØB*		[Ft-Lb]			[Nm]			Tube Nuts	Swivel & Hose Ends
		(UNF)	(in)	(mm)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max		
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	4	9/16-18	0.51	13.00	0.56	14.20	12	13	13	16	18	18	1/4 to 1/2	1/2 to 3/4
	6	11/16-16	0.63	15.90	0.69	17.50	20	21	22	27	28	30	1/4 to 1/2	1/2 to 3/4
	8	13/16-16	0.75	19.10	0.81	20.60	26	28	29	35	38	39	1/4 to 1/2	1/2 to 3/4
	10	1-14	0.94	23.80	1.00	25.40	39	41	43	53	56	58	1/4 to 1/2	1/2 to 3/4
	12	1 3/16-12	1.11	28.20	1.19	30.10	55	58	61	75	79	83	1/4 to 1/2	1/2 to 3/4
	16	1 7/16-12	1.34	34.15	1.44	36.50	72	76	79	98	103	107	1/4 to 1/2	1/2 to 3/4
	20	1 11/16-12	1.59	40.50	1.69	42.90	98	103	108	133	140	146	1/4 to 1/2	1/2 to 3/4
	24	2-12	1.92	48.80	2.00	50.80	150	158	165	203	214	224	1/4 to 1/2	1/2 to 3/4
	32	2 1/2-12	2.43	61.67	2.50	63.50	244	257	269	331	348	365	1/4 to 1/2	1/2 to 3/4

NOTE: * ØA and ØB thread dimensions for reference only.

** Refer to Section 2.8.15, "FFWR and TFFT Methods", for FFWR procedure requirements.

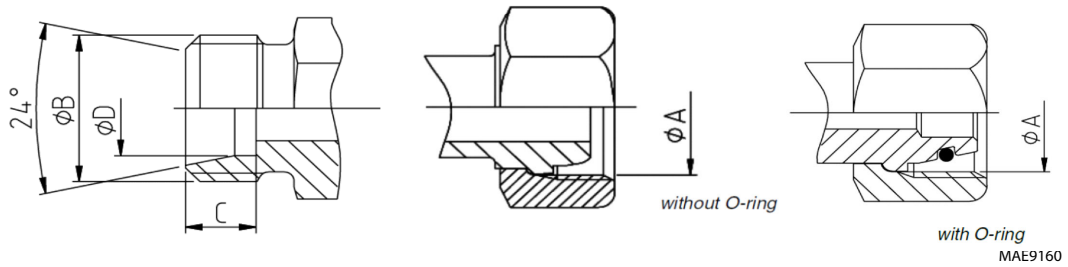
2.8.7 Assembly Instructions for DIN 24° Flare Bite Type Fittings (MBTL and MBTS)

NOTICE

A non-square tube end can cause improperly seated fittings and leakage.

1. Inspect the components to ensure free of contamination, external damage, rust, splits, dirt, foreign matter, or burrs. Ensure tube end is visibly square. If necessary, replace fitting or tube.
2. Lubricate thread and cone of fitting body or hardened pre-assembly tool, as well as the progressive ring and nut threads.
3. Slip nut and progressive ring over tube, assuring that they are in the proper orientation.
4. Push the tube end into the coupling body.
5. Slide collet into position and tighten until finger tight. Mark nut and tube in the finger-tight position. Tighten nut to the number of flats listed while using the Double Wrench Method. The tube must not turn with the nut.

a. DIN 24° CONE (MBTL & MBTS)



TYPE/FITTING IDENTIFICATION							DIN 24° CONE FLARELESS BITE FITTING (WITH OR WITHOUT O-RING)							
Material	Type	Tube O.D.	Thread M Size	ØA*	ØB*	C*	ØD*	Torque [Ft-Lb] Min	Torque [Ft-Lb] Nom	Torque [Ft-Lb] Max	Torque [Nm] Min	Torque [Nm] Nom	Torque [Nm] Max	Flats From Wrench Resistance (F.F.W.R)**
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)							
STEEL FITTINGS WITH STEEL MATING COMPONENTS	DIN 24° CONE FLARELESS BITE (MBTL) FITTING	6	M12 x 1.5	10.50	12.00	7.00	6.20	FFWR is the recommended method of fitting assembly. Torque values are application specific due to variability in the fitting supplier, coating, lubrication, and other physical characteristic of the connection.						1.5 to 1.75
		8	M14 x 1.5	12.50	14.00	7.00	8.20							1.5 to 1.75
		10	M16 x 1.5	14.50	16.00	7.00	10.20							1.5 to 1.75
		12	M18 x 1.5	16.50	18.00	7.00	12.20							1.5 to 1.75
		15	M22 x 1.5	20.50	22.00	7.00	15.20							1.5 to 1.75
		18	M26 x 1.5	24.50	26.00	7.50	18.20							1.5 to 1.75
		22	M30 x 2	27.90	30.00	7.50	22.20							1.5 to 1.75
		28	M36 x 2	33.90	36.00	7.50	28.20							1.5 to 1.75
		35	M45 x 2	42.90	45.00	10.50	35.30							1.5 to 1.75
		42	M52 x 2	49.90	52.00	11.00	42.30							1.5 to 1.75
	Type	Tube O.D.	Thread M Size	ØA*	ØB*	C*	ØD*	Torque [Ft-Lb] Min	Torque [Ft-Lb] Nom	Torque [Ft-Lb] Max	Torque [Nm] Min	Torque [Nm] Nom	Torque [Nm] Max	Flats From Wrench Resistance (F.F.W.R)**
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)							
	DIN 24° CONE FLARELESS BITE (MBTS) FITTING	6	M14 x 1.5	12.50	14.00	7.00	6.20	FFWR is the recommended method of fitting assembly. Torque values are application specific due to variability in the fitting supplier, coating, lubrication, and other physical characteristics of the connection.						1.5 to 1.75
		8	M16 x 1.5	14.50	16.00	7.00	8.20							1.5 to 1.75
		10	M18 x 1.5	16.50	18.00	7.50	10.20							1.5 to 1.75
		12	M20 x 1.5	18.50	20.00	7.50	12.20							1.5 to 1.75
		14	M22 x 1.5	20.50	22.00	8.00	14.20							1.5 to 1.75
		16	M24 x 1.5	22.50	24.00	8.50	16.20							1.5 to 1.75
		20	M30 x 2	27.90	30.00	10.50	20.20							1.5 to 1.75
		25	M36 x 2	33.90	36.00	12.00	25.20							1.5 to 1.75
		30	M42 x 2	39.90	42.00	13.50	30.20							1.5 to 1.75
		38	M52 x 2	49.90	52.00	16.00	38.30							1.5 to 1.75

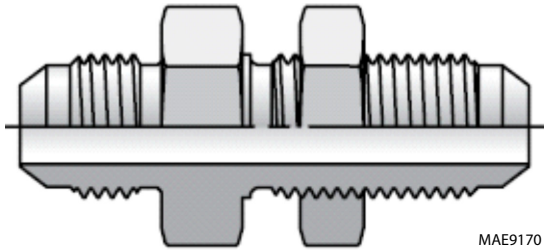
NOTE: * ØA, ØB,C, & ØD thread dimensions for reference only.

** Refer to Section 2.8.15, "FFWR and TFFT Methods", for FFWR procedure requirements.

2.8.8 Assembly Instructions for Bulkhead (BH) Fittings

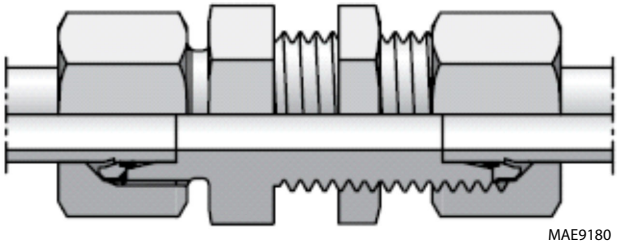
1. Ensure that threads and surface are free of rust, weld and brazing splatter, splits, burrs or other foreign material. If necessary, replace fitting or adapter.
2. Remove the locknut from the bulkhead assembly.
3. Insert the bulkhead side of the fitting into the panel or bulkhead bracket opening.
4. Hand thread the locknut onto the bulkhead end of the fitting body.
5. Torque nut onto fitting while using the Double Wrench Method.

a. Bulkhead Fittings (BH) - INCH



TYPE/FITTING IDENTIFICATION				FASTENING JAM NUT FOR BULKHEAD CONNECTORS					
Material	Type	Dash Size	Thread Size	Torque					
				[Ft-Lb]			[Nm]		
			(UNF)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS	O-RING FACE SEAL (ORFS) BULKHEAD FITTING	4	9/16-18	15	16	17	20	22	23
		6	11/16-16	25	27	28	34	37	38
		8	13/16-16	55	58	61	75	79	83
		10	1-14	85	90	94	115	122	127
		12	1 3/16-12	135	142	149	183	193	202
		14	1 5/16-12	170	179	187	230	243	254
		16	1 7/16-12	200	210	220	271	285	298
		20	1 11/16-12	245	258	270	332	350	366
		24	2-12	270	284	297	366	385	403
	Type	Dash Size	Thread Size	Torque					
				[Ft-Lb]			[Nm]		
			(UNF)	Min	Nom	Max	Min	Nom	Max
	37° FLARE (JIC) BULKHEAD FITTING	3	3/8-24	8	9	9	11	12	12
		4	7/16-20	13	14	14	18	19	19
		5	1/2-20	20	21	22	27	28	30
		6	9/16-18	25	27	28	34	37	38
		8	3/4-16	50	53	55	68	72	75
		10	7/8-14	85	90	94	115	122	127
		12	1 1/16-12	135	142	149	183	193	202
		14	1 3/16-12	170	179	187	230	243	254
		16	1 5/16-12	200	210	220	271	285	298
		20	1 5/8-12	245	258	270	332	350	366
		24	1 7/8-12	270	284	297	366	385	403
		32	2 1/2-12	310	326	341	420	442	462

b. Bulkhead Fittings (BH) - METRIC



TYPE/FITTING IDENTIFICATION				FASTENING JAM NUT FOR BULKHEAD CONNECTORS					
Material	Type	Connecting Tube O.D.	Thread M Size	Torque					
				[Ft-Lb]			[Nm]		
		(mm)	(metric)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS	DIN 24° CONE FLARELESS BITE (MBTL) BULKHEAD FITTING	6	M12 x 1.5	14	15	16	19	20	22
		8	M14 x 1.5	17	18	19	23	24	26
		10	M16 x 1.5	22	23	24	30	31	33
		12	M18 x 1.5	35	37	39	47	50	53
		15	M22 x 1.5	44	47	50	60	64	68
		18	M26 x 1.5	70	75	80	95	102	108
		22	M30 x 2	115	120	125	156	163	169
		28	M36 x 2	150	157	164	203	213	222
		35	M45 x 2	155	162	169	210	220	229
		42	M52 x 2	220	230	240	298	312	325
	Type	Connecting Tube O.D.	Thread M Size	Torque					
				[Ft-Lb]			[Nm]		
		(mm)	(metric)	Min	Nom	Max	Min	Nom	Max
	DIN 24° CONE FLARELESS BITE (MBTS) BULKHEAD FITTING	6	M14 x 1.5	17	15	16	23	20	22
		8	M16 x 1.5	22	18	19	30	24	26
		10	M18 x 1.5	35	23	24	47	31	33
		12	M20 x 1.5	40	35	37	54	47	50
		14	M22 x 1.5	44	47	50	60	64	68
		16	M24 x 1.5	70	75	80	95	102	108
		20	M30 x 2	115	120	125	156	163	169
		25	M36 x 2	150	157	164	203	213	222
		30	M42 x 2	155	162	169	210	220	229
		38	M52 x 2	220	230	240	298	312	325

2.8.9 Assembly Instructions for O-Ring Boss (ORB) Fittings

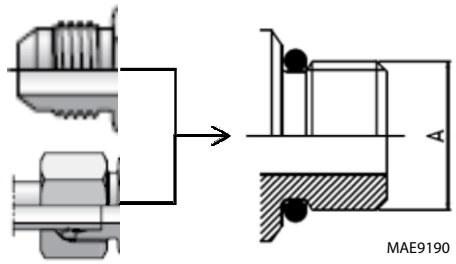
1. Inspect components to ensure that male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Ensure proper o-ring is installed. If o-ring is missing install per o-ring Installation (replacement). Refer to Section g, "Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.", for procedure.

NOTICE

Care to be taken when lubricating o-ring. Avoid adding oil to the threaded connection of the fitting. The lubrication would cause increased clamping force and cause fitting damage.

3. Pre-lubricate the o-ring with hydraulic oil.
4. For non-adjustable and plugs, thread the fitting by hand until contact.
5. For adjustable fittings, refer to Section 2.8.16, "Adjustable Stud End Assembly", for proper assembly.
6. Torque the fitting or nut to value while using the Double Wrench Method.
   a. The table headings identify the straight thread o-ring port and the type on the other side of the fitting. The torque will be applied to the straight thread o-ring port.
   b. Torque values are segregated based on the material configuration of the connection. 'Aluminum/brass fittings or aluminum/brass mating components' indicate either the following material configurations:
      - Steel fittings with aluminum or brass mating components
      - Aluminum or brass fittings with steel mating components
      - Aluminum or brass fittings with aluminum or brass mating components.
7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counter bore of the port.

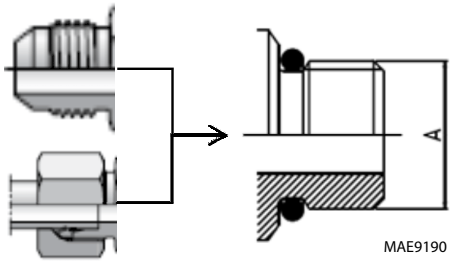
a. O-ring Boss (ORB) - Table 1 of 6



TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(85)	(90)	(94)	10	10	11
	3	3/8-24	0.37	9.52	(155)	(163)	(171)	18	18	19
	4	7/16-20	0.44	11.11	22	23	24	29	31	33
	5	1/2-20	0.50	12.70	23	25	26	32	34	35
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(55)	(58)	(61)	6	7	7
	3	3/8-24	0.37	9.52	(101)	(106)	(111)	11	12	13
	4	7/16-20	0.44	11.11	14	15	16	19	20	22
	5	1/2-20	0.50	12.70	15	16	17	20	22	23
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

NOTE:
1. * ØA thread OD dimension for reference only.
2. Removal torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

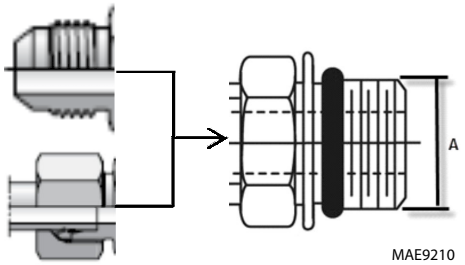
b. O-ring Boss (ORB) - Table 2 of 6



TYPE/FITTING IDENTIFICATION					STUD ENDS WITH (ORFS) OR S ERIES DIN (MBTS) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(85)	(90)	(94)	10	10	11
	3	3/8-24	0.37	9.52	(155)	(163)	(171)	18	18	19
	4	7/16-20	0.44	11.11	22	23	24	29	31	33
	5	1/2-20	0.50	12.70	23	25	26	32	34	35
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(55)	(58)	(61)	6	7	7
	3	3/8-24	0.37	9.52	(101)	(106)	(111)	11	12	13
	4	7/16-20	0.44	11.11	14	15	16	19	20	22
	5	1/2-20	0.50	12.70	15	16	17	20	22	23
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

NOTE:
1. * ØA thread OD dimension for reference only.
2. Removal torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

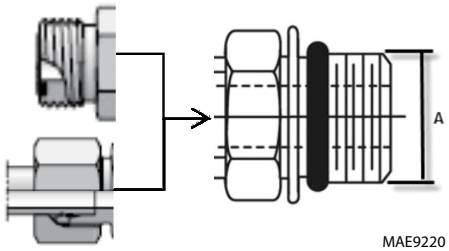
c. O-ring Boss (ORB) - Table 3 of 6



TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(85)	(90)	(94)	10	10	11
	3	3/8-24	0.37	9.52	(155)	(163)	(171)	18	18	19
	4	7/16-20	0.44	11.11	22	23	24	29	31	33
	5	1/2-20	0.50	12.70	23	25	26	32	34	35
	6	9/16-18	0.56	14.28	29	31	32	40	42	43
	8	3/4-16	0.75	19.10	52	55	57	70	75	77
	10	7/8-14	0.87	22.22	85	90	94	115	122	127
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(55)	(58)	(61)	6	7	7
	3	3/8-24	0.37	9.52	(101)	(106)	(111)	11	12	13
	4	7/16-20	0.44	11.11	14	15	16	19	20	22
	5	1/2-20	0.50	12.70	15	16	17	20	22	23
	6	9/16-18	0.56	14.28	19	20	21	26	27	28
	8	3/4-16	0.75	19.10	34	36	37	46	49	50
	10	7/8-14	0.87	22.22	55	58	61	75	79	83
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

NOTE:
1. * ØA thread OD dimension for reference only.
2. Removal torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

d. O-ring Boss (ORB) - Table 4 of 6



TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	15	16	17	20	22	23
	5	1/2-20	0.50	12.70	30	32	33	40	43	45
	6	9/16-18	0.56	14.28	35	37	39	46	50	53
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	--	--	--	--	--	--
	3	3/8-24	0.37	9.52	--	--	--	--	--	--
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	20	21	21	27	28	28
	6	9/16-18	0.56	14.28	23	24	24	31	33	33
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

NOTE:
1. * ØA thread OD dimension for reference only.
2. Removal torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

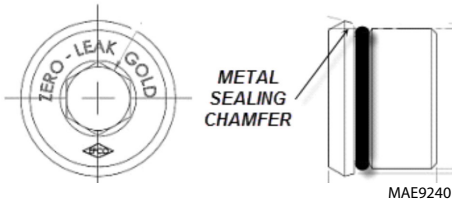
e. O-ring Boss (ORB) - Table 5 of 6

MAE9230

TYPE/FITTING IDENTIFICATION					HOLLOW HEX PLUGS					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(30)	(32)	(33)	3	4	4
	3	3/8-24	0.37	9.52	(55)	(58)	(61)	6	7	7
	4	7/16-20	0.44	11.11	10	11	11	14	15	15
	5	1/2-20	0.50	12.70	14	15	16	19	20	22
	6	9/16-18	0.56	14.28	34	36	38	46	49	52
	8	3/4-16	0.75	19.10	60	63	66	80	85	89
	10	7/8-14	0.87	22.22	100	105	110	135	142	149
	12	1 1/16-12	1.06	27.00	135	142	149	185	193	202
	14	1 3/16-12	1.19	30.10	175	184	193	235	249	262
	16	1 5/16-12	1.31	33.30	200	210	220	270	285	298
	20	1 5/8-12	1.63	41.30	250	263	275	340	357	373
	24	1 7/8-12	1.87	47.60	305	321	336	415	435	456
	32	2 1/2-12	2.50	63.50	375	394	413	510	534	560
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(20)	(21)	(21)	2	2	2
	3	3/8-24	0.37	9.52	(36)	(38)	(40)	4	4	5
	4	7/16-20	0.44	11.11	6	7	7	8	9	9
	5	1/2-20	0.50	12.70	9	10	10	12	14	14
	6	9/16-18	0.56	14.28	22	24	25	30	33	34
	8	3/4-16	0.75	19.10	39	41	43	53	56	58
	10	7/8-14	0.87	22.22	65	69	72	88	94	98
	12	1 1/16-12	1.06	27.00	88	93	97	119	126	132
	14	1 3/16-12	1.19	30.10	114	120	126	155	163	171
	16	1 5/16-12	1.31	33.30	130	137	143	176	186	194
	20	1 5/8-12	1.63	41.30	163	171	179	221	232	243
	24	1 7/8-12	1.87	47.60	198	208	218	268	282	296
	32	2 1/2-12	2.50	63.50	244	256	268	331	347	363

NOTE:
1. * ØA thread OD dimension for reference only.
2. Removal torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

f. O-ring Boss (ORB) - Table 6 of 6



TYPE/FITTING IDENTIFICATION					ZERO LEAK GOLD® HOLLOW HEX PLUGS					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	1 1/16-12	1.06	27.00	51	54	57	69	73	77
	14	1 3/16-12	1.19	30.10	Fitting size greater than -12 is not typically specified . Consult specific service procedure if encountered.					
	16	1 5/16-12	1.31	33.30						
	20	1 5/8-12	1.63	41.30						
	24	1 7/8-12	1.87	47.60						
	32	2 1/2-12	2.50	63.50						
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	2	3	4	3	4	5
	3	3/8-24	0.37	9.52	3	4	5	4	5	7
	4	7/16-20	0.44	11.11	7	8	9	9	11	12
	5	1/2-20	0.50	12.70	9	10	11	12	14	15
	6	9/16-18	0.56	14.28	11	12	13	15	16	18
	8	3/4-16	0.75	19.10	28	30	32	38	41	43
	10	7/8-14	0.87	22.22	46	48	50	62	65	68
	12	1 1/16-12	1.06	27.00	51	54	57	69	73	77
	14	1 3/16-12	1.19	30.10	Fitting size greater than -12 is not typically specified. Consult specific service procedure if encountered.					
	16	1 5/16-12	1.31	33.30						
	20	1 5/8-12	1.63	41.30						
	24	1 7/8-12	1.87	47.60						
	32	2 1/2-12	2.50	63.50						

NOTE:
1. * ØA thread OD dimension for reference only.
2. Removal torque for Zero Leak Gold® Hollow Hex Plugs is significantly higher than install torque, typically 1.5-3.5X install torque.

2.8.10 Assembly Instructions for Adjustable Port End Metric Fittings

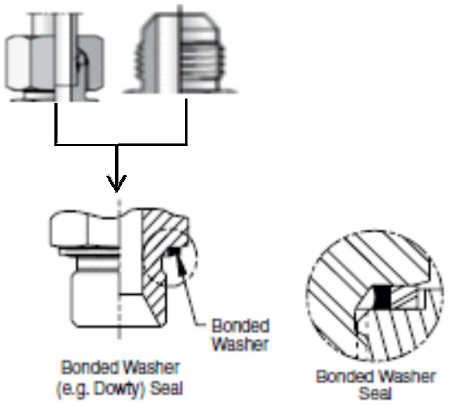
1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If o-ring is not pre-installed, install proper size, taking care not to damage it. Refer to Section g, “Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.”, for procedure.

NOTICE

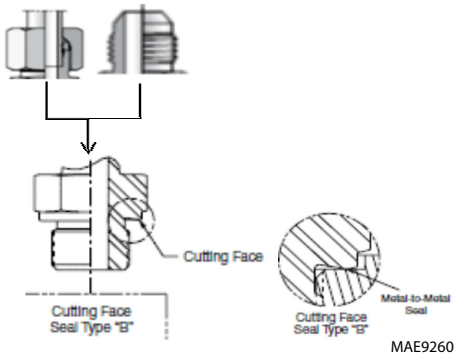
Care to be taken when lubricating o-ring. Avoid adding oil to the threaded connection of the fitting. The lubrication would cause increased clamping force and cause fitting damage.

3. Pre-lubricate the o-ring with hydraulic oil.
4. For non-adjustable fittings and plugs, thread the fitting by hand until contact.
5. For adjustable fittings, refer to Section 2.8.16, “Adjustable Stud End Assembly”, for proper assembly.
6. Torque the fitting or nut to value while using the Double Wrench Method.
   a. The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.
   b. Torque values are segregated based on the material configuration of the connection. ‘Aluminum/brass fittings or aluminum/brass mating components’ indicate either the following material configurations:
      - Steel fittings with aluminum or brass mating components
      - Aluminum or brass fittings with steel mating components
      - Aluminum or brass fittings with aluminum or brass mating components.
7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counter bore of the port.

a. Metric Flat Face Port (MFF) L Series - Table 1 of 3



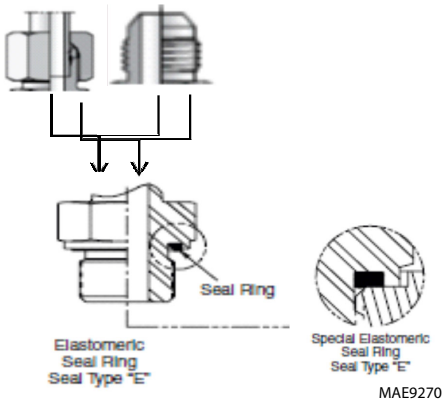
MAE9250

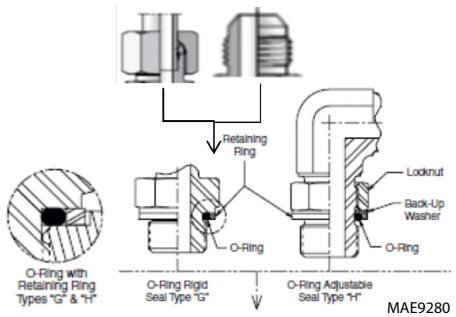


MAE9260

TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS WITH 37° (JIC) or L SERIES DIN (MBTL) OPPOSITE END						FORM B (CUTTING FACE) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	7	8	8	9	11	11	13	14	14	18	19	19
	M12x1.5	8	15	16	17	20	22	23	22	23	24	30	31	33
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	33	35	36	45	47	49	48	51	53	65	69	72
	M18x1.5	15	41	43	45	55	58	61	59	62	65	80	84	88
	M22x1.5	18	48	51	53	65	69	72	103	108	113	140	146	153
	M27x2	22	66	70	73	90	95	99	140	147	154	190	199	209
	M33x2	28	111	117	122	150	159	165	251	264	276	340	358	374
	M42x2	35	177	186	195	240	252	264	369	388	406	500	526	550
	M48x2	42	214	225	235	290	305	319	465	489	512	630	663	694
Material	Thread M Size	Connecting Tube O.D	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/BRASS FITTINGS OR ALUMINUM/BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	4	5	5	5	7	7	8	9	9	11	12	12
	M12x1.5	8	10	11	11	14	15	15	14	15	16	19	20	22
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	21	22	23	28	30	31	31	33	34	42	45	46
	M18x1.5	15	27	28	29	37	38	39	38	40	42	52	54	57
	M22x1.5	18	31	33	34	42	45	46	67	70	73	91	95	99
	M27x2	22	43	45	47	58	61	64	91	96	100	123	130	136
	M33x2	28	72	76	79	98	103	107	163	171	179	221	232	243
	M42x2	35	115	121	127	156	164	172	240	252	264	325	342	358
	M48x2	42	139	146	153	188	198	207	302	318	332	409	431	450

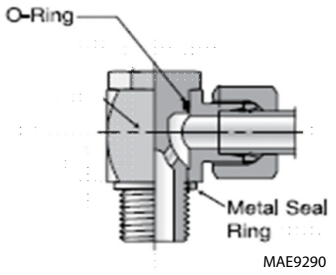
b. Metric Flat Face Port (MFF) L Series - Table 2 of 3



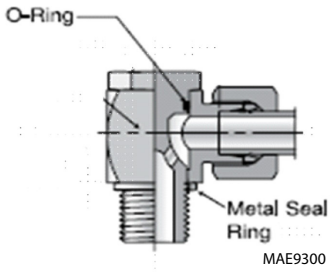


TYPE/FITTING IDENTIFICATION			FORM E (EOLASTIC SEALING RING) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END						FORM G/H (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	15	18	19	20
	M12x1.5	8	18	19	20	25	26	27	18	19	20	25	26	28
	M14x1.5	10	33	35	36	45	47	49	30	31	32	40	42	44
	M16x1.5	12	41	43	45	55	58	61	41	43	45	55	58	61
	M18x1.5	15	52	55	57	70	75	77	52	54	57	70	74	77
	M22x1.5	18	92	97	101	125	132	137	66	70	73	90	95	99
	M27x2	22	133	140	146	180	190	198	133	139	146	180	189	198
	M33x2	28	229	241	252	310	327	342	229	240	252	310	326	341
	M42x2	35	332	349	365	450	473	495	332	348	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
Material	Thread M Size	Connecting Tube O.D	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(UNF)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12
	M12x1.5	8	12	13	13	16	18	18	12	13	13	16	18	18
	M14x1.5	10	21	22	23	28	30	31	19	20	21	26	27	29
	M16x1.5	12	27	28	29	37	38	39	26	28	29	36	38	39
	M18x1.5	15	34	36	37	46	49	50	34	35	37	46	48	50
	M22x1.5	18	60	63	66	81	85	89	43	45	47	59	61	64
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

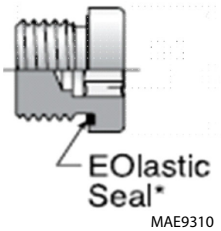
c. Metric Flat Face Port (MFF) L Series - Table 3 of 3



MAE9290



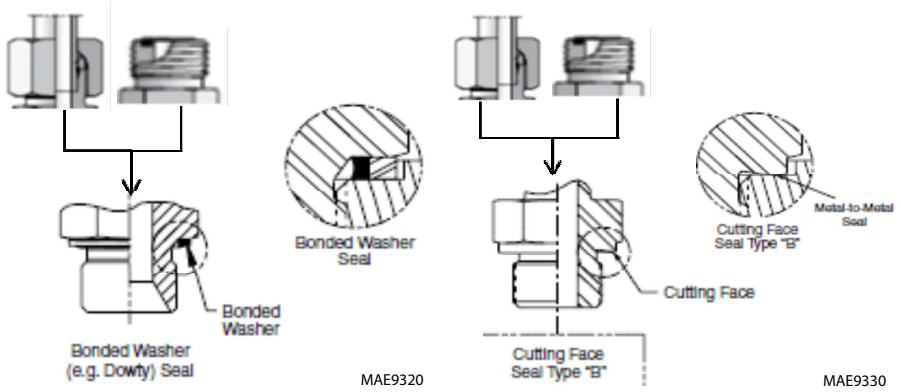
MAE9300



MAE9310

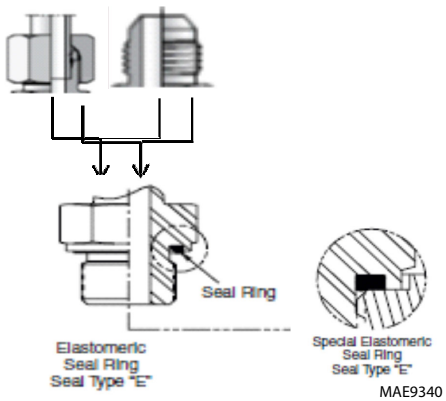
TYPE/FITTING IDENTIFICATION			BANJO FITTINGS WITH L SERIES DIN (MBTL) OPPOSITE END						HIGH PRESSURE BANJO FITTINGS WITH L SERIES DIN (MBTL) OPPOSITE END						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
Material	Thread M Size	Connecting Tube O.D	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	13	14	14	18	19	19	13	14	14	18	19	19	9	10	10	12	14	14
	M12x1.5	8	26	28	29	35	38	39	33	35	36	45	47	49	18	19	20	25	26	27
	M14x1.5	10	37	39	41	50	53	56	41	43	45	55	58	61	26	28	29	35	38	39
	M16x1.5	12	44	46	48	60	62	65	59	62	65	80	84	88	41	43	45	55	58	61
	M18x1.5	15	59	62	65	80	84	88	74	78	81	100	106	110	48	51	53	65	69	72
	M22x1.5	18	89	94	98	120	127	133	103	108	113	140	146	153	66	70	73	90	95	99
	M27x2	22	96	101	106	130	137	144	236	248	260	320	336	353	100	105	110	135	142	149
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	166	175	183	225	237	248
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	266	280	293	360	380	397
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	266	280	293	360	380	397
Material	Thread M Size	Connecting Tube O.D	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	M12x1.5	8	17	18	19	23	24	26	21	22	23	28	30	31	12	13	13	16	18	18
	M14x1.5	10	24	26	27	33	35	37	27	28	29	37	38	39	17	18	19	23	24	26
	M16x1.5	12	29	30	31	39	41	42	38	40	42	52	54	57	27	28	29	37	38	39
	M18x1.5	15	38	40	42	52	54	57	48	51	53	65	69	72	31	33	34	42	45	46
	M22x1.5	18	58	61	64	79	83	87	67	70	73	91	95	99	43	45	47	58	61	64
	M27x2	22	62	66	69	84	89	94	153	161	169	207	218	229	65	69	72	88	94	98
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	108	114	119	146	155	161
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	173	182	190	235	247	258
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	173	182	190	235	247	258

d. Metric Flat Face Port (MFF) S Series - Table 1 of 3

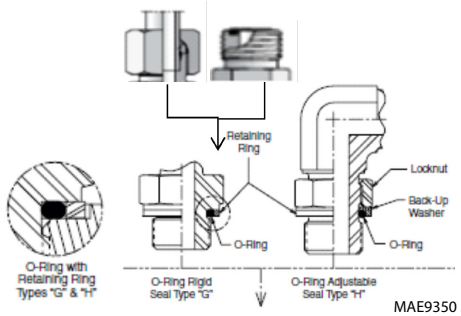


TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END						FORM B (CUTTING FACE) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	15	16	17	20	22	23	26	28	29	35	38	39
	M14x1.5	8	26	28	29	35	38	39	41	43	45	55	58	61
	M16x1.5	10	33	35	36	45	47	49	52	55	57	70	75	77
	M18x1.5	12	41	43	45	55	58	61	81	85	89	110	115	121
	M20x1.5	14	41	43	45	55	58	61	111	117	122	150	159	165
	M22x1.5	16	48	51	53	65	69	72	125	132	138	170	179	187
	M27x2	20	66	70	73	89	95	99	199	209	219	270	283	297
	M33x2	25	111	117	122	150	159	165	302	317	332	410	430	450
	M42x2	30	177	186	195	240	252	264	398	418	438	540	567	594
	M48x2	38	214	225	235	290	305	319	516	542	568	700	735	770
Material	Thread M Size	Connecting Tube O.D	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M12x1.5	6	10	11	11	14	15	15	17	18	19	23	24	26
	M14x1.5	8	17	18	19	23	24	26	27	28	29	37	38	39
	M16x1.5	10	21	22	23	28	30	31	34	36	37	46	49	50
	M18x1.5	12	27	28	29	37	38	39	53	56	58	72	76	79
	M20x1.5	14	27	28	29	37	38	39	72	76	79	98	103	107
	M22x1.5	16	31	33	34	42	45	46	81	86	90	110	117	122
	M27x2	20	43	45	47	58	61	64	129	136	142	175	184	193
	M33x2	25	72	76	79	98	103	107	196	206	216	266	279	293
	M42x2	30	115	121	127	156	164	172	259	272	285	351	369	386
	M48x2	38	139	146	153	188	198	207	335	352	369	454	477	500

e. Metric Flat Face Port (MFF) S Series - Table 2 of 3



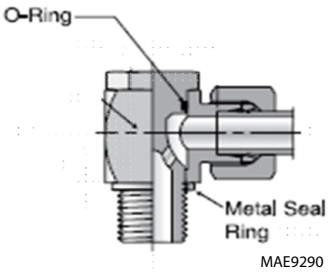
MAE9340



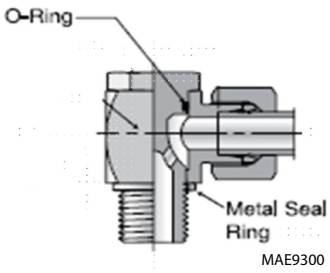
MAE9350

TYPE/FITTING IDENTIFICATION			FORM E (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END						FORM G/H (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	26	28	29	35	38	39
	M12x1.5	8	33	35	36	45	47	49	41	43	45	55	58	61
	M14x1.5	10	52	55	57	70	75	77	52	55	57	70	75	77
	M16x1.5	12	66	70	73	90	95	99	66	70	73	90	95	99
	M18x1.5	15	92	97	101	125	132	137	92	97	101	125	132	137
	M22x1.5	18	100	105	110	135	142	149	100	105	110	135	142	149
	M27x2	22	133	140	146	180	190	198	133	140	146	180	190	198
	M33x2	28	229	241	252	310	327	342	229	241	252	310	327	342
	M42x2	35	332	349	365	450	473	495	332	349	365	450	473	495
	M48x2	42	398	418	438	540	567	594	398	418	438	540	567	594
Material	Thread M Size	Connecting Tube O.D	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	17	18	19	23	24	26
	M12x1.5	8	21	23	23	29	31	32	27	28	29	37	38	39
	M14x1.5	10	34	36	37	46	49	50	34	36	37	46	49	50
	M16x1.5	12	43	45	47	58	61	64	43	45	47	58	61	64
	M18x1.5	15	60	63	66	81	85	89	60	63	66	81	85	89
	M22x1.5	18	65	69	72	88	94	98	65	69	72	88	94	98
	M27x2	22	86	91	95	117	123	129	86	91	95	117	123	129
	M33x2	28	149	157	164	202	213	222	149	157	164	202	213	222
	M42x2	35	216	227	237	293	308	321	216	227	237	293	308	321
	M48x2	42	259	272	285	351	369	386	259	272	285	351	369	386

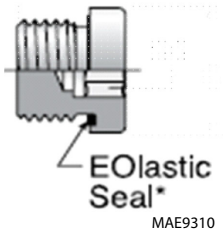
f. Metric Flat Face Port (MFF) S Series - Table 3 of 3



MAE9290



MAE9300



MAE9310

TYPE/FITTING IDENTIFICATION			BANJO FITTINGS WITH S SERIES DIN (MBTS) OPPOSITE END						HIGH PRESSURE BANJO FITTINGS WITH S SERIES DIN (MBTS) OPPOSITE END						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
Material	Thread M Size	Connecting Tube O.D	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	26	28	29	35	38	39	33	35	36	45	47	49	--	--	--	--	--	--
	M12x1.5	8	37	39	41	50	53	56	41	43	45	55	58	61	--	--	--	--	--	--
	M14x1.5	10	44	46	48	60	62	65	59	62	65	80	84	88	--	--	--	--	--	--
	M16x1.5	12	59	62	65	80	84	88	74	78	81	100	106	110	--	--	--	--	--	--
	M18x1.5	15	81	85	89	110	115	121	92	97	101	125	132	137	59	62	65	80	84	88
	M22x1.5	18	89	94	98	120	127	133	100	105	110	135	142	149	--	--	--	--	--	--
	M27x2	22	100	105	110	135	142	149	236	248	260	320	336	353	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	266	280	293	360	380	397	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	398	418	438	540	567	594	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	516	542	568	700	735	770	--	--	--	--	--	--
Material	Thread M Size	Connecting Tube O.D	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M10x1	6	17	18	19	23	24	26	21	22	23	28	30	31	--	--	--	--	--	--
	M12x1.5	8	24	26	27	33	35	37	27	28	29	37	38	39	--	--	--	--	--	--
	M14x1.5	10	29	30	31	39	41	42	38	40	42	52	54	57	--	--	--	--	--	--
	M16x1.5	12	38	40	42	52	54	57	48	51	53	65	69	72	--	--	--	--	--	--
	M18x1.5	15	53	56	58	72	76	79	60	63	66	81	85	89	38	40	42	52	54	57
	M22x1.5	18	58	61	64	79	83	87	65	69	72	88	94	98	--	--	--	--	--	--
	M27x2	22	65	69	72	88	94	98	153	161	169	207	218	229	--	--	--	--	--	--
	M33x2	28	--	--	--	--	--	--	173	182	190	235	247	258	--	--	--	--	--	--
	M42x2	35	--	--	--	--	--	--	259	272	285	351	369	386	--	--	--	--	--	--
	M48x2	42	--	--	--	--	--	--	335	352	369	454	477	500	--	--	--	--	--	--

2.8.11 Assembly Instructions for Metric ISO 6149 Port Assembly Stud Ends

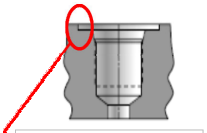
1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If o-ring is not pre installed, install proper size, taking care not to damage it. Refer to Section g, "Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.".

NOTICE

Care to be taken when lubricating o-ring. Avoid adding oil to the threaded connection of the fitting. The lubrication would cause increased clamping force and cause fitting damage.

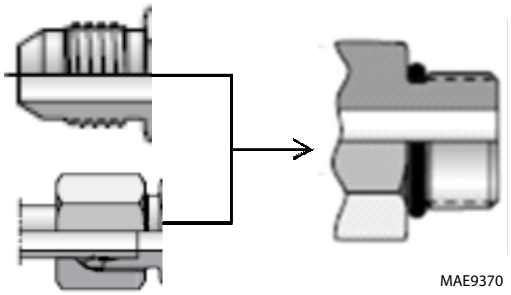
3. Pre-lubricate the o-ring with hydraulic oil.
4. For non-adjustable fittings and plugs, thread the fitting by hand until contact.
5. For adjustable fittings, refer to Section 2.8.16, "Adjustable Stud End Assembly", for proper assembly.
6. Torque the fitting or nut to value while using the Double Wrench Method.
   a. The table headings identify the Metric port and the type on the other side of the fitting. The torque will be applied to the Metric port.
   b. Torque values are segregated based on the material configuration of the connection. 'Aluminum/brass fittings or aluminum/brass mating components' indicate either the following material configurations:
      - Steel fittings with aluminum or brass mating components
      - Aluminum or brass fittings with steel mating components
      - Aluminum or brass fittings with aluminum or brass mating components.
7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counter bore of the port.

a. Metric Pipe Parallel O-Ring Boss (MPP)

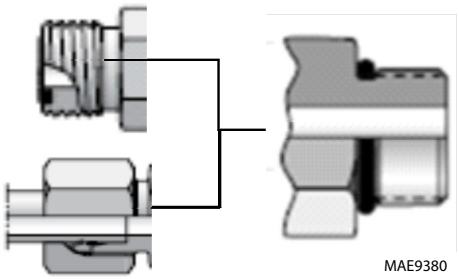


Note: Metric O-ring only style (ISO 6149) requires o-ring chamfer in the port, similar to ISO 11926 (SAE ORB),**but is not interchangeable.**

MAE9360



MAE9370



MAE9380

TYPE/FITTING IDENTIFICATION			STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END						STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	6	7	7	8	9	9	8	9	9	10	12	12
	M10x1	6	11	12	12	15	16	16	15	16	17	20	22	23
	M12x1.5	8	18	19	20	25	26	27	26	28	29	35	38	39
	M14x1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16x1.5	12	30	32	33	40	43	45	41	43	45	55	58	61
	M18x1.5	15	33	35	36	45	47	49	52	55	57	70	75	77
	M20x1.5	--	--	--	--	--	--	--	59	62	65	80	84	88
	M22x1.5	18	44	46	48	60	62	65	74	78	81	100	106	110
	M27x2	22	74	78	81	100	106	110	125	132	138	170	179	187
	M30x2	--	95	100	105	130	136	142	175	184	193	237	249	262
	M33x2	25	120	126	132	160	171	179	230	242	253	310	328	343
	M38x2	--	135	142	149	183	193	202	235	247	259	319	335	351
	M42x2	30	155	163	171	210	221	232	245	258	270	330	350	366
	M48x2	38	190	200	209	260	271	283	310	326	341	420	442	462
	M60x2	50	230	242	253	315	328	343	370	389	407	500	527	552
Material	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	M8x1	4	4	5	5	5	7	7	5	6	6	7	8	8
	M10x1	6	7	8	8	9	11	11	10	11	11	14	15	15
	M12x1.5	8	12	13	13	16	18	18	17	18	19	23	24	26
	M14x1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16x1.5	12	20	21	21	27	28	28	27	28	29	37	38	39
	M18x1.5	15	21	22	23	28	30	31	34	36	37	46	49	50
	M20x1.5	--	--	--	--	--	--	--	30	40	42	41	54	57
	M22x1.5	18	29	30	31	39	41	42	48	51	53	65	69	72
	M27x2	22	48	51	53	65	69	72	81	86	90	110	117	122
	M30x2	--	62	65	68	84	88	92	114	120	125	155	163	169
	M33x2	25	78	82	86	106	111	117	150	157	164	203	213	222
	M38x2	--	88	93	97	119	126	132	153	161	168	207	218	228
	M42x2	30	101	106	111	137	144	150	159	168	176	216	228	239
	M48x2	38	124	130	136	168	176	184	202	212	222	274	287	301
	M60x2	50	150	157	164	203	213	222	241	253	265	327	343	359

2.8.12 Assembly Instructions for Adjustable Port End (BSPP) Fittings

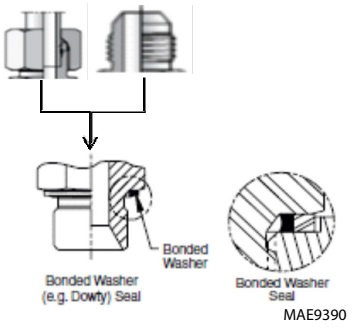
1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If o-ring is not pre installed, install proper size, taking care not to damage it. Refer to Section g, "Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.", for instructions.

NOTICE

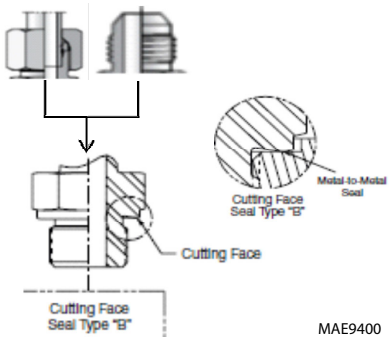
Care to be taken when lubricating o-ring. Avoid adding oil to the threaded connection of the fitting. The lubrication would cause increased clamping force and cause fitting damage.

3. Pre-lubricate the o-ring with hydraulic oil.
4. For non-adjustable fittings and plugs, thread the fitting by hand until contact.
5. For adjustable fittings, refer to Section 2.8.16, "Adjustable Stud End Assembly", for proper assembly.
6. Torque the fitting or nut to value while using the Double Wrench Method.
   a. The table headings identify the BSPP port and the type on the other side of the fitting. The torque will be applied to the BSPP port.
   b. Torque values are segregated based on the material configuration of the connection. 'Aluminum/brass fittings or aluminum/brass mating components' indicate either the following material configurations:
      - Steel fittings with aluminum or brass mating components
      - Aluminum or brass fittings with steel mating components
      - Aluminum or brass fittings with aluminum or brass mating components.
7. Inspect to ensure the o-ring is not pinched and the washer is seated flat on the counter bore of the port.

a. British Standard Parallel Pipe Port (BSPP) - L Series - Table 1 of 3



MAE9390

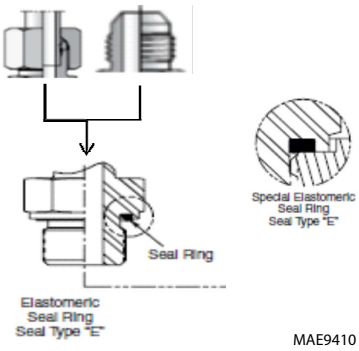


MAE9400

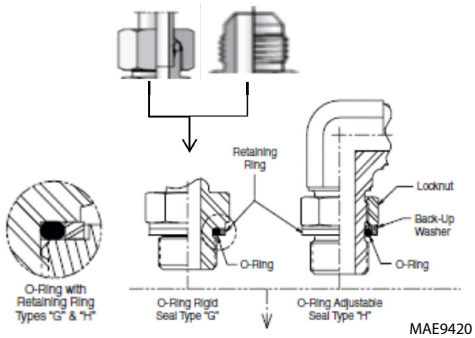
TYPE/FITTING IDENTIFICATION			FORM A**(SEALING WASHER) STUD ENDS WITH 37° (JIC) or L SERIES DIN (MBTL) OPPOSITE END						FORM B** (CUTTING FACE) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	7	8	8	9	11	11	13	14	14	18	19	19
	G 1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G 1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G 3/8A	12	33	35	36	45	47	49	52	55	57	70	75	77
	G 1/2A	15	48	51	53	65	69	72	103	108	113	140	146	153
	G 1/2A	18	48	51	53	65	69	72	74	78	81	100	106	110
	G 3/4A	22	66	70	73	90	95	99	133	140	146	180	190	198
	G 1A	28	111	117	122	150	159	165	243	255	267	330	346	362
	G 1-1/4A	35	177	186	195	240	252	264	398	418	438	540	567	594
	G 1-1/2A	42	214	225	235	290	305	319	465	489	512	630	663	694
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	4	5	5	5	7	7	8	9	9	11	12	12
	G 1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G 1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G 3/8A	12	21	22	23	28	30	31	34	36	37	46	49	50
	G 1/2A	15	31	33	34	42	45	46	67	70	73	91	95	99
	G 1/2A	18	31	33	34	42	45	46	48	51	53	65	69	72
	G 3/4A	22	42	45	47	57	61	64	86	91	95	117	123	129
	G 1A	28	72	76	79	98	103	107	158	166	174	214	225	236
	G 1-1/2A	42	139	146	153	188	198	207	302	318	333	409	431	451

NOTE: ** Non typical for Straight Male Stud Fittings, reference only.

b. British Standard Parallel Pipe Port (BSPP) - L Series - Table 2 of 3



MAE9410

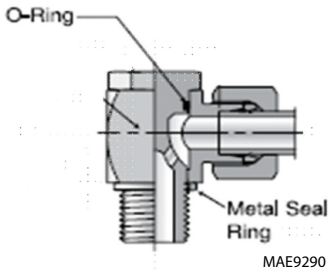


MAE9420

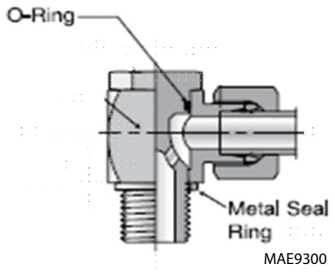
TYPE/FITTING IDENTIFICATION			FORM E*(EOLASTIC SEALING RING) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19
	G 1/4A	8	26	28	29	35	38	39	26	28	29	35	38	39
	G 1/4A	10	26	28	29	35	38	39	26	28	29	35	38	39
	G 3/8A	12	52	55	57	70	75	77	52	55	57	70	75	77
	G 1/2A	15	66	70	73	90	95	99	66	70	73	90	95	99
	G 1/2A	18	66	70	73	90	95	99	66	70	73	90	95	99
	G 3/4A	22	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	28	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	35	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	42	398	418	438	540	567	594	398	418	438	540	567	594
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12
	G 1/4A	8	17	18	19	23	24	26	17	18	19	23	24	26
	G 1/4A	10	17	18	19	23	24	26	17	18	19	23	24	26
	G 3/8A	12	34	36	37	46	49	50	34	36	37	46	49	50
	G 1/2A	15	43	45	47	58	61	64	43	45	47	58	61	64
	G 1/2A	18	43	45	47	58	61	64	43	45	47	58	61	64
	G 3/4A	22	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	28	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/2A	42	259	272	285	351	369	386	259	272	285	351	369	386

NOTE:
*Typical for JLG Straight Male Stud Fittings.
***Typical for JLG Adjustable Fittings.

c. British Standard Parallel Pipe Port (BSPP) L Series - Table 3 of 3



MAE9290

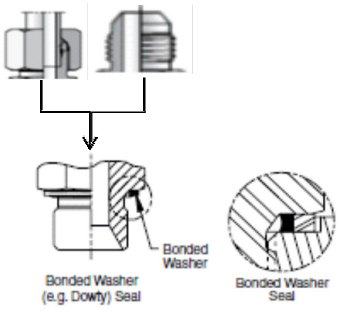


MAE9300

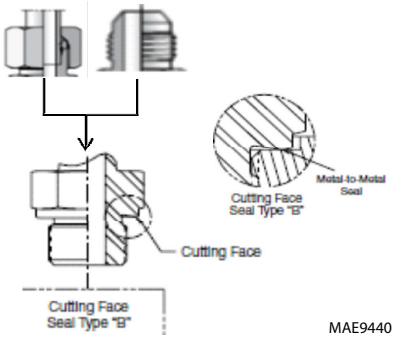
MAE9310

TYPE/FITTING IDENTIFICATION			BANJO FITTINGS WITH L SERIES DIN (MBTL) OPPOSITE END						HIGH PRESSURE BANJO FITTINGS WITH L SERIES DIN (MBTL) OPPOSITE END						FORM E (EOLASTIC SEALING RING) HOLLOW HEX PLUGS					
Material	BSPP Thread G Size	Connecting Tube O.D	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	13	14	14	18	19	19	13	14	14	18	19	19	10	11	11	13	15	15
	G 1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G 1/4A	10	30	32	33	40	43	45	33	35	36	45	47	49	22	23	24	30	31	33
	G 3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77	44	46	48	60	62	65
	G 1/2A	15	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G 1/2A	18	66	70	73	90	95	99	89	94	98	120	127	133	59	62	65	80	84	88
	G 3/4A	22	92	97	101	125	132	137	170	179	187	230	243	254	103	108	113	140	146	153
	G 1A	28	--	--	--	--	--	--	236	248	260	320	336	353	148	156	163	200	212	221
	G 1-1/4A	35	--	--	--	--	--	--	398	418	438	540	567	594	295	313.5	332	400	425	450
	G 1-1/2A	42	--	--	--	--	--	--	516	542	568	700	735	770	332	349	365	450	473	495
Material	BSPP Thread G Size	Connecting Tube O.D	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/8A	6	8	9	9	11	12	12	8	9	9	11	12	12	6	7	7	8	9	9
	G 1/4A	8	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G 1/4A	10	20	21	21	27	28	28	21	22	23	28	30	31	14	15	16	19	20	22
	G 3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50	29	30	31	39	41	42
	G 1/2A	15	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G 1/2A	18	43	45	47	58	61	64	58	61	64	79	83	87	38	40	42	52	54	57
	G 3/4A	22	60	63	66	81	85	89	111	117	122	150	159	165	67	70	73	91	95	99
	G 1A	28	--	--	--	--	--	--	153	161	169	207	218	229	96	101	106	130	137	144
	G 1-1/4A	35	--	--	--	--	--	--	259	272	285	351	369	386	216	227	237	293	308	321
	G 1-1/2A	42	--	--	--	--	--	--	335	352	369	454	477	500	216	227	237	293	308	321

d. British Standard Parallel Pipe Port (BSPP) S Series - Table 1 of 3



MAE9430

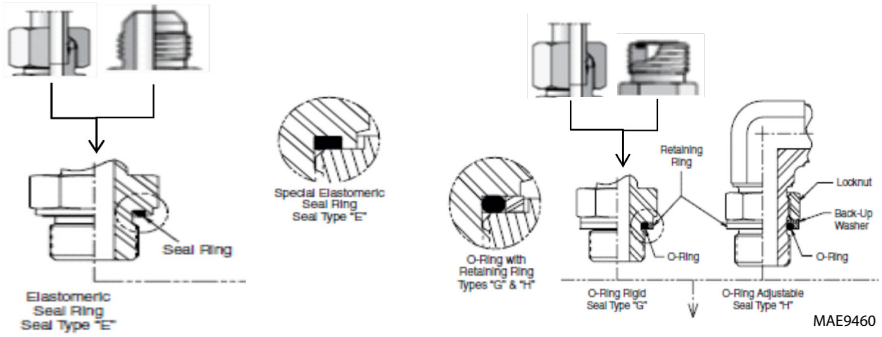


MAE9440

TYPE/FITTING IDENTIFICATION			FORM A** (SEALING WASHER) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END						FORM B** (CUTTING FACE) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	26	28	29	35	38	39	41	43	45	55	58	61
	G 1/4A	8	26	28	29	35	38	39	41	43	45	55	58	61
	G 3/8A	10	33	35	36	45	47	49	66	70	73	90	95	99
	G 3/8A	12	33	35	36	45	47	49	66	70	73	90	95	99
	G 1/2A	14	48	51	53	65	69	72	111	117	122	150	159	165
	G 1/2A	16	48	51	53	65	69	72	96	101	106	130	137	144
	G 3/4A	20	66	70	73	90	95	99	199	209	219	270	283	297
	G 1A	25	111	117	122	150	159	165	251	264	276	340	358	374
	G 1-1/4A	30	177	186	195	240	252	264	398	418	438	540	567	594
	G 1-1/2A	38	214	225	235	290	305	319	516	542	568	700	735	770
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	17	18	19	23	24	26	27	28	29	37	38	39
	G 1/4A	8	17	18	19	23	24	26	27	28	29	37	38	39
	G 3/8A	10	21	22	23	28	30	31	43	45	47	58	61	64
	G 3/8A	12	21	22	23	28	30	31	43	45	47	58	61	64
	G 1/2A	14	31	33	34	42	45	46	72	76	79	98	103	107
	G 1/2A	16	31	33	34	42	45	46	62	66	69	84	89	94
	G 3/4A	20	43	45	47	58	61	64	129	136	142	175	184	193
	G 1A	25	72	76	79	98	103	107	163	171	179	221	232	243
	G 1-1/4A	30	115	121	127	156	164	172	259	272	285	351	369	386
	G 1-1/2A	38	139	146	153	188	198	207	335	352	369	454	477	500

NOTE: ** Non typical for Straight Male Stud Fittings, reference only.

e. British Standard Parallel Pipe Port (BSPP) S Series - Table 2 of 3

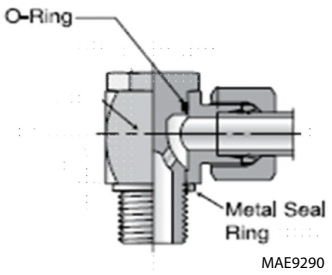


TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS WITH (ORFS) or S SERIES DIN (MBTS) OPPOSITE END						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	41	43	45	55	58	61	26	28	29	35	38	39
	G 1/4A	8	41	43	45	55	58	61	26	28	29	35	38	39
	G 3/8A	10	59	62	65	80	84	88	52	55	57	70	75	77
	G 3/8A	12	59	62	65	80	84	88	52	55	57	70	75	77
	G 1/2A	14	85	90	94	115	122	127	66	70	73	90	95	99
	G 1/2A	16	85	90	94	115	122	127	66	70	73	90	95	99
	G 3/4A	20	133	140	146	180	190	198	133	140	146	180	190	198
	G 1A	25	229	241	252	310	327	342	229	241	252	310	327	342
	G 1-1/4A	30	332	349	365	450	473	495	332	349	365	450	473	495
	G 1-1/2A	38	398	418	438	540	567	594	398	418	438	540	567	594
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	27	28	29	37	38	39	17	18	19	23	24	26
	G 1/4A	8	27	28	29	37	38	39	17	18	19	23	24	26
	G 3/8A	10	38	40	42	52	54	57	34	36	37	46	49	50
	G 3/8A	12	38	40	42	52	54	57	34	36	37	46	49	50
	G 1/2A	14	55	58	61	75	79	83	43	45	47	58	61	64
	G 1/2A	16	55	58	61	75	79	83	43	45	47	58	61	64
	G 3/4A	20	86	91	95	117	123	129	86	91	95	117	123	129
	G 1A	25	149	157	164	202	213	222	149	157	164	202	213	222
	G 1-1/4A	30	216	227	237	293	308	321	216	227	237	293	308	321
	G 1-1/2A	38	259	272	285	351	369	386	259	272	285	351	369	386

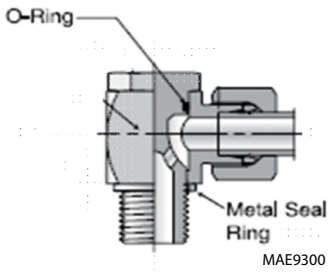
NOTE: *Typical for Straight Male Stud Fittings

***Typical for Adjustable Fittings.

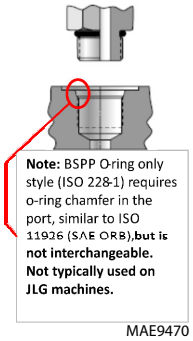
f. British Standard Parallel Pipe Port (BSPP) S Series - Table 3 of 3



MAE9290



MAE9300



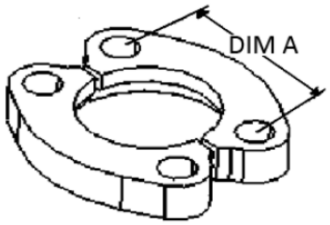
MAE9470

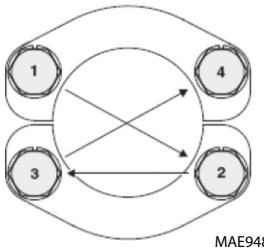
TYPE/FITTING IDENTIFICATION			BANJO FITTINGS WITH S SERIES DIN (MBTS) OPPOSITE END						HIGH PRESSURE BANJO FITTINGS WITH S SERIES DIN (MBTS) OPPOSITE END						JIS/BSPP O-RING ONLY					
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	30	32	33	40	43	45	33	35	36	45	47	49	Fitting type not typically specified on Caterpillar applications. Refer to the specific procedure in this Service Manual.					
	G 1/4A	8	30	32	33	40	43	45	33	35	36	45	47	49						
	G 3/8A	10	48	51	53	65	69	72	52	55	57	70	75	77						
	G 3/8A	12	48	51	53	65	69	72	52	55	57	70	75	77						
	G 1/2A	14	66	70	73	90	95	99	89	94	98	120	127	133						
	G 1/2A	16	66	70	73	90	95	99	89	94	98	120	127	133						
	G 3/4A	20	92	97	101	125	132	137	170	179	187	230	243	254						
	G 1A	25	--	--	--	--	--	--	236	248	260	320	336	353						
	G 1-1/4A	30	--	--	--	--	--	--	398	418	438	540	567	594						
	G 1-1/2A	38	--	--	--	--	--	--	516	542	568	700	735	770						
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
ALUMINUM/ BRASS FITTINGS OR ALUMINUM/ BRASS MATING COMPONENTS; UN-LUBRICATED THREADS	G 1/4A	6	20	21	21	27	28	28	22	22	23	30	30	31	Fitting type not typically specified on Caterpillar applications. Refer to the specific procedure in this Service Manual.					
	G 1/4A	8	20	21	21	27	28	28	22	22	23	30	30	31						
	G 3/8A	10	31	33	34	42	45	46	34	36	37	46	49	50						
	G 3/8A	12	31	33	34	42	45	46	34	36	37	46	49	50						
	G 1/2A	14	43	45	47	58	61	64	58	61	64	79	83	87						
	G 1/2A	16	43	45	47	58	61	64	58	61	64	79	83	87						
	G 3/4A	20	60	63	66	81	85	89	111	117	122	150	159	165						
	G 1A	25	--	--	--	--	--	--	153	161	169	207	218	229						
	G 1-1/4A	30	--	--	--	--	--	--	259	272	285	351	369	386						
	G 1-1/2A	38	--	--	--	--	--	--	335	352	368	454	477	499						

2.8.13 Assembly Instructions for Flange Connections (FL61 and FL62)

1. Ensure sealing surfaces are free of rust, splits, scratches, dirt, foreign matter, or burrs.
2. Pre-lubricate the O-ring with hydraulic oil.
3. Position flange and clamp halves.
4. Place lock washers on bolt and bolt through clamp halves.
5. Tighten all bolts by hand.
6. Torque bolts in diagonal sequence in two or more increments to the torque listed.

a. Flange Code (FL61 & FL62) - Inch Fasteners



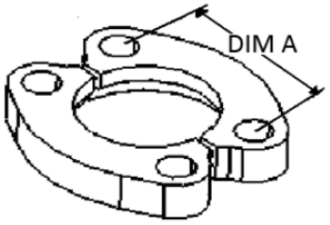


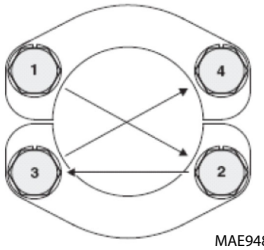
MAE9480

TYPE/FITTING IDENTIFICATION STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)																			
Type	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws					
							[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(in)	(mm)	(in)	(mm)	(UNF)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 61 SPLIT FLANGE (FL61)	8	0.50	13	1.50	38.10	5/16-18	18	19	19	24	25	26	24	25	26	32	34	35
	12	0.75	19	1.88	47.75	3/8-16	32	33	35	43	45	47	44	46	49	60	63	66
	16	1.00	25	2.06	52.32	3/8-16	32	33	35	43	45	47	44	46	49	60	63	66
	20	1.25	32	2.31	58.67	7/16-14	52	54	57	70	74	77	68	71	75	92	97	101
	24	1.50	38	2.75	69.85	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165
	32	2.00	51	3.06	77.72	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165
	40	2.50	64	3.50	88.90	1/2-13	77	81	85	105	110	116	111	116	122	150	158	165
	48	3.00	76	4.19	106.43	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
	56	3.50	89	4.75	120.65	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
	64	4.00	102	5.13	130.30	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
	80	5.00	127	6.00	152.40	5/8-11	155	163	170	210	221	231	218	228	239	295	310	325
Type	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws					
							[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(in)	(mm)	(in)	(mm)	(UNF)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 62 SPLIT FLANGE (FL62)	8	0.50	13	1.59	40.39	5/16-18	--	--	--	--	--	--	24	25	26	32	34	35
	12	0.75	19	2.00	50.80	3/8-16	--	--	--	--	--	--	44	46	49	60	63	66
	16	1.00	25	2.25	57.15	7/16-14	--	--	--	--	--	--	68	71	75	92	97	101
	20	1.25	32	2.62	66.55	1/2-13	--	--	--	--	--	--	111	116	122	150	158	165
	20	1.25	32	2.62	66.55	--	--	--	--	--	--	--	--	--	--	--	--	--
	24	1.50	38	3.12	79.25	5/8-11	--	--	--	--	--	--	218	228	239	295	310	325
	32	2.00	51	3.81	96.77	3/4-10	--	--	--	--	--	--	332	348	365	450	473	495

NOTE: * A dimension for reference only.

b. Flange Code (FL61 & FL62) - Metric Fasteners





MAE9480

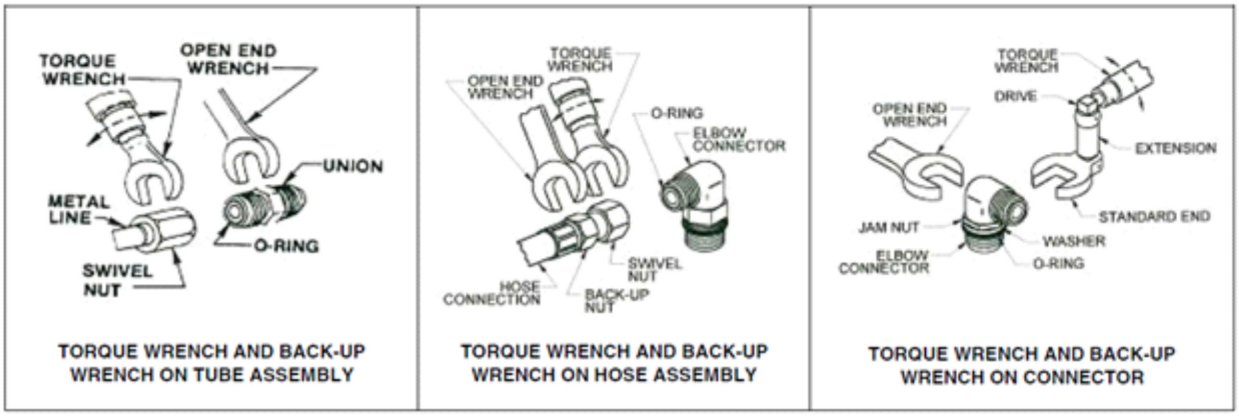
TYPE/FITTING IDENTIFICATION						STEEL 4-BOLT FLANGE SAE J518 (INCH FASTENERS)													
Type	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with CLASS 8.8 Screws						Fastener Torque for Flanges Equipped with CLASS 10.9 Screws					
							[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(in)	(mm)	(in)	(mm)	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 61 SPLIT FLANGE (FL61)	8	0.50	13	1.50	38.10	M8 x 1.25	18	19	19	24	25	26	18	19	19	24	25	26
	12	0.75	19	1.88	47.75	M10 x 1.5	37	39	41	50	53	55	37	39	41	50	53	55
	16	1.00	25	2.06	52.32	M10 x 1.5	37	39	41	50	53	55	37	39	41	50	53	55
	20	1.25	32	2.31	58.67	M10 x 1.5	37	39	41	50	53	55	37	39	41	50	53	55
	24	1.50	38	2.75	69.85	M12 x 1.75	68	71	75	92	97	101	68	71	75	92	97	101
	32	2.00	51	3.06	77.72	M12 x 1.75	68	71	75	92	97	101	68	71	75	92	97	101
	40	2.50	64	3.50	88.90	M12 x 1.75	68	71	75	92	97	101	68	71	75	92	97	101
	48	3.00	76	4.19	106.43	M16 x 2	155	163	170	210	221	231	155	163	170	210	221	231
	56	3.50	89	4.75	120.65	M16 x 2	155	163	170	210	221	231	155	163	170	210	221	231
	64	4.00	102	5.13	130.30	M16 x 2	155	163	170	210	221	231	155	163	170	210	221	231
	80	5.00	127	6.00	152.40	M16 x 2	155	163	170	210	221	231	155	163	170	210	221	231
Type	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with GRADE 5 Screws						Fastener Torque for Flanges Equipped with GRADE 8 Screws					
							[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
		(in)	(mm)	(in)	(mm)	(Metric)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
CODE 62 SPLIT FLANGE (FL62)	8	0.50	13	1.59	40.39	M8 x 1.25	--	--	--	--	--	--	24	25	26	32	34	35
	12	0.75	19	2.00	50.80	M10 x 1.5	--	--	--	--	--	--	52	54	57	70	74	77
	16	1.00	25	2.25	57.15	M12 x 1.75	--	--	--	--	--	--	96	101	105	130	137	143
	20	1.25	32	2.62	66.55	M12 x 1.75	--	--	--	--	--	--	96	101	105	130	137	143
	20	1.25	32	2.62	66.55	M14 x 2	--	--	--	--	--	--	133	139	146	180	189	198
	24	1.50	38	3.12	79.25	M16 x 2	--	--	--	--	--	--	218	228	239	295	310	325
	32	2.00	51	3.81	96.77	M20 x 2.5	--	--	--	--	--	--	406	426	446	550	578	605

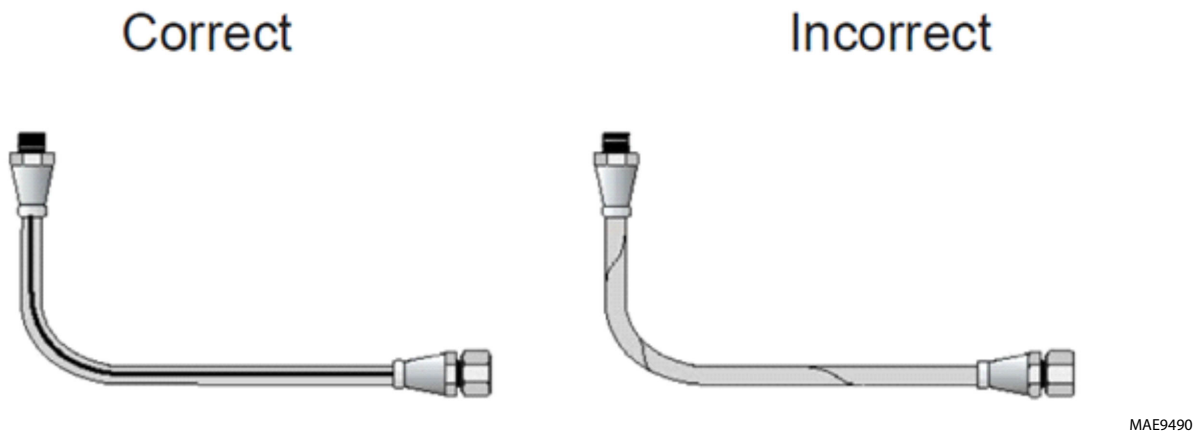
NOTE: * A dimension for reference only.

2.8.14 Double Wrench Method

To prevent undesired hose or connector rotation, two wrenches must be used; one torque wrench and one back- up wrench. If two wrenches are not used, inadvertent component rotation may occur which absorbs torque and causes improper joint load and leads to leaks. For hose connections, the 'layline' printed on the hose is a good indicator of proper hose installation. A twisted lay-line usually indicates the hose is twisted.

Double Wrench Method to Prevent Hose Twist



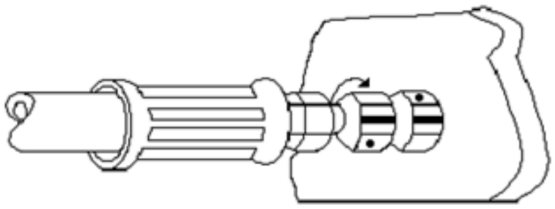


MAE9490

2.8.15 FFWR and TFFT Methods

1. FFWR (Flats from Wrench Resistance Method)
   a. Tighten the swivel nut to the mating fitting until no lateral movement of the swivel nut can be detected; finger tight condition.
   b. Mark a dot on one of the swivel hex nut flats and another dot in line on the connecting tube adapter.
   c. Use the double wrench method per Appendix A, turn the swivel nut to tighten. The nut is to be rotated clockwise the number of hex flats.
   d. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots, to indicate the connection has been properly tightened.

FFWR Method



MAE9500

2. TFFT (Turns from Finger Tight Method)
   a. Tighten the swivel nut to the mating fitting until no lateral movement of the swivel nut can be detected; finger tight condition.
   b. Mark a dot on one of the swivel hex nut flats and another dot in line on the connecting tube adapter.
   c. Use the double wrench method per Appendix A, turn the swivel nut to tighten. The nut is to be rotated clockwise the number of turns.
   d. After the connection has been properly tightened, mark a straight line across the connecting parts, not covering the dots, to indicate the connection has been properly tightened.

2.8.16 Adjustable Stud End Assembly

For Adjustable Stud End Connections; the following assembly steps are to be performed:

a. Lubricate the o-ring with a light coat of hydraulic oil.
b. Position #1 – The o-ring should be located in the groove adjacent to the face of the back-up washer. The washer and o-ring should be positioned at the extreme top end of the groove as shown.
c. Position #2 – Position the locknut to just touch the back-up washer as shown. The locknut in this position will eliminate potential back up washer.
d. Position #3 – Install the connector into the straight thread box port until the metal backup washer contacts the face of the port as shown.
e. Position #4 – Adjust the connector to the proper position by turning out (counterclockwise) up to a maximum of one turn as shown to provide proper alignment with the mating connector, tube assembly, or hose assembly.
f. Position #5 – Using two wrenches, use the backup wrench to hold the connector in the desired position and then use the torque wrench to tighten the locknut to the appropriate torque.
g. Visually inspect, where possible, the joint to ensure the o-ring is not pinched or bulging out from under the washer and that the backup washer is properly seated flat against the face of the port.

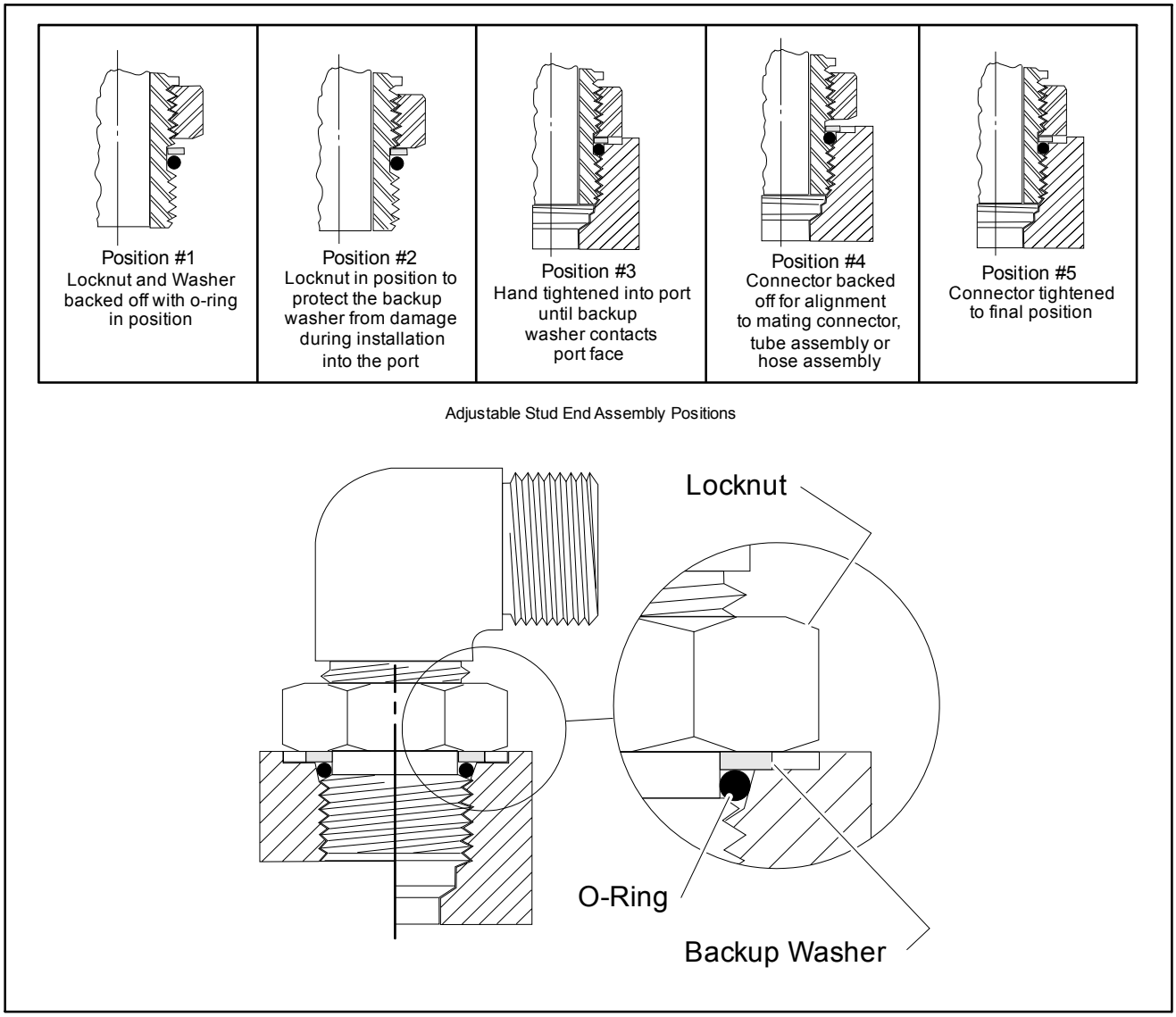


Figure 2-9. Adjustable Stud End Assembly

2.9.17 O-ring Installation (Replacement)

Care must be taken when installing o-rings over threads during replacement or installation. O-rings could become nicked or torn. A damaged o-ring could lead to leakage problems.

1. Inspect o-ring for tears or nicks. If any are found replace o-ring.
2. Ensure proper o-ring to be installed. Many o-rings look the same but are of different material, different hardness, or are slightly different diameters or widths.
3. Use a thread protector when replacing o-rings on fittings.
4. In ORB; ensure o-ring is properly seated in groove. On straight threads, ensure o-ring is seated all the way past the threads prior to installation.
5. Inspect o-ring for any visible nicks or tears. Replace if found.

Section 3
Boom
Contents

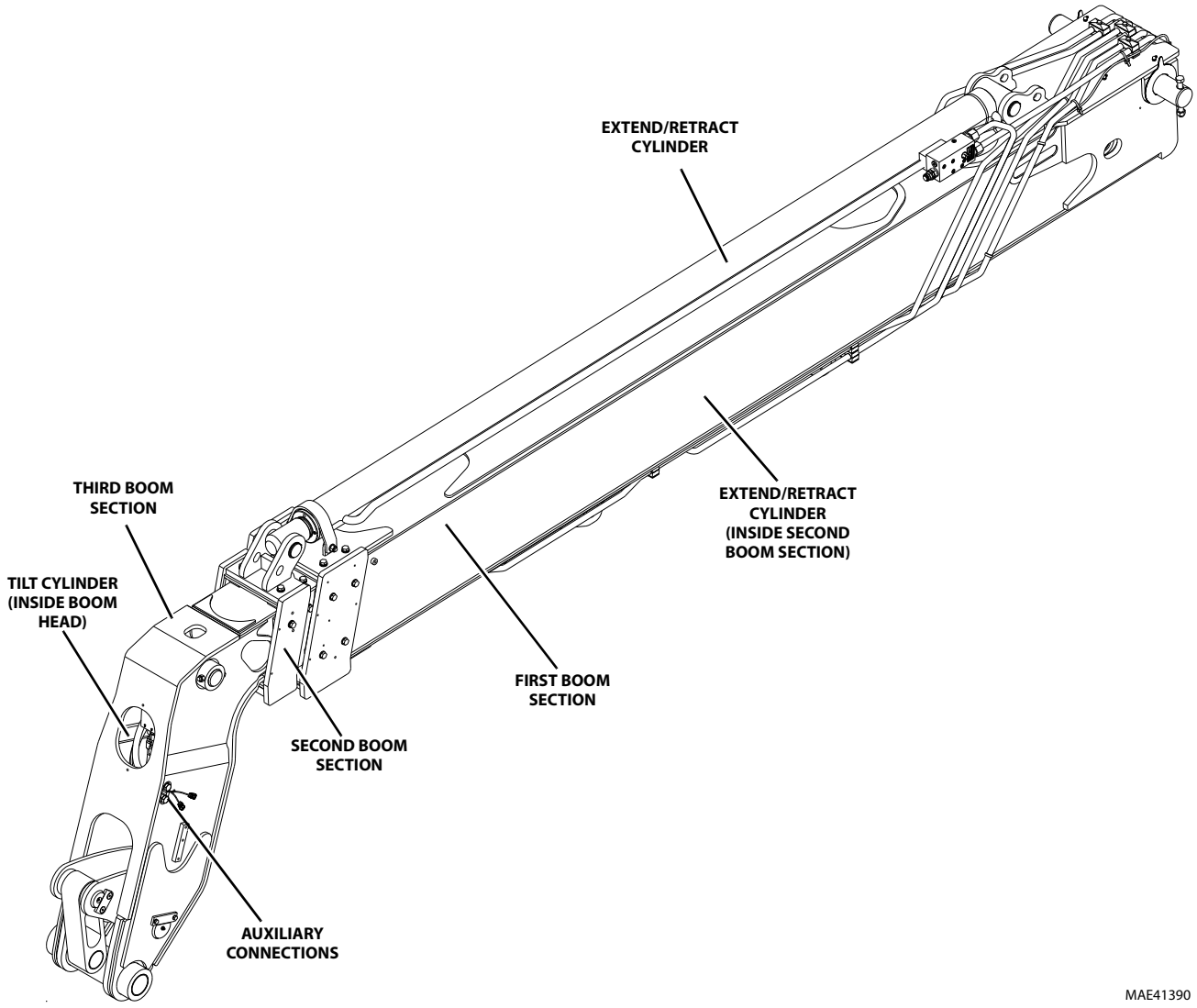
PARAGRAPH		TITLE	PAGE
3.1		**Boom System Component Terminology**	**3-2**
	3.1.1	832	3-2
	3.1.2	925	3-3
3.2		**Boom System**	**3-4**
	3.2.1	Boom System Operation - 832	3-4
	3.2.2	Boom System Operation - 925	3-4
3.3		**Boom Removal/Installation**	**3-4**
	3.3.1	Complete Boom Removal	3-4
	3.3.2	Complete Boom Installation	3-5
3.4		**Boom Assembly Maintenance - 925**	**3-7**
	3.4.1	Second Boom Section Removal	3-8
	3.4.2	Second Boom Section Installation	3-9
3.5		**Boom Assembly Maintenance - 832**	**3-11**
	3.5.1	Second and Third Boom Section Removal	3-11
	3.5.2	Third Boom Section Removal	3-13
	3.5.3	Third Boom Section Installation	3-13
	3.5.4	Second and Third Boom Section Installation	3-14
3.6		**Third Boom Section Removal/Installation Only - 832**	**3-16**
	3.6.1	Removal	3-16
	3.6.2	Installation	3-17
3.7		**Boom Wear Pads**	**3-19**
	3.7.1	Wear Pad Inspection	3-19
	3.7.2	Boom Wear Pad Installation, Lubrication	3-19
3.8		**Quick Coupler**	**3-20**
	3.8.1	Manual Coupler	3-20
	3.8.2	Hydraulic Coupler	3-21
3.9		**Forks**	**3-22**
3.10		**Boom Prop (If Equipped)**	**3-23**
	3.10.1	Prop Installation	3-23
	3.10.2	Prop Removal	3-23
3.11		**Emergency Boom Lowering Procedure**	**3-24**
	3.11.1	Equipment and Supplies Required	3-24
	3.11.2	Lowering Procedure	3-24
3.12		**Troubleshooting**	**3-26**

3.1 BOOM SYSTEM COMPONENT TERMINOLOGY

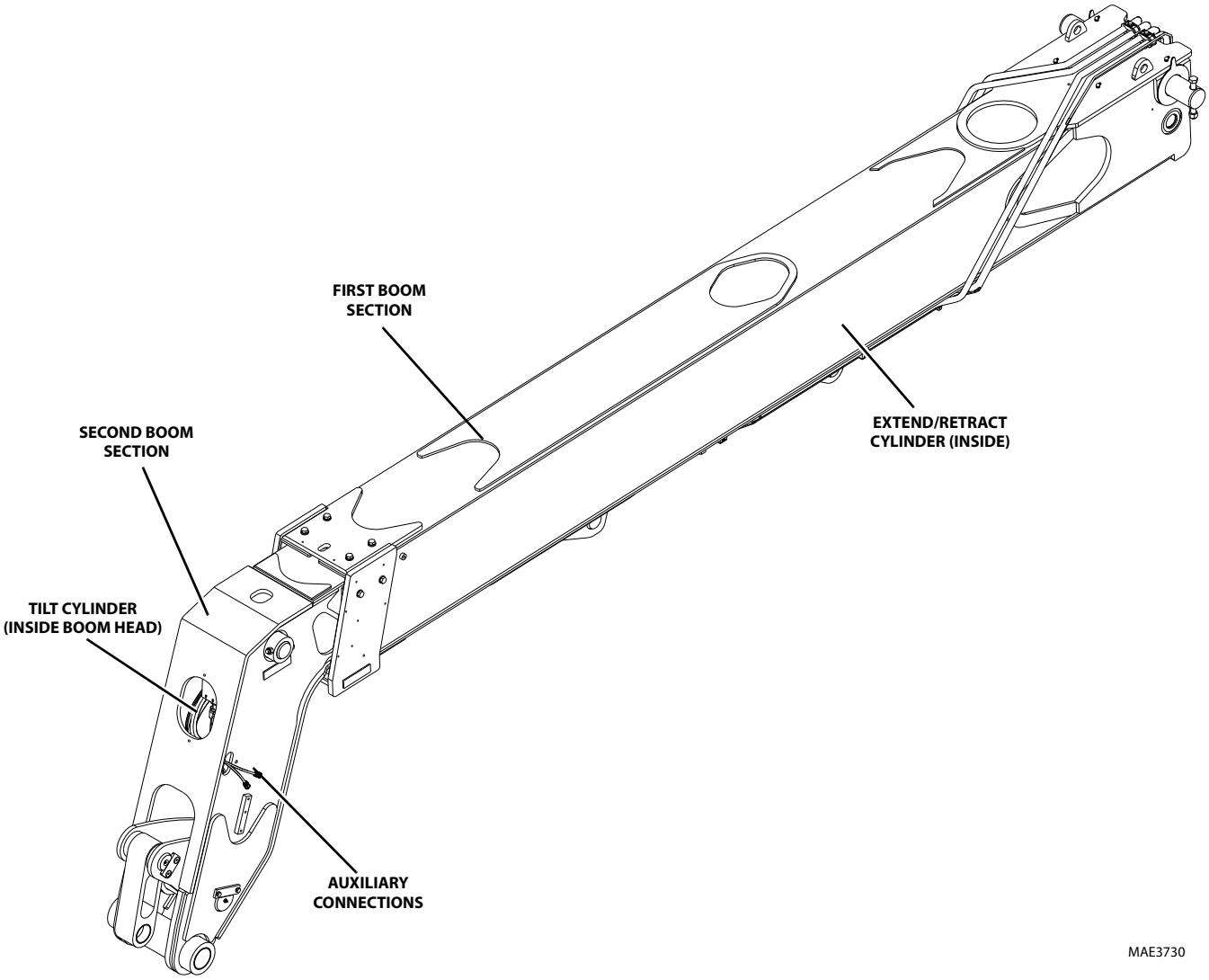
To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the major assemblies of the boom system. The following illustration identifies the components that are referred to throughout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

Refer to Section 2, “General Information and Specifications”, for torque values as required.

3.1.1 832



3.1.2 925


FIRST BOOM SECTION
SECOND BOOM SECTION
TILT CYLINDER (INSIDE BOOM HEAD)
AUXILIARY CONNECTIONS
EXTEND/RETRACT CYLINDER (INSIDE)
MAE3730

3.2 BOOM SYSTEM

3.2.1 Boom System Operation - 832

The three section boom consists of the first, second and third assemblies with two extend/retract cylinders.

The boom sections are connected by extend and retract cylinders. As the outer side extend/retract cylinder, which is anchored at the rear of the first boom section, and the front of the second boom section begins to extend, it pushes the second boom section out of the first boom section.

As the inner side extend/retract cylinder, which is anchored at the rear of the second boom section, and the front of the third boom section begins to extend, it pushes the third boom section out of the second boom section.

As hydraulic pressure is applied to the retract port on the extend/retract cylinder, the retract cylinder pulls the second and third boom sections back into the first boom section.

The first boom section does not extend or retract, but lifts and lowers via action of the lift cylinder.

3.2.2 Boom System Operation - 925

The two section boom consists of the first and second assemblies with extend and retract cylinder.

As the extend/retract cylinder, which is anchored at the front of the second boom section, and the rear of the first boom section begins to extend, it forces the second boom section out of the first boom section.

As hydraulic pressure is applied to the retract port on the extend/retract cylinder, the retract cylinder pulls the second boom section back into the first boom section.

The first boom section does not extend or retract, but lifts and lowers via action of the lift cylinder.

3.3 BOOM REMOVAL/INSTALLATION

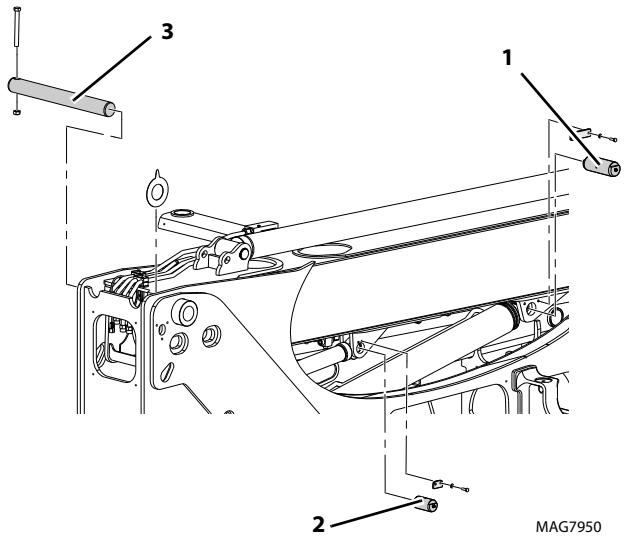
3.3.1 Complete Boom Removal

While the boom sections can be separated from each other on the machine, it is more efficient to remove the complete boom assembly from the machine and place it on suitable supports for separation.

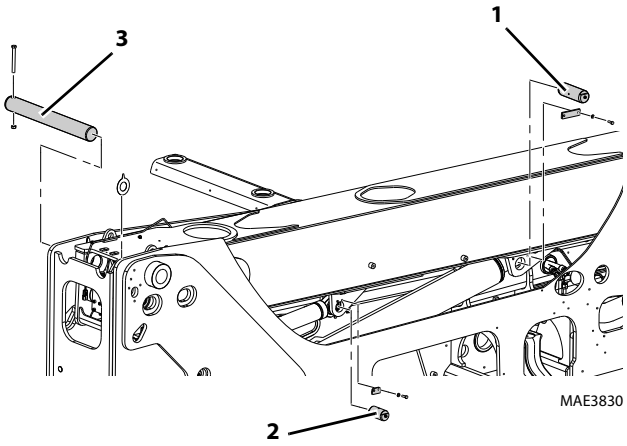
Note: *When removing a complete boom assembly use a hoist or crane with a minimum lift capacity of 4410 lb (2000 kg).*

1. Remove any attachment from the quick coupler assembly. Refer to Operation & Safety Manual.
2. Park the machine on a hard, level surface, fully retract the boom, raise the boom assembly to access lift/lower cylinder pin and the compensation cylinder pin, place the transmission 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.
4. Open the engine cover. Allow the system fluids to cool.
5. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
6. Close engine cover to access lift/lower cylinder pin and the compensation cylinder pin.
7. Properly support the boom assembly using a hoist or crane.
8. Remove boom angle sensor arm. Refer to Section 9.12.6, “Boom Angle Sensor”.

832

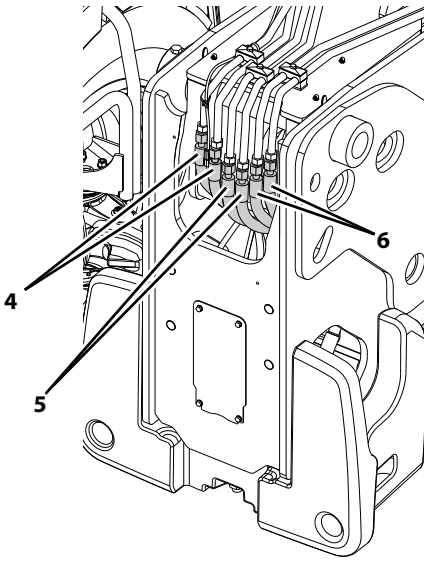


925

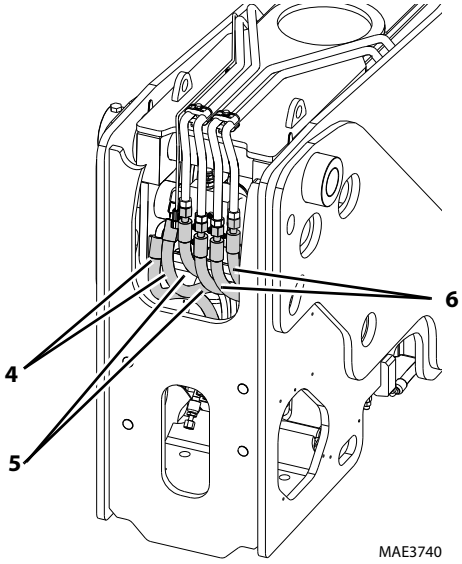


9. Remove the pin (**1**) from the rod end of the lift/lower cylinder being careful not to drop the cylinder. Lower the cylinder to a secure position.
10. Remove the pin (**2**) from the barrel end of the compensation cylinder being careful not to drop the cylinder. Lower the cylinder to a secure position.
11. Lower the boom assembly to level.
12. Place a sling around the first boom section at the balance points.

832



925

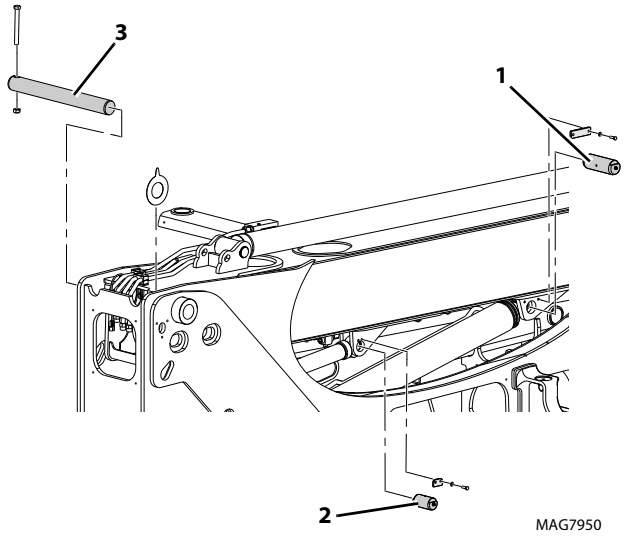


13. Label, disconnect and cap the extend/retract cylinder hoses (**4**). Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.
14. Label, disconnect and cap the tilt hoses (**5**) and auxiliary hoses (**6**). Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.
15. Label and disconnect all electrical connections to the boom assembly.
16. Remove the nut, bolt, boom assembly pivot pin (**3**) and shim.
17. Confirm that the boom assembly is balanced with the sling and remove the boom assembly pivot pins.
18. Lift the boom assembly from the machine and lower onto suitable supports.

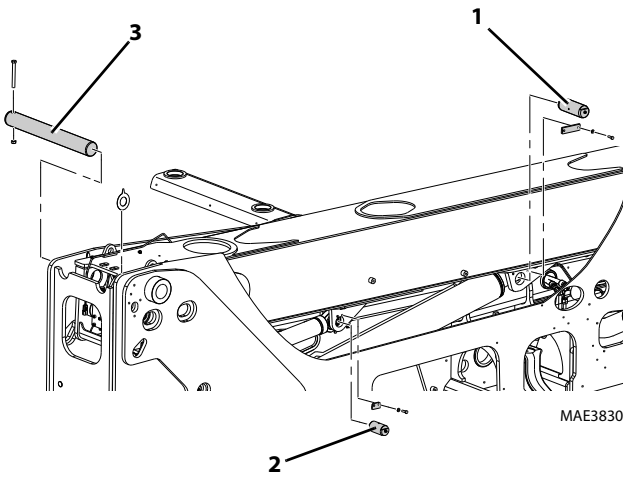
3.3.2 Complete Boom Installation

1. Park the machine on a hard, level surface, place the transmission 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.

832



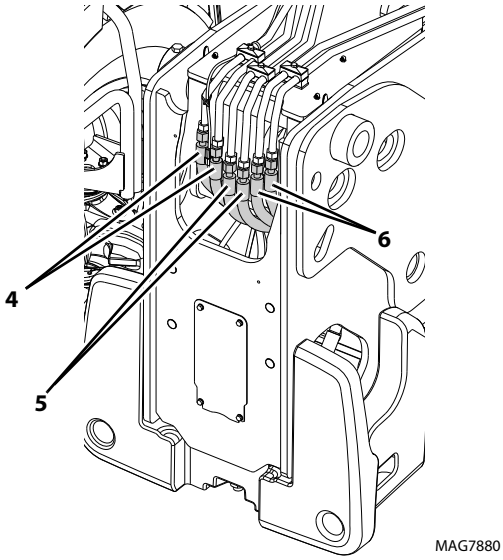
925



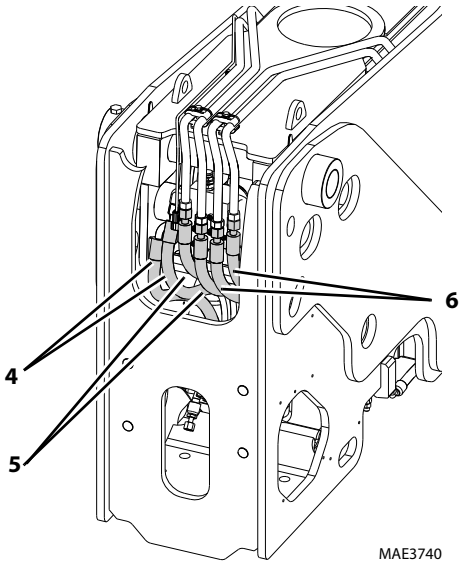
3. Using suitable slings, balance the boom assembly, lift and carefully guide the boom into place. Align the frame pivot bores with the boom assembly pivot bores. Install boom pivot pin (**3**) and lock bolt.
4. With the sling still in place, install the compensating cylinder, pin (**2**) and lock bolts.
5. With the sling still in place, install the rod end of the lift/lower cylinder, pin (**1**), shim, lock bolt and nut.

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.*

832



925



6. Uncap and connect the previously labeled extend/retract cylinder hoses (**4**) to the appropriate tube connection.
7. Uncap and connect the previously labeled tilt hoses (**5**) and auxiliary hoses (**6**) to the appropriate tube connection.
8. Connect all electrical connections to the boom assembly.
9. Install the boom angle sensor arm. Refer to Section 9.12.6, "Boom Angle Sensor".
10. Remove slings and/or supports from the boom assembly.

11. **832:** Refer Section 8.11.4, "Extend/Retract Cylinder Bleeding Procedure - 832", to bleed any air out of the hydraulic system. Check for fluid leaks. Check the hydraulic fluid level in the tank and add fluid as required.
12. **925:** Start the engine and operate all boom functions several times to bleed any air out of the hydraulic system. Check for fluid leaks. Check the hydraulic fluid level in the tank and add fluid as required.

Note: *Before extend the boom, the extend/retract cylinders must be bleed for proper function. If the air is present in the extend/retract cylinders will cause a loss of synchronisation between the boom sections, which in turn will damage the rolling hoses inside the boom sections.*

13. Lower the boom assembly and shut engine OFF.
14. Clean up all debris, hydraulic fluid, etc., in, on, near and around the machine.
15. Install previously removed attachment to quick coupler assembly. Refer to Operation & Safety Manual.

3.4 BOOM ASSEMBLY MAINTENANCE - 925

While the boom sections can be separated from each other on the machine, it is more efficient to remove the complete boom assembly from the machine and place it on suitable supports for separation. Refer Section 3.3, "Boom Removal/ Installation".

These instructions must be completed in sequence. The second boom section is removed from the first boom section.

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

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 •, "Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.")
2. Apply grease at all lubrication points (grease fittings).
   (Refer to Section 2.5, "Lubrication Schedule")
3. Check for proper operation by operating all boom functions through their full ranges of motion several times.

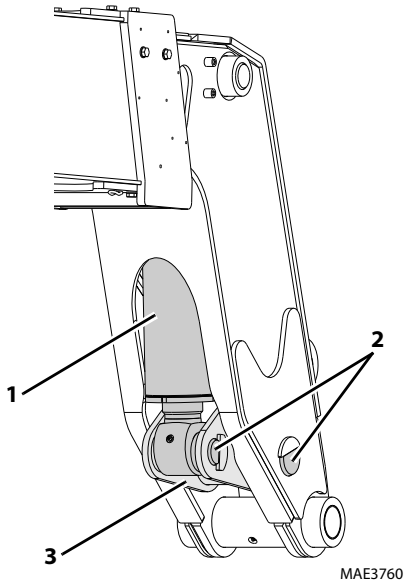
Depending on your particular circumstance, the following procedures explain the removal/installation of individual boom sections or removal/installation of the complete boom.

⚠ WARNING

NEVER modify the boom by welding or drilling unless approved in writing by JLG. The structural integrity of the boom will be impaired if subjected to any repair involving welding or drilling.

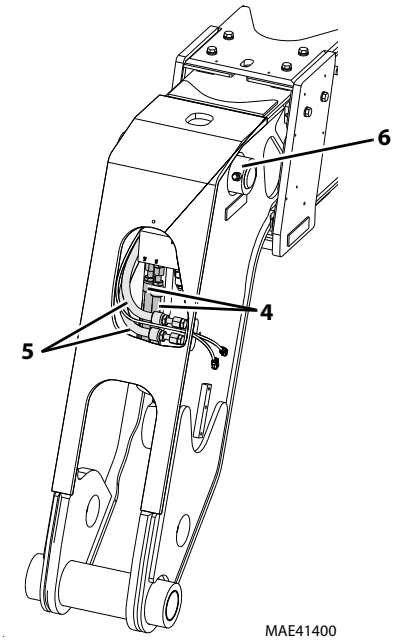
3.4.1 Second Boom Section Removal

1. Remove any attachment from the quick coupler assembly. Refer to Operation & Safety Manual.
2. Remove the quick coupler assembly. Refer to Section 3.8, "Quick Coupler".



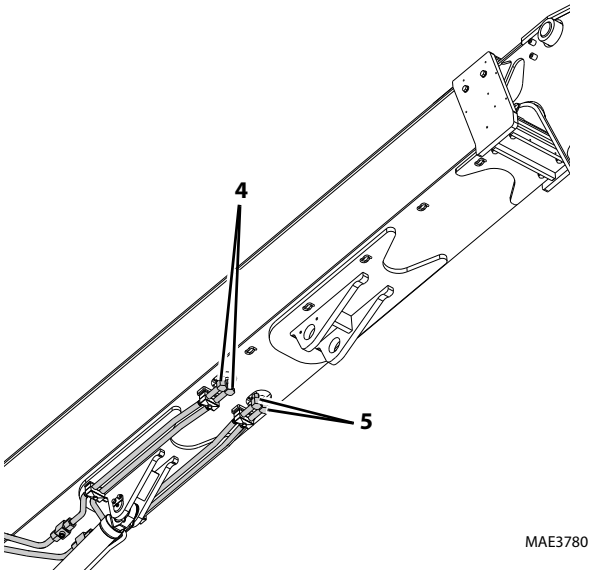
MAE3760

3. Extend the tilt cylinder (**1**) to remove the pins (**2**).
4. Remove the link assembly (**3**) and retract the tilt cylinder (**1**).
5. Park the machine on a hard, level surface, fully retract the boom, raise the boom assembly to access lift/lower cylinder pin and the compensation cylinder pin, place the transmission in (N) NEUTRAL, engage the park brake and shut the engine OFF.
6. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
7. Open the engine cover. Allow the system fluids to cool.
8. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
9. Close engine cover to access lift/lower cylinder pin and the compensation cylinder pin.
10. Verify the boom assembly is set on stable, secure and suitable supports.



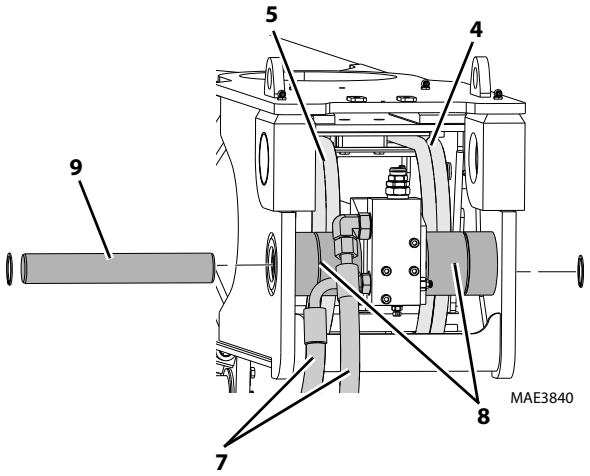
MAE41400

11. Label, disconnect and cap the tilt circuit hoses (**4**) from the tilt cylinder at the front of the second boom section. Label, disconnect and cap the auxiliary circuit hoses (**5**) from the fittings at the top front of the second boom section. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
12. Place a sling through the opening at the top of the boom head and around the tilt cylinder and remove the bolt, lock nut and pin (**6**) at the barrel end of the tilt cylinder. Lower the tilt cylinder and place in a secure location.



MAE3780

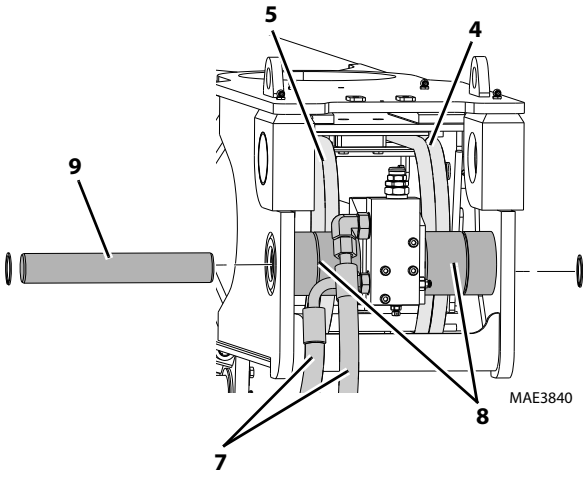
13. Label, disconnect and cap both tilt hoses (**4**) and both auxiliary hoses (**5**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.



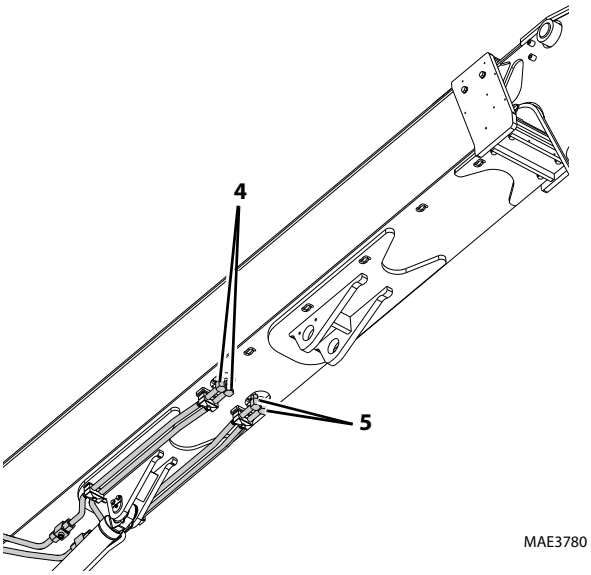
14. Pull both tilt hoses (**4**) and both auxiliary hoses (**5**) through the rear of the first boom section.
15. Label, disconnect and cap both extend/retract cylinder hoses (**7**) attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
16. Remove the two spacers (**8**) and pin (**9**) from barrel end of the extend/retract cylinder.
17. Pull the second boom section out 6 in to 8 in (150 mm to 200 mm) 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.
18. Using a sling around the front of the second boom section, carefully pull the second boom section approximately 3/4 out of first boom section and set on a suitable support. Reposition slings balancing the second boom section and remove from the first boom section. Set the second boom section on suitable supports.
19. Remove the clip and pin from the rod end of the extend/retract cylinder and pull approximately 3/4 out through the rear of the second boom section.
20. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
21. Visually inspect the hoses, hardware, wear pads, mounting points and other components of the first boom section. Replace any item if damaged. (Refer to Section •, "Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.")

3.4.2 Second Boom Section Installation

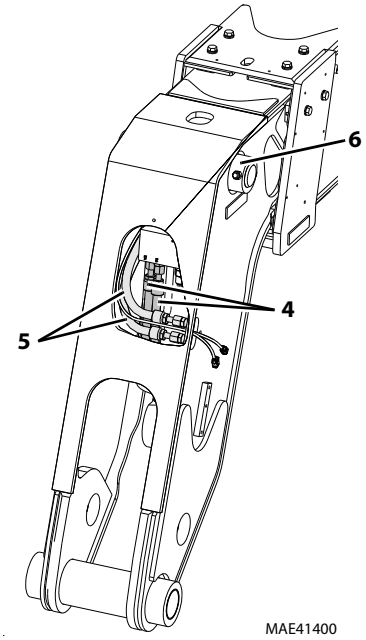
1. Insert the extend/retract cylinder through the rear of the second boom section and attach the pin and clip to the rod end at front side of the boom.
2. Grease the inside first boom section on areas where the second boom section Wear pads will slide.
3. Using a suitable sling, balance the second boom section and carefully slide 3 - 4 ft (1 - 1.5 m) into the front of the first boom section. Leave 6 - 8 in (152 - 203 mm) of the second boom section out to be able to install wear pads in front of the first boom section.
4. With the sling still under the second boom section, install the bottom front wear pads and backing plates on the first boom section. Lower the second boom section and install the top front and side wear pads and backing plates on the first boom section. Do not shim or tighten bolts at this time.
5. Shim all wear pads on the rear of the second boom section and front of the first boom section. Torque as required. Refer to Section 3.7, "Boom Wear Pads".



6. Feed the tilt hoses (**4**) and auxiliary hoses (**5**) between the second and first boom sections.
7. Insert the two spacers (**8**) and pin (**9**) into the barrel end of the extend/retract cylinder.
8. Verify both sets of hoses are run through the opening at the bottom front of the first boom section.



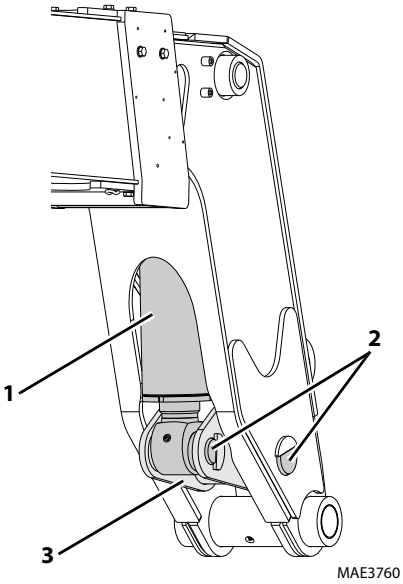
9. Connect the tilt hoses (**4**) and auxiliary hoses (**5**) to the tubes mounted at the bottom front of the first boom section.
10. Uncap and connect the previously labeled extend/retract cylinder hoses (**7**) to the extend/retract cylinder.



11. Using a suitable sling around the barrel end of the tilt cylinder, raise the tilt cylinder into boom head. Align the tilt cylinder barrel end bore with the boom head bore and install the tilt cylinder pin (**6**), bolt and lock nut.

Note: *Grease tilt cylinder barrel end bore and pin before installing.*

12. Remove the plugs from the fittings on the tilt cylinder and the caps from the tilt hoses of the hose carrier. Install both tilt hoses (**4**). Torque as required.
13. Remove the plugs from the auxiliary fittings and the caps from the auxiliary hoses of the hose carrier. Install both auxiliary hoses (**5**). Torque as required.



14. Extend the tilt cylinder (**1**) to insert the pins (**2**).
15. Install the previously removed link assembly (**3**) to the tilt cylinder (**1**).
16. Install the quick coupler assembly. Refer to Section 3.8, “Quick Coupler”.
17. Install previously removed attachment to quick coupler assembly. Refer to Operation & Safety Manual.

3.5 BOOM ASSEMBLY MAINTENANCE - 832

While the boom sections can be separated from each other on the machine, it is more efficient to remove the complete boom assembly from the machine and place it on suitable supports for separation. Refer Section 3.3, "Boom Removal/ Installation".

These instructions must be completed in sequence. The second and third boom sections are removed from the first boom section. The third boom section is removed from the second boom section.

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

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 •, "Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.")
2. Apply grease at all lubrication points (grease fittings). (Refer to Section 2.5, "Lubrication Schedule")
3. Check for proper operation by operating all boom functions through their full ranges of motion several times.

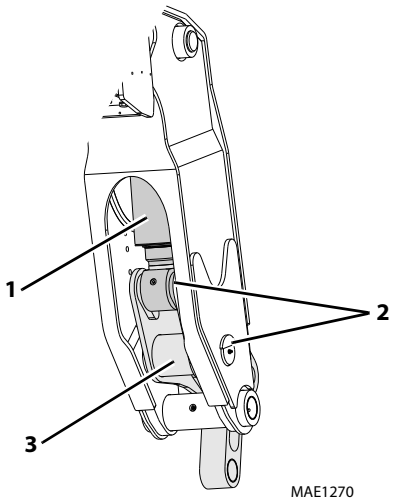
Depending on your particular circumstance, the following procedures explain the removal/installation of individual boom sections or removal/installation of the complete boom.

⚠ WARNING

NEVER modify the boom by welding or drilling unless approved in writing by JLG. The structural integrity of the boom will be impaired if subjected to any repair involving welding or drilling.

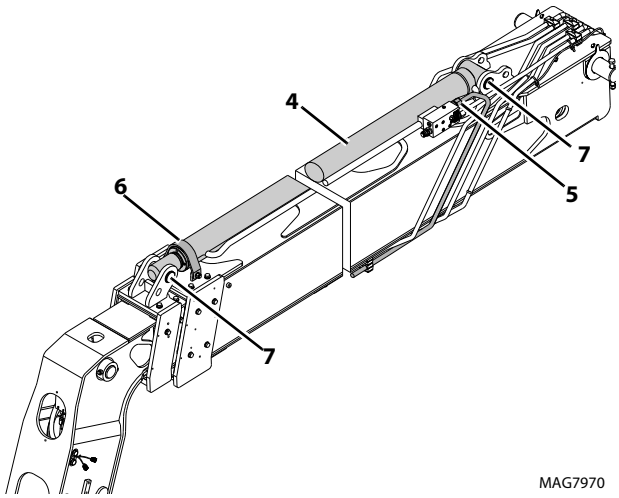
3.5.1 Second and Third Boom Section Removal

1. Remove any attachment from the quick coupler assembly. Refer to Operation & Safety Manual.
2. Remove the quick coupler assembly. Refer to Section 3.8, "Quick Coupler".



MAE1270

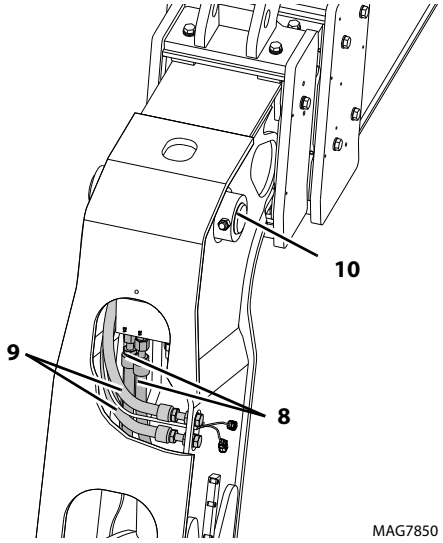
3. Extend the tilt cylinder (**1**) to remove the pins (**2**).
4. Remove the link assembly (**3**) and retract the tilt cylinder (**1**).
5. Verify the boom assembly is set on stable, secure and suitable supports.



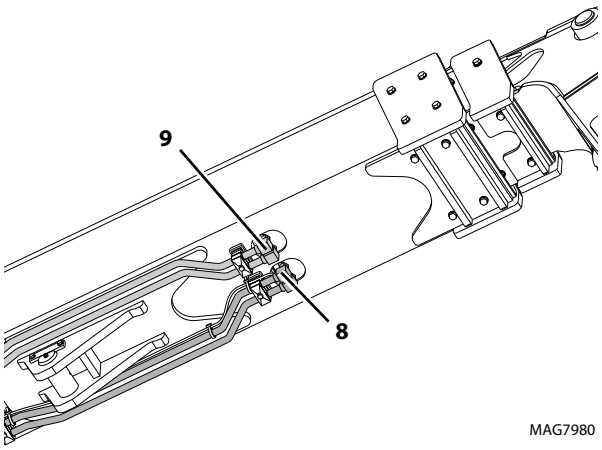
MAG7970

6. Properly support the extend/retract cylinder (**4**) using a hoist or crane.
7. Label, disconnect and cap the extend/retract cylinder hoses (**5**) from the extend/retract cylinder. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
8. Loosen and remove the extend/retract cylinder strap (**6**).

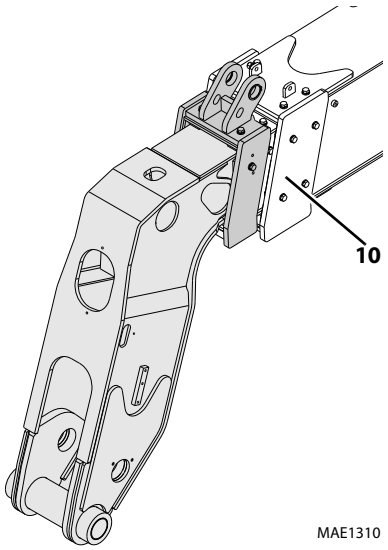
9. Remove one retaining ring from the mounting pin (**7**) at each end of the extend/retract cylinder.
10. Remove the extend/retract cylinder and place it in a secure location.



11. Label, disconnect and cap the tilt circuit hoses (**8**) from the tilt cylinder at the front of the third boom section. If equipped, label, disconnect and cap the auxiliary circuit hoses (**9**) from the fittings at the top front of the third boom section. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
12. Place a sling through the opening at the top of the boom head and around the tilt cylinder and remove the retaining rings and pin (**10**) at the barrel end of the tilt cylinder. Lower the tilt cylinder and place in a secure location.



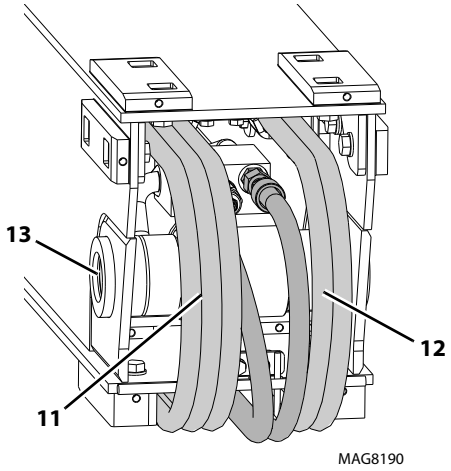
13. Label, disconnect and cap both tilt hoses (**8**) and both auxiliary hoses (**9**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.



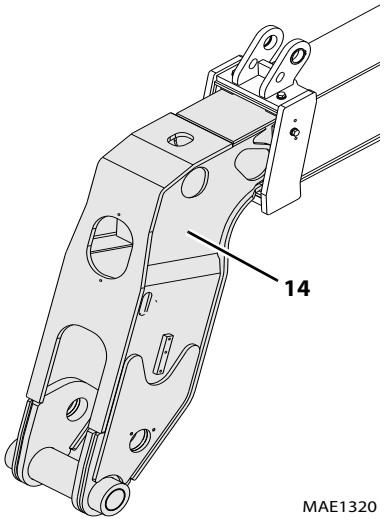
14. Pull the second and third section booms out 6 - 8 in (152 - 203 mm) and remove all the wear pads, shims and backing plates from the front inside of the first section boom (**10**). Label all parts for installation.
15. Place a sling around the front of the second boom section, lift and slide the two boom section 3/4 of the way out of the first boom section. Set the boom head down on a suitable support, then center the sling to be able to balance the two boom sections being removed. Carefully pull the two boom sections the remainder of the way out of the first boom section and set the two boom sections down on suitable supports.
16. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
17. Inspect hoses, hardware, wear pads, mounting points and other components visible with the first boom section. Replace any item if damaged.
(Refer to Section •, "Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.")

3.5.2 Third Boom Section Removal

1. Verify the boom assembly is setting on stable, secure and suitable supports.



2. Pull both tilt hoses (**11**) and both auxiliary hoses (**12**) through the rear of the third boom section.
3. Remove the two retaining rings and pin (**13**) from barrel end of the extend/retract cylinder. Properly support the cylinder before removing.

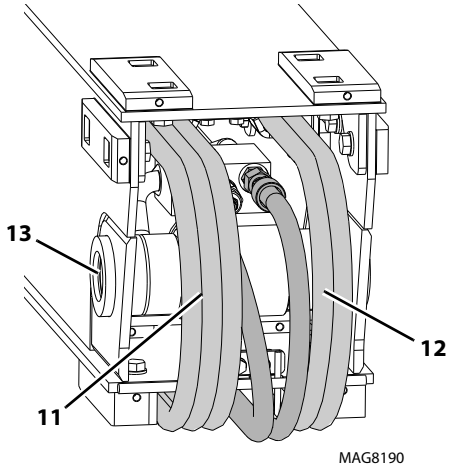


4. Pull the third boom section (**14**) out 6 - 8 in (150 - 200 mm) to be able to loosen and remove all the bolts and remove all the wear pads, backing plates and shims from the front inside of the first section boom. Tag each pad, backing plate, shim and bolts from each location.
5. Remove the clip and pin from the rod end of the extend/retract cylinder and pull through the rear of the third boom section.
6. Using a sling around the front of the third boom section, carefully pull the third boom section from the second boom section.
7. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
8. Visually inspect the hoses, hardware, wear pads, mounting points and other components of the second boom section. Replace any item if damaged. (Refer to Section •, "Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.")

3.5.3 Third Boom Section Installation

Note: *Shim all wear pads. Refer to Section 3.7, "Boom Wear Pads". Final adjustments of the wear pads may required after the boom assembly is installed on the machine and hydraulic power is available.*

1. Insert the extend/retract cylinder through the rear of the third boom section and attach the pin and clip to the rod end.
2. Grease the inside second boom section on areas where the third boom section wear pads will slide.
3. Using a suitable sling, balance the third boom section and carefully slide 3 - 4 ft (1 - 1.5 m) into the front of the second boom section. Leave 6 - 8 in (152 - 203 mm) of the third boom section out to be able to install wear pads in front of the second boom section.
4. With the sling still under the third boom section, install the bottom front wear pads and backing plates on the second boom section. Lower the third boom section and install the top front and side wear pads and backing plates on the second boom section. Do not shim or tighten bolts at this time.
5. Shim all wear pads on the rear of the third boom section and front of the second boom section. Torque as required. Refer to Section 3.7, "Boom Wear Pads".

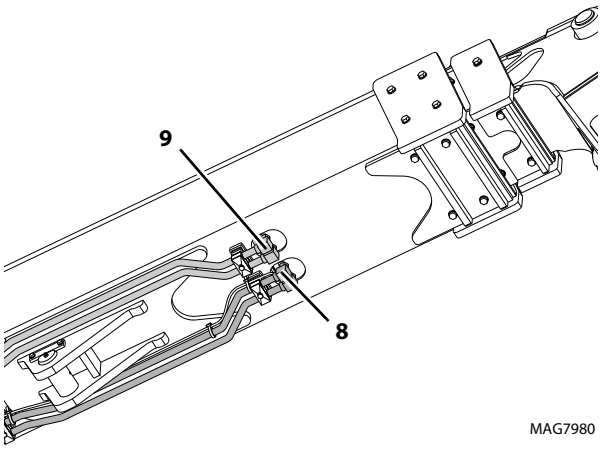


6. Feed the tilt hoses (**11**) and auxiliary hoses (**12**) between the third and second boom sections. Verify both sets of hoses are run through the opening at the bottom front of the first boom section.
7. Insert the pin (**13**) and clip into the barrel end of the extend/retract cylinder.

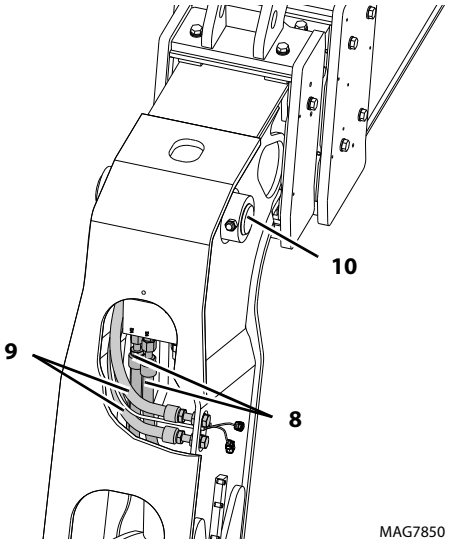
3.5.4 Second and Third Boom Section Installation

Note: *Shim all wear pads. Refer to Section 3.7, "Boom Wear Pads". Final adjustments of the wear pads may required after the boom assembly is installed on the machine and hydraulic power is available.*

1. *Grease the inside first boom section on areas where the second boom section wear pads will slide.*
2. Using a suitable sling, balance the second and third boom sections and carefully slide 3 - 4 ft (914 - 1219 mm) into the front of the first boom section. Set the second and third boom sections onto a suitable support and reset sling under the boom head of the third boom section. Carefully slide the second and third boom sections into the first boom section. Leave 6 - 8 in (152 - 203 mm) of the second boom section out to be able to install wear pads in front of the first boom section.
3. With the sling still under the third boom section, install the bottom front wear pads and backing plates on the first boom section. Lower the third boom section and install the top front and side wear pads and backing plates on the first boom section. Do not shim or tighten bolts at this time.
4. Shim all wear pads on the rear of the second boom section and front of the first boom section. Torque as required. Refer to Section 3.7, "Boom Wear Pads".
5. Feed the tilt hoses and auxiliary hoses between the second and first boom sections. Verify both sets of hoses are run through the opening at the bottom front of the first boom section.



6. Connect the tilt hoses (**8**) and auxiliary hoses (**9**) to the tubes mounted at the bottom front of the first boom section.

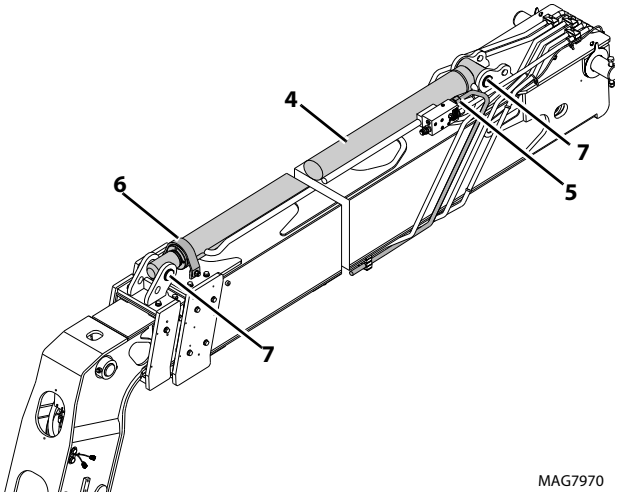


7. Using a suitable sling around the barrel end of the tilt cylinder, raise the tilt cylinder into boom head. Align the tilt cylinder barrel end bore with the boom head bore and install the tilt cylinder pin (**10**), bolt and lock nut.

Note: *Grease tilt cylinder barrel end bore and pin before installing.*

8. Remove the plugs from the fittings on the tilt cylinder and the caps from the tilt hoses of the hose carrier. Install both tilt hoses (**8**). Torque as required.

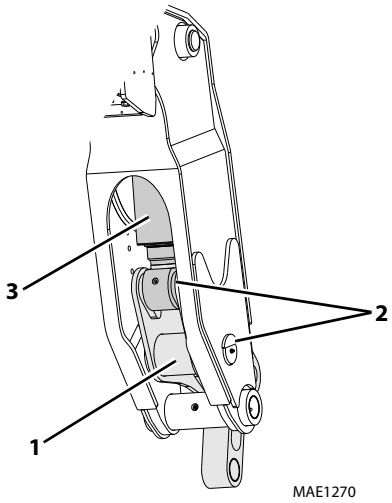
9. Remove the plugs from the auxiliary fittings and the caps from the auxiliary hoses of the hose carrier. Install both auxiliary hoses (**9**). Torque as required.



10. Attach a sling around a balance point on the extend/retract cylinder (**4**) and carefully set on top of the first boom section.

Note: *Grease extend/retract cylinder barrel end bore and rod end bore and pins before installing.*

11. Align the extend/retract cylinder barrel end with bore at rear of the first boom section. Install the pin and retaining clip (**7**).
12. Align the extend/retract cylinder rod end with bore at front of the second boom section. Install the pin and retaining clip (**7**).
13. Install extend/retract cylinder strap (**6**). Torque as required.
14. Uncap and connect the previously labeled extend/retract cylinder hoses (**5**) to the extend/retract cylinder.

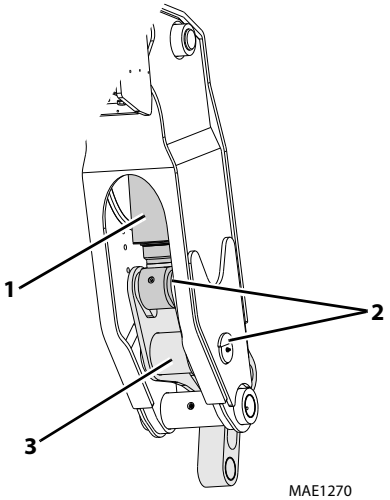


15. Extend the tilt cylinder (**3**) to insert the pins (**2**).
16. Install the previously removed link assembly (**1**) to the tilt cylinder (**3**).
17. Install the quick coupler assembly. Refer to Section 3.8, "Quick Coupler".
18. Install previously removed attachment to quick coupler assembly. Refer to Operation & Safety Manual.

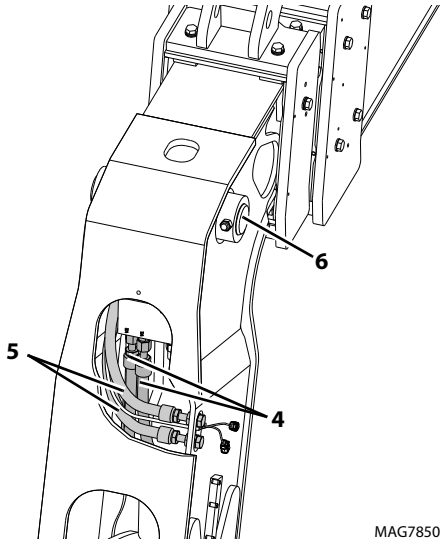
3.6 THIRD BOOM SECTION REMOVAL/ INSTALLATION ONLY - 832

3.6.1 Removal

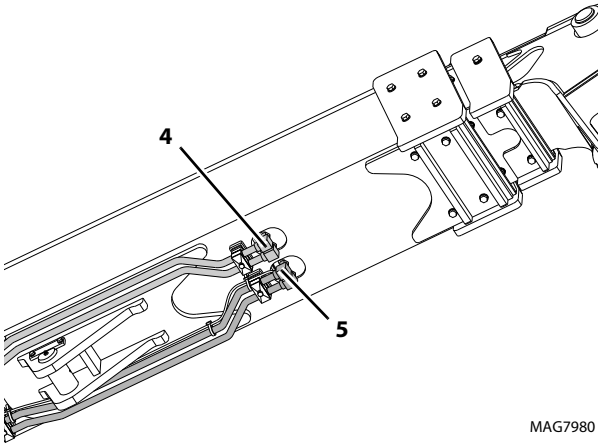
1. Remove any attachment from the quick coupler assembly. Refer to Operation & Safety Manual.
2. Remove the quick coupler assembly. Refer to Section 3.8, "Quick Coupler".



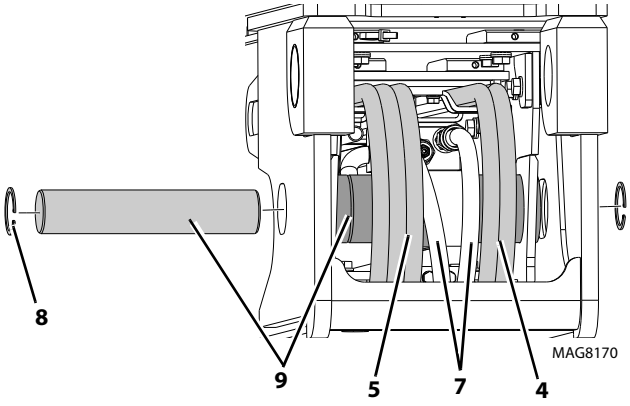
3. Extend the tilt cylinder (**1**) to remove the pins (**2**).
4. Remove the link assembly (**3**) and retract the tilt cylinder (**1**).



5. Label, disconnect and cap the tilt circuit hoses (**4**) from the tilt cylinder at the front of the third boom section. If equipped, label, disconnect and cap the auxiliary circuit hoses (**5**) from the fittings at the top front of the third boom section. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
6. Place a sling through the opening at the top of the boom head and around the tilt cylinder and remove the bolt, lock nut and pin (**6**) at the barrel end of the tilt cylinder. Lower the tilt cylinder and place in a secure location.



7. Label, disconnect and cap both tilt hoses (**4**) and both auxiliary hoses (**5**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
8. Secure a rope/wire to both tilt hoses (**4**) and both auxiliary hoses (**5**).



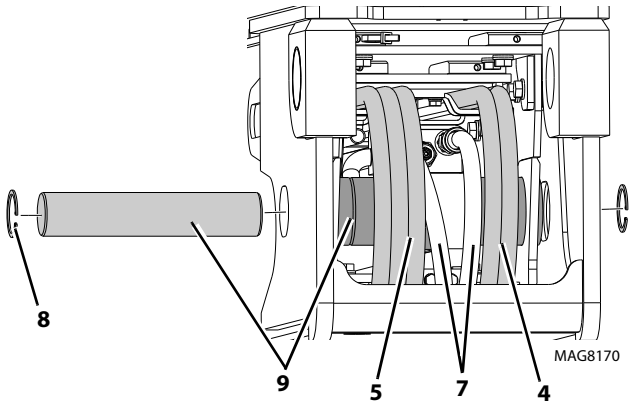
9. Pull both tilt hoses (**4**) and both auxiliary hoses (**5**) through the rear of the first boom section.
10. Label, disconnect and cap both extend/retract cylinder hoses (**7**) attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
11. Remove the two snap rings (**8**) and spacers and pin (**9**) from barrel end of the inside extend/retract cylinder.

12. Pull the third boom section out 6 in - 8 in (150 - 200 mm) 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 second section boom. Tag each pad, backing plate, shim and bolts from each location.
13. Remove the clip and pin from the rod end of the inside extend/retract cylinder and pull through the rear of the first boom section.
14. Place a sling around the front of the third boom section. Lift and slide the two boom section 3/4 of the way out of the second boom section. Set the boom head down on a suitable support, then center the sling to be able to balance the third boom sections being removed. Carefully pull the third boom section the remainder of the way out of the second boom section and set the third boom sections down on suitable supports.
15. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
16. Visually inspect the hoses, hardware, wear pads, mounting points and other components of the second boom section. Replace any item if damaged. (Refer to Section •, "Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.")

3.6.2 Installation

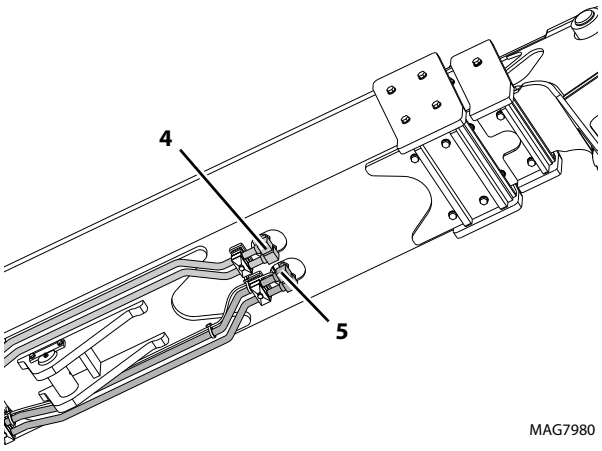
Note: *Shim all wear pads. Refer to Section 3.7, "Boom Wear Pads". Final adjustments of the wear pads may required after the boom assembly is installed on the machine and hydraulic power is available.*

1. Using a suitable sling, balance the third boom section and carefully slide 3 ft - 4 ft (914 - 219 mm) into the front of the second boom section. Set the third boom section head onto suitable support and reset sling under the boom head of the third boom section. Feed the tilt hoses and auxiliary hoses through the front of the second boom section. Carefully slide the third boom section into the second boom section. Leave 6 ft - 8 ft (1829 - 2438 mm) of the third boom section out to be able to install wear pads in front of the second boom section.
2. With the sling still under boom head install the bottom front wear pads and backing plates on the second boom section. Lower the third boom section and install the top front and side wear pads and backing plates on the second boom section. Tighten as required.

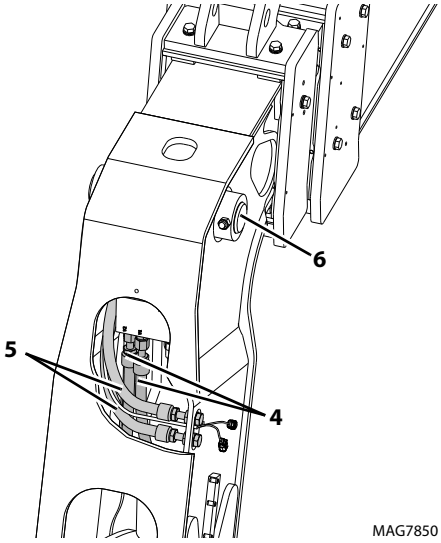


3. Install the two snap rings (**8**) and spacers and pin (**9**) to barrel end of the inside extend/retract cylinder.
4. Uncap and connect the previously labeled extend/retract cylinder hoses (**7**) to the extend/retract cylinder.

5. Feed the tilt hoses (**9**) and auxiliary hoses (**10**) between the first and second boom sections.



6. Connect the tilt hoses (**5**) and auxiliary hoses (**4**) to the tubes mounted at the bottom front of the first boom section.

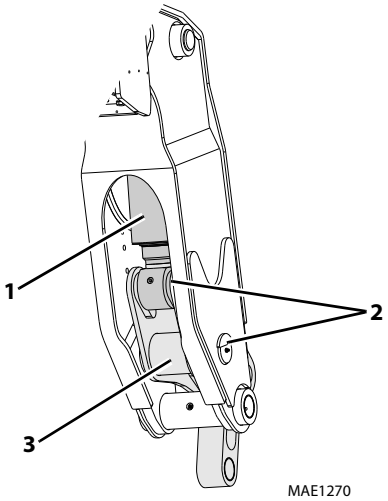


7. Using a suitable sling around the barrel end of the tilt cylinder, raise the tilt cylinder into boom head. Align the tilt cylinder barrel end bore with the boom head bore and install the tilt cylinder pin (**6**), bolt and lock nut.

Note: *Grease tilt cylinder barrel end bore and pin before installing.*

8. Remove the plugs from the fittings on the tilt cylinder and the caps from the tilt hoses of the hose carrier. Install both tilt hoses (**4**). Torque as required.

9. Remove the plugs from the auxiliary fittings and the caps from the auxiliary hoses of the hose carrier. Install both auxiliary hoses (**5**). Torque as required.

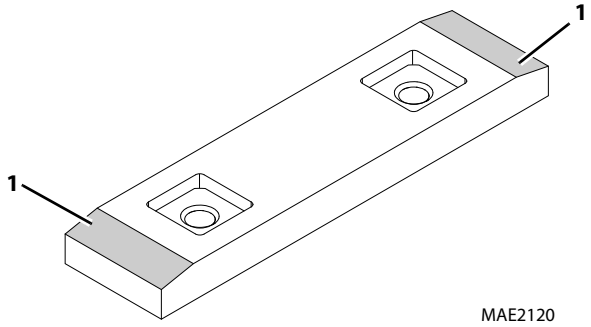


10. Extend the tilt cylinder (**1**) to insert the pins (**2**).
11. Install the previously removed link assembly (**3**) to the tilt cylinder (**1**).
12. Install the quick coupler assembly. Refer to Section 3.8, “Quick Coupler”.
13. Install previously removed attachment to quick coupler assembly. Refer to Operation & Safety Manual.

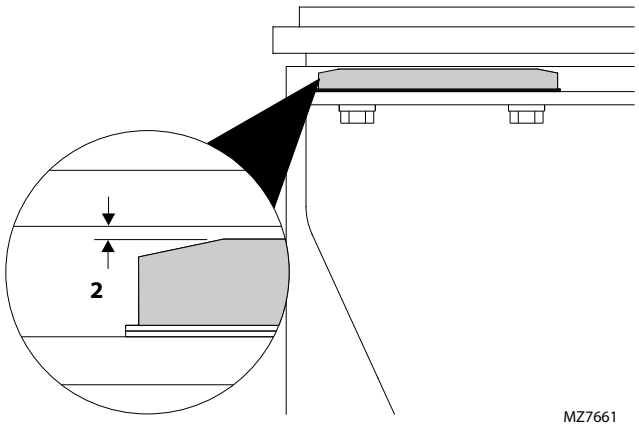
3.7 BOOM WEAR PADS

The boom wear pads are flat rectangular plastic blocks with metal inserts.

3.7.1 Wear Pad Inspection



1. Park the machine on a firm, level surface. Place the transmission in (N) NEUTRAL, engage the park brake switch, retract and level the boom.
2. Inspect all wear pads for wear. If the angle indicators (**1**) on the ends of the wear pads are not visible, or show uneven wear, they should be replaced. Always replace pads as a set.



3. Measure all side and top wear pads for proper clearance. Acceptable gap between the wear pad and the next boom section (**2**) is 0.019 - 0.059 in (0,5 - 1,5 mm).
4. Shim each wear pad to within the above measurement if required.

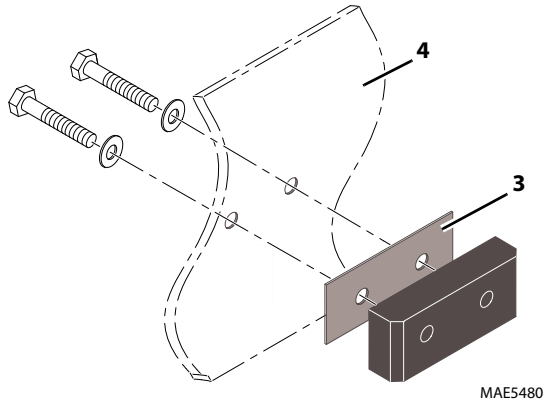
3.7.2 Boom Wear Pad Installation, Lubrication

The boom has been factory lubricated for proper wear pad break-in and will normally require minor further lubrication. However, after replacing any wear pad(s), or after prolonged periods of inoperation, lubrication of the boom wear surfaces is recommended to keep the boom wear surfaces lubricated properly. Refer to Section 2.3, "Fluid and Lubricant Capacities", for appropriate lubricants to be used.

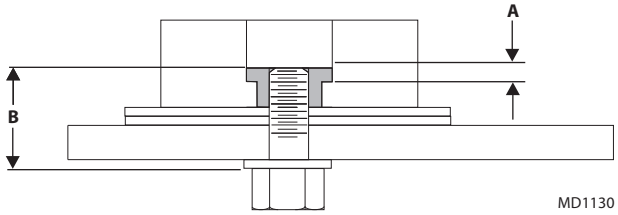
Lubrication of the boom wear surfaces is also recommended when the machine is stored, to help prevent rusting.

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

- Maintain a total boom section clearance between the wear pad and the next boom section (**2**).
- The wear pad inserts and mounting bolts MUST be clean before mounting bolts are installed.
- Refer to Section 2.2, "Specifications".



- A Spacer (**3**) must inserted between the wear pad support plate and 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.



- The length of the wear pad bolt depends on the number of spacers and washers being used.
- The bolt length can be ± 0.004 in (1.0 mm) from the face of the insert.
- 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).

- 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.
- Torque wear pad bolts as required.
- 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 Multipurpose Grease.
- Clean and lightly grease the hose carrier guide bar pathway with Multipurpose Grease.

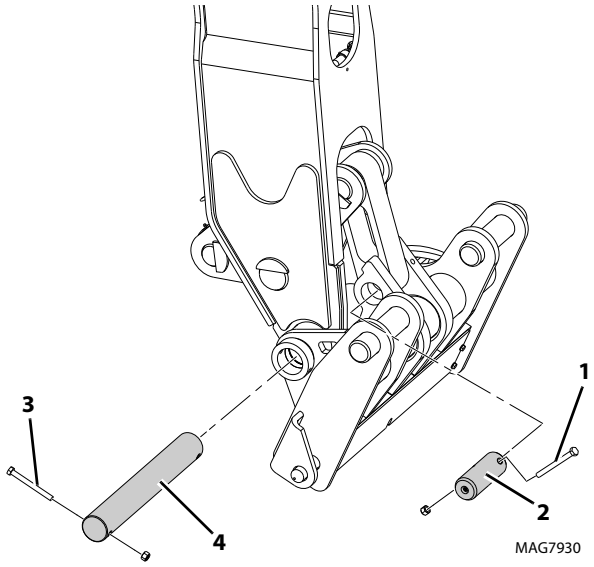
3.8 QUICK COUPLER

Note: *The following procedures covers all styles of quick couplers.*

3.8.1 Manual Coupler

a. Removal

1. Tilt coupler forward to access coupler pin and lower to ground. Set park brake and turn off engine.



2. Remove the bolt and washer (**1**) securing the tilt cylinder rod end to the quick coupler assembly. Remove the rod end pin (**2**).
3. Support the quick coupler assembly. Remove the bolt and nut (**3**) securing the quick coupler assembly to the boom head. Remove the pin (**4**) from the quick coupler assembly.
4. Inspect the above pins 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.

b. Installation

1. Assemble the quick coupler to the boom head. Line up the quick coupler between the mounts on the boom head. The quick coupler should be centered in the boom head.

NOTICE

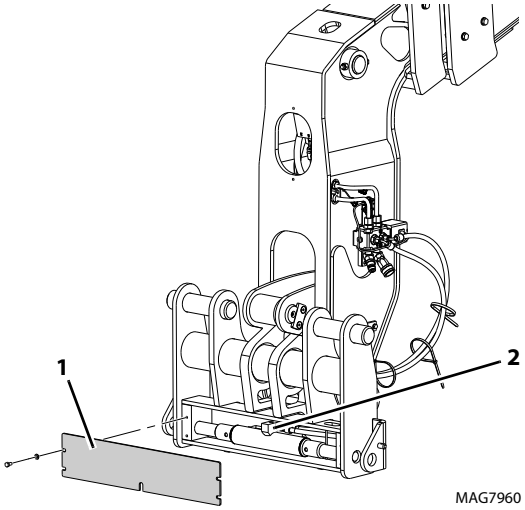
DO NOT coat the pin or any rotating parts.

2. Coat the static, non-rotating pin bores with anti-seize lube.
3. Coat all bushings, sheaves and rotating pin bores with grease. Refer to Section 2.3, "Fluid and Lubricant Capacities", for grease details.
4. Insert the quick coupler pivot pin (**4**) through the quick coupler and boom head. Secure with the previously removed bolt and nut (**3**).
5. Shim equally on both sides to maximum total clearance of 0.079 in (2.0 mm).
6. Align the quick coupler with the tilt cylinder rod end and insert the coupler pin (**2**). Secure with the previously removed bolt and washer (**1**).

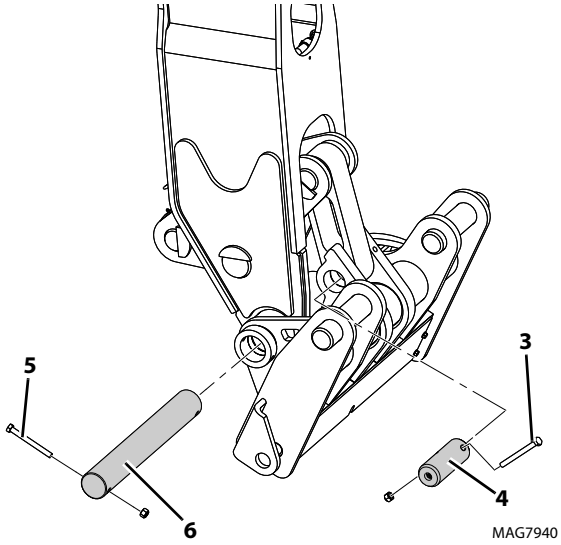
3.8.2 Hydraulic Coupler

a. Removal

1. Tilt coupler forward to access coupler pin and lower to ground. Set park brake and turn off engine.



2. Remove cylinder cover (**1**). Label and disconnect the hydraulic hoses (**2**) attached to the quick coupler assembly. Drain fluid into suitable container.
3. Plug and cap the hose ends to prevent dirt and debris from entering the hydraulic system.



4. Remove the bolt and washer (**3**) securing the tilt cylinder rod end to the quick coupler assembly. Remove the rod end pin (**4**).
5. Support the quick coupler assembly. Remove the bolt and nut (**5**) securing the quick coupler assembly to the boom head. Remove the pin (**6**) from the quick coupler assembly.

6. Inspect the above pins 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.

b. Installation

1. Assemble the quick coupler to the boom head. Line up the quick coupler between the mounts on the boom head. The quick coupler should be centered in the boom head.

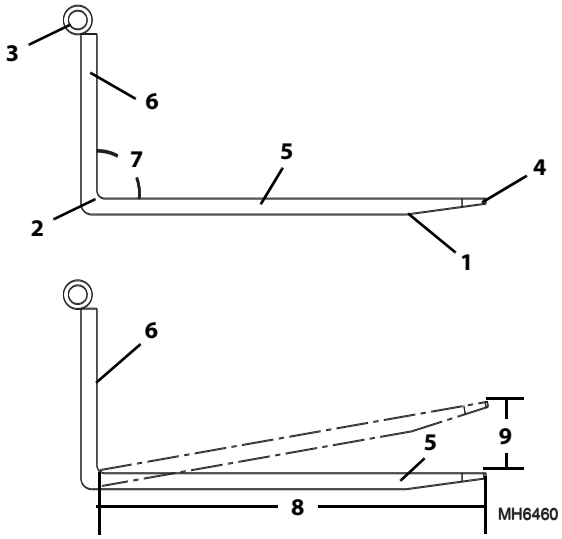
NOTICE

DO NOT coat the pin or any rotating parts.

2. Coat the static, non-rotating pin bores with anti-seize lube.
3. Coat all bushings, sheaves and rotating pin bores with grease. Refer to Section 2.3, "Fluid and Lubricant Capacities", for grease details.
4. Insert the quick coupler pivot pin (**4**) through the quick coupler and boom head. Secure with the previously removed bolt and nut (**3**).
5. Shim equally on both sides to maximum total clearance of 0.079 in (2.0 mm).
6. Align the quick coupler with the tilt cylinder rod end and insert the coupler pin (**2**). Secure with the previously removed bolt and washer (**2**).
7. Uncap and reconnect the hydraulic hoses (**7**) to proper fittings on the quick coupler assembly on the boom head.
8. Reinstall cylinder cover (**6**) with the hardware removed earlier.

3.9 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 (**1**) for cracks, paying special attention to heel (**2**) and mounting tubes (**3**).
2. Inspect forks for broken or bent tips (**4**) and twisted blades (**5**) and shanks (**6**).

Yearly Inspection

1. Straightness of the upper face of blade (**5**) and the front face of shank (**6**) should not exceed 0.5 percent of the length of blade or height of shank.
2. Angle (**7**) between upper face of blade and front face of shank should not exceed 93 degrees.
3. Thickness of blade (**5**) and shank (**6**) should not be reduced to 90 percent of original thickness.

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

4. Ensure fork length (**8**) is adequate for intended loads.
5. Fork markings should be legible, re-stamp if required.
6. Compare fork tips (**9**) when mounted on a carriage. Maximum difference in height of fork tips is 3 percent of the length of the blade (**8**).

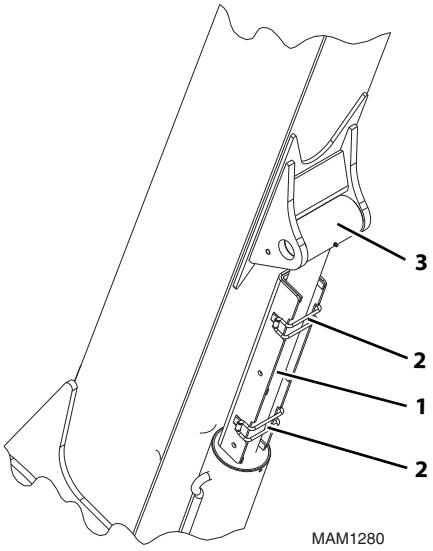
3.10 BOOM PROP (IF EQUIPPED)

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.

3.10.1 Prop Installation

1. Park the machine on a firm, level surface. Place the transmission in (N) NEUTRAL, engage the park brake.
2. Raise the boom to an angle of approximately 20 degree.
3. Shut engine OFF.
4. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
5. 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.



6. 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.
7. Start the engine and SLOWLY lower the boom until there is a clearance of 0.25 in (6 mm) between the end of the boom prop and the lift/lower cylinder rod end (**3**).
8. Shut engine OFF.

NOTICE

EQUIPMENT DAMAGE. Auxiliary Hydraulic Power Supply hydraulic oil must be compatible with hydraulic oil shown in Section 2.3, “Fluid and Lubricant Capacities”.

3.10.2 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.

3.11 EMERGENCY BOOM LOWERING PROCEDURE

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.

3.11.1 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 9 gal (35 L) 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 2.3, “Fluid and Lubricant Capacities”.

832

Hoses:

- Two Hydraulic Hoses - Approximately 26 ft (6 m) each, with a minimum I.D. of 0.5 in (12.7 mm) and a minimum rating of 275,8 bar (4000 psi).
- One Hydraulic Hose - Approximately 11.8 ft (3.6 m), with a minimum I.D. of 0,6 in (15.6 mm) and a minimum rating of 275,8 bar (4000 psi).

Fittings:

- Two - 13/ 16 - 16-2B ORFS Caps
- Two - 13 / 16 - 16-2B ORFS Plugs

925

Hoses:

- Two Hydraulic Hoses - Approximately 21.3 - 21.7 ft (6.5 - 6.6 m) each, with a minimum I.D. of 0.5 in (12.7 mm) and a minimum rating of 275,8 bar (4000 psi).

Fittings:

- Two - 8 STR FM SW ORFS
- Two - 8 90S FM SW ORFS

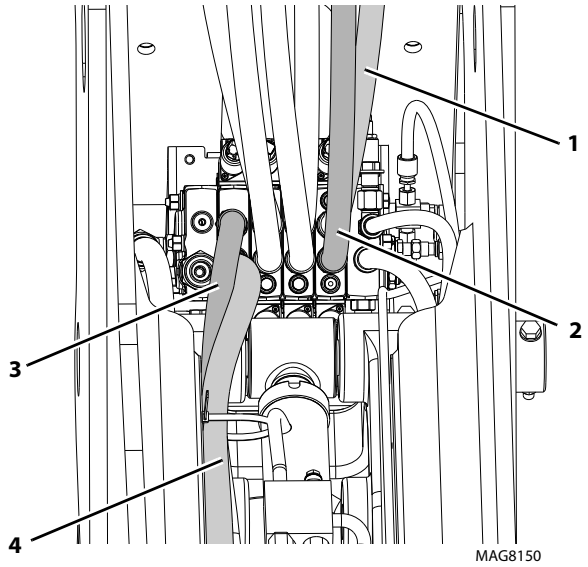
Note: *Machine extend/retract and lift/lower hoses are -8 ORFS. The adapter size may vary depending on the hose ends of the auxiliary hydraulic power supply.*

3.11.2 Lowering Procedure

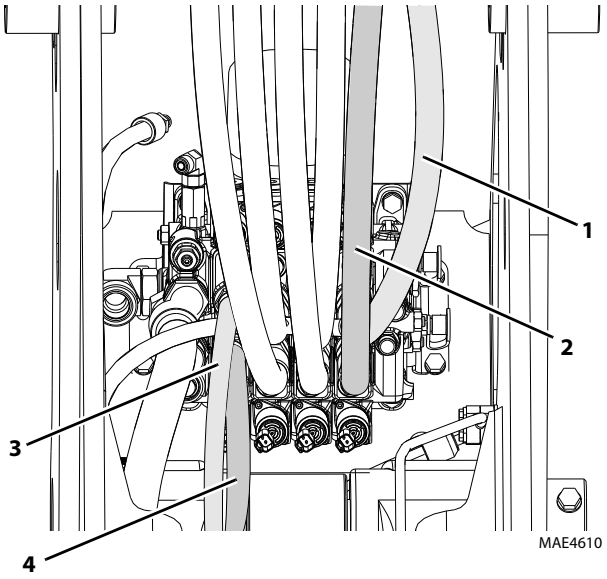
a. Retract the boom as follows:

1. Remove the cover at the rear of the frame to access the main control valve.
2. Place a suitable receptacle under the main control valve.

832



925



3. Label and disconnect the extend/retract cylinder hoses (**1** and **2**) from the main control valve. Install plugs in hoses to prevent fluid 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, connect the hoses between the auxiliary hydraulic power supply and the hoses removed from the main control valve extend/retract section of the affected machine.
5. Retract hose (**2**) is the supply and extend hose (**1**) is the return. Connect the hoses in the proper order to ensure that the cylinder is retracted, not extended.
6. Use the auxiliary power supply to retract the extend/retract cylinder.
7. Loosen and remove the jumper hoses and reconnect the extend/retract cylinder hoses.
8. 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.
9. Clean up all debris, hydraulic fluid, 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 (**3** and **4**) from the main control valve. Install plugs in hoses to prevent fluid 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.
4. Hose (**4**) is the supply (lower) and hose (**3**) is the return. Connect the hoses in the proper order to ensure that the boom is lowered, not raised.
5. Use the auxiliary power supply to lower the boom.
6. Loosen and remove the jumper hoses and reconnect the lift/lower 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 fluid, etc., in, on, near and around the machine.
9. Install the previously removed rear cover.

3.12 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. 2. Extend/retract hydraulic system not operating properly. 3. Faulty extend/retract cylinder. 4. Electrical System not operating properly.	1. Locate break, replace hose(s) or tube(s), tighten connections. 2. Refer to Section 8.5, "Hydraulic Circuits". 3. Repair cylinder. Refer to Section 8.11.1, "General Cylinder Removal Instructions". 4. Refer to Section 9.5, "Electrical System Schematic".
2. 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 3.7, "Boom Wear Pads".
3. Excessive pivot pin noise and/or wear.	1. Insufficient lubrication. 2. Worn bearing(s).	1. Lubricate at regular intervals. Refer to Section 2.5, "Lubrication Schedule". Replace worn pins as needed. 2. Replace bearing(s) and lubricate at regular intervals Refer to Section 2.5, "Lubrication Schedule".
4. Excessive Compensation cylinder pivot pin noise and/or wear.	1. Insufficient lubrication. 2. Worn bushing(s).	1. Lubricate at regular intervals. Refer to Section 2.5, "Lubrication Schedule". Replace worn pins as needed. 2. Replace bushing(s) and lubricate at regular intervals.
5. Boom will not raise or lower.	1. Broken hydraulic hoses or tubes and/or connection leaks. 2. Lift/lower hydraulic system not operating properly. 3. Faulty lift/lower cylinder. 4. Seized boom pivot pin bushing. 5. Electrical System not operating properly.	1. Locate break, replace hose(s) or tube(s), tighten connections. 2. Refer to Section 8.5, "Hydraulic Circuits". 3. Repair cylinder. Refer to Section 8.11.1, "General Cylinder Removal Instructions". 4. Replace bushing. 5. Refer to Section 9.5, "Electrical System Schematic".

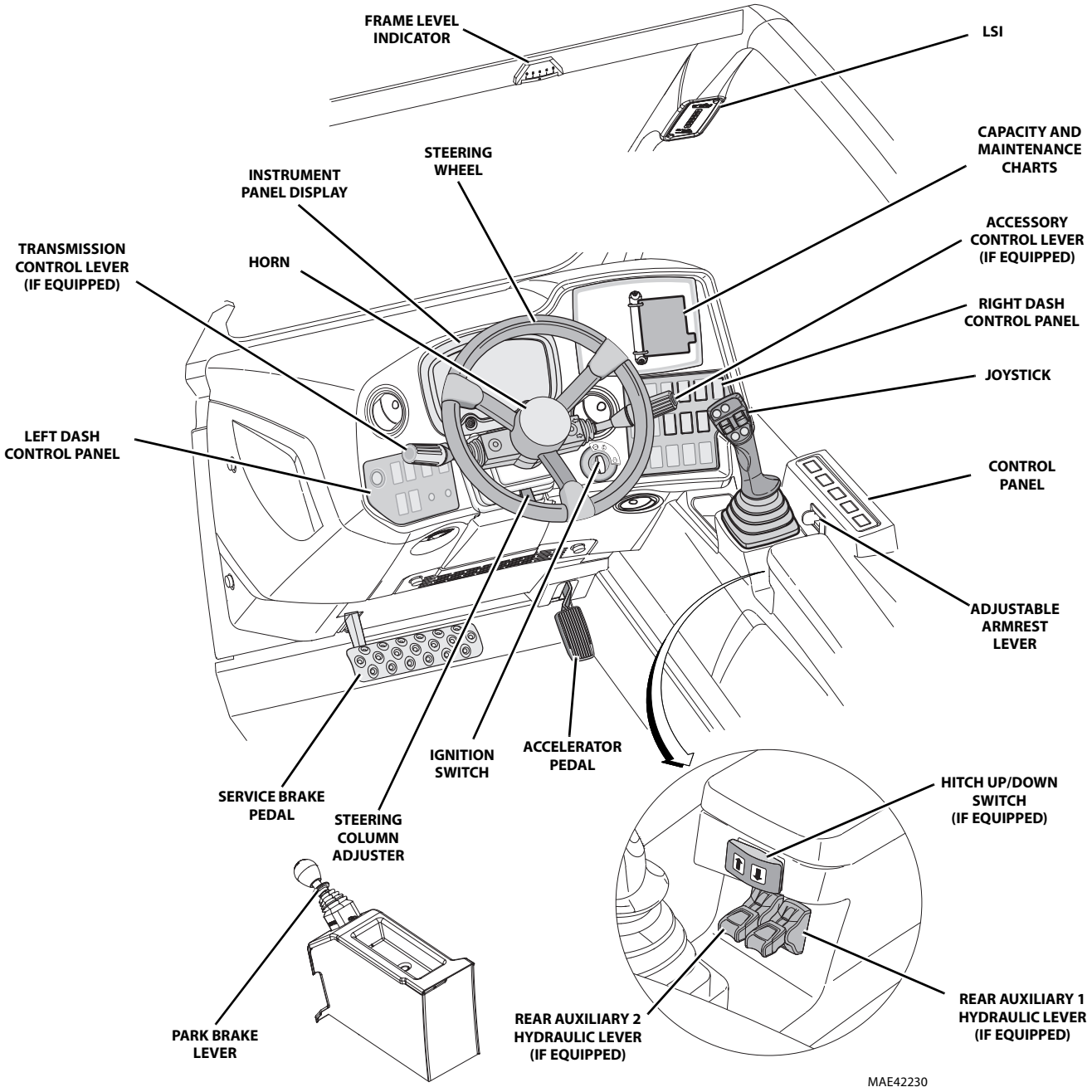
Problem	Possible Causes	Remedy
6. Excessive Lift/Lower cylinder pivot pin noise and/or wear.	1. Insufficient lubrication.	1. Lubricate at regular intervals. Refer to Section 2.4, "Service and Maintenance Schedules". Replace worn pins as needed. Refer to Section 8.11.1, "General Cylinder Removal Instructions".
	2. Worn self-aligning bushing(s).	2. Replace bushing(s) and lubricate at regular intervals. Refer to Section 2.5, "Lubrication Schedule".
7. Rapid boom pad wear.	1. Incorrect wear pad gap.	1. Check wear pad gaps and correct as needed. Refer to Section 3.7, "Boom Wear Pads".
	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.
8. Auxiliary hydraulics will not operate.	1. Auxiliary hydraulic system not operating properly.	1. Refer to Section 8.5, "Hydraulic Circuits".

Section 4
Cab
Contents

PARAGRAPH		TITLE	PAGE
4.1		**Operator Cab Component Terminology**	**4-2**
4.2		**Operator Cab**	**4-3**
	4.2.1	Operator Cab Safety	4-3
	4.2.2	Serial Number Plate	4-3
4.3		**Cab Components**	**4-3**
	4.3.1	Steering Wheel	4-3
	4.3.2	Steering Column/Orbital Valve	4-4
	4.3.3	Service Brake	4-5
	4.3.4	Electronic Throttle Pedal	4-6
	4.3.5	Joystick Assembly	4-7
	4.3.6	Window Wiper Assembly	4-7
	4.3.7	Heater System (If equipped)	4-7
	4.3.8	Heater/Air Conditioning System (If equipped)	4-9
4.4		**Cab Removal**	**4-11**
4.5		**Cab Installation**	**4-13**

4.1 OPERATOR CAB COMPONENT TERMINOLOGY

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



4.2 OPERATOR CAB

WARNING

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

4.2.1 Operator Cab Safety

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 of correct size, grade, and torqued to their specified value.

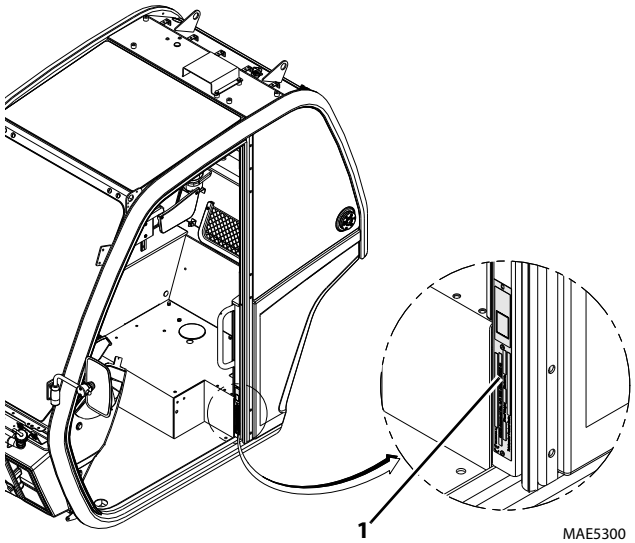
WARNING

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

Refer to the appropriate parts manual for ordering information.

4.2.2 Serial Number Plate

The cab serial number plate is located on the B post (**1**). 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.

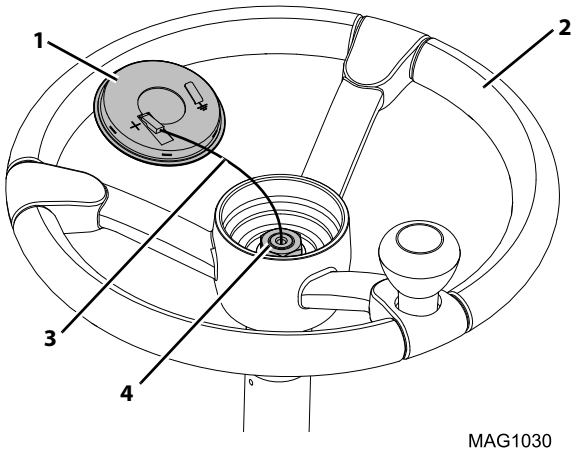


4.3 CAB COMPONENTS

4.3.1 Steering Wheel

a. Steering Wheel Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Carefully pry horn button (**1**) out of steering wheel (**2**).
6. Remove horn wire (**3**) from back of horn button.
7. Mark steering wheel and shaft to ensure proper installation. Remove nut (**4**) securing the steering wheel (**2**) to splined steering column shaft.
8. Use a steering wheel puller to remove steering wheel (**2**) from splined shaft.

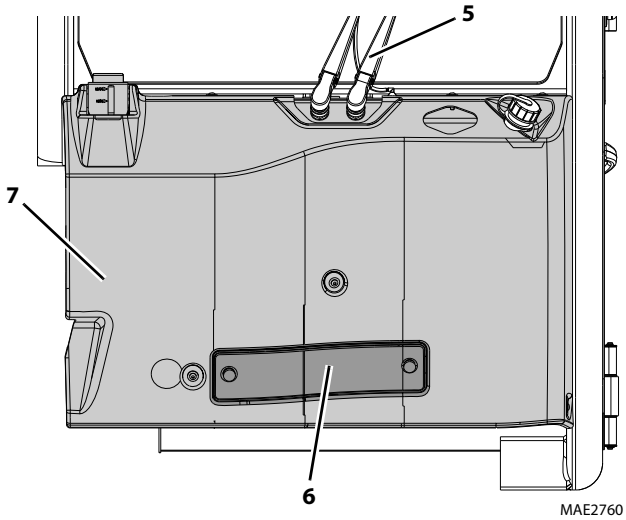
b. Steering Wheel Installation

1. Install steering wheel (**2**) onto splined steering column shaft.
2. Secure steering wheel with nut (**4**). Torque as required.
3. Connect the previously remove horn connectors (**3**).
4. Press the horn button (**1**) onto steering wheel.
5. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
6. Close and secure engine covers.
7. Remove Do Not Operate Tag from ignition key switch and steering wheel.

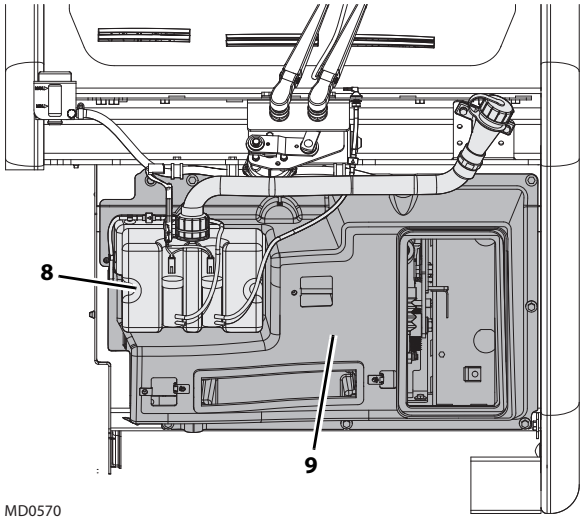
4.3.2 Steering Column/Orbital Valve

a. Steering Column and Orbital Valve Removal

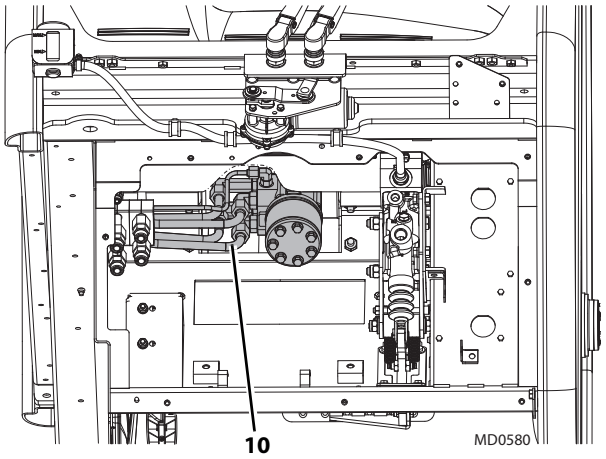
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Remove lower dash panel in cab.



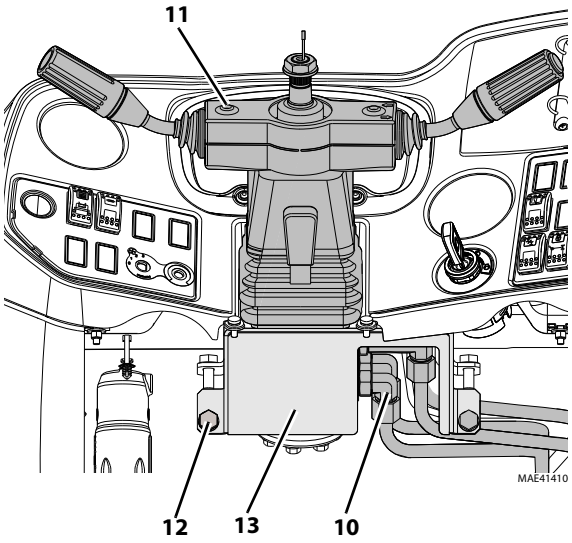
6. If equipped, remove the windshield wiper assembly (**5**).
7. Remove cab air filter cover (**6**).
8. Remove access covers (**7**) from front of cab.



9. If equipped, remove windshield washer assembly (**8**), heater cover and heater assembly (**9**). Refer to Section 4.3.7, "Heater System (If equipped)".
10. Slowly turn surge tank cap to first stop and allow any pressure to escape. Remove surge tank cap.
11. Place a suitable container beneath radiator drain.
12. Place a funnel at base of radiator to channel drained coolant into a container. Open drain plug and slowly remove to allow coolant to drain. Transfer coolant into a properly labeled container. Dispose of properly if coolant needs to be replaced. Replace surge tank cap. Close radiator drain plug.



13. Label, disconnect and cap hydraulic tubes (**10**) attached to orbital valve.
14. Remove steering wheel. Refer to Section 4.3.1, "Steering Wheel".



15. If equipped, disconnect and remove the transmission control lever (**11**), and if equipped accessory control lever. Disconnect control lever(s) harness from the main cab harness.
16. Label, disconnect and cap hydraulic tubes (**10**) attached to orbital valve.
17. Remove four bolts (**12**) securing orbital valve bracket (**13**) to cab.
18. Remove the steering column assembly through the dash panel opening.
19. Lift rubber cover and remove four bolts securing orbital valve to the bracket (**13**) and steering column.

***Note: DO NOT** disassemble orbital valve. The orbital valve is not serviceable and must be replaced fully, if defective.*

b. Steering Column and Orbital Valve Installation

1. Secure the steering column to bracket and valve with previously removed hardware. Torque as required.
2. Install orbital assembly to original orientation in cab. Secure with the previously removed four bolts (**12**). Torque as required.
3. Install transmission control lever and if equipped, install accessory control lever. Connect control lever(s) harness connector to main cab harness and install steering wheel assembly.
4. Uncap and connect previously labeled hydraulic hoses to orbital valve.
5. Install previously removed steering wheel. Refer to Section 4.3.1, “Steering Wheel”, for detailed installation instructions.
6. If equipped, install heater (**8**) and windshield washer assembly (**9**).
7. Open surge tank cap and fill the radiator completely with coolant. Replace and tighten surge tank cap. Refer to Section 2.3, “Fluid and Lubricant Capacities”, for proper capacities.
8. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
9. Start engine and check operation of steering system. Check for hydraulic fluid leaks. Check hydraulic fluid level in tank and add fluid as required.
10. Install access covers to front of cab.
11. Install lower dash panel in cab.
12. Close and secure engine cover.
13. Remove Do Not Operate Tag from ignition key switch and steering wheel.

c. Steering Test

Conduct a pressure check of the steering hydraulic circuits. Refer to Section 8.4.1, “Pressure Checks and Adjustments”.

4.3.3 Service Brake

a. Brake Valve Removal

Refer to Section 8.9.3, “Service Brake Valve”, for removal information.

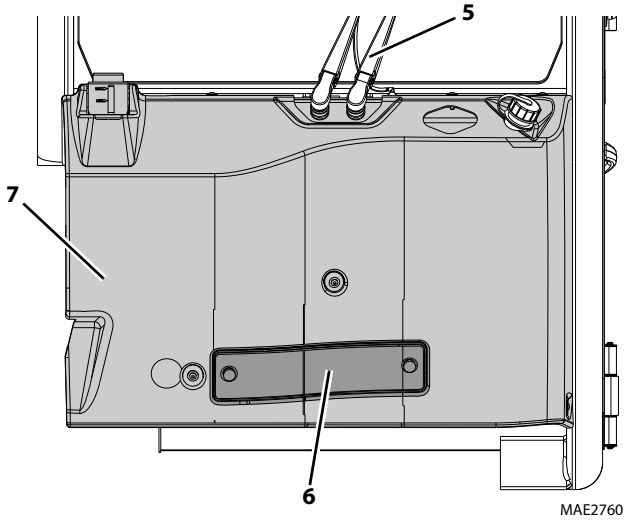
b. Brake Valve Installation

Refer to Section 8.9.3, “Service Brake Valve”, for installation information.

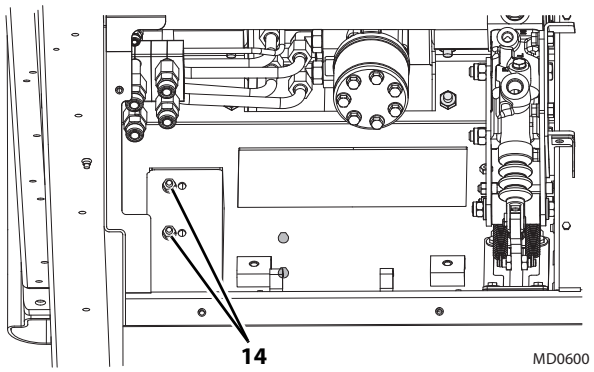
4.3.4 Electronic Throttle Pedal

a. Throttle Pedal Removal

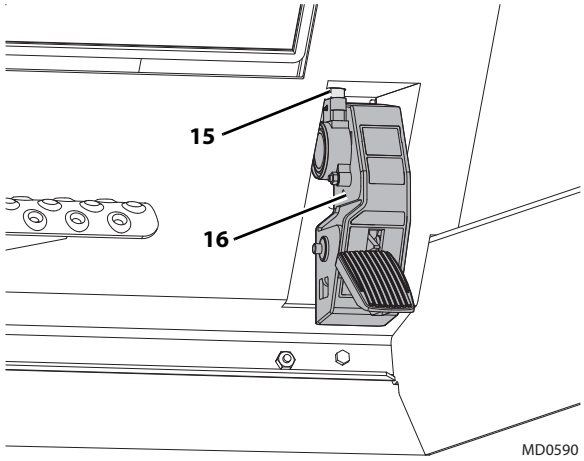
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.



5. If equipped, remove the windshield wiper assembly (**5**).
6. Remove cab air filter cover (**6**).
7. Remove access covers from front of cab (**7**).
8. If equipped, remove heater and windshield washer assembly.
9. Slowly turn surge tank cap to first stop and allow any pressure to escape. Remove surge tank cap.
10. Place a suitable container beneath radiator drain.
11. Place a funnel at base of radiator to channel drained coolant into a container. Open drain plug and slowly remove to allow coolant to drain. Transfer coolant into a properly labeled container. Dispose of properly if coolant needs replaced. Replace surge tank cap. Close radiator drain plug.



12. Remove hardware (**14**) securing pedal assembly.



13. Disconnect electrical connection (**15**) to pedal assembly (**16**).
14. Remove throttle pedal assembly from cab.

b. Throttle Pedal Installation

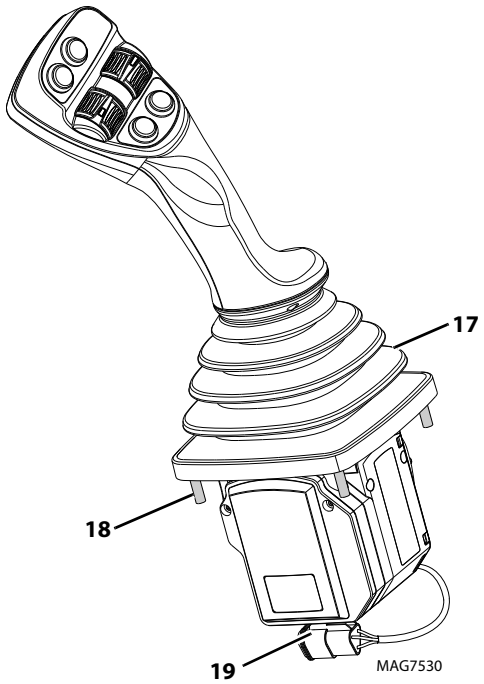
1. Position throttle pedal on its mounting location in cab.
2. Reconnect electrical connection to pedal assembly.
3. Secure throttle pedal into position with previously used hardware (**14**).
4. If equipped, install heater and windshield washer assembly.
5. Open surge tank cap and fill the radiator completely with coolant. Replace and tighten surge tank cap. Refer to Section 2.3, “Fluid and Lubricant Capacities”, for proper capacities.
6. Install protective covers.
7. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
8. Close and secure engine cover.

9. Remove Do Not Operate Tag from ignition key switch and the steering wheel.

4.3.5 Joystick Assembly

a. Joystick Assembly Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Raise rubber boot (**17**) from base of joystick.
6. Remove hardware (**18**) securing joystick assembly.
7. Lift joystick from its mounting position.
8. Label and disconnect electrical connector (**19**) attached to joystick.
9. Remove joystick assembly.

b. Joystick Assembly Installation

1. Connect previously labeled electrical connectors to joystick.
2. Secure joystick assembly to cab using previously removed hardware.
3. Seat rubber boot to joystick base.
4. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
5. Test joystick functions.
6. Close and secure engine cover.
7. Remove Do Not Operate Tag from ignition key switch and steering wheel.

4.3.6 Window Wiper Assembly

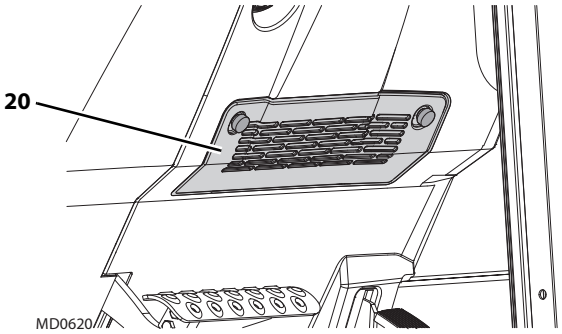
Refer to Section 9.10, "Window Wiper System (if equipped)", for removal and installation information.

4.3.7 Heater System (If equipped)

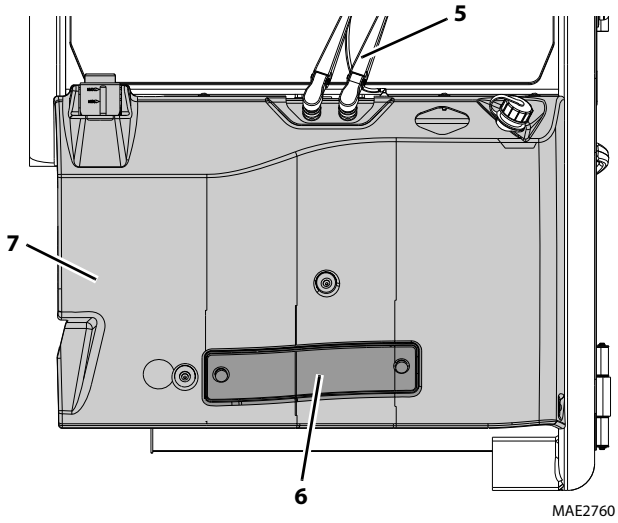
Note: *If machine is equipped with air conditioning,* ***DO NOT*** *loosen or disconnect any air conditioning hoses until the air conditioning system has been properly drained by the local distributor or certified air conditioning service center.*

a. Heater System Removal

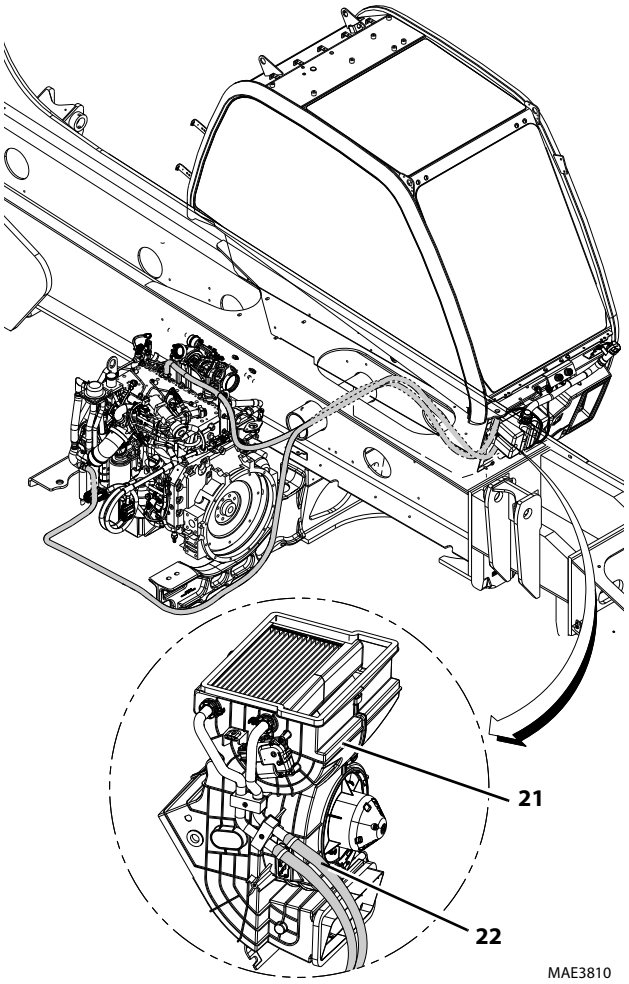
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Place a suitable container beneath radiator. Slowly turn surge tank cap and allow any pressure to escape. Remove surge tank cap.
6. Place a funnel at base of radiator to channel drained coolant into container. Remove drain plug and allow coolant to drain.
7. Transfer coolant to a container with a cover, and label as "Used Coolant". Dispose of used coolant at an approved recycling facility.
8. Tighten radiator drain plug.



9. Remove heater cover (**20**) inside cab.



10. If equipped, remove the windshield wiper assembly (**5**).
11. Remove access covers (**6** and **7**) from front of cab.



12. Label and disconnect heater (**21**) electrical connections.
13. Label and remove hoses (**22**) connected to heater.
14. Remove bolts securing heater assembly to cab. Remove heater assembly.

b. Heater System Installation

1. Position heater assembly to original orientation to cab. Secure with previously removed hardware.
2. Connect previously labeled electrical connections.
3. Connect previously labeled heater hoses to appropriate locations.
4. Fill cooling system completely with coolant, allowing time for the coolant to fill the engine block. The cooling system capacity is listed in Section 2.3, “Fluid and Lubricant Capacities”.

Note: *If machine is equipped with air conditioning, air conditioning system must be charged by local distributor or certified air conditioning service center.*

5. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
6. Start engine, run it briefly at low idle and check machine for any visual sign of fluid leakage.

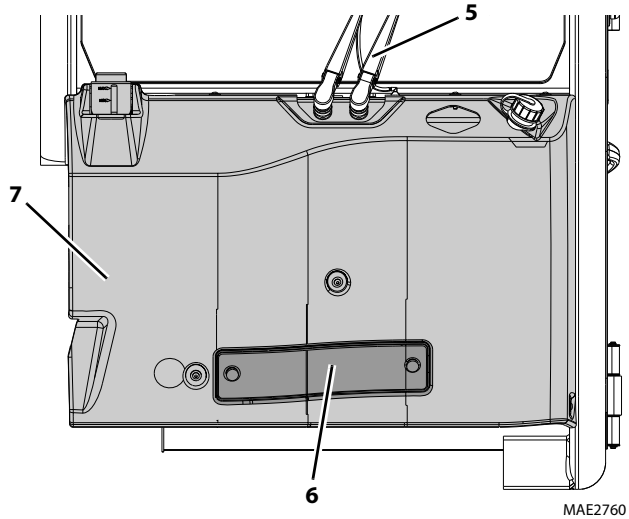
Note: *STOP engine immediately if any leakage is noted, and make any necessary repairs before continuing.*

7. Wait for engine to cool and check coolant level. Add coolant as required to bring coolant to proper level.
8. Install protective covers.
9. Install heater cover inside cab.
10. Close and secure the engine cover.
11. Remove Do Not Operate Tag from ignition key switch and steering wheel.

4.3.8 Heater/Air Conditioning System (If equipped)

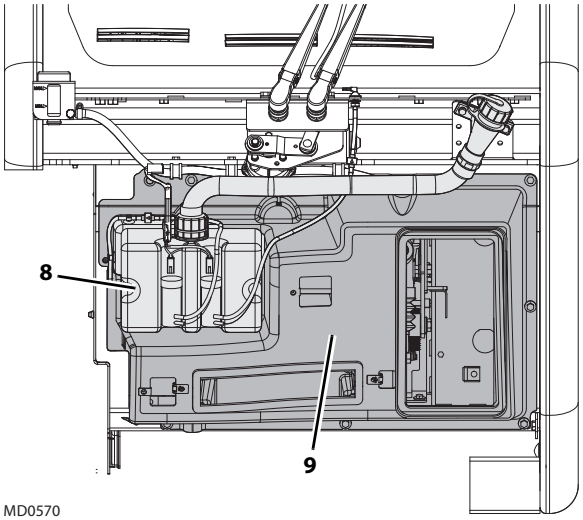
a. Heater/Air Conditioning System Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Tighten radiator drain plug.



MAE2760

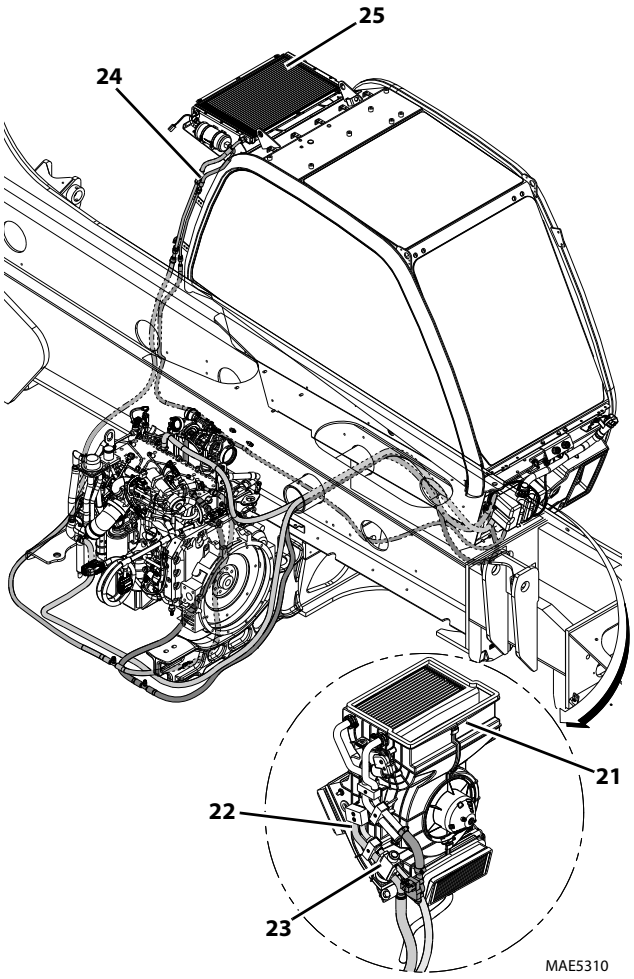
6. If equipped, remove windshield wiper assembly (**5**).
7. Remove access covers (**6** and **7**) from front of cab.



MD0570

8. If equipped, remove windshield washer assembly (**8**) and heater cover (**9**).
9. Place a suitable container beneath radiator. Slowly turn surge tank cap and allow any pressure to escape. Remove surge tank cap.
10. Place a funnel at base of radiator to channel drained coolant into container. Remove drain plug and allow coolant to drain.
11. Transfer coolant to a container with a cover, and label as "Used Coolant". Dispose of used coolant at an approved recycling facility.
12. Tighten radiator drain plug.
13. Drain the refrigerant from the air conditioning system.

Note: *The local JLG dealer or certified air conditioning service center or personnel to perform the refrigerant removal from the system. Refer to Section 2.3, "Fluid and Lubricant Capacities", for refrigerant type and capacity*.



TYPICAL ILLUSTRATION

14. Label and disconnect hoses (**24**) attached to the condenser assembly (**25**).
15. Label and disconnect all electrical connections attached to the condenser assembly.
16. Remove bolts securing the condenser assembly (**25**) to cab roof. Remove condenser assembly from rear of the cab roof.
17. Label and disconnect all electrical connections attached to the heater and air conditioning assembly (**21**).
18. Label and remove hoses (**22**) connected to the heater and air conditioning assembly (**21**).
19. Label and disconnect air conditioning hoses (**23**) attached to heater assembly.
20. Remove bolts securing heater assembly to cab. Remove heater assembly.

b. Heater/Air Conditioning System Installation

1. Install cab condenser assembly (**25**) to cab roof. Secure with previously removed hardware.
2. Connect previously labeled electrical connections to the condenser assembly (**25**).
3. Connect previously labeled hoses (**24**) to condenser assembly (**25**).
4. Position heater and air conditioning assembly (**21**) to original orientation to cab. Secure with previously removed hardware.
5. Connect previously labeled electrical connections to heater and air conditioning assembly.
6. Connect previously labeled heater and air conditioning hoses (**23**) to appropriate locations.
7. Connect previously labeled hoses (**22**) to appropriate locations.
8. Fill cooling system completely with coolant, allowing time for the coolant to fill the engine block. The cooling system capacity is listed in Section 2.3, “Fluid and Lubricant Capacities”.
9. Fill air conditioning system completely with refrigerant. Refer Section 2.3, “Fluid and Lubricant Capacities”, for refrigerant type and capacity.

Note: *If machine is equipped with air conditioning, air conditioning system must be charged by local distributor or certified air conditioning service center.*

10. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
11. Start engine, run it briefly at low idle and check machine for any visual sign of fluid leakage.

Note: *STOP engine immediately if any leakage is noted, and make any necessary repairs before continuing.*

12. Wait for engine to cool and check coolant level. Add coolant as required to bring coolant to proper level.
13. Install protective covers.
14. If equipped, install windshield wiper assembly (**5**).
15. Close and secure the engine cover.
16. Remove Do Not Operate Tag from ignition key switch and steering wheel.

4.4 CAB REMOVAL

WARNING

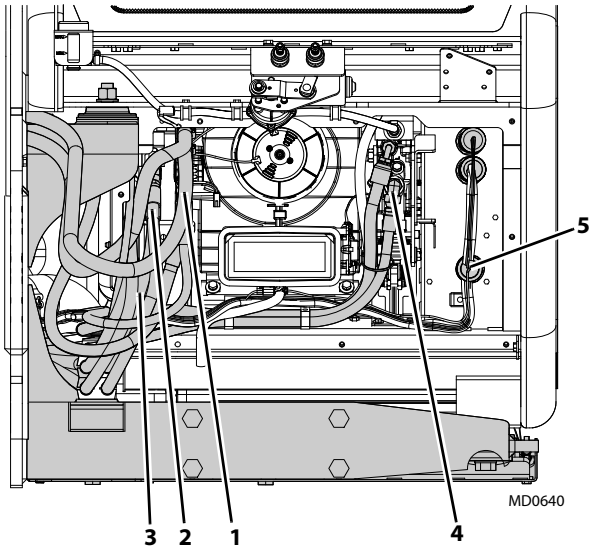
The protection offered by this ROPS/FOPS will be impaired if subjected to any modification or structural damage, at which time replacement is necessary. ROPS/FOPS must be properly installed using fasteners of correct size and grade, and torqued to their specified value.

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

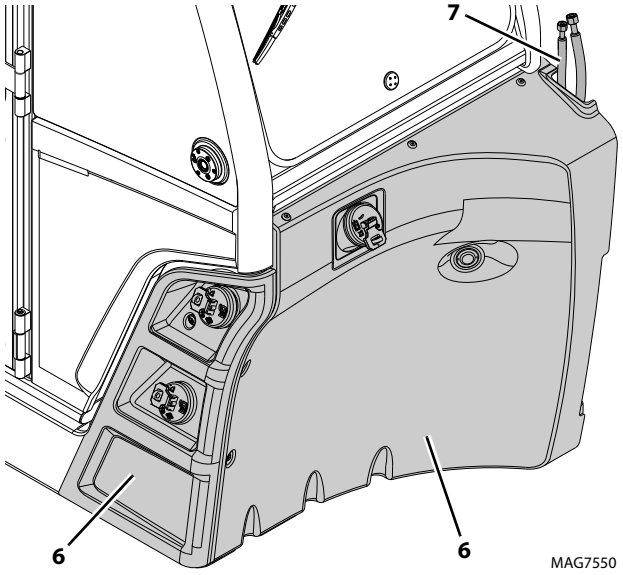
Inspect cab, its welds and mounts. If modification, damage, a cracked weld and/or fatigued metal is discovered, replace cab. Contact local *JLG* dealer with any questions about suitability or condition of a cab.

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

1. Park machine on a firm, level surface. Allow sufficient overhead and side clearance for cab removal. Level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL position, engage park brake and shut engine OFF.
2. Block all four wheels to help prevent machine from moving. Assure that there is sufficient overhead and side clearance for cab removal.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Place a funnel at base of cooling system to channel drained coolant into suitable container. Remove drain plug and allow coolant to drain.
6. Transfer coolant to a container with a cover, and label as "Used Antifreeze". Dispose of used coolant at an approved recycling facility.
7. Replace and tighten drain plug.

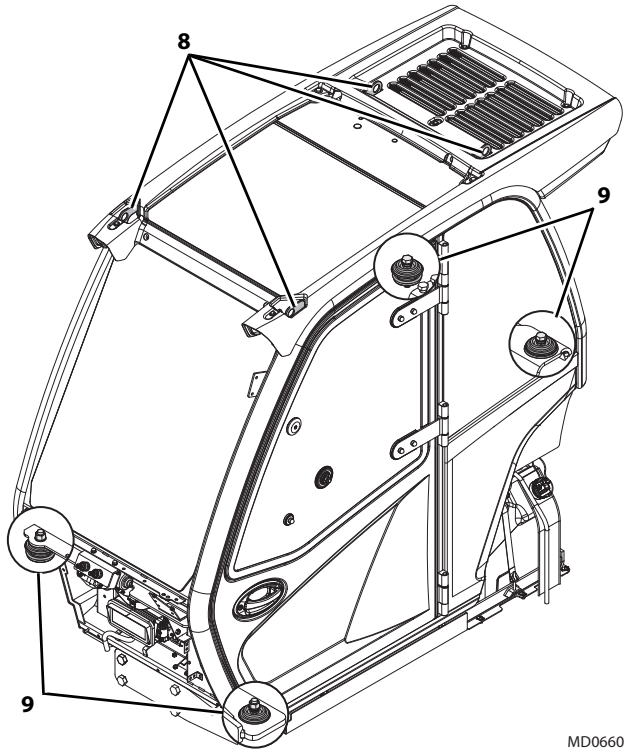


8. Label and disconnect cab heater hoses (**1**). Refer to Section 4.3.7, "Heater System (If equipped)".
9. Label and disconnect cab AC hoses (**2**). Refer to Section 4.3.7, "Heater System (If equipped)".
10. Label, disconnect and cap all hydraulic hoses attached to the steering orbital valve (**3**). Cap all fittings and openings to keep dirt and debris from entering hydraulic system.
11. Label, disconnect and cap all hydraulic hoses attached to the brake assembly (**4**). Cap all fittings and openings to keep dirt and debris from entering hydraulic system.
12. Label and disconnect all electrical connections (**5**) attached to the cab.



TYPICAL ILLUSTRATION

13. Remove rear cab covers (**6**) and secure hardware.
14. If equipped, label and disconnect the air conditioning connections (**7**). Move the hoses clear of the cab to prevent damage during cab removal.



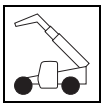
15. Install four lifting eye bolts with a minimum lifting capacity of 1200 lb (545 kg) in the existing lifting holes at top corners of the cab (**8**).
16. Use a hoist or overhead crane and sling with a minimum lifting capacity of 1200 lb (545 kg) attached to the four eye bolts. **DO NOT** attempt to lift the cab at this point.
17. Remove four nuts, bolts and washers (**9**) securing cab to frame.
18. Remove mirrors and all other cab components as needed, if not previously removed.
19. When all wiring, hydraulic hoses and fasteners are disconnected or removed, carefully and slowly lift cab and remove it from frame. Readjust position of sling as needed to help balance cab during removal.
20. When cab is completely clear of machine, carefully lower it to ground. Block up or support cab so it does not move or fall.
21. Assure that no personnel enter cab while it is being removed from machine.
22. Inspect and replace machine parts that are exposed with cab removed. Repair or replace as required.

4.5 CAB INSTALLATION

1. Block all four wheels to help prevent machine from moving. Assure that there is sufficient overhead and side clearance for cab installation.
2. Attach a sling with a minimum lifting capacity of 1200 lb (545 kg) through lifting eyes of cab.
3. Use a hoist or overhead crane and sling attached to cab. Carefully begin to align cab with mounting holes in frame. Stop and check that wiring, hydraulic hoses, cables, etc., will not be pinched or damaged as cab is positioned. Re-adjust position of sling as needed to help balance cab during installation.
4. Install four cab to frame mount washers, bolts and nuts to 199 - 258 lb-ft (270 - 350 Nm).
5. Connect previously labeled cab harness connectors to their appropriate locations.
6. Uncap and reconnect previously labeled hydraulic hoses to their appropriate locations.
7. Reconnect any remaining electrical connections to their appropriate locations.
8. Reconnect heater hoses to cab heater. Refer to Section 4.3.7, “Heater System (If equipped)”.
9. Fill cooling system completely with coolant, allowing time for coolant to fill engine block. Cooling system capacity is listed in Section 2.3, “Fluid and Lubricant Capacities”.
10. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
11. Carefully examine all cab components, fasteners, etc., before engine start-up. Rectify any faulty conditions.
12. Start engine and check operation of all controls. Check for hydraulic fluid leaks. Check hydraulic fluid level in tank and add fluid as required.

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

13. Wait for engine to cool and check coolant level. Add coolant as required to bring coolant to proper level.
14. Install protective covers to front of cab.
15. Install the mirrors and all other cab components as needed, if removed.
16. Install protective cover to rear of cab.
17. Unblock wheels.
18. Close and secure engine cover.
19. Remove Do Not Operate Tag from ignition key switch and steering wheel.

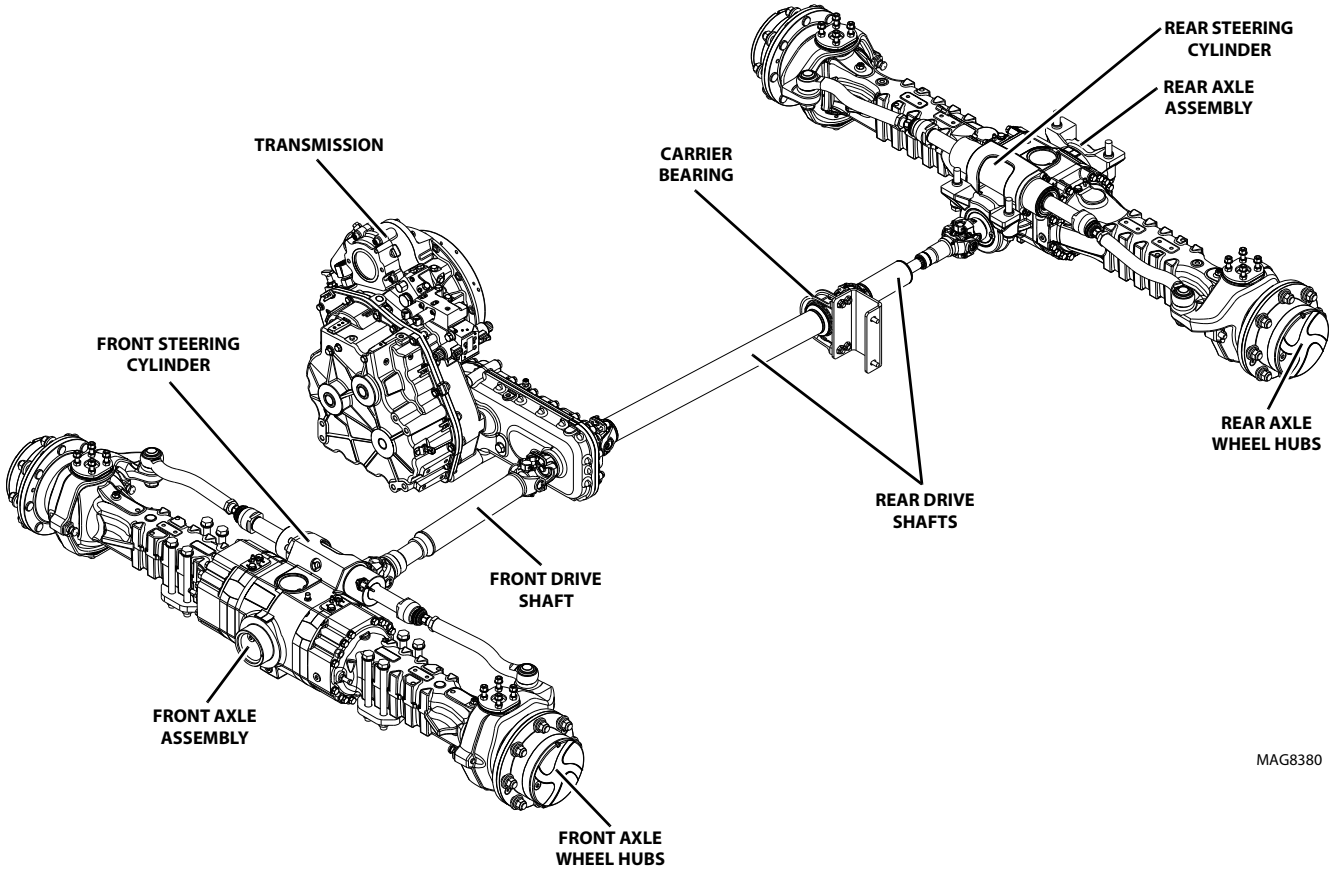


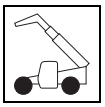
Section 5
Axles, Drive Shafts, Wheels and Tires
Contents

PARAGRAPH		TITLE	PAGE
5.1		**Axle, Drive Shaft and Wheel Component Terminology**	**5-2**
5.2		**Axle Serial Number**	**5-3**
5.3		**Axle Specifications and Maintenance Information**	**5-3**
5.4		**Axle Replacement**	**5-3**
	5.4.1	Axle Removal	5-3
	5.4.2	Axle Installation	5-5
5.5		**Brake Inspection**	**5-6**
5.6		**Steering Angle Adjustment**	**5-6**
5.7		**Axle Assembly and Drive Shaft Troubleshooting**	**5-7**
5.8		**Drive Shafts**	**5-10**
	5.8.1	Drive Shaft Inspection	5-10
	5.8.2	Drive Shaft Maintenance	5-10
	5.8.3	Drive Shaft	5-10
	5.8.4	Drive Shaft Cleaning and Drying	5-11
5.9		**Wheels and Tires**	**5-11**
	5.9.1	Removing Wheel and Tire Assembly from Machine	5-11
	5.9.2	Installing Wheel and Tire Assembly onto Machine	5-12
5.10		**Towing a Disabled Machine**	**5-12**
	5.10.1	Manually Releasing the Park Brake	5-12
	5.10.2	Manually Resetting the Park Brake	5-13

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.





WARNING

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

5.2 AXLE SERIAL NUMBER

Front and rear axle serial number plate is located on top 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 the axle assembly or the axle components.

5.3 AXLE SPECIFICATIONS AND MAINTENANCE INFORMATION

For axle, oil specifications and maintenance information, refer to Section 2.3, "Fluid and Lubricant Capacities".

Detailed axle service instructions are provided in the following publications:

Model	Publication Type	Publication #
832	Service Manual	31200162
	Parts Manual	31211473
925	Service Manual	31200162
	Parts Manual	31211474

5.4 AXLE REPLACEMENT

5.4.1 Axle Removal

WARNING

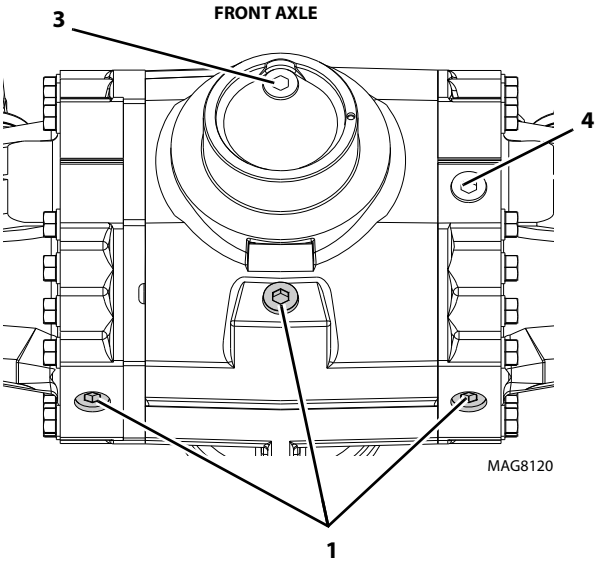
An improperly supported machine can fall. Safely raise and adequately support the machine so that it will remain stable and in place before attempting to remove an axle.

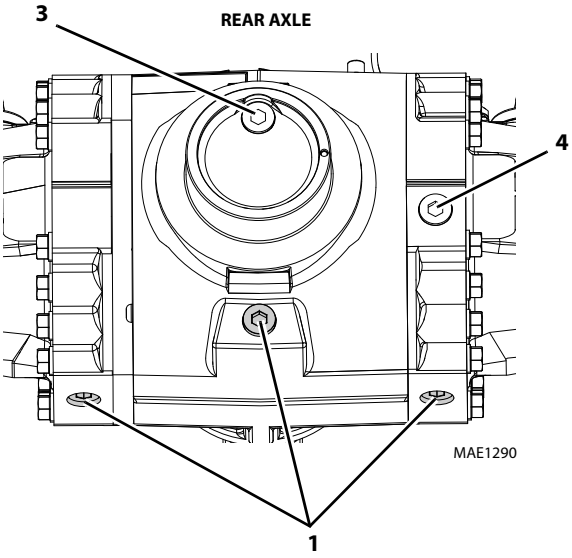
The front and rear axle assemblies differ, in that front axle assembly is equipped with a parking brake mechanism and a limited slip feature; rear axle has neither. The following steps outline a typical axle removal procedure, suitable for either front or rear axle assembly.

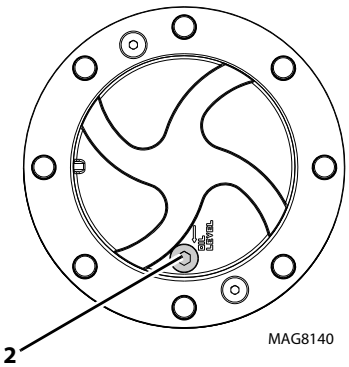
Cleanliness is extremely important. Before attempting to remove the axle, thoroughly clean the machine. Avoid spraying water or cleaning solution on electrical components. If using a steam cleaner, seal all openings before steam cleaning.

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

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Remove bolts securing fender assembly to axle.







6. Rotate axle hub until drain plug (**2**) is positioned at the bottom of the hub.
7. Loosen and remove the axle oil fill plug (**3**) and check fill plug (**4**).
8. If axle will be disassembled after removal, place a suitable receptacle under axle and wheel hub drain plugs (**1** and **2**). Remove drain plugs and allow oil to drain into receptacle. Transfer used oil into a suitable covered container, and label container as "Used Oil". Dispose of used oil at an approved recycling facility.
9. Install previously removed drain plugs (**1** and **2**).
10. Label and disconnect the electrical connections.
11. Label, disconnect and cap steering and brake lines at axle. Wipe up any spilled oil.
12. Block front and rear of both tires on axle that is not being removed. Ensure that machine will remain in place during axle removal before proceeding.
13. Raise machine using a suitable jack or hoist. Place suitable supports under both sides of frame and lower machine onto supports. Ensure that machine will remain in place during axle removal.
14. Support axle that is being removed with a suitable jack, hoist or overhead crane and sling. **DO NOT** raise axle or machine.
15. Remove both the wheel and the tire assemblies from the axle that is being removed. Refer to Section 5.9.1, "Removing Wheel and Tire Assembly from Machine".

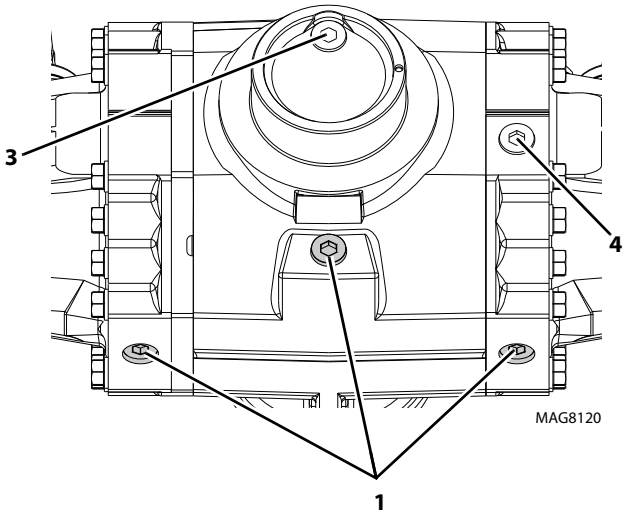
Note: *The wheel and tire assemblies must be re-installed later with the directional tread pattern "arrows" facing in the direction of forward travel.*

16. Remove the drive shaft assembly. Refer to Section 5.8, "Drive Shafts".
17. On front axle, remove capscrew and locknuts securing lower position cylinder-mount pin to the front cylinder. Tap the cylinder mount pin out, and move the cylinder to prevent it from interfering with axle removal.
18. Remove bolts and locknuts securing axle to frame.
19. Remove axles from machine using jack, hoist or overhead crane and sling supporting axle. **DO NOT** raise or otherwise disturb machine while removing axle. Balance axle and prevent it from tipping, turning or falling while removing it from beneath machine. Place the axle on a suitable support or holding stand.

5.4.2 Axle Installation

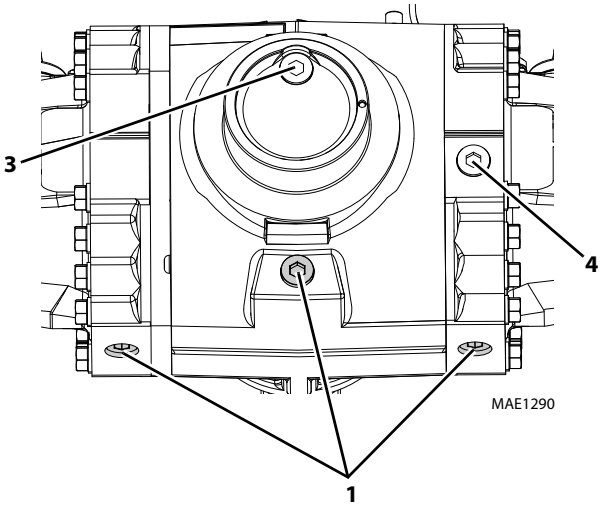
1. If applicable, raise machine using a suitable jack or hoist. Place suitable supports beneath the frame and lower the machine onto the supports, allowing enough room for axle installation.
2. Before proceeding, ensure machine will remain in place during axle installation.
3. Using a suitable jack, hoist or overhead crane and sling, remove axle from its support or holding stand. Balance axle and prevent it from tipping, turning or falling while positioning it beneath machine. **DO NOT** raise or otherwise disturb machine while installing the axle.
4. Keep axle supported and balanced on the jack, hoist or overhead crane and sling throughout the installation procedure.
5. Position axle under frame, and align axle housings with holes in frame.
6. Refer to Section 2.2, "Specifications", for all thread locking requirements.
7. Install axle mounting bolts and nuts. Tighten and torque as required.
8. Install the drive shaft assemblies. Refer to Section 5.8.3.b, "Installation".
9. If reinstalling an axle previously removed from machine, position drive shaft yoke on axle according to alignment marks made earlier.
10. If installing a new axle, note position of drive shaft yoke at transmission. Align drive shaft yoke on axle in same plane as yoke on transmission.
11. Connect the steering and brake lines at axle. Bleed both the brake and steering systems.

FRONT AXLE

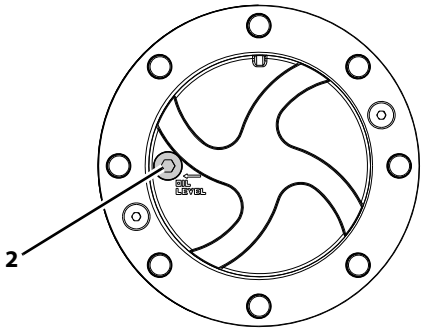


MAG8120

REAR AXLE



MAE1290



MAE1400

12. Tighten axle oil drain plugs (**1**). Fill until oil level reaches bottom of check fill plug. Refer to Section 2.3, "Fluid and Lubricant Capacities", for proper oil and capacities.

13. Rotate wheel hubs 90 degrees so wheel hub drain plug becomes the fill plug (**2**). Refer to Section 2.3, "Fluid and Lubricant Capacities", for proper oil and capacities.
14. Install and tighten the axle oil fill plug (**3**) and check fill plug (**4**).
15. Install the wheel and tire assemblies. Refer to Section 5.9.2, "Installing Wheel and Tire Assembly onto Machine".
16. Carefully remove jack, hoist or overhead crane and sling supporting axle.
17. Carefully raise machine using a suitable jack or hoist. Remove supports from beneath frame and lower machine to ground.
18. Remove blocks from front and rear of both tires on other axle.

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

19. Install new o-rings into fittings. Lubricate o-rings with clean hydraulic oil.
20. Uncap and connect steering and brake lines at their axle fittings.
21. Start engine. Turn steering wheel several times lock to lock, operate frame tilt function several times in both directions and check function of brakes. Check for hydraulic leaks, and tighten or repair as necessary.
22. Check hydraulic reservoir oil level.
23. Install fender assembly. Torque as required.
24. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
25. Close and secure engine cover.
26. Remove Do Not Operate Tag from ignition key switch and steering wheel.

Note: *Service brake circuit will need to bled after axle installation. Refer to Section 8.9.4, "Service Brake Bleeding", for detailed instructions.*

5.5 BRAKE INSPECTION

Detailed axle service instructions are provided in the Axle Service Manual, refer to Section 5.3, "Axle Specifications and Maintenance Information".

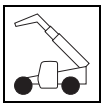
5.6 STEERING ANGLE ADJUSTMENT

Detailed axle service instructions are provided in the Axle Service Manual, refer to Section 5.3, "Axle Specifications and Maintenance Information". Refer to Section 2.2.7, "Steering Angle Specification", for steering angle information.

5.7 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 2.3, "Fluid and Lubricant 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 2.3, "Fluid and Lubricant 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 2.3, "Fluid and Lubricant 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 assembly(ies) 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(s) damaged/ unbalanced.	3. Replace drive shaft(s) as needed.

Problem	Possible Causes	Remedy
4. Oil leaking from axle (differential housing and/or axle housings).	1. Drain and/or inspection plugs loose and/or o-rings damaged or missing.	1. Replace o-rings as needed and tighten plugs to 96 lb-ft (130 Nm).
	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 manufacturer Service Manual.
	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. Refer torque value described in the manufacturer Service Manual.
	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. Refer torque value described in the manufacturer Service Manual.
	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. Refer torque value described in the manufacturer Service Manual.
	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.



Problem	Possible Causes	Remedy
7. Axle overheating.	1. Oil level too high.	1. Fill oil to correct level. Refer to Section 2.3, "Fluid and Lubricant Capacities".
	2. Axle and/or wheel end housings filled with incorrect oil or oil contaminated or oil level low.	2. Drain axle and fill to correct level. Refer to Section 2.3, "Fluid and Lubricant Capacities".
	3. Dragging park brake.	3. Adjust park brake cable as needed. Refer to Section Note:, "Service brake circuit will need to bled after axle installation. Refer to Section 8.9.4, "Service Brake Bleeding", for detailed instructions."
8. High steering effort required.	1. Steering (hydraulic) system not operating properly.	1. Refer to Section 8.5, "Hydraulic Circuits".
	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 Section 8.5, "Hydraulic Circuits".
	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 Section 5.5, "Brake Inspection".
	2. Brake discs damaged.	2. Replace brake discs.
11. Brakes will not engage.	1. Brake (hydraulic) system not operating properly.	1. Refer to Section 8.5, "Hydraulic Circuits".
	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 Section 5.5, "Brake Inspection".
	2. Brake (hydraulic) system not operating properly.	2. Refer to Section 8.9.4, "Service Brake Bleeding".
	3. Brake piston o-rings and seals damaged (leaking).	3. Replace o-rings and seals.

5.8 DRIVE SHAFTS

5.8.1 Drive Shaft Inspection

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

Note: *To ensure optimum performance, the drive shaft assemblies are specially balanced as a unit at the factory. When servicing any flange yoke, slip yoke or drive shaft tube, order a complete assembly if components are bent or damaged. Refer to the appropriate parts manual for ordering information.*

Note: *Any bolt removed from the drive shaft assembly MUST be replaced. Do Not re-torque.*

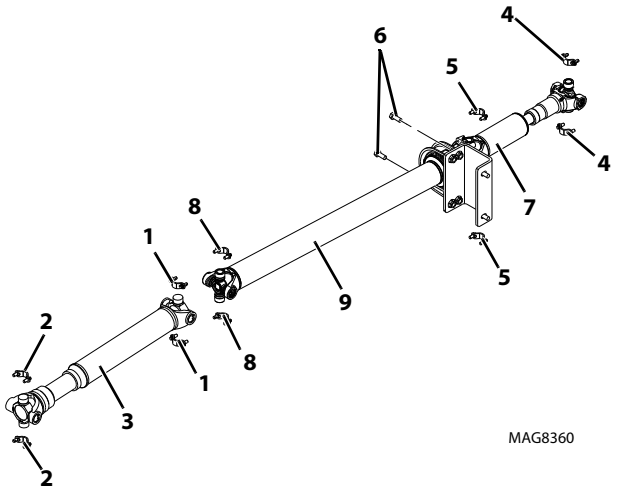
5.8.2 Drive Shaft Maintenance

Refer to Section 2.3, "Fluid and Lubricant Capacities", for information regarding the lubrication of the grease fittings on the drive shafts.

5.8.3 Drive Shaft

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel.
3. Open engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Block the wheels.
6. The drive shaft assembly is a balanced assembly. Mark yoke and axle, transmission and shaft and slip yoke so that these components can be returned to their original positions when reinstalled. Yokes at both ends of drive shaft must be in same plane to help prevent excessive vibration shaft must be in same plane to help prevent excessive vibration.



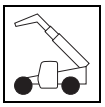
7. Remove four bolts and two straps (**1**) securing bearing cross to the transmission output shaft flange. Discard bolts.
8. Remove four bolts and two straps (**2**) securing bearing crosses to the axle. Discard bolts.
9. Remove front drive shaft assembly (**3**).
10. Remove four bolts and two straps (**4**) securing bearing cross to rear axle. Discard bolts.
11. Remove four bolts and two straps (**5**) securing bearing crosses to rear axle (**7**) at carrier bearing. Discard bolts.
12. Remove two bolts, nuts and washers (**6**) securing carrier bearing to frame.
13. Remove rear drive shaft assembly (**7**).
14. Remove four bolts and two straps (**8**) securing bearing cross to transmission output shaft flange. Discard bolts.
15. Remove rear drive shaft assembly (**9**).

b. Installation

1. Raise drive shaft assembly into position. Slip-yoke end of drive shaft mounts toward axle. If reinstalling a drive shaft previously removed, align flange yokes according to alignment marks made during removal.

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

2. Refer to Section 2.2, "Specifications", for all thread locking requirements.
3. Install two straps and four new bolts (**1**) securing bearing crosses to transmission. Torque bolts to 29 - 37 lb-ft (40 - 50 Nm).



4. Install two straps and four new bolts (**2**) securing bearing crosses to axle. Torque bolts to 29 - 37 lb-ft (40 - 50 Nm).
5. Install front drive shaft assembly (**3**).
6. Install two straps and four new bolts (**4**) securing bearing crosses to axle. Torque bolts to 29 - 37 lb-ft (40 - 50 Nm).
7. Install previously removed bolts, nuts and washers (**6**) and secure the carrier bearing to frame. Torque to 64 lb-ft (88 Nm).
8. Install rear drive shaft assembly (**7**).
9. Install two straps and four new bolts (**5**) securing bearing crosses to the transmission. Torque bolts to 29 - 37 lb-ft (40 - 50 Nm).
10. Install two straps and four new bolts (**8**) securing the rear axle (**9**) bearing crosses to the rear axle (**7**) at the carrier bearing. Torque bolts to 29 - 37 lb-ft (40 - 50 Nm).
11. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
12. Close and secure the engine cover.
13. Unblock the wheels.
14. Remove Do Not Operate Tags from both ignition key switch and steering wheel.

5.8.4 Drive Shaft Cleaning and Drying

1. Disassemble and clean all parts using an approved cleaning fluid. Allow to dry.
2. Remove and burrs or rough spots from all machined surfaces. Re-clean and dry as required.

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

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.

Foam filled tires have a positive effect on the weight, stability and handling characteristics of the machine, especially under load. The use of hydrofill as a tire-fill substance is not recommended because of possible environmental impact.

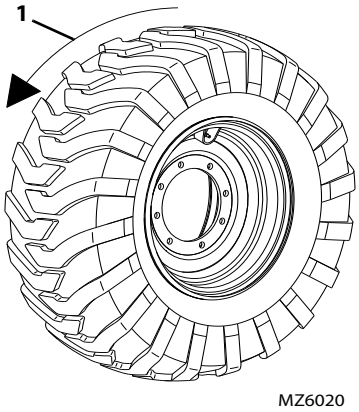
Large-bore valve stems are used to help expedite tire inflation and deflation. An inner tube may be used if a tire does not provide an airtight seal. Check tire inflation pressures when the tires are cold. When mounting a tire on the wheel, the tire must be mounted on the wheel respective of the directional tread pattern of the tire; this produces a left or right tire and wheel assembly.

5.9.1 Removing Wheel and Tire Assembly from Machine

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Loosen but **DO NOT** remove the lug nuts on the wheel and tire assembly to be removed.

4. Place a suitable jack under axle pad closest to wheel being removed. Raise machine and position a suitable support beneath axle. Allow sufficient room to lower machine onto support and to remove wheel and tire assembly.
5. Lower machine onto support.
6. Remove lug nuts and washers in alternating pattern.
7. Remove wheel and tire assembly from machine.

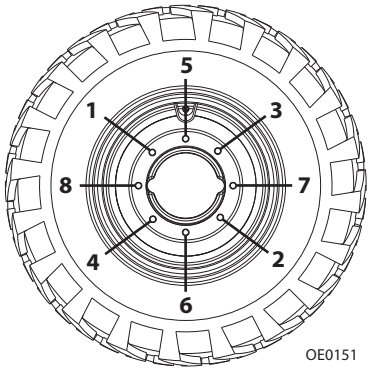
5.9.2 Installing Wheel and Tire Assembly onto Machine



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

Note: *Verify valve stems face outward on all wheel and tire assemblies.*

1. Position wheel onto studs on wheel end of axle.
2. Install wheel washers onto studs.
3. Start all lug nuts by hand to prevent cross threading. Apply one drop of lubrication oil.



4. Tighten lug nuts in an alternating pattern as indicated in previous figure. Torque to 350 - 400 lb-ft (477 - 542 Nm).
5. Remove machine from supports.
6. Remove Do Not Operate Tag from ignition key switch and steering wheel.

5.10 TOWING A DISABLED MACHINE

5.10.1 Manually Releasing the Park Brake

1. Remove load from machine.
2. Fully retract the boom. Position attachment approximately 24 in (610 mm) above the ground.

Note: *If total loss of power has occurred, refer to Section 3.10, "Boom Prop (If Equipped)"* .

WARNING

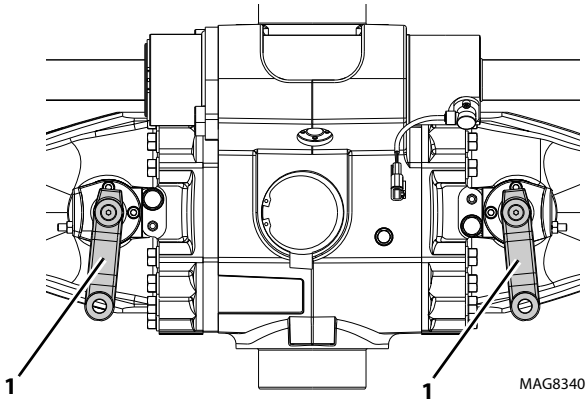
DO NOT attempt to tow a machine that is loaded or the boom/attachment is raised more than approximately 24 in (610 mm).

3. Place transmission in (N) NEUTRAL, engage park brake and shut the engine OFF.
4. Block all four wheels.

WARNING

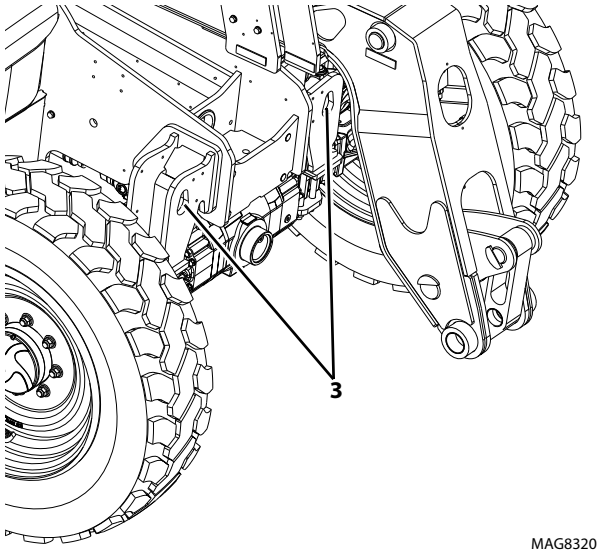
Block all four wheels when preparing the machine for towing to prevent any unexpected movement.

5. Remove front and rear drive shafts. Refer to Section 5.8, "Drive Shafts".



6. Pull the levers (**1**) for the manual release of the braking units. Actuation distance of the levers are approximately 1.26 in (32 mm).
7. Repeat the above step for other side of differential.

Note: *After machine has been towed to a secure location, reactivate parking brake. Carefully follow procedures from start to finish. Contact local JLG dealer if you are unsure about any part of the procedure, or for specific instructions concerning your particular situation.*



8. Secure machine to a suitable towing vehicle.
   a. For towing or retrieval from front of machine, attach towing equipment to lifting points (**3**) on each side of the frame.
   b. For towing or retrieval from rear of machine, attach towing equipment to the retrieval hitch.

⚠ WARNING

Use a vehicle of sufficient capacity to tow the machine. Tow vehicle must be capable of providing braking for both vehicle and machine.

9. Clear area of any unnecessary personnel.
10. Have an operator seated in machine operator cab.
11. Remove blocks from all four wheels.
12. Disengage machine park brake.
13. Tow machine to a secure location.

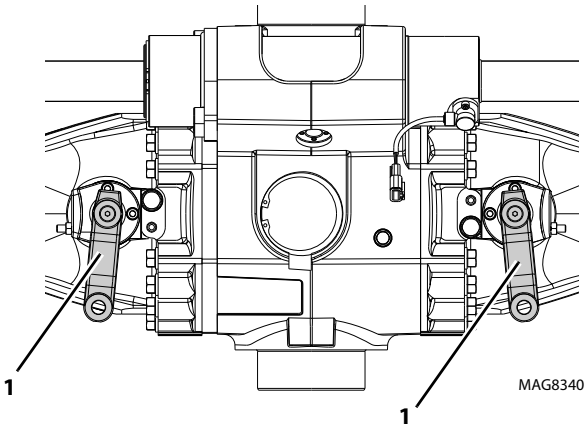
Note: *Tow machine at a very slow speed.*

14. After towing is complete, engage park brake.
15. Block all four wheels.
16. Reinstall front and rear drive shafts. Refer to Section 5.8, "Drive Shafts".
17. Repair machine as necessary.

Note: *Block the wheels of the machine BEFORE attempting to release the park brake. Once the park brake is released the machine's park brake AND service brakes are inoperable.*

5.10.2 Manually Resetting the Park Brake

Note: *Block the wheels of the machine BEFORE attempting to reset the machine's park brake. Once the park brake is released the machine's park brake AND service brakes are inoperable.*



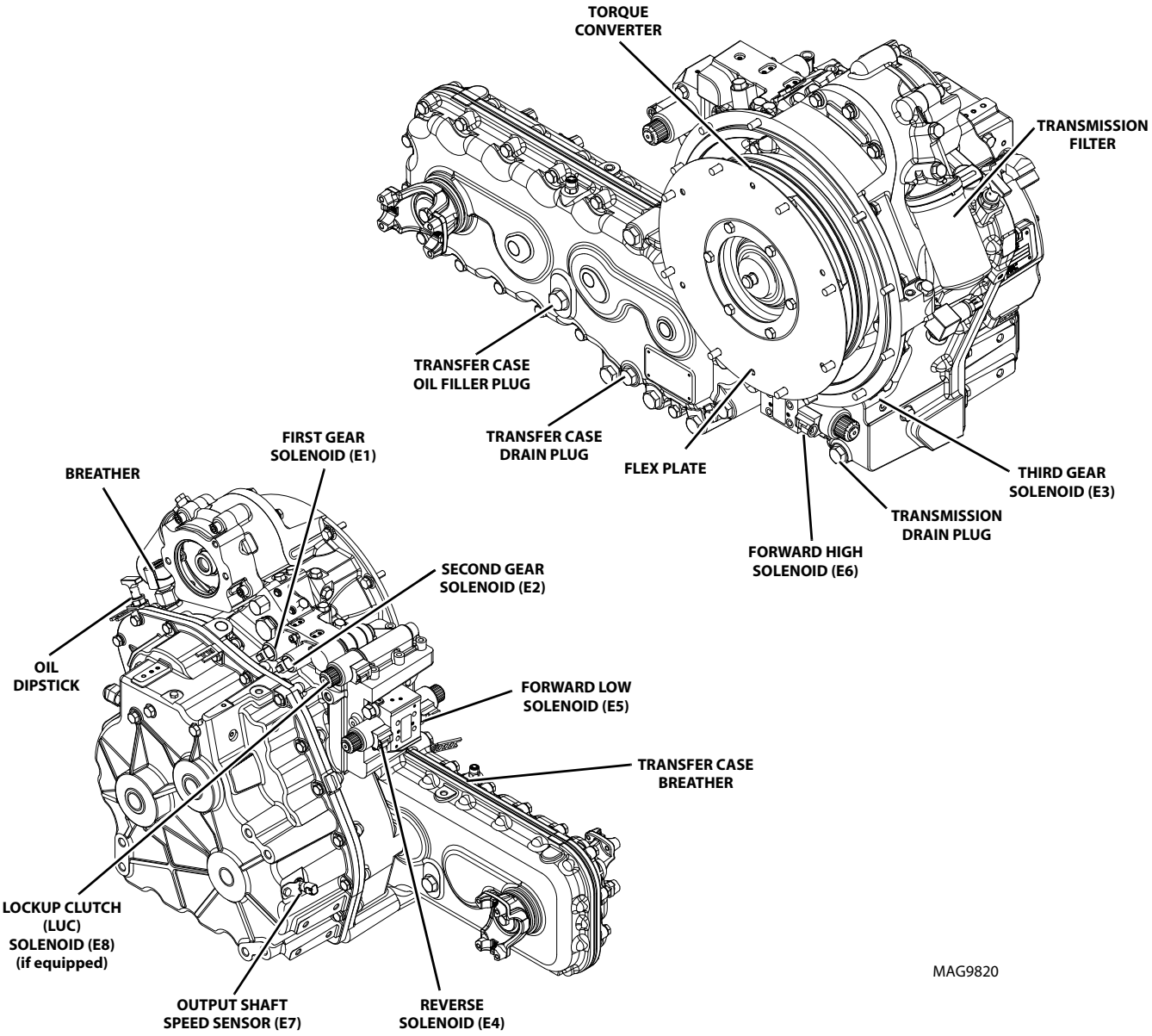
18. Push the levers (**1**) for the manual setting of the braking units. Actuation distance of the levers are approximately 1.26 in (32 mm).
19. Repeat the above step for other side of differential.
20. After repairs to machine have been made, start machine and check park brake and service brakes for proper function. Refer to Section 8.9.4, "Service Brake Bleeding", Section d, "Free Play Adjustment" and Section 8.9.4, "Service Brake Bleeding".

Section 6
Transmission
Contents

PARAGRAPH		TITLE	PAGE
6.1		**Transmission Assembly Component Terminology**	**6-2**
6.2		**Transmission Serial Number**	**6-3**
6.3		**Specifications and Maintenance Information**	**6-3**
6.4		**Transmission Replacement**	**6-3**
	6.4.1	Transmission Removal	6-3
	6.4.2	Transmission Inspection and Internal Repair	6-4
	6.4.3	Transmission Installation	6-4
6.5		**Transmission Fluid/Filter Replacement**	**6-5**
6.6		**Transmission Fluid Level Check**	**6-5**
6.7		**Torque Converter Diaphragm**	**6-6**
	6.7.1	Torque Converter Diaphragm Removal	6-6
	6.7.2	Torque Converter Diaphragm Installation	6-6

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.

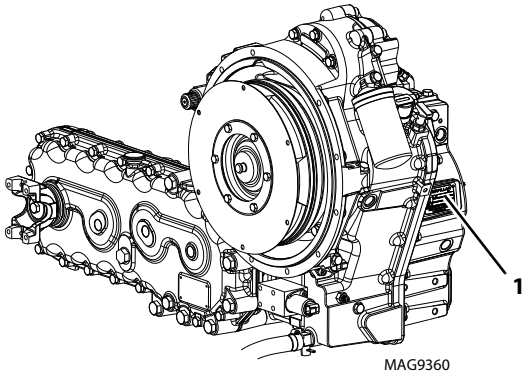


WARNING

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

Note: *These instructions cover only the routine maintenance, removal, and installation of the transmission. Refer to the local JLG dealer and the applicable Transmission Service Manual for assistance with comprehensive transmission diagnosis, repair and component replacement.*

6.2 TRANSMISSION SERIAL NUMBER



The transmission serial number plate (**1**) is located on the front of the transmission case behind the oil dipstick. Information contained in the serial number is required in correspondence with the transmission manufacturer.

6.3 SPECIFICATIONS AND MAINTENANCE INFORMATION

For transmission, oil specifications and maintenance information, refer to Section 2, "General Information and Specifications".

Detailed transmission service instructions are provided in the following publications:

Model	Publication Type	Publication #
832	Transmission Manual	31200908
	Parts Manual	31211473
925	Transmission Manual	31200908
	Parts Manual	31211474

6.4 TRANSMISSION REPLACEMENT

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

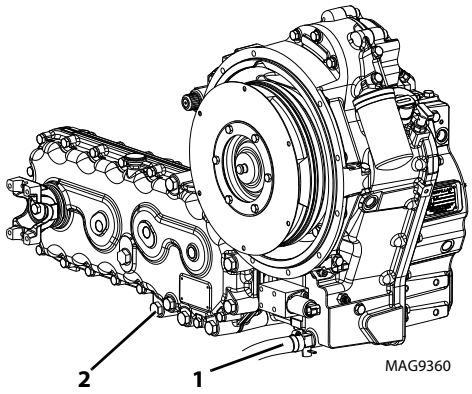
Cleanliness is of extreme importance. Before attempting to remove the transmission, thoroughly clean the exterior of the transmission to help prevent dirt from entering during the replacement process. Avoid spraying water or cleaning solution onto or near the transmission shift solenoids and other electrical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

6.4.1 Transmission Removal

WARNING

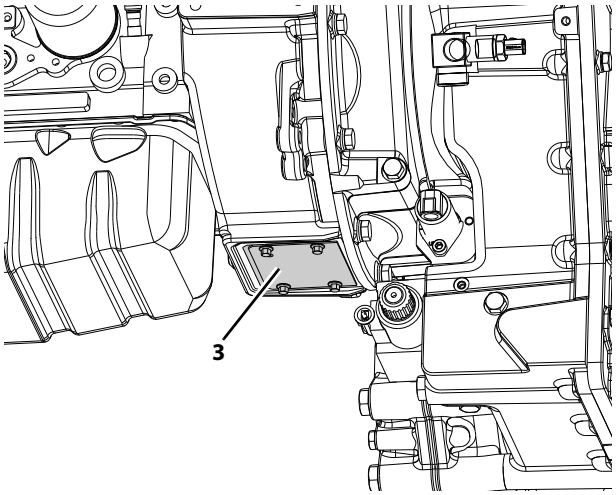
NEVER lift a transmission alone; use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 865.3 lb (392,5 kg).

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. If not previously removed, remove the implement pump. Refer to Section 8.8.1, "Pump Replacement".
5. Refer to Section 7.9, "Engine Replacement", for detailed removal instructions.



6. Place a suitable receptacle under transmission drain plug (**1**). Remove the transmission drain plug, and allow the transmission oil to drain into the receptacle. Repeat the drain procedure with the transfer case (**2**).
7. Transfer used transmission oil into a suitable, covered container, and label container as "Used Oil". Dispose of used oil at an approved recycling facility. Clean and reinstall the transmission and transfer case drain plugs.

8. Remove drive shaft assemblies. Refer to Section 5.8, “Drive Shafts”.
9. Label, disconnect and cap all the coolant lines attached to the transmission.
10. Label and disconnect all electrical wire connections on transmission.



11. Remove access cover (**3**) from bottom of engine bell housing. This will allow access to remove six bolts holding the torque convertor diaphragm to the engine flywheel.
12. Turn the engine over slowly by hand and align each of the six torque converter diaphragm bolts to be accessed. Remove them one at a time.
13. Connect a lifting strap or chain to lifting eye at top of transmission, and to a suitable hoist or overhead crane.
14. Carefully remove the transmission from the engine. Avoid causing damage to the transmission or surrounding parts.
15. Lift the transmission clear of the engine, and lower it onto suitable supports or secure it to a stand built especially for transmission or engine service. Secure the transmission so that it will not move or fall.
16. Drain and flush entire transmission cooling system.
17. Thoroughly clean transmission filter screens and cases, and replace transmission filter elements.

6.4.2 Transmission Inspection and Internal Repair

Refer to Section 6.3, “Specifications and Maintenance Information”, for inspection and repair.

6.4.3 Transmission Installation

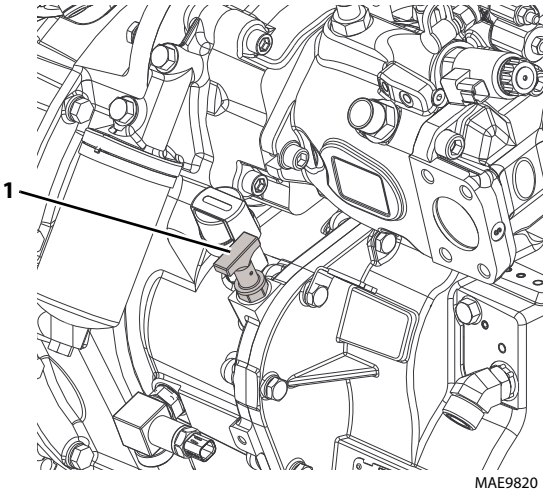
WARNING

NEVER lift a transmission alone; use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 865.3 lb (392,5 kg).

1. Install two guide studs near the top of the bell housing holes.
2. Use a hoist or overhead crane and sling attached to the lifting eye at the top of the transmission. Raise and position the transmission behind the engine.
3. Align the torque converter, align the transmission bolt holes with the two studs in the bell housing. Install the eight bolts and washers and torque to 53 lb-ft (72 Nm). Remove the two alignment studs and install and torque the last two transmission mounting bolts.
4. Turn the engine over slowly by hand and align each of the six torque convertor diaphragm bolts through the access cover in the bell housing. Install them one at a time. **DO NOT** fully tighten until all of the capscrews and locknuts are in place. Torque to 26 - 39 lb-ft (35 - 59 Nm). Replace access cover.
5. If previously removed, install the implement pump. Refer to Section 8.8.1, “Pump Replacement”.
6. Refer to Section 7.9.1, “Engine/Transmission Removal”, for detailed installation instructions.
7. Install drive shaft assemblies. Refer to Section 5.8, “Drive Shafts”.
8. Connect and secure all the previously labeled hydraulic hoses, fuel lines and electrical wire connections on transmission.
9. Initially fill the transmission with 16.9 quartz (16 liters).
10. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
11. Check transmission fluid level. Refer to Section 6.6, “Transmission Fluid Level Check”, for procedure.
12. Check all drain plugs, lines, connections, etc, for leaks, and tighten where necessary.
13. Close and secure engine cover.
14. Shut down machine. Remove the Do Not Operate tags from both the ignition key switch and steering wheel.

6.5 TRANSMISSION FLUID/FILTER REPLACEMENT

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery" for procedure.
5. Remove the belly pan underneath the transmission.

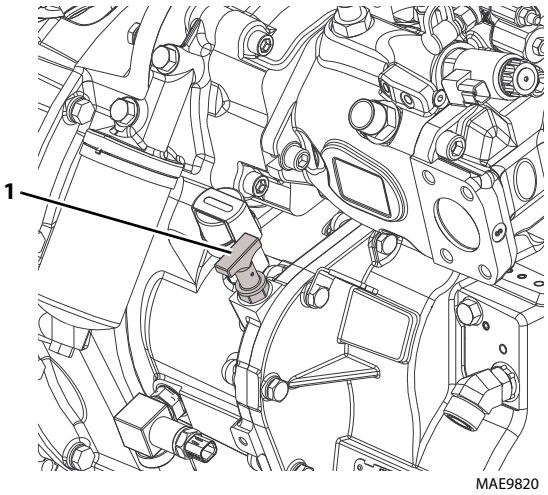


6. Remove transmission dipstick (**1**).
7. Place a suitable container beneath the transmission drain. Open drain valve and allow transmission oil to drain into a properly labeled container. Close transmission drain valve. Dispose of used transmission oil properly.
8. Reinstall belly pan.
9. Remove transmission filter. Drain and dispose of properly.
10. Install a new transmission filter. Make sure to lubricate the transmission filter gasket with a thin film of clean transmission oil. Tighten the filter according to the requirements printed on the filter body.
11. Fill transmission initially with 12 quarts (11,4 liters) through the transmission dipstick tube.
12. Reconnect the battery. Refer Section 9.8, "Battery", for procedure.
13. Perform the Transmission Fluid Level Check as outlined in Section 6.6, "Transmission Fluid Level Check".

6.6 TRANSMISSION FLUID LEVEL CHECK

Note: *Final transmission oil level must always be checked with engine at idle and transmission oil at operating temperature (minimum 80°C/176°F).*

1. Start machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and run engine at idle.
2. Open engine cover.



3. Remove the transmission dipstick (**1**) and check the oil level. The oil level after 2-3 minutes of idle must be between the MIN and MAX oil level marks.

Note: *Depending on the amount of fluid remaining in the transmission oil cooler, the oil level may read substantially above the MAX level mark at this time. The correct oil level can be obtained after the transmission fluid is at operating temperature.*

4. If the oil is low, add oil as required.
5. Replace the transmission dipstick.
6. Close and secure the engine cover.
7. Ensure that the front of the machine is clear of persons or obstacles.
8. Apply the service brake and disengage the park brake. Place the transmission in (F) FORWARD at 4^{th} gear.
9. Stall the transmission against the service brake at full throttle a maximum of 60 seconds. If transmission temperature warning light illuminates, go to step 12.
10. Allow the engine to run at idle for 30 seconds.
11. Repeat steps 9 and 10 three more times, or until the transmission temperature warning light illuminates.

12. Place the transmission in (N) NEUTRAL and apply the park brake. Allow the engine to run at idle for 30 seconds.
13. Open the engine cover.
14. Verify that top of transmission oil cooler is warm and oil is circulating through the cooler. If the top tank of the transmission oil cooler is not warm, repeat steps 6 thru 10.
15. Remove the transmission dipstick (**1**) and check the oil level. The oil level should be in MAX level mark.
16. Add oil as required.
17. Replace the transmission dipstick.
18. Close and secure the engine cover.
19. Shut engine OFF.

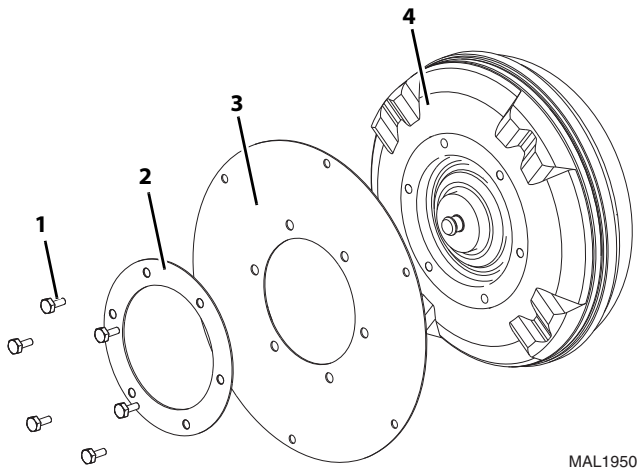
6.7 TORQUE CONVERTER DIAPHRAGM

6.7.1 Torque Converter Diaphragm Removal

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

Note: *In order to remove engine drive plates, engine and transmission must be separated.*

2. Refer to Section 6.4.1, "Transmission Removal" or Section 7.9.1, "Engine/Transmission Removal".



3. With drive plates and torque converter removed, loosen and remove six bolts (**1**) and holding the support ring (**2**) and diaphragm (**3**) to the torque converter (**4**).
4. Replace diaphragm if damaged.

6.7.2 Torque Converter Diaphragm Installation

1. Install new diaphragm on torque converter and install the six bolts with lock washers.
2. Mount the diaphragm/converter assembly to the transmission.
3. Refer to Section 6.4.3, "Transmission Installation" or Section 7.9.4, "Engine/Transmission Installation", for the remainder of the installation.

Section 7
Engine
Contents

PARAGRAPH		TITLE	PAGE
7.1		**Introduction**	**7-2**
	7.1.1	Disclaimer and Scope	7-2
	7.1.2	Component Terminology	7-3
7.2		**Engine Serial Number**	**7-5**
7.3		**Specifications and Maintenance Information**	**7-5**
7.4		**Engine Cooling System**	**7-5**
	7.4.1	Surge Tank Cap	7-5
	7.4.2	Thermostat Replacement	7-5
	7.4.3	Radiator Assembly Replacement	7-6
7.5		**Engine Electrical System**	**7-7**
7.6		**Fuel System**	**7-7**
	7.6.1	Diesel Fuel	7-7
	7.6.2	Diesel Exhaust Fluid (DEF) Tank	7-7
	7.6.3	Diesel Exhaust Fluid (DEF) Filter	7-9
	7.6.4	Diesel Exhaust Fluid (DEF) Pump Filter	7-11
	7.6.5	Diesel Exhaust Fluid (DEF) Tank Header Element Cleaning	7-12
	7.6.6	Fuel Tank	7-13
	7.6.7	After Fuel System Service	7-14
7.7		**Engine Exhaust System**	**7-14**
	7.7.1	If equipped for ULS	7-14
	7.7.2	If equipped for LS	7-16
7.8		**Air Cleaner Assembly**	**7-17**
	7.8.1	Air Cleaner Assembly Removal	7-17
	7.8.2	Air Cleaner Assembly Installation	7-18
7.9		**Engine Replacement**	**7-18**
	7.9.1	Engine/Transmission Removal	7-18
	7.9.2	Transmission Removal/Installation	7-19
	7.9.3	Engine Disassembly, Inspection and Service	7-19
	7.9.4	Engine/Transmission Installation	7-20
7.10		**Troubleshooting**	**7-20**

7.1 INTRODUCTION

WARNING

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

WARNING

Engine fuel lines are pressurized. **DO NOT** attempt repairs unless specific training has been completed.

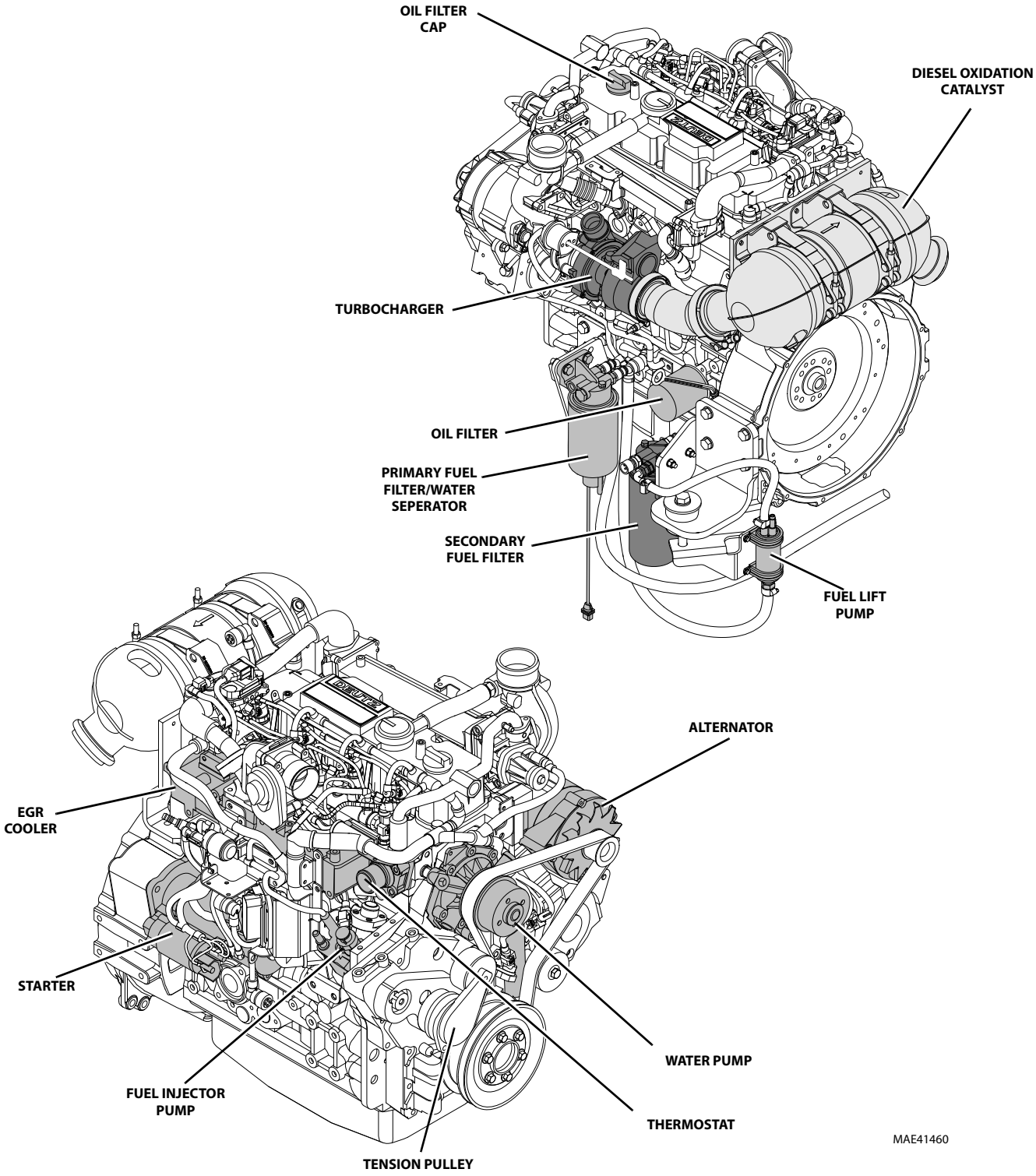
7.1.1 Disclaimer and Scope

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.

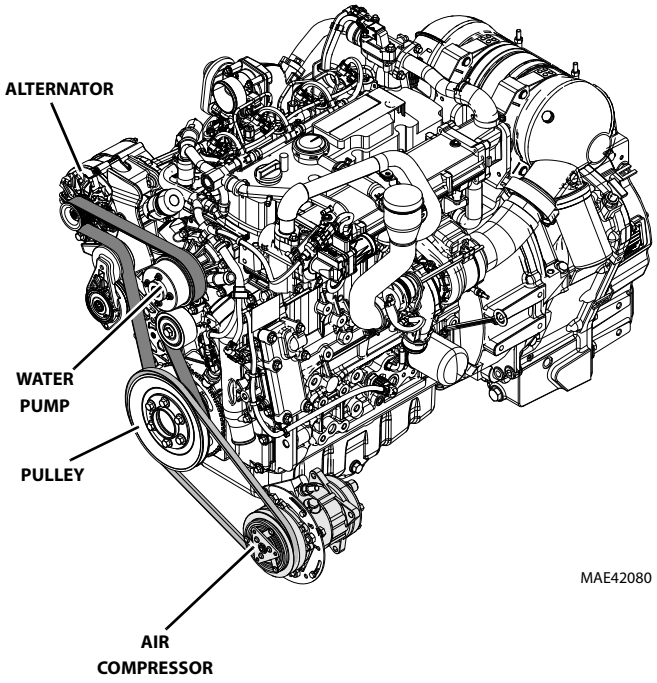
Note: *Detailed engine service instructions (covering disassembly, inspection, internal repair, assembly, adjustment and troubleshooting information) are provided in appropriate engine service manual. A gradual running-in (break-in) of a new engine is not necessary. Full load can be applied to a new engine as soon as the engine is put into service and the coolant temperature is at least 140° F (60° C). 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

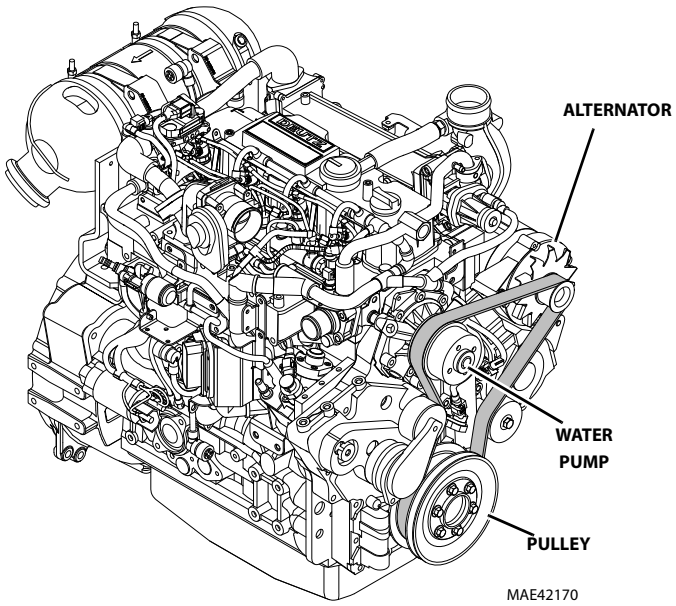
To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the engine components. The following illustration identifies the components that are referred to throughout this section.

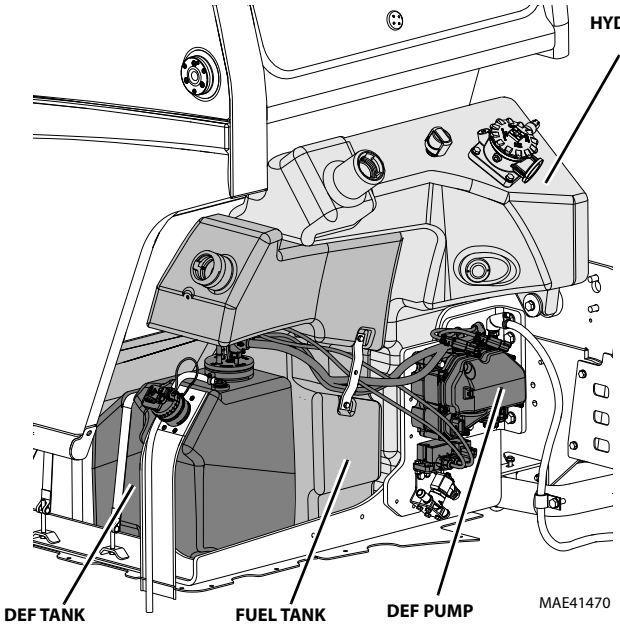


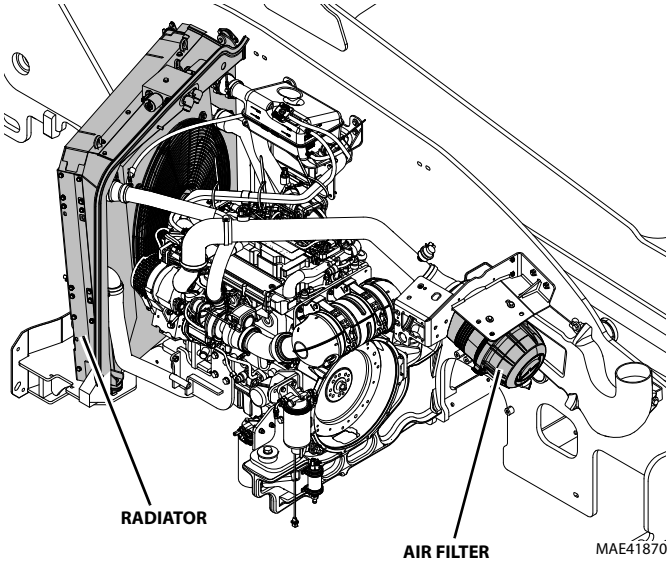
BELT ROUTING
(WITH A/C)



BELT ROUTING
(WITHOUT A/C)







7.2 ENGINE SERIAL NUMBER

The engine serial number is located on the turbocharger side of the valve cover. Information contained in the serial number is required in correspondence with the engine manufacturer.

7.3 SPECIFICATIONS AND MAINTENANCE INFORMATION

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

Refer to Section 9.17, "Fault Codes", for diagnostic codes and descriptions.

7.4 ENGINE COOLING SYSTEM

7.4.1 Surge Tank Cap

A 1.2 Bar (17.4 psi) cap is used on the surge tank. An incorrect or malfunctioning cap can result in the loss of coolant and a hot running engine.

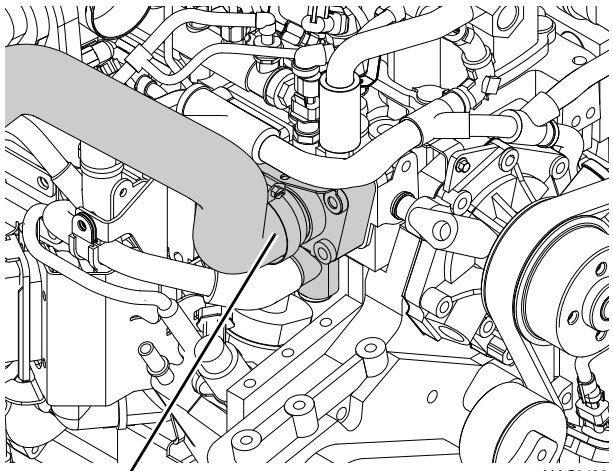
7.4.2 Thermostat Replacement

Before considering thermostat replacement, check the coolant level, A/C belt tension and instrument cluster temperature indicator.

- If engine seems to take a long time to warm up, thermostat may be stuck in the open position and requires replacement.
- If engine runs hot, check temperature of upper radiator hose.
- If hose is not hot, thermostat may be stuck in closed position.
- If 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. Thermostat Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, "Battery", for procedure.
5. Slowly turn surge tank cap to first stop and allow any pressure to escape. Remove surge tank cap.
6. Place a funnel at base of radiator to channel drained coolant into container. Loosen the drain plug and slowly remove to allow coolant to drain. Transfer coolant into a properly labeled container. Dispose of properly if coolant needs to be replaced. Replace surge tank cap. Replace the radiator drain plug.



TYPICAL ILLUSTRATION

7. Remove the hose attached to the thermostat.
8. Remove capscrews securing thermostat housing (**1**) to engine.
9. Remove thermostat housing, old gasket and thermostat. Clean all gasket surfaces. **DO NOT** let any debris into thermostat opening.

Note: *ALWAYS use correct thermostat and install a new gasket.* ***NEVER*** *operate engine without a thermostat, or engine damage will result.*

b. Thermostat Installation

1. Install engine thermostat, thermostat gasket and thermostat housing. Secure with the previously removed capscrews. Torque to 3.3 - 4.1 lb-ft (4.5 - 5.6 Nm)
2. Properly connect battery. Refer Section 9.8, "Battery", for procedure.
3. Open the surge tank cap, fill system complete to the "Full Cold" level with coolant. Replace and tighten the surge tank cap.
4. Run engine to operating temperature. Visually check for leaks with engine running. Check coolant level in surge tank and fill or drain as necessary.

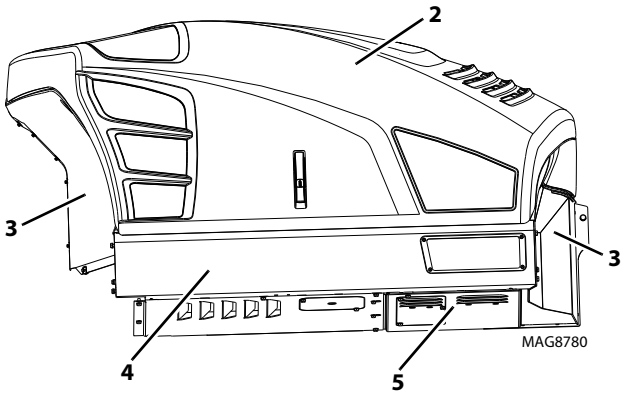
7.4.3 Radiator Assembly Replacement

Before considering radiator assembly replacement for other than obvious damage, conduct a cooling system pressure test check coolant specific gravity, coolant level, A/C belt tension and temperature indicator.

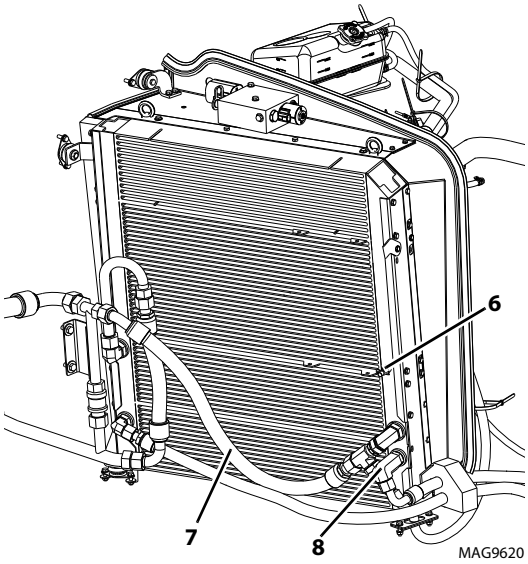
- If engine runs hot, check temperature of upper radiator hose.
- If hose is not hot, thermostat may be stuck in closed position.
- If engine has overheated, performance may suffer, indicating other damage including a leaking cylinder head gasket, cracked cylinder head or block, and/or other internal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

a. Radiator Assembly Removal

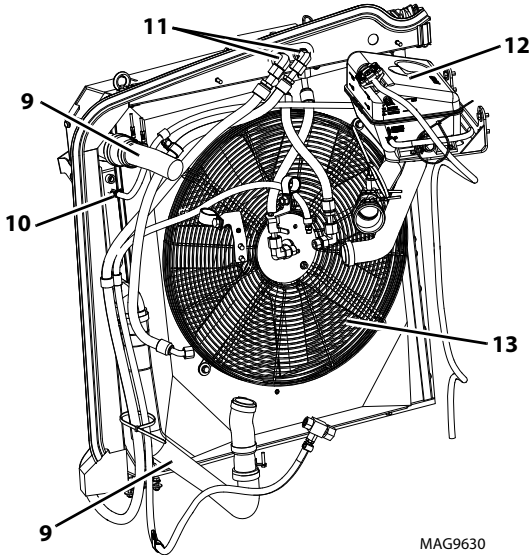
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, “Battery”, for procedure.



5. Remove hood (**2**), end covers (**3**), side skirt (**4**) and belly pan (**5**) from engine compartment.
6. Place a suitable receptacle under transmission drain plug. Remove transmission drain plug, and allow the transmission oil to drain into receptacle.
7. Transfer used transmission oil into a suitable, covered container, and label container as “Used Oil”. Dispose of used oil at an approved recycling facility. Clean and reinstall transmission drain plug.
8. Drain hydraulic oil reservoir. Refer to Section 8.7.1, “Hydraulic Oil Reservoir Draining”.
9. Slowly turn surge tank cap to first stop and allow any pressure to escape. Remove surge tank cap.
10. Place a suitable container beneath radiator drain.



11. Place a funnel at base of radiator to channel drained coolant into a container. Open drain plug (**6**) and slowly remove to allow coolant to drain. Transfer coolant into a properly labeled container. Dispose of properly if coolant needs replaced. Replace surge tank cap. Close radiator drain plug.
12. Label and disconnect the outer hydraulic cooler hoses (**7**). Cap all fittings and openings to prevent dirt and debris from entering hydraulic system.
13. Label and disconnect both transmission cooler hoses (**8**). Cap all fittings and openings to prevent dirt and debris from entering hydraulic system.



14. Loosen and remove radiator assembly mounting bolts, washers and (if equipped) shims. Note the number of shims being used and there location.
15. Loosen and remove air intercooler tubes (**9**) from radiator assembly.
16. Loosen and remove the radiator hoses (**10**) from radiator assembly.
17. Label and disconnect the A/C hoses (**11**). Cap all fittings and openings to prevent dirt and debris from entering hydraulic system.
18. Label, disconnect and cap hoses attached to surge tank (**12**). Remove surge tank and mounting plate.
19. Remove bolts and washers attaching the fan guard (**13**). Remove fan guard.
20. Carefully lift the radiator assembly out of the engine compartment.

Note: *Fan guard can be removed after radiator assembly is removed and placed in a secure location.*

b. Radiator Assembly Installation

1. Place radiator assembly in engine compartment at the original orientation. Secure with the previously used hardware.
2. Install the fan guard (**13**) with bolts and washers.
3. Uncap and connect previously labeled hoses to radiator, transmission cooler and oil cooler.
4. Fill hydraulic oil reservoir. Refer to Section 8.7.2, “Hydraulic Oil Reservoir Filling”.
5. Fill transmission. Refer to Section 2.3, “Fluid and Lubricant Capacities”.
6. Open surge tank cap and fill the radiator completely with coolant. Replace and tighten surge tank cap. Refer to Section 2.3, “Fluid and Lubricant Capacities”, for proper capacities.
7. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
8. Run engine to operating temperature. Visually check for leaks with engine running. Check all fluid levels for correct levels.
9. Install the end cover, hood and belly pans on the engine compartment.
10. Close and secure engine cover.
11. Remove Do Not Operate Tag from ignition key switch and the steering wheel.

7.5 ENGINE ELECTRICAL SYSTEM

The engine electrical system, including the starter, alternator and primary wiring, is described in Section 9.5, “Electrical System Schematic”.

7.6 FUEL SYSTEM

7.6.1 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.
Refer Section 2.3, “Fluid and Lubricant Capacities”, for approved fuel specification.

7.6.2 Diesel Exhaust Fluid (DEF) Tank

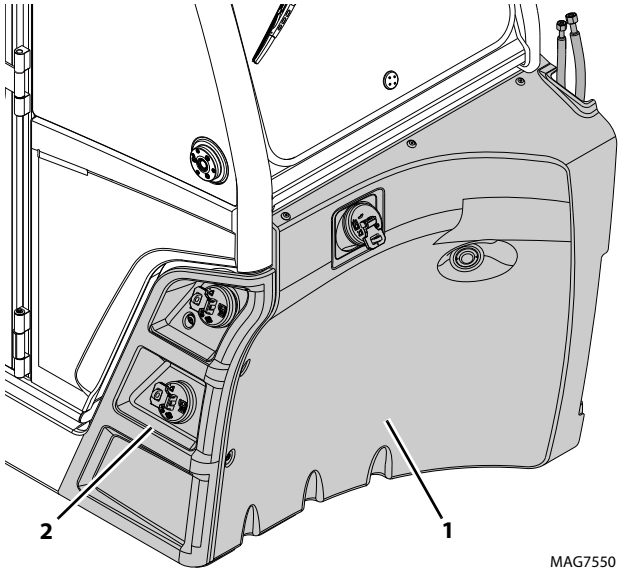
Note: *DEF tank is a one piece unit. It is located under the cab. If it is determined that DEF tank must be removed, fluid must be drained before tank removal. Always dispose off fuel properly.*

a. DEF Tank Removal

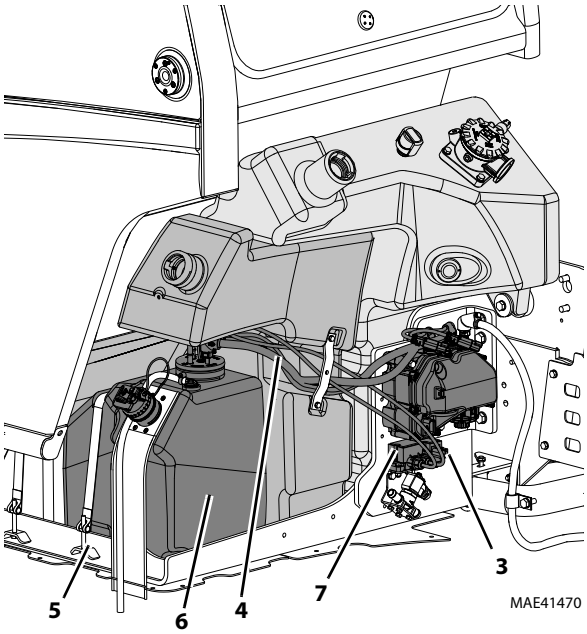
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, “Battery”, for procedure.

Note: *If replacing the tank, remove all internal and external components from the old tank, and retain for use on the replacement tank.*

Note: *Have a dry chemical (Class B) fire extinguisher near the work area.*



5. Remove fuel tank/hydraulic tank access cover (**1**) and DEF tank access cover (**2**).



6. Disconnect the electrical connection from chassis harness to pin (**3**).
7. Remove hardware securing DEF header controller (**7**) to support frame.

Note: *Do not disconnect electrical connections from DEF controller to header.*

8. Label and disconnect all fluid hoses (**4**).
9. Remove hardware (**5**) securing DEF tank (**6**) to frame.
10. Remove DEF tank drain plug, and drain fluid into an approved and suitable container. Dispose of fluid properly.
11. Remove DEF tank from the support frame.

b. Disassembly

DEF tank is a one-piece unit and cannot be disassembled. Fluid indicator can be removed and reused on new replacement tank. Dispose of old tank according to local regulations concerning hazardous materials disposal.

c. Cleaning and Drying

If contaminated fluid or foreign material is in the tank, clean the tank.

To clean the DEF tank:

1. Have a dry chemical (Class B) fire extinguisher near work area.
2. Remove the DEF tank drain plug, and safely drain any fluid into a suitable container. Dispose of fluid properly.
3. Clean DEF tank with a high pressure washer, or flush tank with hot water for five minutes and drain water. Dispose of contaminated water properly.
4. Refill DEF tank with water until it overflows. Completely flush tank with water. Empty DEF tank and allow it to dry completely.

d. Assembly

Indicator can be removed and reused on new replacement tank. Dispose of old tank according to local regulations concerning hazardous materials disposal regulations.

e. Inspection

1. Inspect DEF tank thoroughly for any cracks, slices, leaks or other damage.
2. With DEF tank removed from machine, plug all openings except one elbow fitting. Install elbow fitting, and apply approximately 1-1.5 psi (7-10 kPa) of air pressure through elbow. Check reservoir for leaks by applying a soap solution to exterior and look for bubbles to appear at cracked or damaged area.

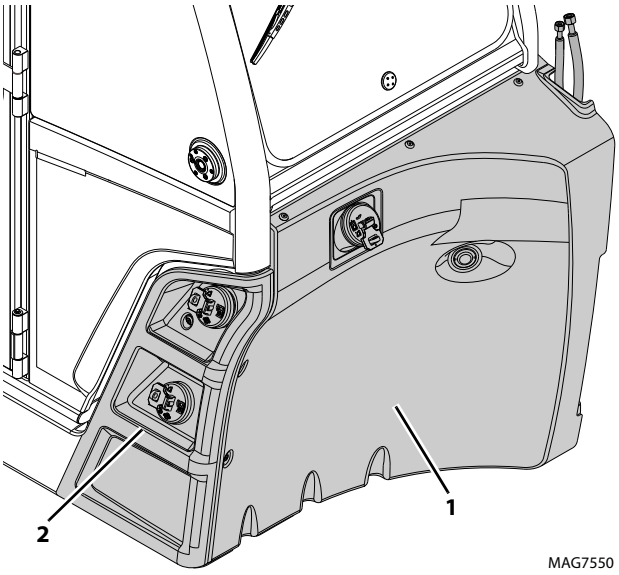
f. DEF Tank Installation

1. Install the DEF tank and support bracket to their original orientation on cab.
2. Connect previously labeled fluid hoses to their appropriate locations. Secure with clamps.
3. Install the DEF header controller on the support frame and secure using previously used hardware.
4. Connect the electrical connector with the chassis harness on pin (**3**).
5. Secure the DEF tank with previously used hardware.
6. Fill DEF tank according to specifications. Refer to Section 2.3, “Fluid and Lubricant Capacities”.
7. Check DEF tank for leaks.
8. Install previously removed covers.
9. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
10. Close and secure engine cover.
11. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.6.3 Diesel Exhaust Fluid (DEF) Filter

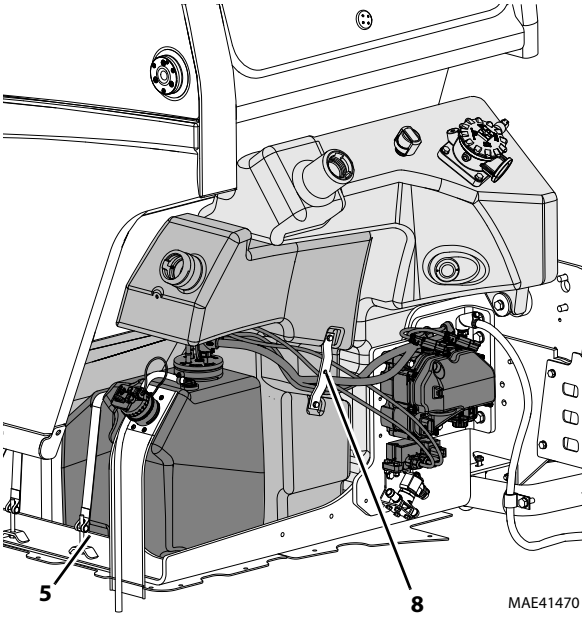
a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.



MAG7550

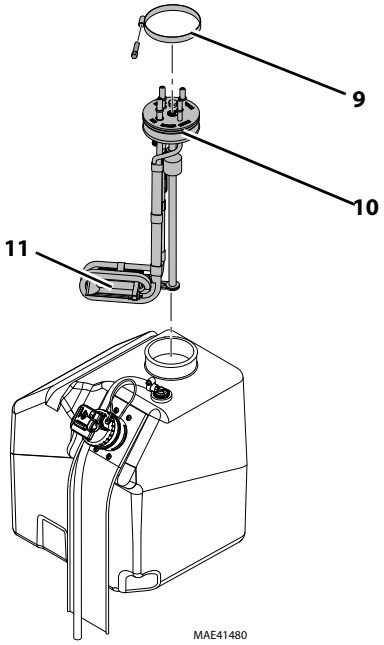
5. Remove fuel tank/hydraulic tank access cover (**1**) and DEF tank access cover (**2**).



6. Clean the DEF tank and surrounding parts to prevent contamination.
7. Remove hardware (**5**) securing DEF tank to frame.
8. Remove the clamp (**8**) with hardware securing the DEF tank hoses .
9. Disconnect the electrical connection from chassis harness to pin (**3**).
10. Remove hardware securing DEF header controller (**7**) to support frame.
11. Remove DEF tank drain plug, and drain fluid into an approved and suitable container. Dispose of fluid properly.

Note: *Do not disconnect electrical connections from DEF controller to header.*

12. Place the DEF tank on clean surface.



13. Loosen and remove gear clamp (**9**) securing header assembly (**10**) to the DEF tank. Remove the header from tank.
14. Remove the retaining ring securing the filter to the header assembly.
15. Remove and discard the DEF filter (**11**) from header assembly (**10**).

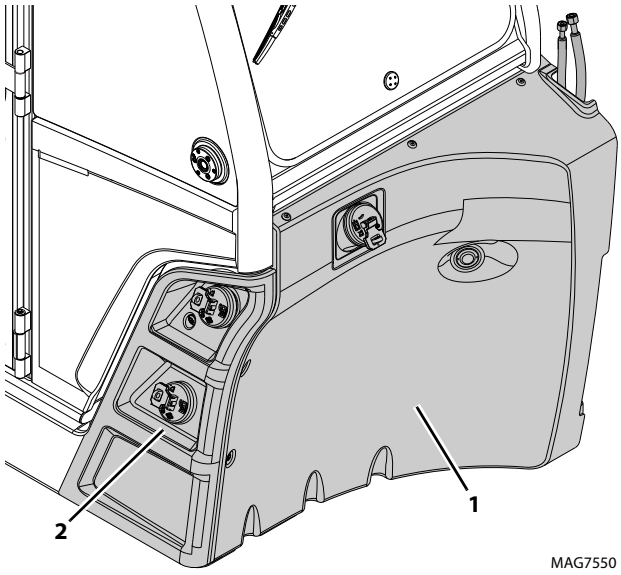
b. Installation

1. Install new filter (**11**) to the header assembly (**10**) and secure with previously used retaining ring.
2. Install header assembly (**10**) to the DEF tank and secure with the previously removed gear clamp (**9**).
3. Fill the DEF tank. Refer to Section 2.3, "Fluid and Lubricant Capacities".
4. Install the DEF tank and support bracket to their original orientation on cab.
5. Install the clamp (**8**) securing the hoses.
6. Install the DEF header controller on the support frame and secure using previously used hardware.
7. Connect the electrical connector with the chassis harness on pin (**3**).
8. Install the access covers (**1** and **2**).

7.6.4 Diesel Exhaust Fluid (DEF) Pump Filter

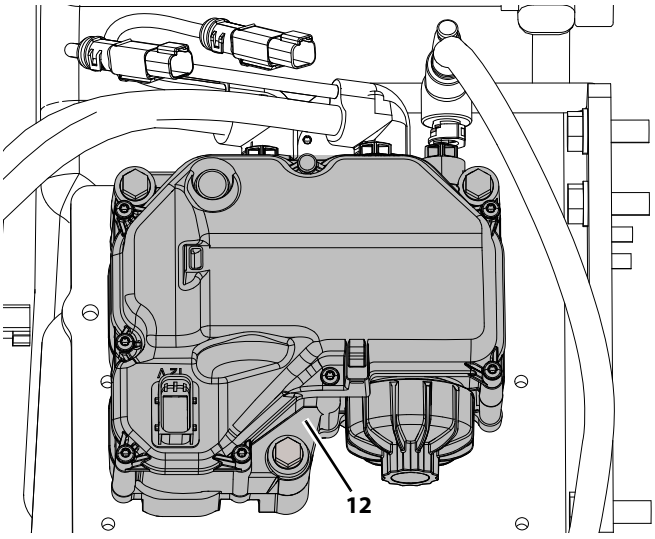
a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



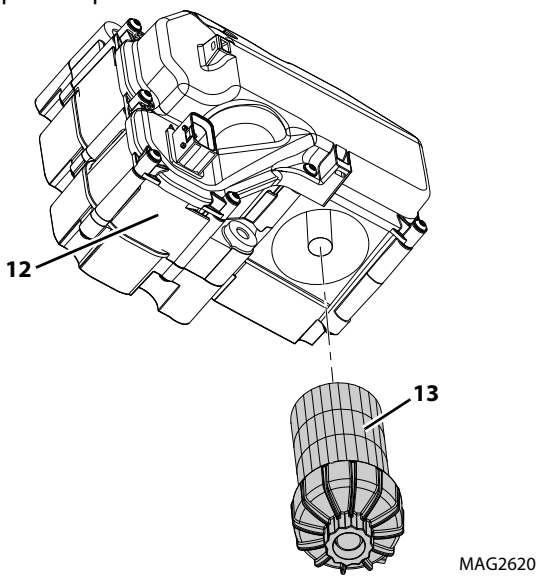
MAG7550

5. Remove fuel tank/hydraulic tank access cover (**1**) and DEF tank access cover (**2**).



MAE41520

6. Clean the DEF pump module (**12**) and surrounding parts to prevent contamination.



MAG2620

7. Remove and discard the pump filter (**13**) from DEF pump module (**12**).

b. Installation

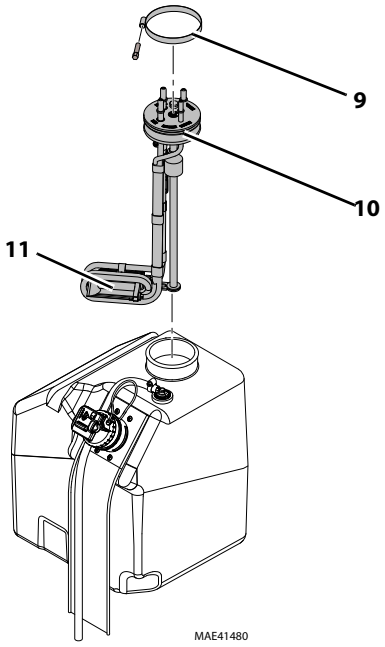
1. Install the new pump filter (**13**) to DEF pump module (**12**).
2. Install the access covers (**1** and **2**).

7.6.5 Diesel Exhaust Fluid (DEF) Tank Header Element Cleaning

Note: *Cleaning of the Header Assembly is only required due to fluid contamination.*

a. Disassembly

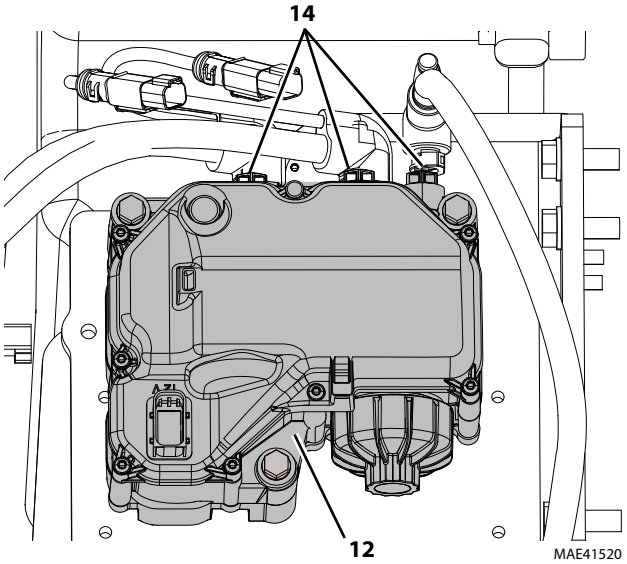
1. Refer to Section 7.6.2, "Diesel Exhaust Fluid (DEF) Tank" for detailed DEF tank removal.



2. Loosen and remove the gear clamp (**9**) securing the header (**10**) to the DEF tank.
3. Loosen and remove the header (**10**) from the DEF tank and remove the filter assembly (**11**).
4. Remove the retaining ring securing the filter to the header assembly.
5. Remove and discard the DEF filter assembly (**11**) from header **(10**).

b. Cleaning and Drying

1. Clean the header (**10**) with a mixture of warm water and a light petroleum based soap.



2. If DEF fluid lines are contaminated, label and remove the lines (**14**) from the DEF pump module (**12**). Flush with a mixture of warm water and a light petroleum based soap.
3. Rinse all soap mixture with deionized or distilled water and allow to air dry.

c. Assembly

1. Install new filter to the header assembly (**10**) and secure with previously used retaining ring.
2. Install header (**10**) to the DEF tank and secure with the previously removed gear clamp (**9**).
3. Refer to Section 7.6.2, "Diesel Exhaust Fluid (DEF) Tank", for detailed DEF tank installation.
4. Fill the DEF tank. Refer to Section 2.3, "Fluid and Lubricant Capacities".

7.6.6 Fuel Tank

Note: *Fuel tank is a one piece unit. It is located under the cab. If it is determined that fuel tank must be removed, fuel must be drained before tank removal. Always dispose off fuel properly.*

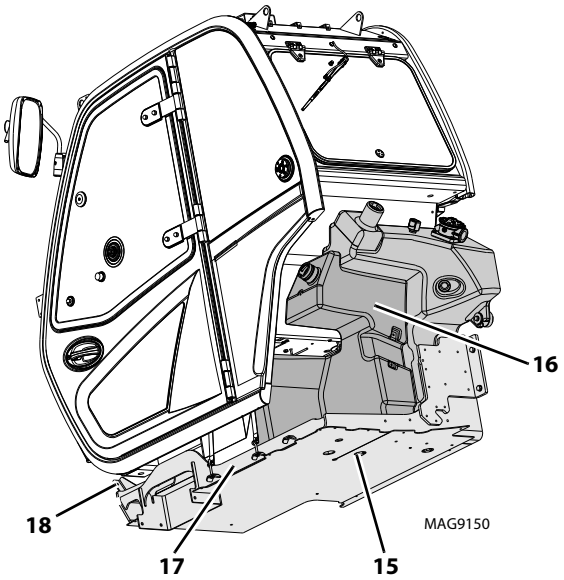
a. Fuel Tank Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, "Battery", for procedure.

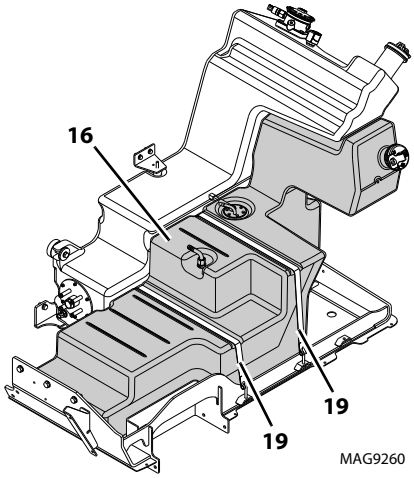
Note: *If replacing the tank, remove all internal and external components from the old tank, and retain for use on the replacement tank.*

Note: *Have a dry chemical (Class B) fire extinguisher near the work area.*

5. If equipped, refer to Section 7.6.2, "Diesel Exhaust Fluid (DEF) Tank", for detailed removal instructions of the DEF covers and tank.



6. Remove drain plug (**15**) from fuel tank (**16**) and drain fuel into an approved and suitable container. Dispose of fuel properly.
7. Install the fuel tank drain plug.
8. Support fuel tank support frame (**17**) with a floor jack or suitable supports.
9. Remove hardware (**18**) securing fuel tank support frame to machine frame.
10. Carefully lower fuel tank support frame approximately 12 in (305 mm) away from cab.
11. Label, disconnect and cap fuel lines from the top of the fuel tank. Disconnect fuel sender.
12. Verify all hoses and electrical wires are disconnected.
13. Lower the fuel tank support frame away from the cab.



14. Remove hardware and strap (**19**) securing fuel tank (**16**) to frame.
15. Remove fuel tank from the frame support.

b. Disassembly

Fuel tank is a one-piece unit and cannot be disassembled. Fuel level indicator can be removed and reused on new replacement tank. Dispose off old tank according to local regulations concerning hazardous materials disposal.

c. Cleaning and Drying

If contaminated fuel or foreign material is in the tank, clean the tank.

To clean the fuel tank:

1. Have a dry chemical (Class B) fire extinguisher near work area.
2. Remove the fuel or oil tank drain plug, and safely drain any fuel into a suitable container. Dispose off fuel properly.
3. Clean fuel tank with a high pressure washer, or flush tank with hot water for five minutes and drain water. Dispose off contaminated water properly.
4. Add a diesel fuel emulsifying agent to tank. Refer to manufacturer's instructions for correct emulsifying agent-to-water mixture ratio. Refill tank with water, and agitate mixture for 10 minutes. Drain tank completely. Dispose of contaminated water properly.

5. Refill fuel tank with water until it overflows. Completely flush tank with water. Empty fuel tank, and allow it to dry completely.

d. Assembly

Fuel level indicator can be removed and reused on new replacement tank. Dispose of old tank according to local regulations concerning hazardous materials disposal regulations.

e. Inspection

1. Inspect fuel tank thoroughly for any cracks, slices, leaks or other damage.
2. With fuel tank removed from machine, plug all openings except one elbow fitting. Install elbow fitting, and apply approximately 1-1.5 psi (7-10 kPa) of air pressure through elbow. Check reservoir for leaks by applying a soap solution to exterior and look for bubbles to appear at cracked or damaged area.

f. Fuel Tank Installation

1. Install the fuel tank to the support frame using the previously removed straps and mounting hardware.
2. Using a floor jack, lift fuel tank and support bracket and connect previously labeled fuel hoses to their appropriate locations. Secure with clamps. Connect fuel sender.
3. Using a floor jack, lift fuel tank and support bracket to their original orientation on cab.
4. Secure the fuel tank frame support with previously used hardware. Remove floor jack.
5. Fill fuel tank according to specifications. Refer to Section 2.3, "Fluid and Lubricant Capacities".
6. Check fuel tank for leaks.
7. Properly connect battery. Refer Section 9.8, "Battery", for procedure.
8. Close and secure engine cover.
9. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.6.7 After Fuel System Service

1. Drain and flush the fuel tank if it was contaminated.
2. Vent air from fuel system in accordance with instructions found in the appropriate Engine Operation & Safety Manual.
3. Fill the fuel tank with fresh, clean diesel fuel as required.

7.7 ENGINE EXHAUST SYSTEM

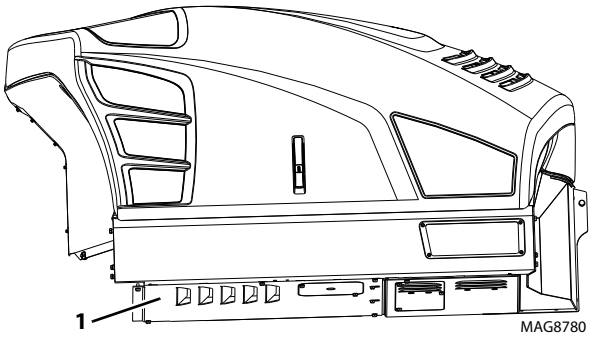
Note: *Emission Sensitive Exhaust. Assembly must be replaced exactly as removed. Contact your local JLG dealer before removing the muffler system.*

Note: *When removing or installing the flex pipe assembly, DO NOT apply excessive force to the flex section that could over-extend, compress, or twist the flex.*

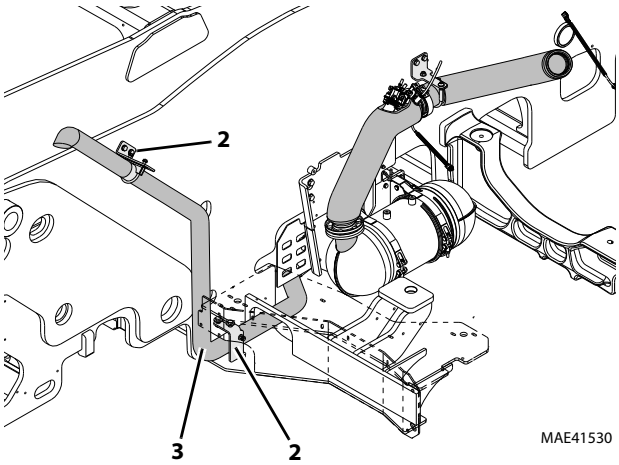
7.7.1 If equipped for ULS

a. Removal

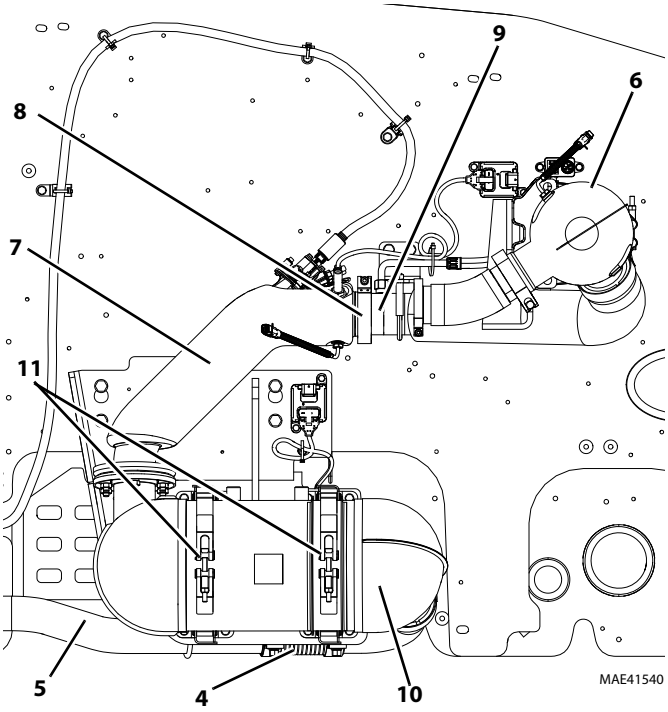
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, "Battery", for procedure.



5. Remove belly pans (**1**).



6. Loosen and remove clamps (**2**) at tail pipe (**3**).
7. Remove tail pipe (**3**).

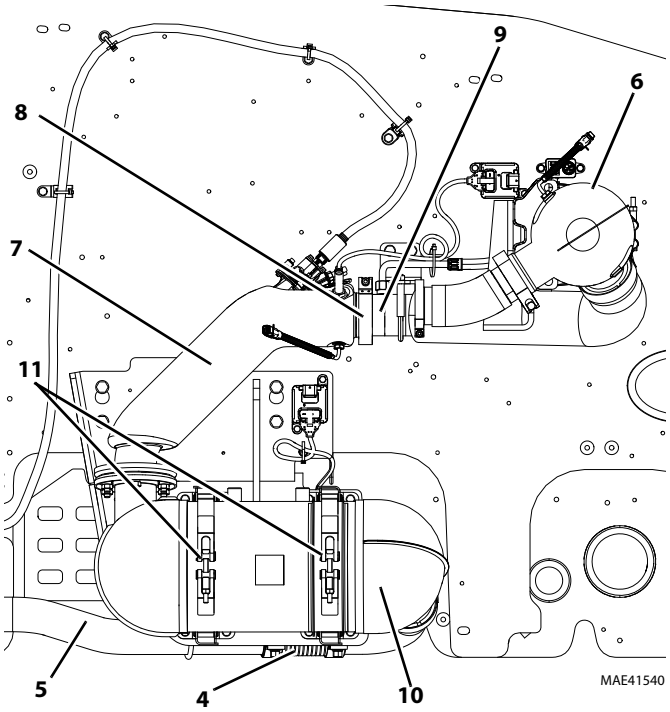


8. Loosen and remove exhaust pipe clamp (**4**) and exhaust pipe (**5**).
9. Label and disconnect all connections to the Diesel Oxidation Catalyst (DOC) assembly (**6**).
10. Remove the Diesel Oxidation Catalyst (DOC) assembly (**6**) and exhaust pipe.
11. Label and disconnect all connections to the mixing pipe (**7**).
12. Loosen and remove mixing pipe (**7**), V-band clamps (**8**) and exhaust pipe (**9**). Remove the mixing pipe and exhaust pipe.
13. Label and disconnect all connections to the Selective Catalytic Reduction unit (SCR) assembly (**10**).
14. Loosen and remove SCR bracket (**11**) from SCR module.
15. Remove the bolts of the exhaust support plate from frame.
16. Carefully lower the SCR module from the machine.

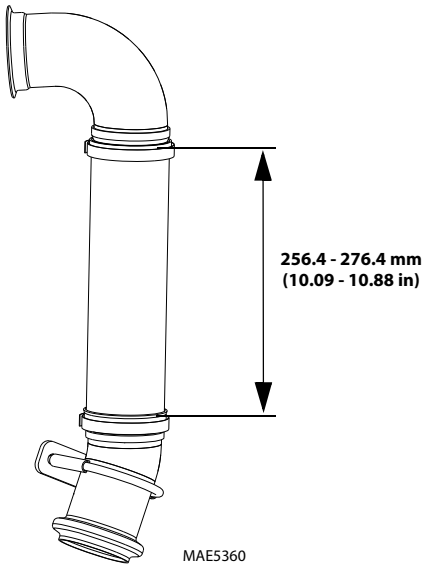
b. Installation

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

Note: *Clamps and bellows flex pipe assembly MUST be replaced if the SCR assembly is removed from the machine.*



1. Install SCR module (**10**) to mounting bracket (**11**) and tight straps by hand.
2. Connect mixing pipe (**7**) to the SCR module (**10**), Insert a six hole gasket between the SCR tank flange and mixing pipe flange.

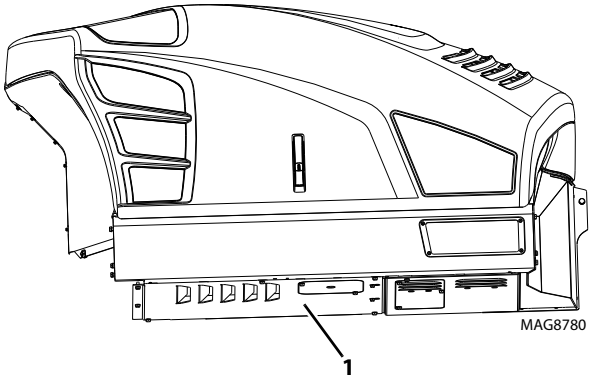


3. Install exhaust flexible pipe (**9**) as follows:
   a. Loosely install the upper end of flex pipe to Diesel Oxidation Catalyst (DOC) with new V-clamp (**12**).
   b. Loosely install the lower end of flex pipe to mixing pipe with new V-band clamp (**9**).
   c. Measure to ensure the flex length between the center of pins is in range of 10.09 - 10.88 in (256.4 - 276.4 mm).
   d. Torque V-clamp (**12**) to 8.85 lb-ft (12 Nm).
   e. Torque V-band clamp (**8**) to 8.85 lb-ft (12 Nm).
4. Install the exhaust support plate to frame and tighten the bolts by hand.
5. Connect all the electrical connections to exhaust system.
6. Install the exhaust pipe (**5**) and secure with the previously removed clamp (**4**). Do Not tighten.
7. Install the tail pipe (**2**) to the exhaust pipe (**5**) and secure to frame with previously used clamps (**3**). Do Not tighten.
8. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
9. Start engine and check for exhaust leaks at all exhaust connections. Adjust or repair as needed.
10. Install belly pan.
11. Close and secure engine cover.
12. Remove Do Not Operate Tag from ignition key switch and steering wheel.

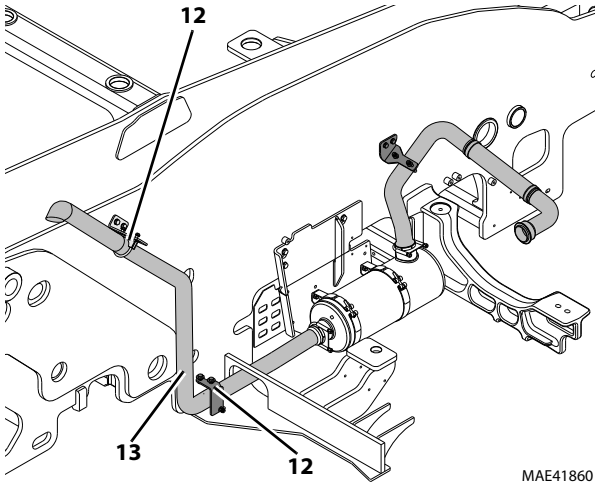
7.7.2 If equipped for LS

a. Removal

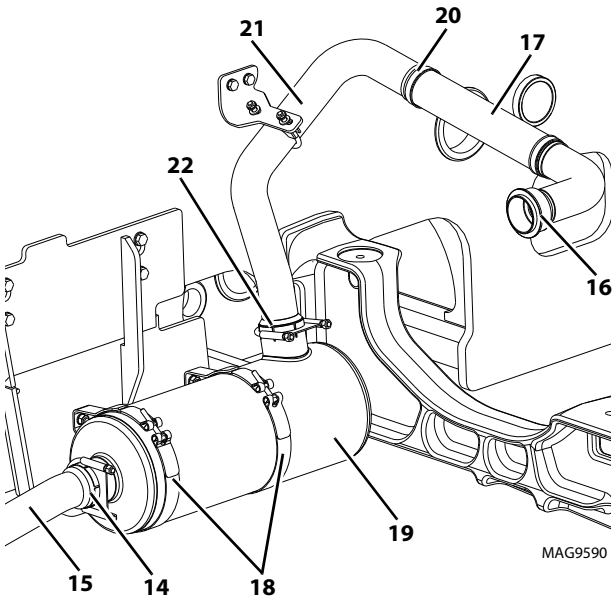
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, “Battery”, for procedure.



5. Remove belly pan (**1**).



6. Loosen and remove clamps (**12**) at tail pipe end segment (**13**).
7. Remove tail pipe segment (**13**).



8. Loosen and remove exhaust pipe clamp (**14**).
9. Remove exhaust pipe (**15**).
10. Loosen and remove V-band clamp (**16**) securing flex pipe assembly (**17**).
11. Remove hardware (**18**) securing muffler (**19**) to frame.
12. Carefully lower muffler (**19**) from machine.
13. Loosen and remove clamp (**20**) securing flex pipe assembly (**17**) to exhaust pipe assembly (**21**).
14. Remove flex pipe assembly (**15**).

b. Installation

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

1. Install exhaust pipe (**15**) to muffler and secure with clamp (**14**).
2. Install muffler (**19**) and secure with hardware (**18**) removed earlier. Do not tighten hangars.
3. Install the tail pipe segment (**13**) to the exhaust pipe (**15**) with clamp (**14**) and secure to frame on existing bracket. Do Not Tighten.
4. Secure exhaust pipe to engine with V-band clamp (**22**). Do Not Tighten.
5. Adjust the muffler (**19**), tail and exhaust pipes for proper clearance then tighten all clamps.
6. Torque clamps (**16**) to 8 - 9.5 lb-ft (11 - 13 Nm).
7. Torque clamps (**12** and **14**) to 8 - 9.5 lb-ft (11 - 13 Nm).
8. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
9. Start engine and check for exhaust leaks at all exhaust connections. Adjust or repair as needed.
10. Install belly pan.
11. Close and secure engine cover.
12. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.8 AIR CLEANER ASSEMBLY

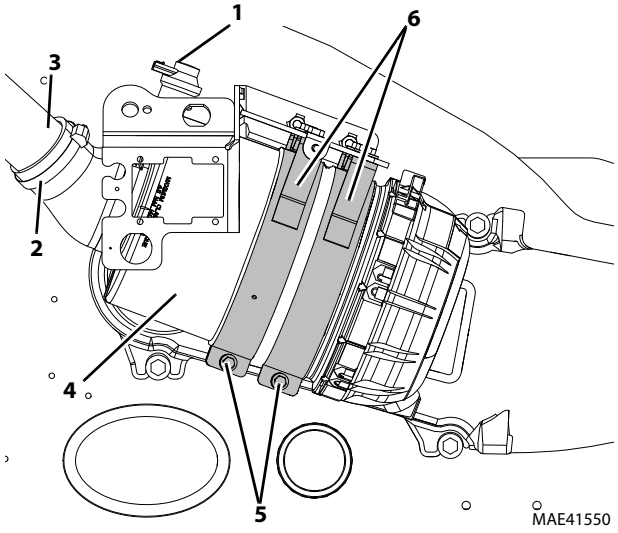
NOTICE

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

Note: *Refer to the appropriate machine Operation & Safety Manual for the correct element change procedure.*

7.8.1 Air Cleaner Assembly Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery. Refer Section 9.8, “Battery”, for procedure.



5. Disconnect the harness from air intake restriction indicator (**1**)
6. Loosen and remove clamp (**2**) securing air intake tube (**3**) to air cleaner (**4**). Pull air intake elbow off air cleaner.
7. Remove bolts (**5**) securing air cleaner strap(s) (**6**) to air cleaner (**4**). Remove air cleaner assembly.

7.8.2 Air Cleaner Assembly Installation

1. Properly connect the harness on air intake restriction indicator (**1**).
2. Install the air cleaner assembly (**4**) to the air cleaner mounting plate and secure with the previously used hardware.
3. Place the loosened clamp (**2**) over the air intake elbow (**3**) and install elbow on the air cleaner assembly. Tighten clamp.
4. Connect the harness to air intake restriction indicator (**1**).
5. Properly connect battery. Refer Section 9.8, "Battery", for procedure.
6. Close and secure engine cover. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.9 ENGINE REPLACEMENT

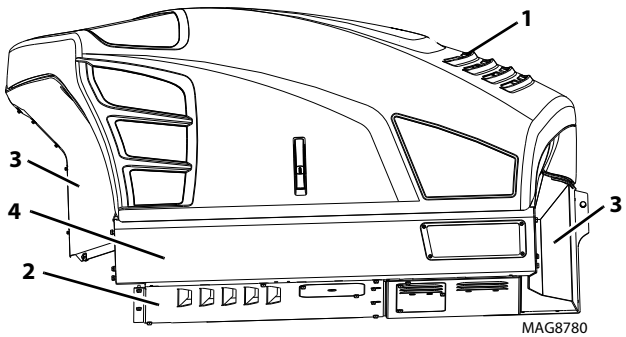
WARNING

NEVER lift a engine/transmission alone; use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 2205 lb (1000 kg).

7.9.1 Engine/Transmission Removal

Note: *The radiator assembly must be removed from the machine before engine/transmission removal. Refer to Section 7.4.3, "Radiator Assembly Replacement". Several additional components must be removed before engine/transmission removal. They will be addressed in the following procedures.*

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect battery(s). Refer Section 9.8, "Battery", for procedure.

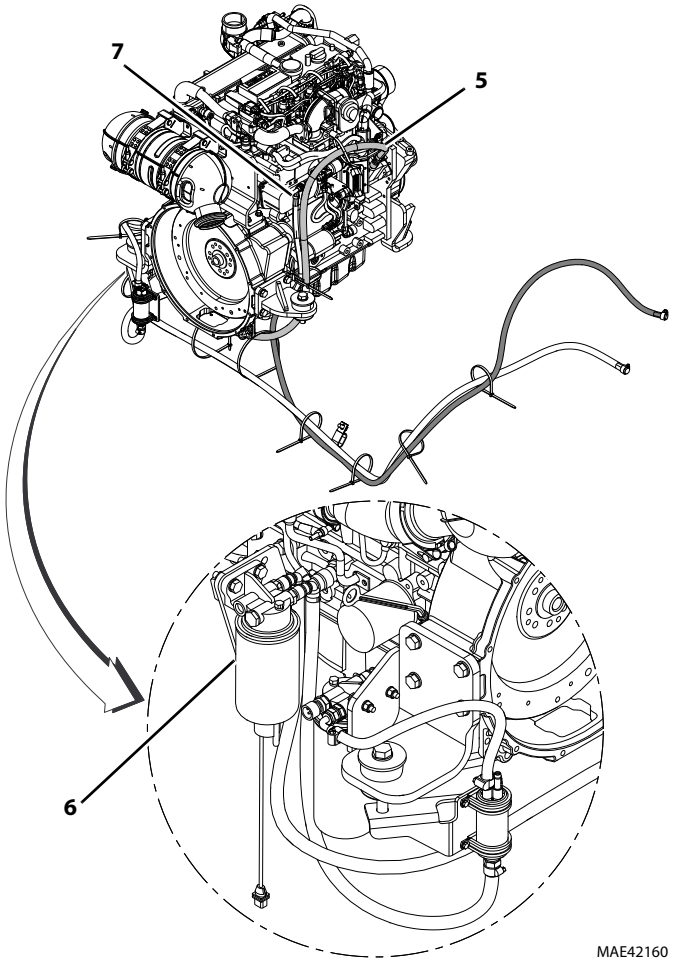


MAG8780

5. Mark position of cover to help with cover adjustment when being reinstalled.
6. Remove hood (**1**), belly pan (**2**), end covers (**3**) and front cover (**4**) from engine compartment.
7. Properly drain hydraulic oil system. Refer to Section 8.7, "Hydraulic Reservoir", for detailed instructions.
8. Properly drain transmission. Refer to Section 6.4.1, "Transmission Removal", for detailed instructions.
9. Label, disconnect and cap/plug all hydraulic connections on the engine/transmission.

Note: *Engine/transmission harness is routed and attached to engine/transmission using hold-down clamps and plastic wire ties at various places on engine. Before removing engine/transmission, ensure that harness has been completely separated (disconnected) from engine/transmission. Move harness clear of engine/transmission, and with help of an observer, ensure that engine/transmission clears the harness during removal.*

10. Label and disconnect all electrical wire connections on engine/transmission.

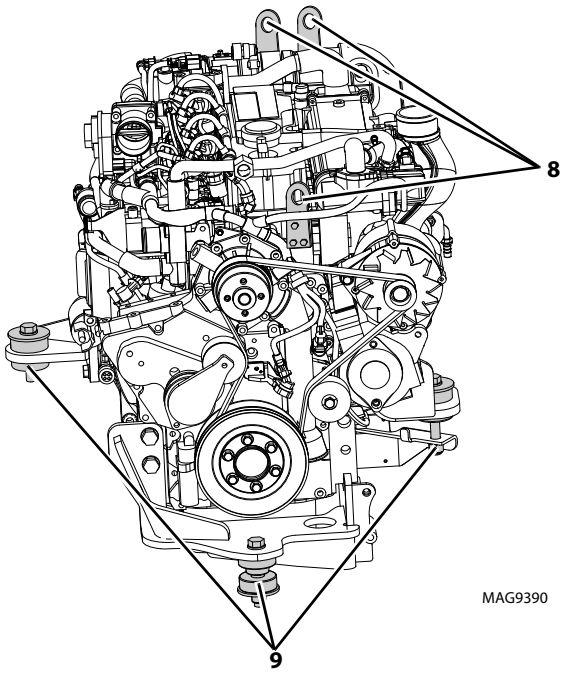


MAE42160

11. Label, disconnect and cap the fuel inlet lines (**5**).
12. Loosen and remove three fuel filter bracket bolts and fuel filter assembly (**6**).
13. Label, disconnect and cap the fuel return lines (**7**).
14. Label and remove all clamps securing any fuel line on engine.
15. Remove exhaust pipe from exhaust manifold. Refer to Section 7.7, "Engine Exhaust System".

Note: *Emission Sensitive Exhaust. Assembly must be replaced exactly as removed.*

16. Remove air cleaner assembly. Refer to Section 7.8, "Air Cleaner Assembly".
17. Remove drive shaft assemblies. Refer to Section 5.8, "Drive Shafts".
18. Drain and Remove the radiator/oil cooler assembly. Refer to *Section 7.4.3, "Radiator Assembly Replacement"*, for detailed removal instructions.
19. Label, disconnect and cap all hydraulic hoses attached to engine and transmission, cap all fittings and plug hoses to keep dirt and debris from entering hydraulic system.



20. Install lifting lugs (**8**).
21. Secure engine with a lifting strap or chain from appropriate lifting points (**8**). Use a suitable hoist or overhead crane.
22. Loosen and remove engine/transmission mounting bolts (**9**).
23. Slightly lift and pull engine/transmission out of machine. Have an assistant ensure that engine/transmission clears all frame components during removal.
24. Place engine/transmission on a flat, level surface.

7.9.2 Transmission Removal/Installation

1. Refer to Section 6.4, "Transmission Replacement", for detailed transmission removal and installation instructions.

7.9.3 Engine Disassembly, Inspection and Service

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

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

7.9.4 Engine/Transmission Installation

WARNING

NEVER lift a engine/transmission alone; Use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 2204.6 lb (1000 kg).

1. Attach a lifting chain to the front and rear engine lift brackets, and lift engine/transmission clear of the ground.
2. Refer to Section 2.2, "Specifications", for all thread locking requirements.
3. Lift engine/transmission and slowly push and lower into engine compartment. Have an assistant ensure that engine/transmission clears frame, hose and harness components during engine/transmission installation. Position engine/transmission brackets over frame mounts.
4. Align engine mount holes and install front mounting bolts.
5. Align engine mount holes and install rear mounting bolts.
6. Lower engine onto isolators.
7. Install flat washer and nut on front two mounting bolts.
8. Remove lifting lugs and chains.
9. Torque engine /transmission mounting bolts (**9**) to 178 lb-ft (241 Nm).
10. Install air cleaner. Refer to Section 7.8.2, "Air Cleaner Assembly Installation".
11. Install exhaust pipe. Refer to Section 7.7.1, b. "Installation".
12. Install radiator assembly. Refer to Section 7.4.3, "Radiator Assembly Replacement".
13. Install drive shaft assemblies. Refer to Section 5.8, "Drive Shafts".
14. Connect and secure all the previously labeled hydraulic hoses, fuel lines and electrical wire connections on engine and transmission.
15. **If equipped:** Install heater and cooling hoses to engine and tighten clamps.
16. Properly connect battery(s). Refer Section 9.8, "Battery", for procedure.
17. Check that all hydraulic system, electrical system, cooling system, fuel system and exhaust system connections are correct and connected tightly.

Note: *Have an assistant stand by with a Class B fire extinguisher.*

18. Check for proper fluid levels prior to startup. Refer to Section 2.3, "Fluid and Lubricant Capacities".
19. Start engine and run to normal operating temperature then shut off engine. While engine is cooling, check for leaks.
20. Allow engine to cool. Check radiator coolant level. Add coolant as required.
21. Check for leaks from engine, main hydraulic pump and lines, transmission, hydraulic reservoir and fuel tank. Check levels of all fluids and lubricants. Fill as required.

Note: *During full throttle check:*

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

22. Check engine rpm at full throttle.
23. Purge the hydraulic system of air by operating all boom functions through their entire range of motion several times.
24. Check hydraulic oil level. If oil is warm, oil level should be visible in gauge window.
25. Check for proper operation of all components.
26. Turn engine OFF.
27. Install front cover (**4**), end covers (**3**), belly pan (**2**) and hood (**1**) at the engine compartment and adjust if necessary.
28. Close and secure engine cover.
29. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.10 TROUBLESHOOTING

Refer to Section 7.3, "Specifications and Maintenance Information", for detailed engine service information.

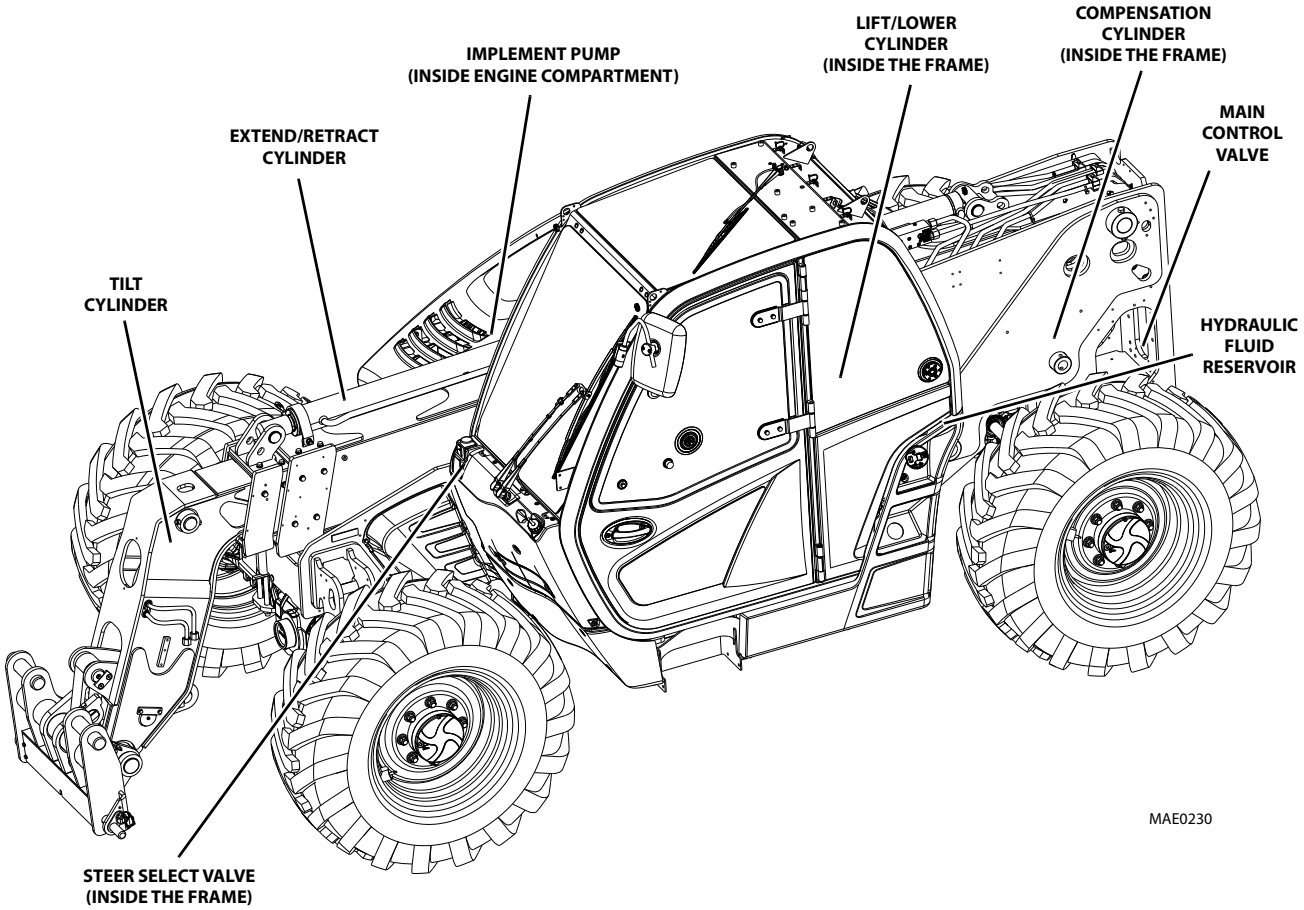
Section 8
Hydraulic System
Contents

PARAGRAPH		TITLE	PAGE
8.1		**Hydraulic Component Terminology**	**8-2**
	8.1.1	832	8-2
	8.1.2	925	8-3
8.3		**Specifications**	**8-4**
8.4		**Hydraulic Pressure Diagnosis**	**8-5**
	8.4.1	Pressure Checks and Adjustments	8-5
8.5		**Hydraulic Circuits**	**8-5**
	8.5.1	Hydraulic Pressures	8-5
8.6		**Hydraulic Schematic**	**8-9**
8.7		**Hydraulic Reservoir**	**8-12**
	8.7.1	Hydraulic Oil Reservoir Draining	8-12
	8.7.2	Hydraulic Oil Reservoir Filling	8-12
	8.7.3	Hydraulic Filter Replacement	8-13
	8.7.4	Hydraulic Oil Reservoir Removal/Installation	8-13
8.8		**Implement Pump**	**8-16**
	8.8.1	Pump Replacement	8-16
8.9		**Control Valves**	**8-17**
	8.9.1	Main Control Valve	8-17
	8.9.2	Priority Valve	8-18
	8.9.3	Service Brake Valve	8-19
	8.9.4	Service Brake Bleeding	8-21
	8.9.5	Steering Orbital Valve	8-23
	8.9.6	Steer Select Valve	8-23
8.10		**Boom Ride Control (If Equipped)**	**8-25**
	8.10.1	General Accumulator Information	8-25
	8.10.2	Pre-Charging Accumulator	8-26
	8.10.2	Pre-Charging Accumulator	8-26
	8.10.3	Checking Pre-Charge	8-27
8.11		**Hydraulic Cylinders**	**8-27**
	8.11.1	General Cylinder Removal Instructions	8-27
	8.11.2	Cylinder Pressure Checking	8-29
	8.11.3	Steering Cylinders	8-29
	8.11.4	Extend/Retract Cylinder Bleeding Procedure - 832	8-30
	8.11.5	Cylinder Torque Specifications	8-31

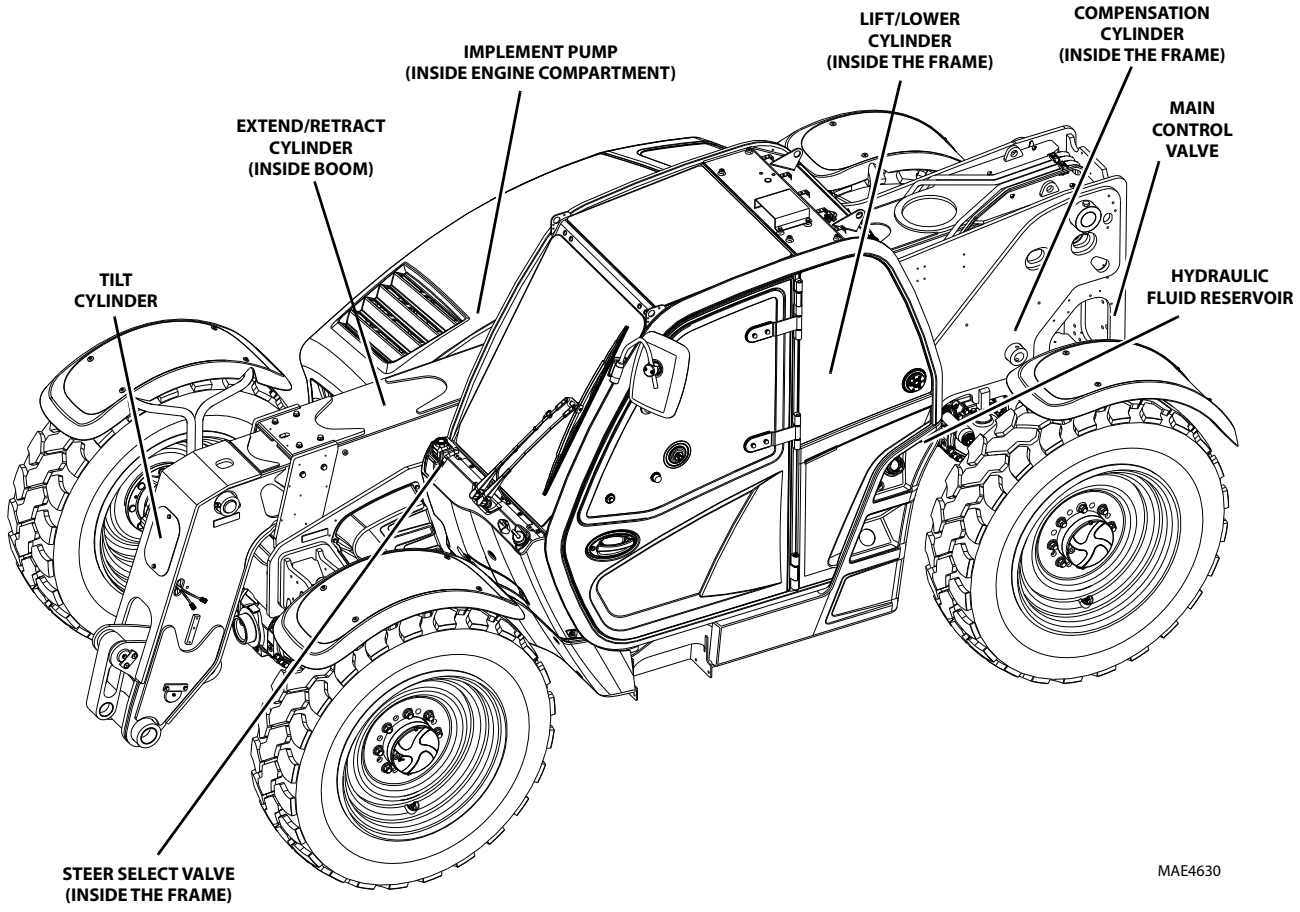
8.1 HYDRAULIC COMPONENT TERMINOLOGY

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.

8.1.1 832



8.1.2 925


LIFT/LOWER CYLINDER (INSIDE THE FRAME)
COMPENSATION CYLINDER (INSIDE THE FRAME)
IMPLEMENT PUMP (INSIDE ENGINE COMPARTMENT)
EXTEND/RETRACT CYLINDER (INSIDE BOOM)
MAIN CONTROL VALVE
TILT CYLINDER
HYDRAULIC FLUID RESERVOIR
STEER SELECT VALVE (INSIDE THE FRAME)
MAE4630

8.2 SAFETY INFORMATION

WARNING

DO NOT service the machine without following all safety precautions as outlined in Section 1, "Safety Practices".

Reference Section 2.4, "Service and Maintenance Schedules", for the appropriate maintenance intervals based on hours of operation, but if your equipment is exposed to extremely dirty or hostile conditions service may be required more frequently. Always use OEM filters to assure the necessary filtration requirements are met.

Petroleum-based hydraulic fluids are used in this machine. The temperature of hydraulic fluid increases during the operation of various hydraulic functions. A heated petroleum-based hydraulic fluid 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 fluid 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 fluid 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 fluid as clean as possible will help avoid downtime and repairs. Dirty or contaminated hydraulic oil can damage internal components and void the manufacturer's warranty. 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.

Manufacture's recommended hydraulic oil cleanliness levels are based on the three digit ISO code for 6 micron/ 14 micron particle sizes found in one ml of fluid (reference ISO 4406: 199(E). The acceptable level is 17/14 or below; anything higher requires system cleaning and filter replacement.

Note: *The human eye can only distinguish particles down to 40 microns.*

Reference Section 2.4, "Service and Maintenance Schedules", for the appropriate maintenance intervals based on hours of operation, but if your equipment is exposed to extremely dirty or hostile conditions service may be required more frequently. Always use OEM filters to assure the necessary filtration requirements are met.

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. Refer to Section 9.5, "Electrical System Schematic".

8.3 SPECIFICATIONS

Refer to Section 2.8, "Hydraulic Connection Assembly and Torque Specification", for hydraulic system specifications.

8.4 HYDRAULIC PRESSURE DIAGNOSIS

8.4.1 Pressure Checks and Adjustments

When diagnosing trouble in the hydraulic system, use the hydraulic testing information in Section 8.5.1, "Hydraulic Pressures".

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 in (N) NEUTRAL, level the boom and turn the engine OFF.
2. At the proper test port, 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 100-120° F (38-49° C). If a temperature gauge or thermometer is unavailable, the hydraulic oil reservoir should be warm to the touch.
4. Fully depress the accelerator pedal if 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 specified in the Pressure Readings column of the charts found in Section 8.5.1, "Hydraulic Pressures". 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. Adjust the relief valve by turning the adjustment screw. Turning clockwise will increase the pressure; turning the screw counterclockwise will decrease the pressure.
7. Start the engine and check the pressure again. Turn the engine OFF. If there is pressure reading in the gauge, bleed it off then disconnect or remove the pressure gauge from the machine.

8.5 HYDRAULIC CIRCUITS

This section covers the hydraulic circuits and includes listings for all hydraulic function pressures, where and how to check those pressures and a hydraulic schematic.

Electrical and hydraulic functions are often related. Verify that the electrical components of the circuit are functioning properly whenever troubleshooting the hydraulic circuit.

Always check the following before beginning to troubleshoot a circuit that is not functioning correctly.

1. Check the hydraulic oil level in the reservoir. If oil is cold, oil level should be visible in the lower gauge window with all cylinders retracted.
2. Check hoses, tubes, fittings and other hydraulic components for leaks, bends, kinks, interference, etc.
3. Check for air in the hydraulic system. Erratic machine performance and/or spongy cylinder operation are signs of air in the hydraulic system.

   If air in the hydraulic system is suspected, you will hear air leakage when hydraulic fittings are loosened and see air bubbles in the hydraulic fluid.

   Loose fittings, faulty o-rings or seals, trapped oil, leaks, system opened for service, etc., can cause air in the system. Determine what is causing air to enter the system and correct it. Bleed air from the system.

8.5.1 Hydraulic Pressures

a. Checking Pressure

1. Start the machine and warm the hydraulic system to operating temperature.
2. Shut off the machine and install a digital or a 5000 psi (345 bar) gauge to the appropriate test port on the priority function valve.
3. Start the machine, run the engine at idle and bottom the appropriate hydraulic function. Refer to Section 8.5.1. c, "Pressure Specifications",, for the correct pressure rating.

b. Adjusting Maximum Hydraulic Pressure

1. Shut the machine off.
2. Start the machine and loosen the jam nut on the relief. Turn the relief clockwise to increase pressure or counter-clockwise to decrease pressure. Set to the correct pressure.
3. Tighten the jam nut and recheck the pressure. If the reading is within specification, shut the machine off, install the safety cap and remove the gauge from the test port.

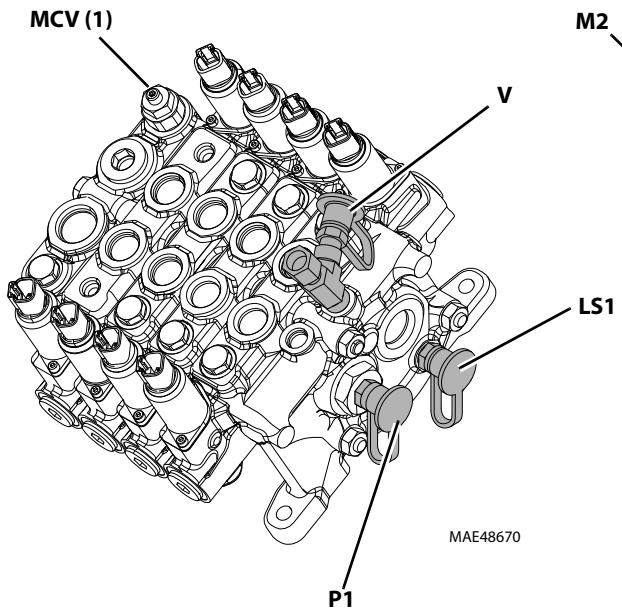
4. If the proper pressure cannot be set, use the accompanying hydraulic schematic and/or the electrical schematic to help troubleshoot and correct the problem.

Note: ***DO NOT*** *operate any other function while checking steering pressure.*

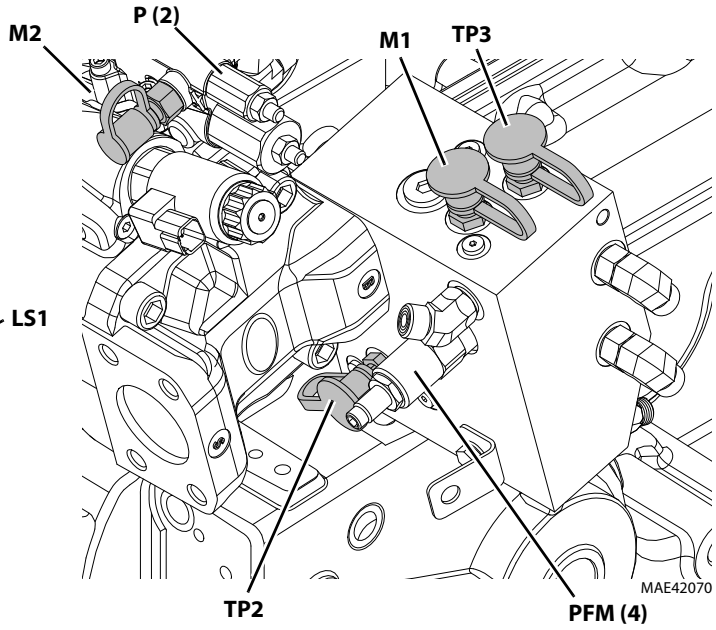
Note: *The steering pressure is pre-set from the manufacturer and cannot be adjusted.*

c. Pressure Specifications

MAIN CONTROL VALVE



IMPLEMENT PUMP AND PRIORITY VALVE



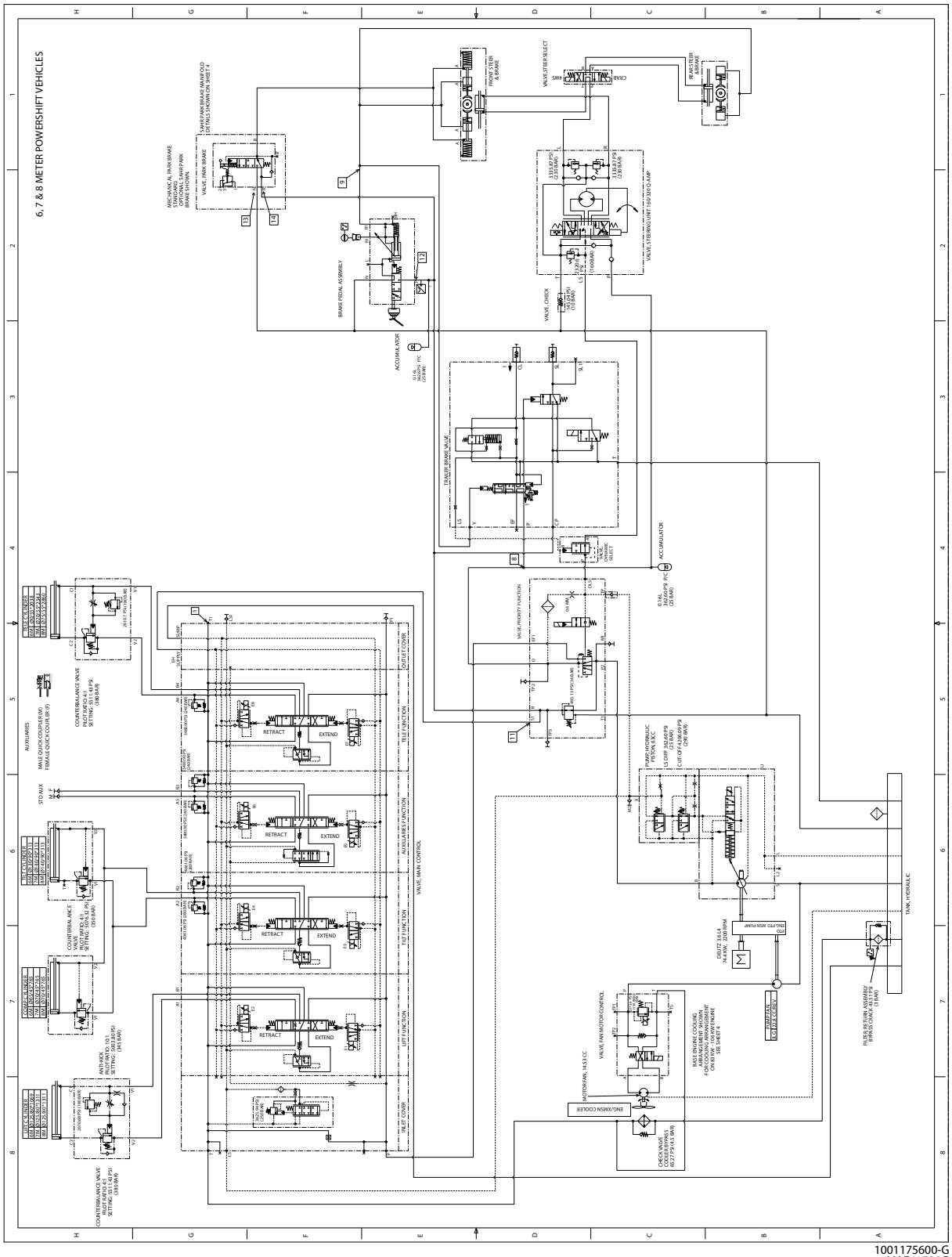
Note: *All pressures must be checked in numerical order.*

Steps	Hydraulic Circuit	Test Port	Procedure	Adjustment Location	Pressure Range	Nominal Value	Notes
1	Standby Pressure	**M1**	Connect gauge to M1 port, run engine at low idle, no function, Park Brake On (set)	P (2)	464 - 609 psi (32 - 42 bar)	536.6 psi (37 bar)	Check steps 2 and 3 before adjusting
2	LS at standby	**M2**	Connect gauge to M2 port, run engine at low idle, no function, Park Brake On (set)	N/A	116 - 232 psi (8 - 16 bar)	174 psi (12 bar)	If specifications not achieved, diagnose steering LS or other LS network issue
3	Margin	-	(1)Standby Pressure - (2) LS Pressure = Margin Pressure	Calculation	348 - 377 psi (24 - 26 bar)	362.6 psi (25 bar)	If specifications not achieved, add value observed at step 2 to Nominal Pressure for step 3 and target the resulting sum as the set point in step 1.

Steps	Hydraulic Circuit	Test Port	Procedure	Adjustment Location	Pressure Range	Nominal Value	Notes
4	Main High Pressure Cutoff	**M1**	Connect gauge to M1 port, run engine at low idle, stall tilt up, Park Brake On (set)	MCV (1)	3901.5 - 4075.6 psi (269 - 281 bar)	3988.5 psi (275 bar)	If specifications not achieved by adjustment at MCV (1), recheck by stalling tilt down. If no change see step 8.
5	Pilot	**TP3**	Connect gauge to TP3 port, run engine at low idle, stall tilt up, Park Brake On (set)	PFM (4)	464 - 507.6 psi (32 - 35 bar)	478.6 psi (33 bar)	Verification that PRV closes at correct pressure, with function
6	Steering Priority Load Sense	**TP2**	Connect gauge to TP2 port, run engine at low idle, stall steering	N/A	2697.7 - 2784.7 psi (186 - 192 bar)	2741 psi (189 bar)	Non Adjustable - LS Relief Pre-set in the Steering unit
7	Auxiliary	**M2**	Connect gauge to M2 port, run engine at low idle, stall auxiliary one direction, check, then stall auxiliary other direction, repeat check	N/A	3016.8 - 3335.9 psi (208 - 230 bar)	3161.8 psi (218 bar)	Pressure / Functional Check
8	Load Sense Relief (Please see note section)	**M2**	- Adjust Standby pressure as in steps 1, 2, and 3. - Adjust Main Compensator High Pressure Cut Off to 4206 psi (290 bar). Note that adjustment may require incrementally increasing Load Sense Relief Valve (MCV 1) first, then Main Pump Compensator until a setting of 4206 psi (290 bar) can be observed on the M1 gauge.	MCV (1)	3597 - 3727.5 psi (248 - 257 bar)	3626 psi (250 bar)	Only needed if step 4 cannot be achieved
9	Tele	**M2**	Connect gauge to M2 port, run engine at low idle, stall tele extend	N/A	3408.4 - 3727.5 psi (235 - 257 bar)	3481 psi (240 bar)	Pressure / Functional Check

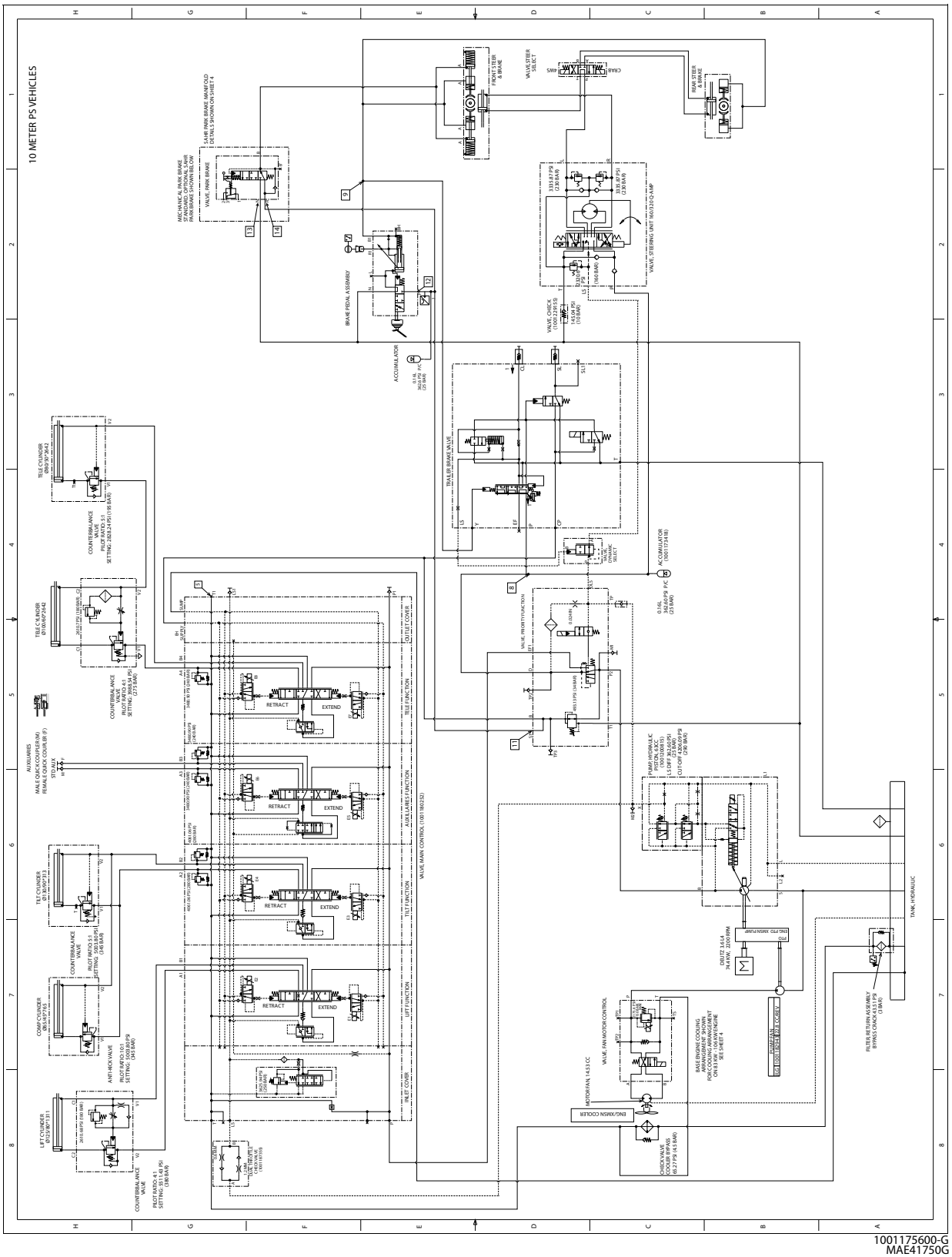
8.6 HYDRAULIC SCHEMATIC

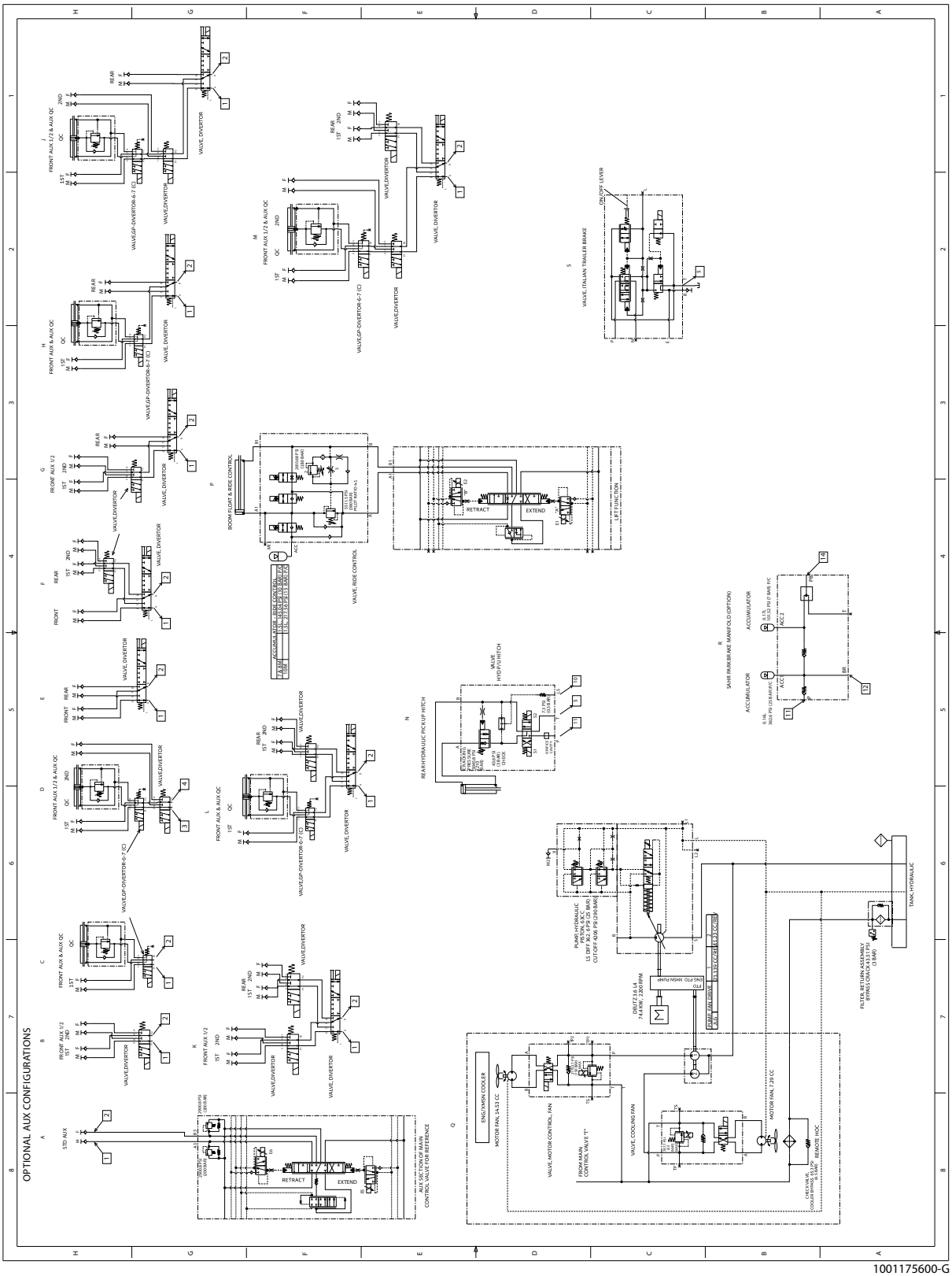
a. 925



1001175600-G
MAE41730G

b. 832





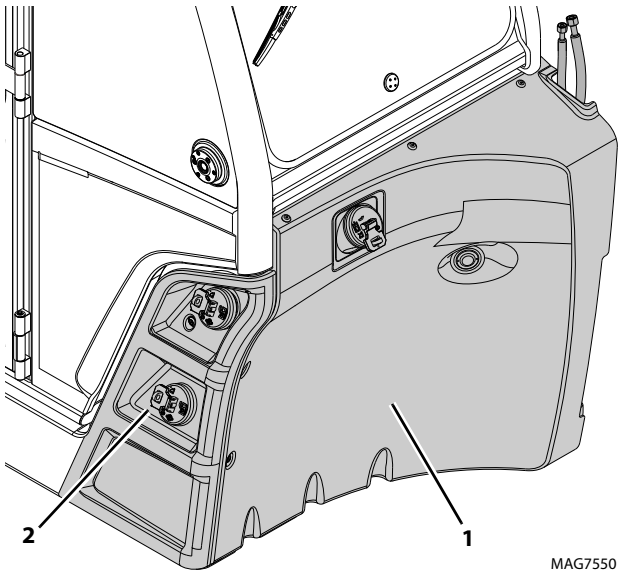
1001175600-G
MAE41760G

8.7 HYDRAULIC RESERVOIR

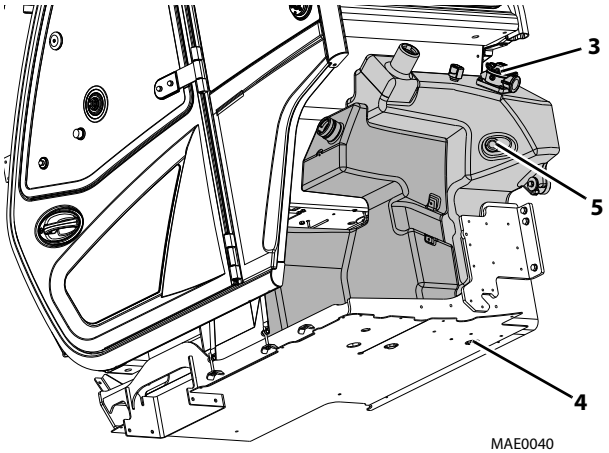
The hydraulic reservoir is located between the cab and the frame.

8.7.1 Hydraulic Oil Reservoir Draining

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Remove fuel tank/hydraulic tank access cover (**1**).
6. Remove DEF tank access cover (**2**).

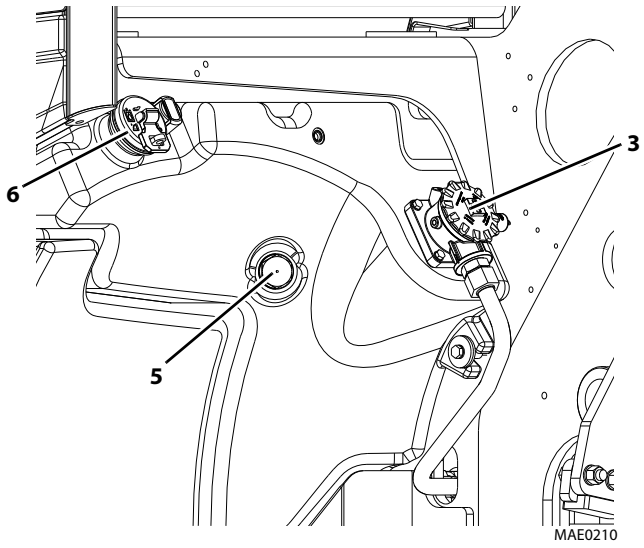


7. Open the filler cap (**3**) on the hydraulic oil reservoir. Remove the drain plug (**4**) on the bottom of the hydraulic oil reservoir.
8. Transfer the used hydraulic oil into a suitable covered container, and label as "Used Oil". Dispose of used oil at an approved recycling facility. Clean and reinstall the drain plug. Torque drain plug to 22-29 lb-ft (30-40 Nm).
9. Wipe up any hydraulic fluid spillage in, on, near and around the machine and the work area.

8.7.2 Hydraulic Oil Reservoir Filling

1. Be sure the reservoir is clean and free of all debris.
2. Install a new hydraulic oil filter. Refer to Section 8.7.3, "Hydraulic Filter Replacement".
3. Fill the reservoir with oil until oil level is visible in the gauge window (**5**). Refer to Section 2.3, "Fluid and Lubricant Capacities".
4. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
5. Close and secure the engine cover.
6. Start machine and check all hydraulic functions for proper operation. Check for any hydraulic oil leaks. Shut machine OFF and check hydraulic oil level. If oil is warm, oil level should be visible in the gauge window (**5**). Add hydraulic oil if necessary.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

8.7.3 Hydraulic Filter Replacement

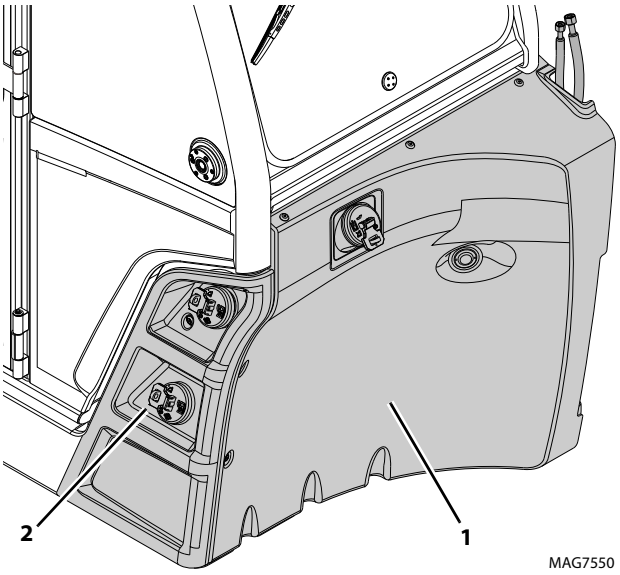


a. Hydraulic Filter Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Remove hydraulic tank access cover (**1**).
6. Remove Fuel / DEF tank access cover (**2**).
7. Remove the cab access panels at the rear of the cab.
8. Be sure the filter area is clean and free of all debris.
9. Remove the hydraulic filter cap (**3**) on the hydraulic oil reservoir.
10. Lift hydraulic filter handle and pull filter assembly from the reservoir. Cover the filter opening to keep dirt and debris from entering the hydraulic system.
11. Transfer the used hydraulic oil filter into a suitable covered container, and label as “Used Oil”. Dispose of used filter at an approved recycling facility.

b. Hydraulic Filter Installation

1. Apply a light coating of clean hydraulic oil to the new hydraulic filter base.
2. Remove cover from hydraulic tank filter opening and install filter. Verify filter is seated in reservoir.
3. Install hydraulic filter cap (**3**).
4. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.



5. Close and secure the engine cover.
6. Start machine and check all hydraulic functions for proper operation. Check for any hydraulic oil leaks. Shut machine OFF and check hydraulic oil level. If oil is warm, oil level should be visible in the gauge window (**5**). Add hydraulic oil if necessary (**6**). Refer to Section 2.3, “Fluid and Lubricant Capacities”.
7. Install the cab access panels at the rear of the cab.
8. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

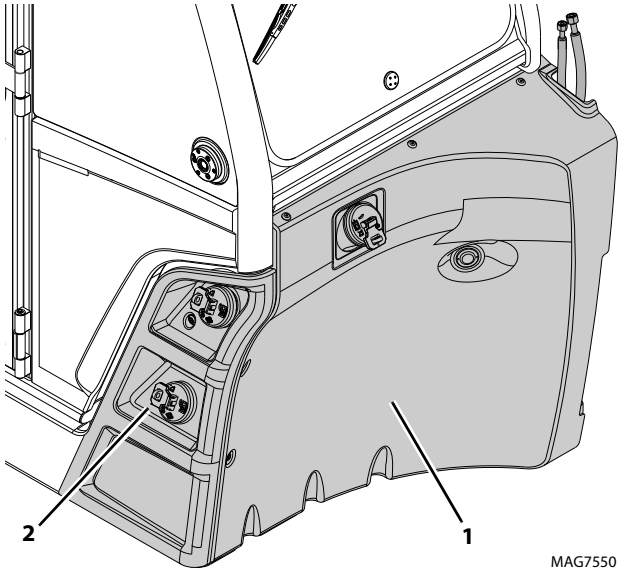
8.7.4 Hydraulic Oil Reservoir Removal/ Installation

If it is determined that the hydraulic oil reservoir must be removed, the hydraulic oil must be drained before the reservoir is removed. Always dispose of hydraulic oil properly.

a. Reservoir Removal

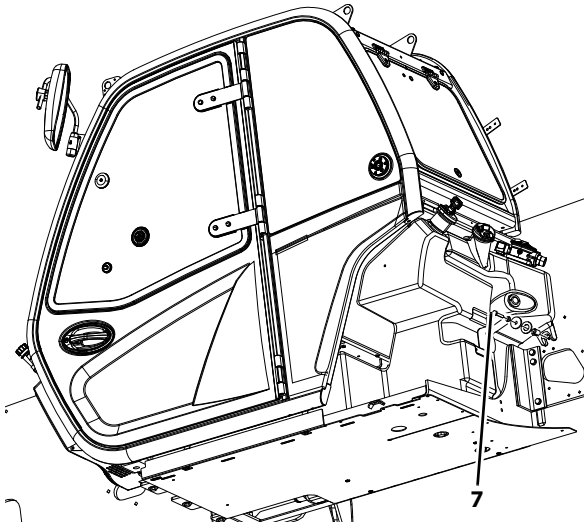
1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
3. Open the engine cover.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

4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.

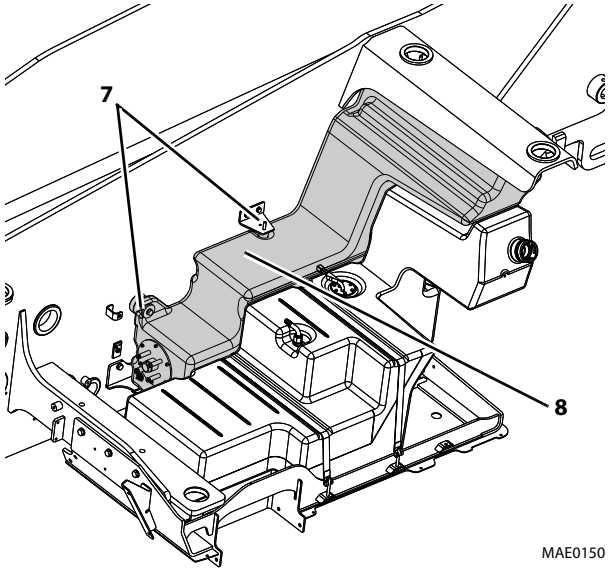


MAG7550

5. Remove hydraulic tank access cover (**1**).
6. Remove Fuel/DEF tank access cover (**2**).
7. Drain the hydraulic oil reservoir. Refer to Section 8.7.1, “Hydraulic Oil Reservoir Draining”.
8. Label, disconnect and cap all hydraulic hoses attached to the hydraulic oil reservoir. Cap all fittings and openings to keep dirt and debris from entering the hydraulic system.



MAG0890



MAE0150

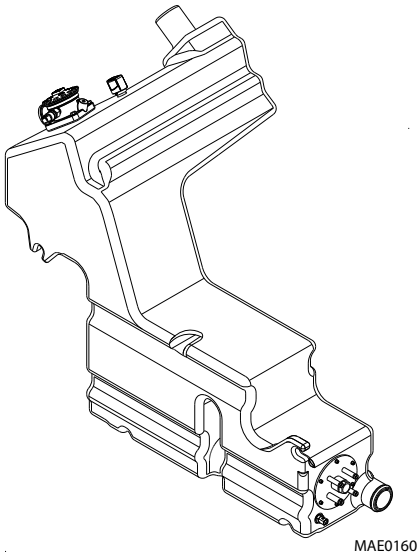
9. Properly support the cab.
10. Loosen and remove cab mounting bolts and pull cab away from frame to allow removal of the hydraulic reservoir (**8**).

Note: *If required, label, disconnect and cap any hydraulic hoses and/or electrical wires attached to the cab that would provide additional clearance in the removal of hydraulic tank. Cap fittings and openings to keep dirt and debris from entering the hydraulic systems.*

11. Drain the fuel tank and remove the fuel tank and tray.
12. Properly support the hydraulic reservoir (**8**).
13. Remove hardware (**7**) from hydraulic reservoir (**8**). Remove the hydraulic reservoir (**8**).

b. Disassembly

Dispose of the old reservoir according to local regulations concerning hazardous materials disposal.


MAE0160

1. Note the orientation of all fittings, adapters and tubes on the hydraulic tank.
2. Label and remove all fittings, adapters and tubes from the hydraulic tank.

c. Cleaning and Drying

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

To clean the hydraulic oil reservoir:

1. Have a dry chemical (Class B) fire extinguisher near the work area.
2. Remove the hydraulic oil reservoir drain plug, and safely drain any hydraulic oil into a suitable container. Dispose of hydraulic oil properly.
3. Clean the hydraulic oil reservoir with a high-pressure washer, or flush the tank with hot water for five minutes and drain the water. Dispose of contaminated water properly.

d. Inspection

1. Inspect the hydraulic oil reservoir (**8**) thoroughly for any cracks, slices, leaks or other damage.

e. Assembly

1. Install the previously removed fittings, adapters and tubes in the correct orientation.
2. Properly torque all fittings and adapters as required.

f. Reservoir Installation

1. Place the hydraulic oil reservoir (**8**) into its original orientation.
2. Secure the hydraulic oil reservoir (**8**) to the frame with the previous mounting hardware (**7**).
3. Uncap and connect the previously labeled hydraulic hoses to their appropriate locations. Be sure all lines are free of kinks and sharp bends.
4. Tighten previously loosened cab mounting bolts. Torque as required.
5. Fill the reservoir with oil until oil level is visible in the gauge window. Refer to Section 2.3, “Fluid and Lubricant Capacities”.
6. Check the hydraulic oil reservoir for leaks.
7. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
8. Close and secure the engine cover.
9. Start machine and check all hydraulic functions for proper operation. Check for any hydraulic oil leaks. Shut machine OFF and check hydraulic oil level. If oil is warm, oil level should be visible in the gauge window. Add hydraulic oil if necessary.
10. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

8.8 IMPLEMENT PUMP

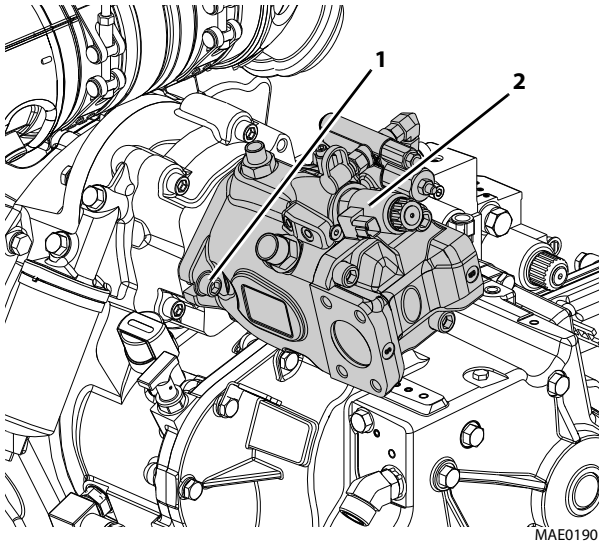
8.8.1 Pump Replacement

a. Pump Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Thoroughly clean the pump and surrounding area, including all hoses and fittings before proceeding.

Note: *Cap all hoses as you remove them to prevent unnecessary fluid spillage.*

6. Label, disconnect and cap the hydraulic hoses attached to the pump.



7. Remove the two bolts and lockwashers (**1**) securing the pump (**2**) to the adapter plate. Remove the o-ring located between the plate and the pump.
8. Wipe up any hydraulic fluid spillage in, on, near and around the machine and the work area.

Note: DO NOT *disassemble the operating pump. The pump is pre-set from the manufacturer.*

b. Pump Installation

1. Refer to Section 2.2, "Specifications", for correct threadlocking compound.
2. If the adapter plate was removed, place into position with a new, oiled o-ring on the transmission. Secure with the previously used hardware.
3. Place the pump and a new, oiled o-ring into position on the adapter plate. Align the pump shaft with the internal gear, so that the machined teeth mesh together.
4. Align the bolt holes with the pump mount holes. Secure the pump to the adapter plate with the two bolts and washers. Torque as required.
5. Uncap and connect the previously labeled hydraulic hoses to their appropriate locations.

Note: *Prime the pump by filling the case with fresh, filtered hydraulic oil from a clean container through fill port before installing hose and flanges.*

6. Fill the hydraulic reservoir. Refer to Section 8.7.2, "Hydraulic Oil Reservoir Filling".
7. Check all routing of hoses and tubing for sharp bends or interference with any rotating members.
8. Inspect for leaks and check all fluid levels. The hydraulic reservoir oil level must be to the middle of the sight gauge.
9. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
10. Close and secure the engine cover.
11. Start machine and verify proper operation.
12. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

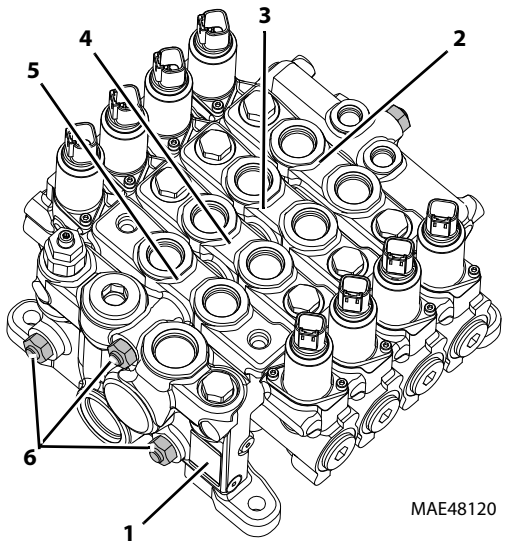
c. Implement Pump Test

Refer to Section 8.4.1, "Pressure Checks and Adjustments".

8.9 CONTROL VALVES

8.9.1 Main Control Valve

The main control valve is mounted at the rear frame.



The main control valve assembly (**1**) consists of working sections with their own valve assemblies, each providing a specific hydraulic function. Those functions are: extend/retract (**2**), aux (**3**), tilt (up/down) (**4**), and lift (up/down) (**5**).

a. Main Control Valve Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Remove the main control valve cover.
6. Thoroughly clean the main control valve and surrounding area, including all hoses and fittings, before proceeding.
7. Place a suitable container to catch hydraulic fluid drainage beneath the frame.
8. Label, disconnect and cap all the hydraulic hoses, tubes and wires at the main control valve. Slowly turn hose fittings to allow any trapped pressure in the hydraulic system to escape.
9. Wipe up any hydraulic fluid spillage in, on, near and around the machine and the work area.
10. Support the valve and remove the four bolts securing the main control valve to the frame. Remove the main control valve.

b. Main Control Valve Disassembly

Disassemble the Main Control Valve

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

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

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

Disassemble each Valve Section

1. Carefully separate the load sense outlet section from the next section.
2. Remove the o-rings from between the two sections.
3. Carefully separate each remaining section.
4. Remove any check valves, compensator valves, anti-cavitation valves or shock valves from 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 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 fluid 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 check valves, compensator valves, anti-cavitation valves or shock valves from each individual valve sections if equipped.
2. Install the end caps on each end of the valve section.

Assemble the Main Control Valve

1. If removed, install all four tie rods into the end main control valve section.
2. Stand the end main control valve section on end.
3. Install the proper o-rings and load sense shuttle on the inner face of the end main control valve section. Align the next valve section over the three tie rods and slide onto the end main control valve section.
4. Using the proper o-rings and load sense shuttle, repeat step three for the remaining valve sections and lastly the inlet end valve section.
5. Install the nuts on the tie rods (**6**) and torque to 30.98 lb-ft (42 Nm).

f. Main Control Valve Installation

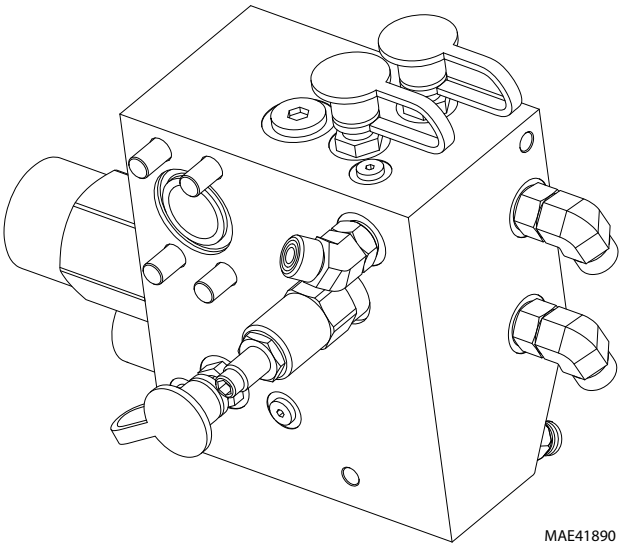
1. Install the main control valve onto the frame, aligning the bolts with the holes in the end sections of the main control valve. Slide the main control valve into position, and tighten the bolts.
2. Prime the main control valve by filling the inlet openings with fresh, filtered hydraulic oil from a clean container, before attaching the hoses.
3. Use new oiled o-rings as required. Uncap and connect all hoses, clamps, etc. to the main control valve.
4. 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.
5. Fill the hydraulic oil reservoir. Refer to Section 8.7.2, “Hydraulic Oil Reservoir Filling”.
6. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
7. 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.
8. Inspect for leaks and check the level of the hydraulic fluid in the reservoir. Shut the engine OFF.
9. Wipe up any hydraulic fluid spillage in, on, near and around the machine, work area and tools.
10. Install main control valve cover.
11. Close and secure the engine cover.
12. Remove the Do Not Operate Tag from 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 8.5.1, “Hydraulic Pressures”.

8.9.2 Priority Valve

The priority valve is mounted on the on the implement pump inside the engine compartment.



The function of a priority valve is to allow hydraulic fluid flow to certain functions within a hydraulic system when the pressure is greater than or equal to a specified level. In effect, the priority valve gives priority to certain components over less critical components.

a. Priority Valve Removal

1. Park the machine on a firm, level surface, level the machine, fully retract and lower the boom, place the transmission 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.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Remove the priority valve access cover.
6. Thoroughly clean the priority valve and surrounding area, including all hoses and fittings, before proceeding.
7. Place a suitable container to catch hydraulic fluid drainage beneath the frame.

8. Drain the hydraulic oil reservoir. Refer to Section 8.7.1, "Hydraulic Oil Reservoir Draining".
9. Label, disconnect and cap all the hydraulic hoses, tubes and wires at the priority valve. Slowly turn hose fittings to allow any trapped pressure in the hydraulic system to escape.
10. Wipe up any hydraulic fluid spillage in, on, near and around the machine and the work area.
11. Support the valve and remove the three bolts securing the priority valve to the frame. Remove the priority valve.

b. Priority Valve Disassembly, Cleaning, Inspection and Assembly

1. Place the priority valve assembly on a suitable work surface.
2. Separate the priority valve solenoids from the spool. Discard the o-rings.
3. Clean all components with a suitable cleaner before inspection.
4. Inspect the solenoid cartridges for proper operation. Check by shifting the spool to ensure that it is operating properly. Check that the spring is intact. Inspect the cartridge interior for contamination.

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.*

5. Install the solenoids in the priority valve housing.

c. Priority Valve Parts Cleaning

Clean all components with a suitable cleaner before continuing. Blow dry.

d. Priority 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 fluid causes failure of internal seals, damage to the polished surfaces within the component, and wear of and/or harm to other parts.

e. Priority Valve Installation

1. Install the priority valve to the frame using the previously removed nuts. Torque as required.
2. Connect all the hydraulic hoses, fittings, solenoid wire terminal leads, etc., to the priority valve.
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 hose clamps.
4. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
5. 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.
6. Inspect for leaks and check the level of the hydraulic fluid in the reservoir. Shut the engine OFF.

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

7. Wipe up any hydraulic fluid spillage in, on, near and around the machine, work area and tools.
8. Install the previously removed access cover.
9. Close and secure the engine cover.
10. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

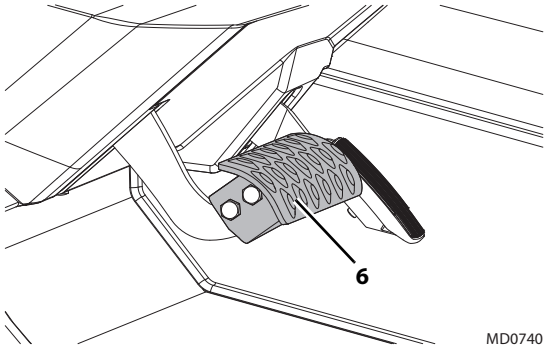
f. Priority Valve Test

Conduct a pressure check of the hydraulic system in its entirety. Adjust pressure(s) as required. Refer to Section 8.5.1, "Hydraulic Pressures".

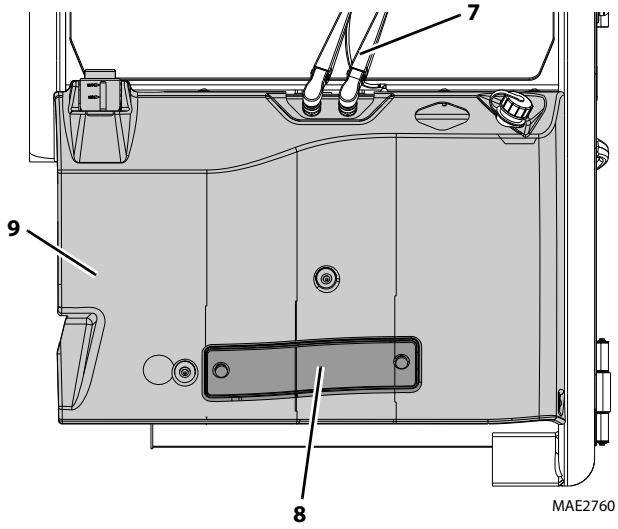
8.9.3 Service Brake Valve

a. Service Brake Valve Removal

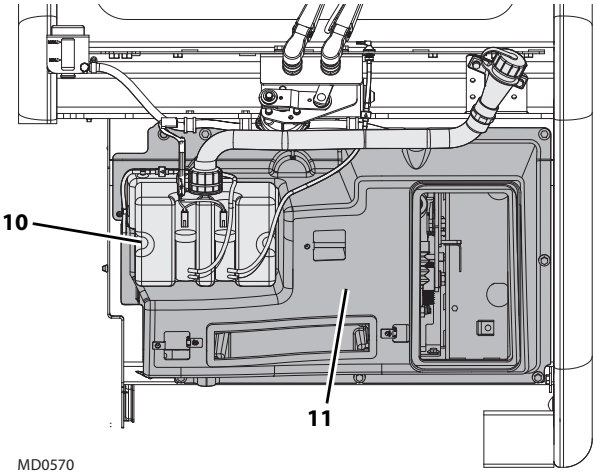
1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



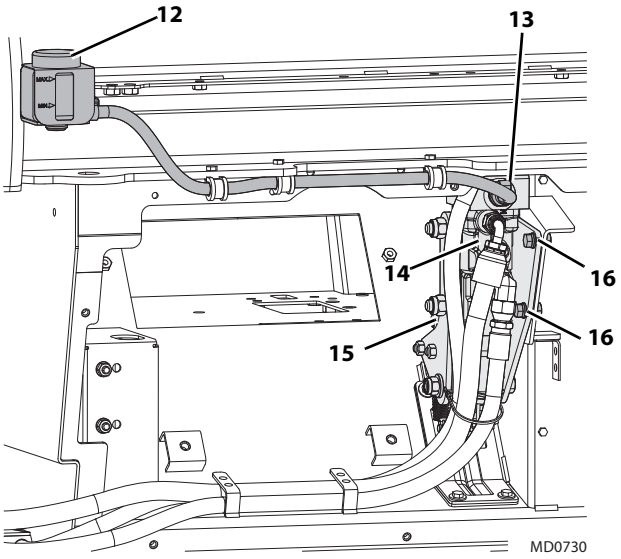
5. Remove brake pedal (**6**).



6. If equipped, remove the windshield wiper assembly (**7**).
7. Remove cab air filter cover (**8**).
8. Remove access covers from front of cab (**9**).



9. If equipped, remove windshield washer assembly (**10**), heater cover (**11**) and heater assembly.
10. Slowly turn surge tank cap to first stop and allow any pressure to escape. Remove surge tank cap.
11. Place a suitable container beneath radiator drain.
12. Place a funnel at base of radiator to channel drained coolant into a container. Open drain plug and slowly remove to allow coolant to drain. Transfer coolant into a properly labeled container. Dispose of properly if coolant needs replaced. Close radiator drain plug.



13. Remove the brake reservoir cap (**12**) and place a suitable container beneath brake reservoir connection (**13**).
14. Label, disconnect and cap all hoses attached to the service brake valve (**14**).
15. Disconnect and remove the electrical connector (**15**).
16. Remove the two nuts (**16**) securing the service brake valve to the cab.
17. Remove the valve through the front of the cab.

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

b. Service Brake Valve Installation

1. Install the service brake valve to its original orientation in the cab. Secure with the previously used hardware.
2. Install the service brake pedal.
3. Uncap and connect the previously labeled hydraulic hoses to the service brake valve.
4. Connect electrical connector.

5. 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.
6. Fill the brake reservoir.
7. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
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 the service brake valve and connections for leaks, and check the level of the fluid in the reservoir. Shut the engine OFF.
10. Wipe up any hydraulic fluid spillage in, on, near and around the machine, work area and tools.
11. Install the cover panel in the cab.
12. Install the access covers to the outside of the cab.
13. Close and secure the engine cover.
14. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

8.9.4 Service Brake Bleeding

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.

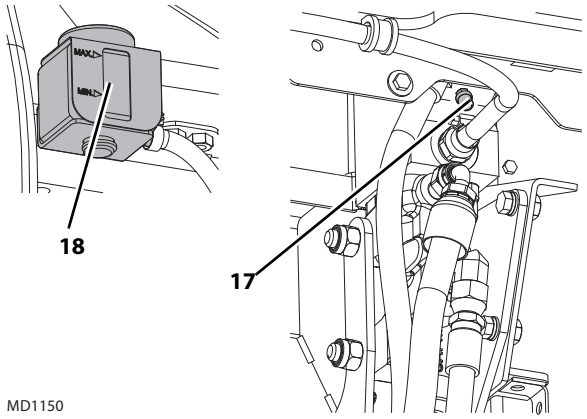
There are two service brake bleeders located on the front and rear axles.

Work with an assistant to perform this procedure.

Note: *Verify brake reservoir oil is at the full mark.* ***DO NOT*** *allow the brake reservoir oil to go below the minimum level during the bleeding procedure.*

a. Bleeding the Master Cylinder

1. Place the transmission in (N) NEUTRAL, engage the park brake, and start the engine.



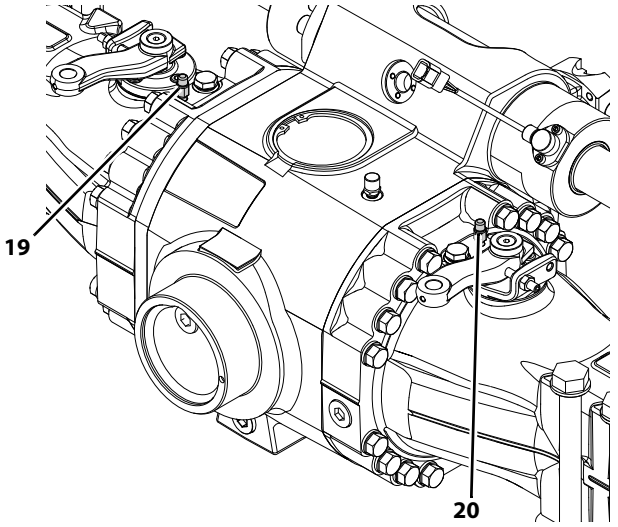
MD1150

2. Open the master cylinder valve bleeder (**17**) and allow the master cylinder to gravity fill and slowly depress the brake pedal.
3. Close the master cylinder valve bleeder (**17**) when service brake pedal is fully depressed.
4. Slowly release the brake pedal completely allowing oil to refill the master cylinder.
5. Repeat above process until oil is no longer aerated. Ensure to monitor the oil level.
6. Refill the brake reservoir (**18**).

b. Bleeding the Front and Rear Axles

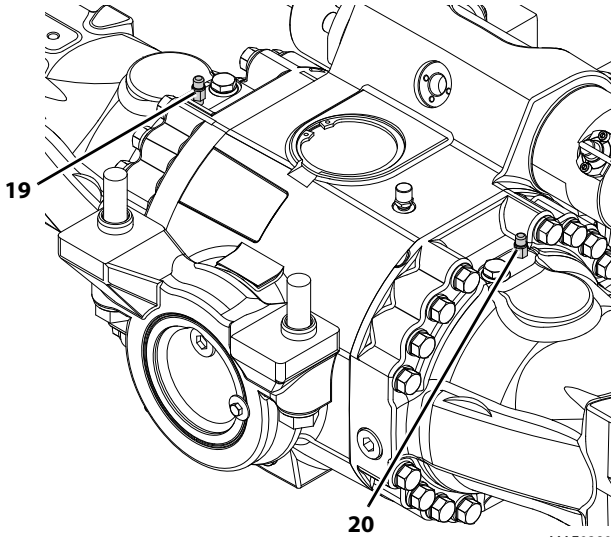
1. Place the transmission in (N) NEUTRAL, engage the park brake, and start the engine.

FRONT AXLE



MAE0270

REAR AXLE

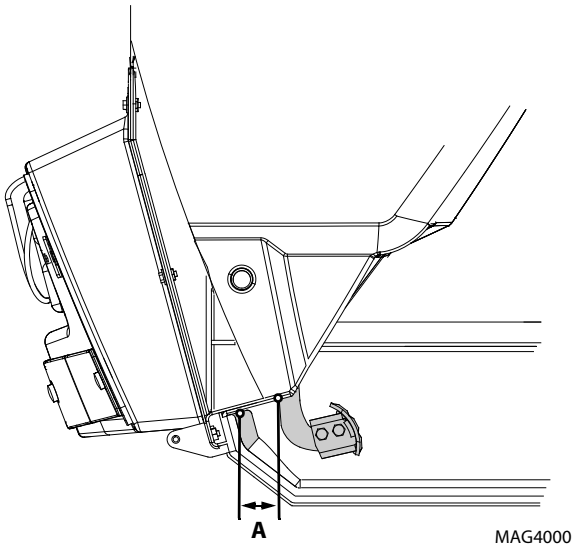


MAE0280

2. Remove the plastic cap from the right rear brake bleeder (**19**). 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 automatic transmission fluid (ATF 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. Have the assistant depress the brake pedal. Close the brake bleeder when brake pedal is fully depressed. Repeat the procedure until oil is not aerated further. Remove the tubing from the brake bleeder.
4. Repeat steps 2 and 3 for the left rear brake bleeder (**20**).
5. Repeat steps 2 and 3 for the right front brake bleeder.
6. Repeat steps 2 and 3 for the left front brake bleeder.
7. Repeat steps 2 thru 6 three times.
8. Repeat Section 8.9.4, “Service Brake Bleeding”, one additional time.

c. Brake System Check

1. Start the engine.
2. Release the park brake.
3. Apply service brake several times slowly (this brings the service brake pistons in contact with the brake pressure plate).
4. Wait approximately 10 seconds (this allows pressure in the brake circuit to fully decay).
5. Apply service brakes with a single pedal press until brake power assist ceases. Hold brake pedal in this position. Brake pedal force will rise sharply for pedal motion beyond this point. Typical pedal force level is 245 - 275 N.
6. Measure the distance from the back of the pedal arm to cab firewall. Floor mat removal may be necessary. This distance should be ≥57 mm.



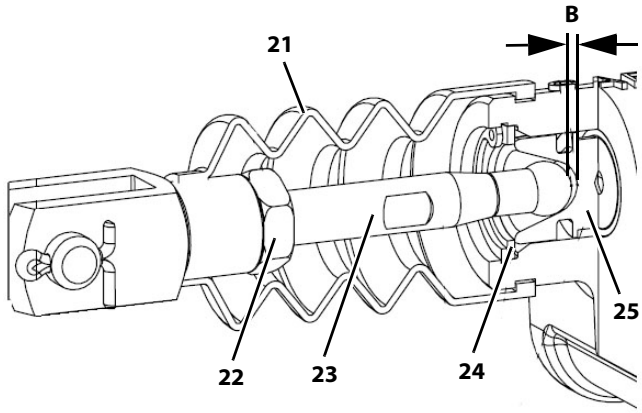
MAG4000

7. If pedal distance is <57 mm, check the pedal for free play. If free play exists, it may be adjusted to minimum of "0" by using the pedal free play adjustment procedure. If free play is correct, then re-bleed brake system.

d. Free Play Adjustment

⚠ CAUTION

DO NOT adjust when engine is off. Over-adjustment of the free play can result in brake drag.



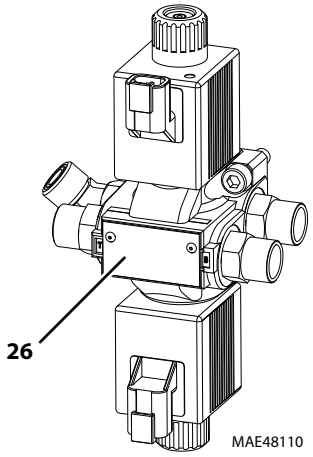
MAG4010

1. Slide boot (**21**) up to reveal locknut (**22**) and pushrod (**23**).
2. Start the engine. This will supply boost pressure and ensure that pushrod (**23**) is fully returned to the stop ring (**24**).
3. Loosen locknut (**22**), swivel the pushrod (**23**) first clockwise to shorten it (to be sure it was not previously over-adjusted), and then counterclockwise to lengthen it until it contacts the piston (**25**). Use only hand effort to adjust. To achieve the free play shown in image above, the pushrod gap (**B**) will be 0 - 0.5 mm.
4. Hold the pushrod (**23**) with pliers and tighten the locknut (**22**). Reinstall the boot (**21**).

8.9.5 Steering Orbital Valve

The steering orbital valve is located at the base of the steering wheel shaft, concealed by the front access covers. The valve is not serviceable and must be replaced in it's entirety if defective. For detailed information, refer to Section 4.3.2, "Steering Column/Orbital Valve".

8.9.6 Steer Select Valve



MAE48110

The machine can be used in the front-wheel, four-wheel or crab steering mode. The steer select valve (**26**) controls the direction of hydraulic fluid flow to the steering cylinder mounted on each axle. The steer select valve is attached inside the frame above the priority valve.

Verify the correct operation of the steer select valve solenoids before considering replacement of the valve. Refer to Section 9.5, "Electrical System Schematic". The housing of the steer select valve is not serviceable and must be replaced if defective.

a. Steer Select Valve Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Label, disconnect and cap the hydraulic hoses and the electrical plugs connected to the steering select valve.
6. Remove the bolts holding the steer select valve to the mounting plate on the frame.
7. Remove the steer select valve from the machine. Wipe up any hydraulic fluid spillage in, on, near and around the machine.

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

1. Place the steer select assembly on a suitable work surface.
2. Separate the steer select solenoids from the spool. Discard the o-rings.
3. Clean all components with a suitable cleaner before inspection.
4. 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.
5. Inspect internal passageways of the steer select 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 fluid causes failure of internal seals and damage to the polished surfaces within the secondary function manifold.

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 solenoids in the steer select housing.

c. Steer Select Valve Installation

1. Install the steer select valve to the mounting plate under the left front side of the frame using the two bolts.
2. Connect all the hydraulic hoses, fittings, solenoid wire terminal leads, etc., to the steer select valve.
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 hose clamps.
4. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
5. 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.
6. Inspect for leaks and check the level of the hydraulic fluid in the reservoir. Shut the engine OFF.

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

7. Wipe up any hydraulic fluid 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 Tag from the ignition key switch and the steering wheel.

d. Steering Test

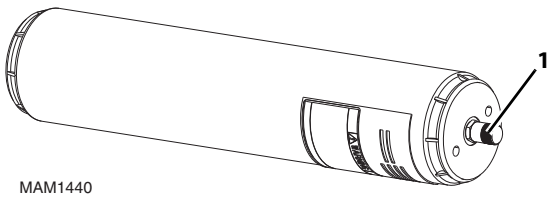
Refer to Section 8.5.1, "Hydraulic Pressures".

1. Conduct a pressure check of the steering hydraulic circuit.
2. Check each steering mode for proper function.

8.10 BOOM RIDE CONTROL (IF EQUIPPED)

8.10.1 General Accumulator Information

The accumulator is a piston type accumulator.
The pneumatic accumulator is operated by compressed gas. Gas and hydraulic oil occupy the same container. When oil pressure rises, incoming oil compresses the gas. When oil pressure drops, the gas expands, forcing the oil out into the lift side of the lift/lower cylinder.
The gas is separated from the oil by a piston. This prevents the mixing of gas and oil and keeps gas out of the hydraulic system.



The accumulator must be "pre-charged" with gas before use in the hydraulic system. This is done by filling the gas chamber with dry nitrogen. The schrader valve is located under the protective cap (**1**) at the top of the accumulator. The schrader valve is used for pre-charging and testing the accumulator.

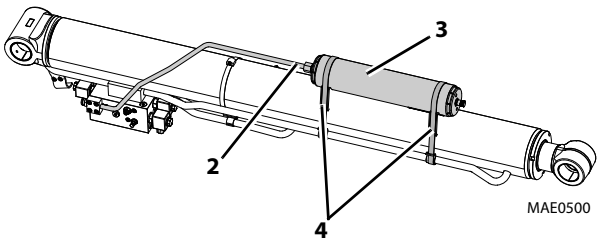
This section covers the charging of the accumulator system.

The accumulator is located and mounted on the lift/lower cylinder. The internal parts of the accumulator are not serviceable. If the internal piston is leaking, or the seals on the top or bottom cap are leaking, the accumulator requires replacement.

The accumulator pre-charge pressure will vary depending on the ambient temperature that the accumulator was pre-charged at and the actual operating temperature of the accumulator.

a. Accumulator Removal

1. Remove any attachment from the machine. Park the machine on a firm level surface and fully retract the boom. Raise the boom to allow sufficient work space around the lift/lower cylinder to allow the accumulator to be removed. Support the boom. Place the transmission in (N) NEUTRAL, engage the park brake, shut the engine OFF and chock wheels.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
3. Open the engine cover. Allow the system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Disconnect and cap or plug the hydraulic tube (**2**) at the accumulator (**3**).
6. Remove the two clamps (**4**) securing the accumulator to the lift/lower cylinder.
7. Remove the accumulator.
8. Wipe up any hydraulic fluid spillage in, on, near and around the machine, work area and tools.

b. Accumulator Installation

1. Secure the accumulator (**3**) to the lift/lower cylinder with the two clamps (**4**). Do Not tighten.
2. Uncap and connect the hydraulic tube (**2**) to the accumulator.
3. Adjust accumulator and tighten hose clamps (**4**).
4. Remove the boom support.
5. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.
8. Refer to Section 8.10.2, "Pre-Charging Accumulator", for Accumulator pre-charging instructions.

8.10.2 Pre-Charging Accumulator

WARNING

NEVER fill an accumulator with oxygen! An explosion could result if oil and oxygen are mixed under pressure. Only fill accumulator with dry nitrogen.

Pre-charged the accumulator with nitrogen gas only. Nitrogen gas is free of water vapor and oxygen which makes it harmless to internal parts and will not react if mixed with oil under pressure.

NOTICE

Never fill an accumulator with air! Air contains moisture which can cause corrosion. This corrosion may damage seals and ruin the accumulator.

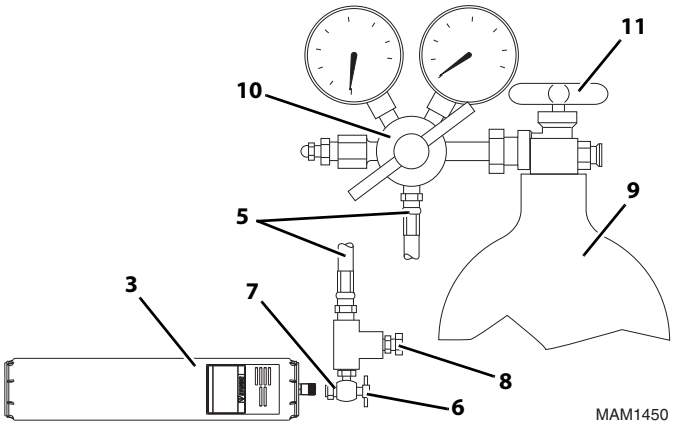
Never charge an accumulator to a pressure more than specified. The proper pressure for the accumulator is :

- 925 - 145 psi (10 bar).
- 832 - 217.5 psi (15 bar)

Note: *Make sure the nitrogen bottle, as well as the charging and gauge assembly used is compatible with the schrader valve assembly on the accumulator. The nitrogen bottle and all components must be rated for a pressure at least as high as the nitrogen source. It is strongly recommended that the nitrogen bottle has a high pressure regulator.*

You will require an accumulator fill kit to properly charge the accumulators. Refer to the parts manual or contact the local JLG dealer.

Use the following steps to properly pre-charge each accumulator:

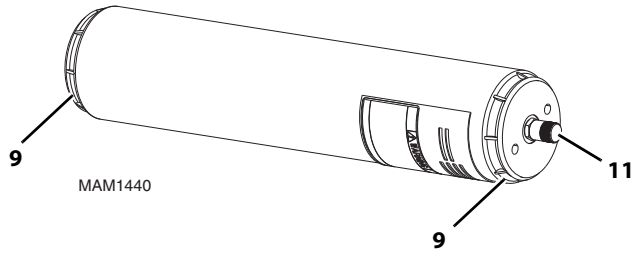


1. Thoroughly clean the top of each accumulator (**3**).
2. Make sure the nitrogen supply is shut off.
3. Attach the accumulator fill kit (**5**) to the nitrogen bottle (**9**).
4. Remove the protective cap from the gas valve on the accumulator.
5. Back the "T" handle (**6**) on the accumulator fill kit all the way out (counter-clockwise). Attach the schrader adaptor (**7**) to the gas valve on the accumulator. Tighten securely.
6. Turn the gas valve/bleed valve (**8**) on the accumulator fill kit all the way in.
7. Turn the "T" handle (**6**) all the way in to open the valve core on the accumulator.
8. Open the valve (**11**) on the nitrogen bottle (**9**).
9. Slowly adjust the regulator (**10**) on the nitrogen bottle to read pressure as below:
   - 925 - 145 psi (10 bar)
   - 832 - 217.5 psi (15 bar)
10. Close the main valve (**11**) on the nitrogen bottle (**9**).
11. Back the "T" handle (**6**) on the accumulator fill kit all the way out (counter-clockwise).
12. Let the pre-charge on the accumulator set for 10 - 15 minutes. This will allow the gas temperature to stabilize. If the desired pre-charged range is exceeded, turn the "T" handle (**6**) all the way in. With the main valve (**11**) closed on the nitrogen bottle, turn the gas valve/bleeder valve (**8**) out to bleed pressure off the accumulator. Turn the valve all the way in and check the pressure reading on the regulator gauge.

13. When the correct pressure is reached, back the "T" handle (**6**) on the accumulator fill kit all the way out (counter-clockwise). Bleed the pressure from the hose by turning the gas valve/bleed valve out to relieve the pressure.
14. Turn the gas valve/bleed valve (**8**) all the way in and remove the schrader adapter (**7**) from the valve on the accumulator.
15. Reassemble the protective cap onto the gas valve on the accumulator.

8.10.3 Checking Pre-Charge

a. Gas Leaks



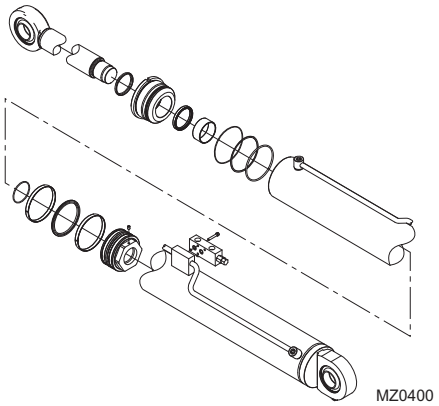
1. If an external leak is suspected, apply soapy water to the gas valve (**11**) and the seams of the gas bottle (**9**). If bubbles form, the accumulator has to be replaced.
2. If an internal leak is suspected, check for foaming oil in the hydraulic reservoir and/or no accumulator action. If any of these signs are evident, the accumulator has to be replaced.

8.11 HYDRAULIC CYLINDERS

8.11.1 General Cylinder Removal Instructions

1. Remove any attachment from the machine. Park the machine on a firm level surface and fully retract the boom. Allow sufficient work space around the hydraulic cylinder being removed. Support the boom if the lift/lower cylinder is being removed. Place the transmission in (N) NEUTRAL, engage the park brake, shut the engine OFF and chock wheels.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
3. Open the engine cover. Allow the system fluids to cool.
4. Label, disconnect and cap or plug hydraulic hoses in relation to the cylinder.
5. Attach a suitable sling to an appropriate lifting device and to the cylinder. Make sure the device used can actually support the cylinder.
6. Remove the lock bolt and/or any retaining clips securing the cylinder pins. Remove the cylinder pins.
7. Remove the cylinder.
8. Wipe up any hydraulic fluid spillage in, on, near and around the machine, work area and tools.

a. 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.

WARNING

Significant pressure may be trapped inside the cylinder. Exercise caution when removing a counterbalance valve or a pilot-operated check valve from a cylinder.

Note: *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.

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

4. Extend the rod as required to allow access to the base of the cylinder.

Note: *Protect the finish of 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 from the tube. A considerable amount of force will be needed to remove the head gland. Carefully slide the head gland down along the rod toward the rod eye, away from the cylinder barrel.

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

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

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 assembled with a 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 300 - 400° F (149 - 204° C) 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 from the rod and carefully slide the head gland off the end of the rod.
10. Remove all seals, back-up rings and o-rings 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 catalog for ordering information.

b. Cylinder Cleaning Instructions

1. Discard all seals, back-up rings and o-rings. Replace with new items from seal kit to 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 or parts, it can be removed by using a soft brass wire brush. Wipe with a cleaner/primerprior to reassembly.*

c. Cylinder Inspection

1. Inspect internal surfaces and all parts for wear, damage, etc. If the inner surface of the cylinder barrel does not display a smooth finish, or is scored or damaged in any way, replace the barrel.
2. Remove light scratches on the piston, head gland, rod or inner surface of the cylinder barrel 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.

d. General Cylinder Assembly Instructions

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

Note: *The extend/retract 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 to prevent any damage to the rod.

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

4. Refer to Section 2.2, "Specifications", for all thread locking requirements.
5. Lubricate and slide the head gland over the cylinder rod. Install the piston head on to the end of the cylinder rod. Install the set screw in the piston head. Refer to Section 8.11.5, "Cylinder Torque Specifications", for torque specifications for the piston head and the set screw.

Note: *Avoid using excess 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.*

6. Place the cylinder barrel in a soft-jawed vise or other acceptable holding devise.

Note: *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.*

7. Carefully insert the cylinder rod assembly into the cylinder barrel.
8. Screw the head gland into the cylinder barrel and tighten with a spanner wrench. Refer to Section 8.11.5, "Cylinder Torque Specifications", for torque specifications for the head gland.
9. If applicable, install new counter balance valve into block on the cylinder barrel.

e. General Cylinder Installation

1. Grease the bushings at the ends of the hydraulic cylinder. Using an appropriate sling, lift the cylinder into the mounting position.
2. Align cylinder bushing and install pin, lock bolt or retaining clip.
3. Connect the hydraulic hoses in relation to the labels or markings made during removal.
4. Before starting the machine, check fluid level of the hydraulic fluid reservoir and if necessary fill to full mark with 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 fluid in reservoir. Add hydraulic fluid if needed. Shut the engine OFF.
7. Wipe up any hydraulic fluid spillage in, on, near and around the machine, work area and tools.
8. Close and secure the engine cover.

8.11.2 Cylinder Pressure Checking

Attach a 5000 psi (345 bar) gauge to the test port on the P1 port on the hydraulic manifold to check the system pressure. For more information, refer to Section 8.4.1, "Pressure Checks and Adjustments".

Note: *If a hydraulic cylinder pressure is greater than the main control valve pressure, increase the main control valve pressure by adjusting the main relief. Generally, one half turn clockwise will be adequate to check an individual circuit. Activate the circuit and if pressure is obtained turn the main relief counter clockwise one half turn. Re-check the main relief setting and adjust if necessary.*

8.11.3 Steering Cylinders

Refer to Section 5.3, "Axle Specifications and Maintenance Information", for detailed service information.

8.11.4 Extend/Retract Cylinder Bleeding Procedure - 832

Note: *Do not extend the boom until the extend/retract cylinders have been bled. If the hydraulics have been disturbed, air may become trapped between the two extend cylinders. Operating the boom in this condition will cause a loss of synchronization between the boom sections, which in turn will damage the rolling hoses inside.*

Note: *Both extend cylinders incorporate synchronization valves which can allow oil to circulate through the extend cylinders and purge out any trapped air.*

Note: *Allow the oil in the hydraulic tank to settle for a few hours if the hydraulic system has been significantly disturbed.*

a. Bleeding the Extend/Retract Cylinder

1. Place the transmission in (N) NEUTRAL and engage the park brake.
2. Start the engine.
3. With boom in fully retracted position, operate the retract function for approximately 20 seconds.
4. Extend the boom very slowly for no more than 300 mm. Check that the sections are moving together at the same speed. If not, repeat the procedure.
5. If the sections are moving together, gradually extend and retract the boom in greater increments until maximum extension is achieved. Hold the retract for 2 to 3 seconds between each incremental extension.

8.11.5 Cylinder Torque Specifications

a. Lift/Lower Cylinder

Model	Head	Piston	Piston Set Screw
832, 925	332 lb-ft (450 Nm)	1246 lb-ft (1960Nm)	7 lb-ft (10 Nm)

b. Extend/Retract Cylinder

Model	Head	Piston	CB Valve	Piston Set Screw
925	221 lb-ft (300 Nm)	287 lb-ft (390 Nm)	NA	3.6 lb-ft (5 Nm)
832	811.3 lb-ft (1100 Nm)	737 lb-ft* (1000 Nm)	NA	8.8 lb-ft (12 Nm)
	737 lb-ft (1000 Nm)	590 lb-ft (800 Nm)	51 lb-ft (70 Nm)	14.7 lb-ft (20 Nm)
*Torque piston and rod end attachment eye together to this value.				

c. Tilt Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve	Piston Set Screw
832	703-859 lb-ft (882-1078 Nm)	1220-1491 lb-ft (1655-2022 Nm)	41-51lb-ft (56-69 Nm)	41-51lb-ft (56-69 Nm)	45-50 lb-ft (61-68 Nm)	13.2-15.4 lb-ft (18-21 Nm)
925	754.5-922.6 lb-ft (1023-1251 Nm)	1220-1491 lb-ft (1655-2022 Nm)	41-51lb-ft (56-69 Nm)	41-51lb-ft (56-69 Nm)	45-50 lb-ft (61-68 Nm)	13.2-15.4 lb-ft (18-21 Nm)

d. Compensation Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve	Piston Set Screw
832, 925	258-280 lb-ft (350-380 Nm)	213-228 lb-ft (290-310 Nm)	NA	NA	NA	5.1-6.7 lb-ft (7-9 Nm)

Section 9
Electrical System
Contents

PARAGRAPH		TITLE	PAGE
9.1		**Electrical Component Terminology**	**9-4**
	9.1.1	General Overview	9-4
9.2		**Specifications**	**9-5**
9.3		**Safety Information**	**9-5**
9.4		**Power Distribution Boards**	**9-6**
	9.4.1	Cab Power Distribution Board	9-6
	9.4.2	Frame Power Distribution Board	9-10
	9.4.3	Option 1 Distribution Board	9-12
	9.4.4	Option 2 Distribution Board	9-14
	9.4.5	Engine Harness Fuses and Relays	9-17
9.5		**Electrical System Schematic**	**9-19**
9.6		**Dielectric Grease Application**	**9-30**
	9.6.1	Installation	9-30
9.7		**Engine Start Circuit**	**9-32**
	9.7.1	Starter	9-32
	9.7.2	Charging Circuit	9-33
	9.7.3	Alternator	9-34
9.8		**Battery**	**9-34**
	9.8.1	Battery Inspection	9-34
	9.8.2	Battery Removal/Installation	9-35
	9.8.3	Battery Disconnect/Connect	9-35
9.9		**Electrical Master Switch**	**9-36**
	9.9.1	Electrical Master Switch Removal	9-36
	9.9.2	Electrical Master Switch Installation	9-36
9.10		**Window Wiper System (if equipped)**	**9-37**
	9.10.1	Front Windshield Wiper Motor	9-37
	9.10.2	Rear Window Wiper Motor	9-38
	9.10.3	Roof Window Wiper Motor	9-39
	9.10.4	Washer Fluid Reservoir	9-40
9.11		**Cab Heater and A/C (if equipped)**	**9-41**
	9.11.1	Cab Heater/Air Conditioning Controls	9-41

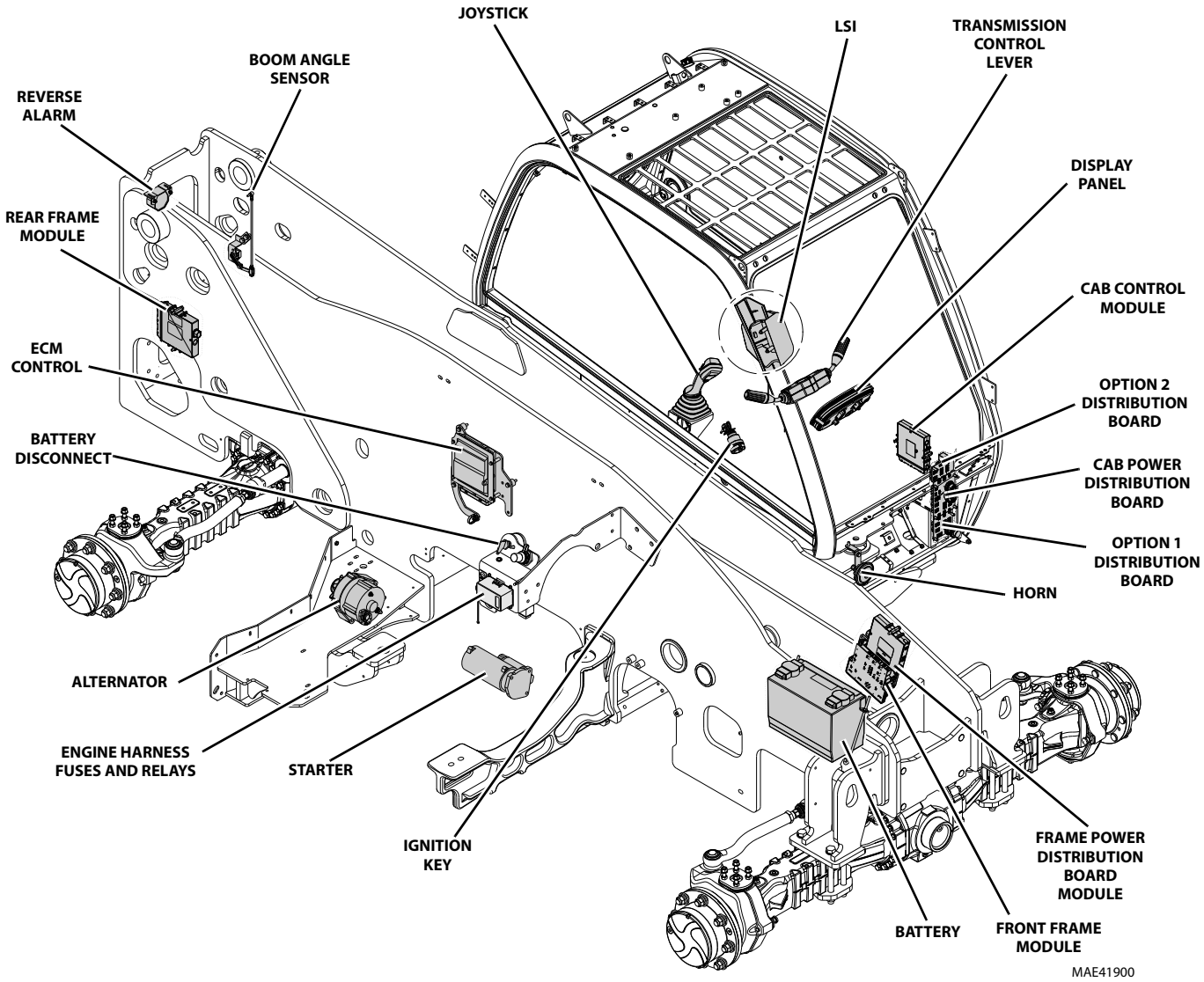
9.12 Solenoids, Sensors and Senders 9-42
9.12.1 Transmission Solenoid Valves 9-42
9.12.2 Transmission Oil Temperature Switch 9-42
9.12.3 Transmission Mounted Speed Sensor 9-43
9.12.4 Engine Coolant Temperature Sensor 9-43
9.12.5 Fuel Level Sender 9-44
9.12.6 Boom Angle Sensor 9-44
9.12.7 Reverse Alarm 9-45
9.12.8 Boom Retract Sensor 9-45
9.13 Dash Switches 9-47
9.13.1 Ignition Key Switch 9-47
9.13.2 Dash Switches 9-48
9.14 Machine Data 9-48
9.14.1 Machine Data Access 9-48
9.14.2 Analyzer 9-49
9.14.3 Analyzer Software Version P.18.0 9-50
9.15 Analyzer Software Accessibility 9-58
9.15.1 Access Level 9-58
9.15.2 Diagnostics 9-58
9.15.3 Machine Set-Up 9-60
9.15.4 Personalities 9-63
9.15.5 Operator Tools 9-69
9.15.6 Calibrations 9-72
9.16 Load Stability Indicator (LSI) (if equipped) 9-82
9.16.1 Load Stability Indicator 9-82
9.16.2 LSI Sensor 9-82
9.16.3 LSI System Calibration 9-85
9.17 Fault Codes 9-86

9.18 Machine Fault Codes 9-87
9.18.1 Help Comment (00x) 9-87
9.18.2 Power-Up (21x) 9-88
9.18.3 Platform Controls (22x) 9-92
9.18.4 Ground Inputs(23x) 9-94
9.18.5 Other Inputs (24x) 9-110
9.18.6 Function Prevented (25x) 9-111
9.18.7 Line Contactor Open-Circuit (31x) 9-117
9.18.8 Line Contactor Short-Circuit (32x) 9-118
9.18.9 Output Drivers (33x) 9-119
9.18.10 Engine (43x) 9-153
9.18.11 Battery Supply (44x) 9-159
9.18.12 Transmission and Drive System (46x) 9-160
9.18.13 Communications (66x) 9-202
9.18.14 Envelope Control (84x) 9-206
9.18.15 Tilt Sensor (81x) 9-207
9.18.16 Load Moment (85x) 9-208
9.18.17 Steering (86x) 9-214
9.18.19 Hardware (99x) 9-216
9.19 Engine Diagnostic 9-222

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.

9.1.1 General Overview



9.2 SPECIFICATIONS

Electrical system specifications are listed in Section 2, “General Information and Specifications”.

9.3 SAFETY INFORMATION

WARNING

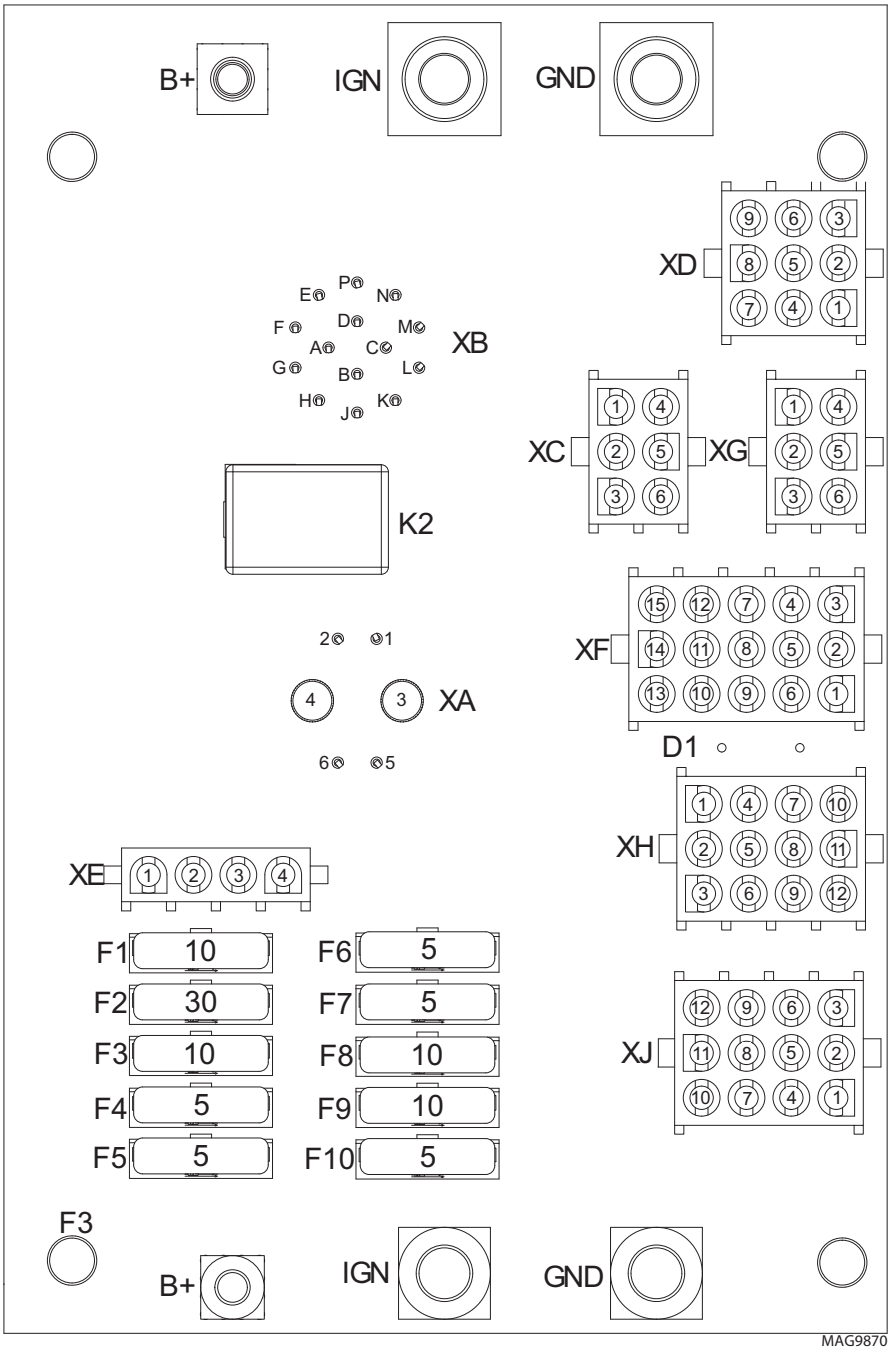
DO NOT service the machine without following all safety precautions as outlined in Section 1, “Safety Practices”, of this manual.

9.4 POWER DISTRIBUTION BOARDS

9.4.1 Cab Power Distribution Board

Power distribution board is located in cab. For access, remove screws securing the small side panel at the left side of the dash.

Note: *Connectors XA, XB, XC, XD, XE, XF, XG, XH and XJ are marked with pin numbers.*



FUSE/RELAY	FUNCTION	AMP RATING
F1	AUXILIARY POWER	10
F2	MODULE POWER	30
F3	DISPLAY IGNITION, JOYSTICK IGNITION, RS232 POWER	10
F4	SWITCH IGNITION (2), HI BEAM POWER, SHIFT IGNITION, COLUMN IGNITION, SEAT IGNITION	5
F5	TELEMATICS B+	5
F6	TELEMATICS IGNITION	5
F7	HAZARD POWER, KEY BATTERY, BRAKE POWER	5
F8	HORN B+ (3)	10
F9	REVERSE SENSOR POWER, DOME IGNITION, REAR WIPER POWER	10
F10	BEACON POWER	5
K2	HORN RELAY	15

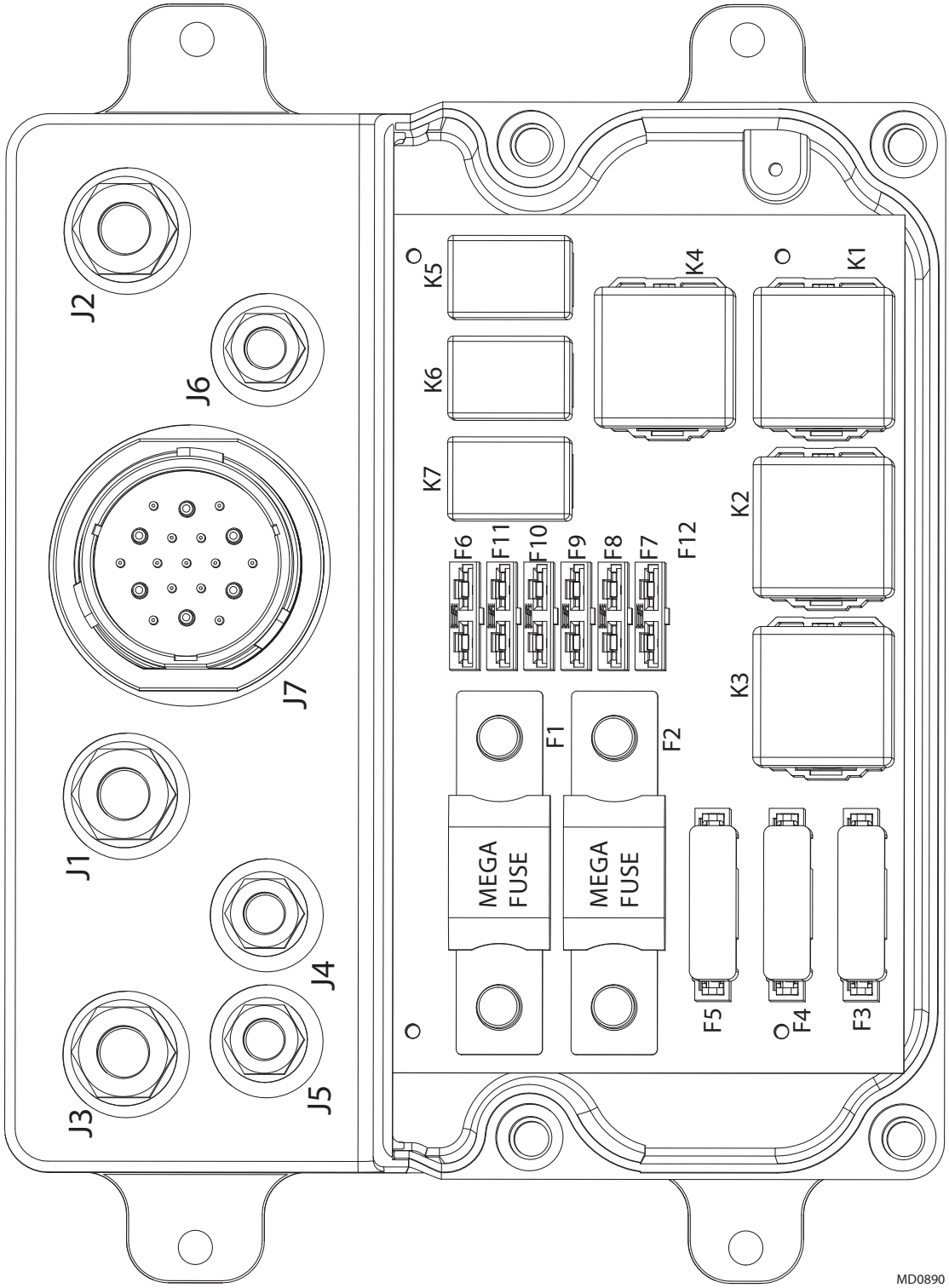
CONNECTOR	PIN	FUNCTION
XB	A	KEY IGNITION
	B	CAN1 HIGH
	C	CAN1 LOW
	D	SPARE
	E	SPARE
	F	KEY PLAT
	G	IGNITION OUT
	H	SPARE
	J	HVAC COMPRESSOR OUT
	K	REVERSE SIGNAL 2
	L	REVERSE SIGNAL 1
	M	BOOM WORK LIGHTS
	N	HORN OUT
	P	SPARE

CONNECTOR	PIN	FUNCTION
XA	1	B+
	2	B+
	3	GND
	4	IGNITION
	5	CLEAN IGNITION
	6	CLEAN IGNITION
XC	1	REVERSE SIGNAL 1
	2	REVERSE SIGNAL 2
	3	HVAC COMPRESSOR OUT
	4	BOOM WORK LIGHTS
	5	HORN SW
	6	SPARE
XD	1	RS232 RX
	2	RS232 TX
	3	KEY PLAT
	4	CAN1 HIGH
	5	KEY IGNITION
	6	SPARE
	7	CAN1 LOW
	8	SPARE
	9	SPARE
XE	1	RS232 POWER
	2	RS232 RX
	3	RS232 TX
	4	RS232 GND
XG	1	GND
	2	TELEMATICS B+
	3	TELEMATICS IGNITION
	4	SHIELD
	5	CAN 2 LOW
	6	CAN2 HIGH

CONNECTOR	PIN	FUNCTION
XH	1	HAZARD POWER
	2	HORN B+
	3	REVERSE SENSOR POWER
	4	KEY BATTERY
	5	MARKER LT MODULE
	6	DOME IGNITION
	7	BRAKE POWER
	8	D1
	9	REAR WIPER POWER
	10	IGNITION OUT
	11	-
	12	BEACON POWER
XF	1	SHIELD
	2	CAN2 LOW
	3	CAN2 HIGH
	4	SEAT IGNITION
	5	COLUMN IGNITION
	6	SHIFT IGNITION
	7	HIGH BEAM POWER
	8	SWITCH IGNITION
	9	SWITCH IGNITION
	10	JOYSTICK IGNITION
	11	JOYSTICK IGNITION
	12	DISPLAY IGNITION
	13	MODULE POWER
	14	MODULE POWER
	15	AUXILIARY POWER SOCKET
XJ	ALL PINS	GROUND

9.4.2 Frame Power Distribution Board

Power distribution board is located on the right inside frame.



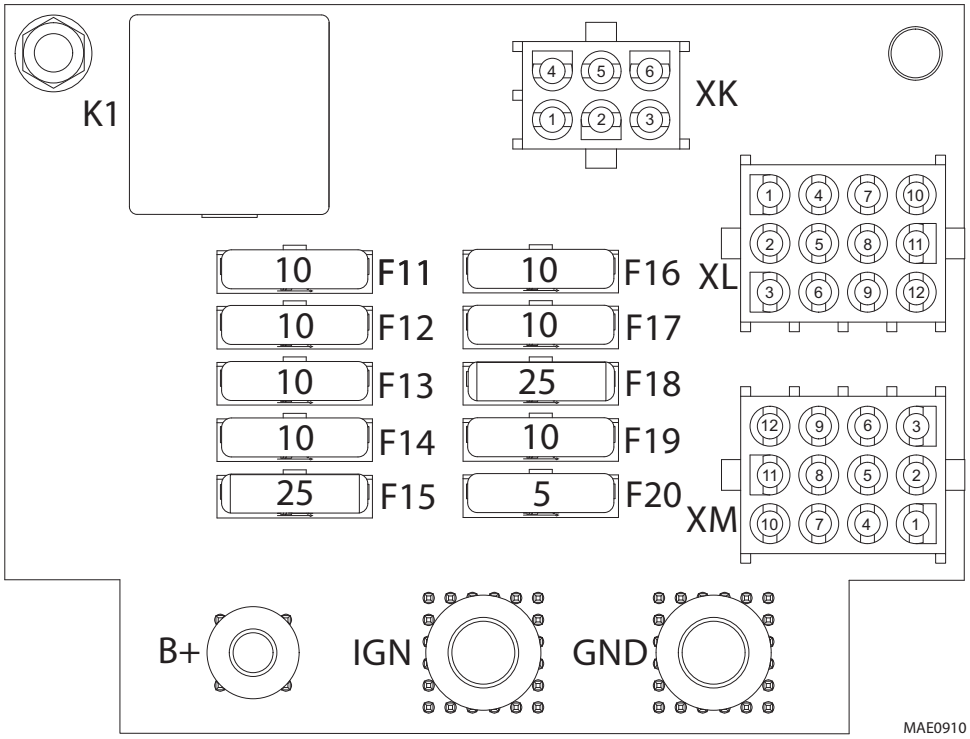
FUSE/RELAY	FUNCTION	AMP RATING
F1	GLOW PLUGS	150
F2	ALTERNATOR	200
F3	REAR FRAME	80
F4	FRONT FRAME	80
F5	CAB	80
F6	ECM IGNITION	25
F7	FRAME IGNITION	15
F8	ECM B+	30
F9	CAB B+	25
F10	AC FANS	30
F11	STARTER	30
F12	CAB MODULE	30
K1	FRONT FRAME IGNITION	70
K2	REAR FRAME IGNITION	70
K3	SYSTEM IGNITION	70
K4	SYSTEM IGNITION	70
K5	ECM IGNITION	30
K6	AC FAN POWER	30
K7	START SIGNAL TO ENGINE (STARTER OUT)	30

HIGH POWER CONNECTIONS			
LOCATION	FUNCTION	AMP RATING	SIZE
J1	B+	200	M10
J2	ALTERNATOR	200	M10
J3	GLOW PLUGS	150	M10
J4	FRONT FRAME	80	M8
J5	REAR FRAME	80	M8
J6	CAB	80	M8

9.4.3 Option 1 Distribution Board

Option 1 distribution board is located in the cab. For access, remove screws securing the small side panel to cab.

Note: *Connectors XK, XL and XM are marked with pin numbers.*



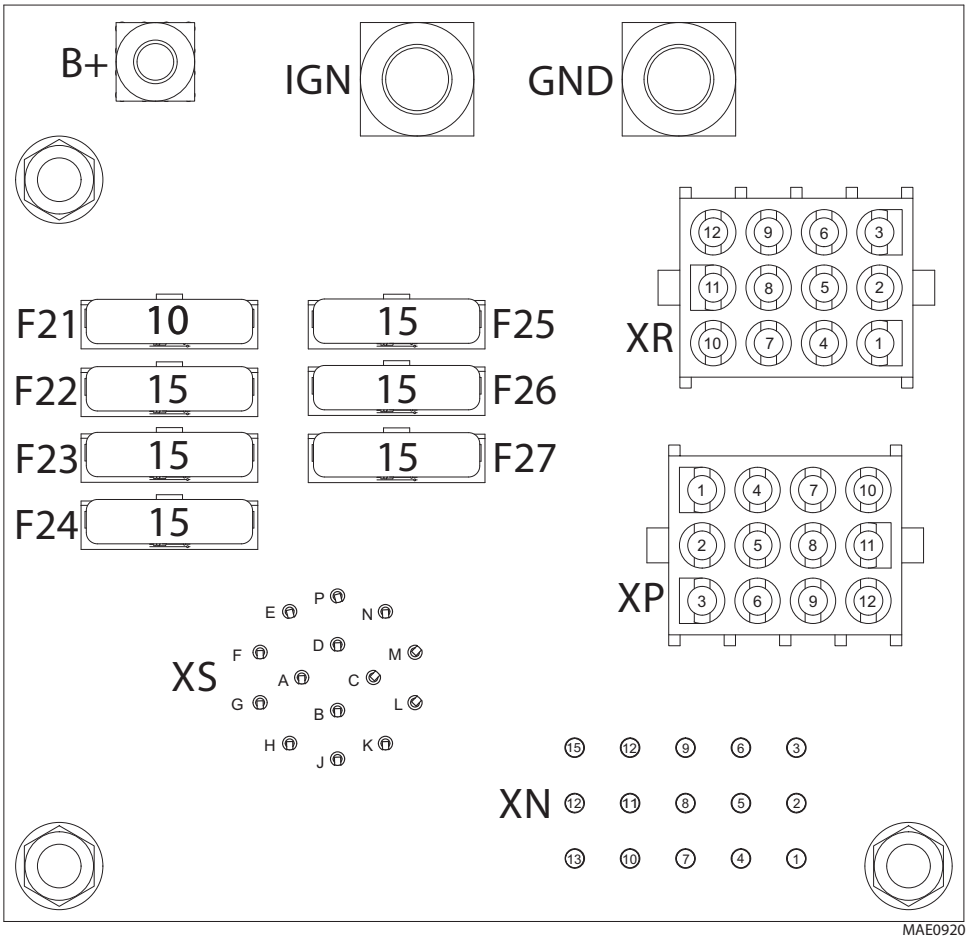
FUSE/RELAY	FUNCTION	AMP RATING
F11	BOOM WORK LIGHTS	10
F12	FRONT WORK LIGHTS	10
F13	REAR WORLK LIGHTS	10
F14	REAR WIPER	10
F15	WIPER POWER	25
F16	IGNITION	10
F17	ROOF WIPER POWER	10
F18	HVAC BLOWER POWER	25
F19	ROOF WIPER POWER	10
F20	AC FANS	5
K1	LIGHTS	

CONNECTOR	PIN	FUNCTION
XK	1	GND
	2	GND
	3	GND
	4	LIGHTS ON SIGNAL
	5	WIPER POWER
	6	REAR WIPER POWER
XL	1	SW IGNITION
	2	HVAC BLOWER POWER
	3	ROOF WIPER POWER
	4	COLUMN IGNITION
	5	HVAC COMPRESSOR OUT
	6	ROOF WIPER POWER
	7	HI BEAM IGNITION
	8	AC CMD
	9	IGNITION
	10	BOOM WORKLIGHT POWER
	11	FT WORKLIGHT POWER
	12	RR WORKLIGHT POWER
XM	ALL PINS	GROUND

9.4.4 Option 2 Distribution Board

Option 2 distribution board is located in the cab. For access, remove screws securing the small side panel to cab.

Note: *Connectors XN, XP, XR and XS are marked with pin numbers.*



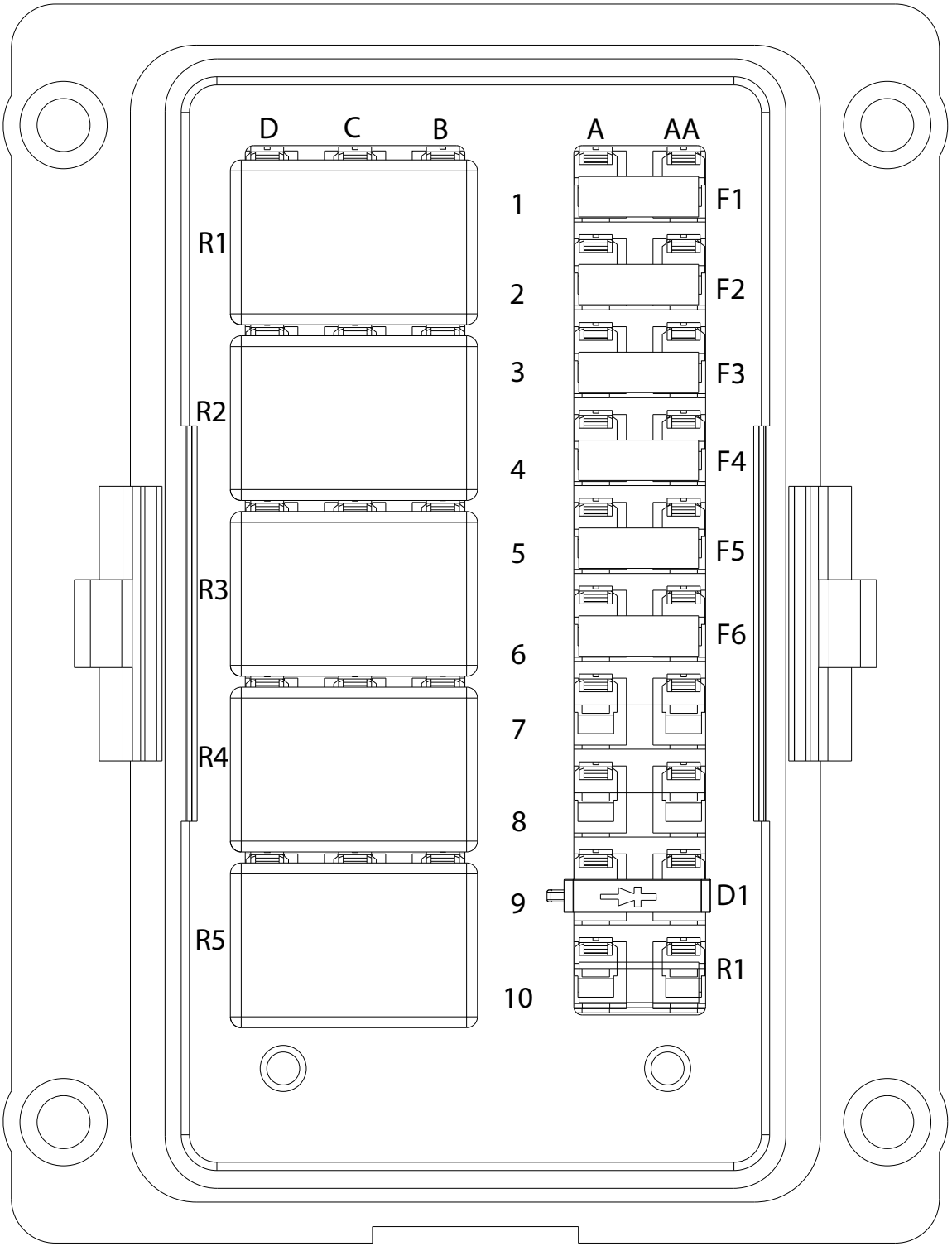
FUSE/RELAY	FUNCTION	AMP RATING
F21	RADIO	10
F22	AIR RIDE SEAT POWER	15
F23	RADIO B+	15
F24	SPARE	15
F25	AUXILARY POWER	15
F26	SPARE (IGNITION SWITCH)	15
F27	SPARE	15

CONNECTOR	PIN	FUNCTION
XS	A	SPARE
	B	SPARE
	C	CAMERA GND
	D	CAMERA POWER
	E	SPARE
	F	SPARE
	G	SPARE
	H	SPARE
	J	LMIS CAN H
	K	LMIS CAN L
	L	SPARE
	M	SPARE
	N	CAMERA SIGI
	P	AUXILARY ELECTRIC POWER OUT
XP	1	DISPLAY IGN
	2	CAMERA POWER
	3	HI DISPLAY POWER
	4	SW IGNITION
	5	SPARE
	6	SPARE
	7	AUXILARY ELECTRIC POWER
	8	-
	9	SPARE
	10	RADIO IGNITION
	11	RADIO B+
	12	AIR RIDE SEAT POWER
XR	ALL PINS	GROUND

CONNECTOR	PIN	FUNCTION
XN	1	SPARE
	2	SPARE
	3	CAMERA POWER
	4	SPARE
	5	-
	6	AUXILARY ELECTRIC POWER OUT
	7	SPARE
	8	CAMERA GND
	9	CAMERA SIGI
	10	SPARE
	11	SPARE
	12	SPARE
	13	LMIS CAN H
	14	LMIS CAN L
	15	SPARE

9.4.5 Engine Harness Fuses and Relays

Engine harness fuses and relays box is located inside the engine compartment.

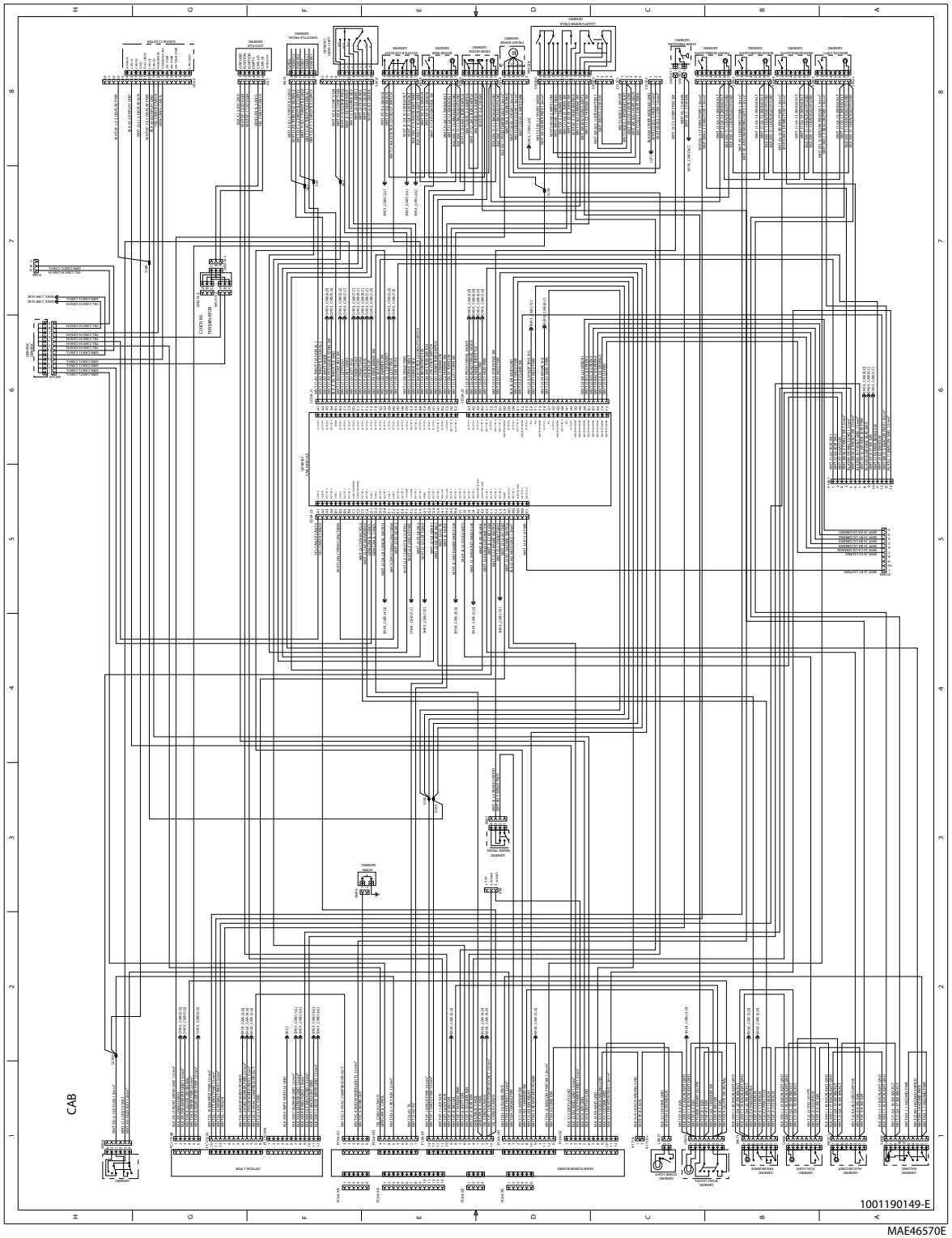


MAG2960

FUSE/RELAY	FUNCTION	AMP RATING
F1	AIR INTAKE THROTTLE	5
F2	DEF QUALITY SENSOR	5
F3	NOX SENSOR POWER	15
F4	ALT EXCITE POWER	5
F5	ECM IGNITION POWER	5
F6	DIAGNOSTIC POWER	5
F7	FUEL PUMP POWER	25
F8	SCR POWER	30
R1	SUPPLY MODULE HEATER RELAY	35
R2	DEF HEATER 2 RELAY	35
R3	DEF HEATER 3 RELAY	35
R4	DEF HEATER 4 RELAY	35
R5	SCR CONTROL RELAY	35
D1	ALTERNATE EXCITE POWER	6

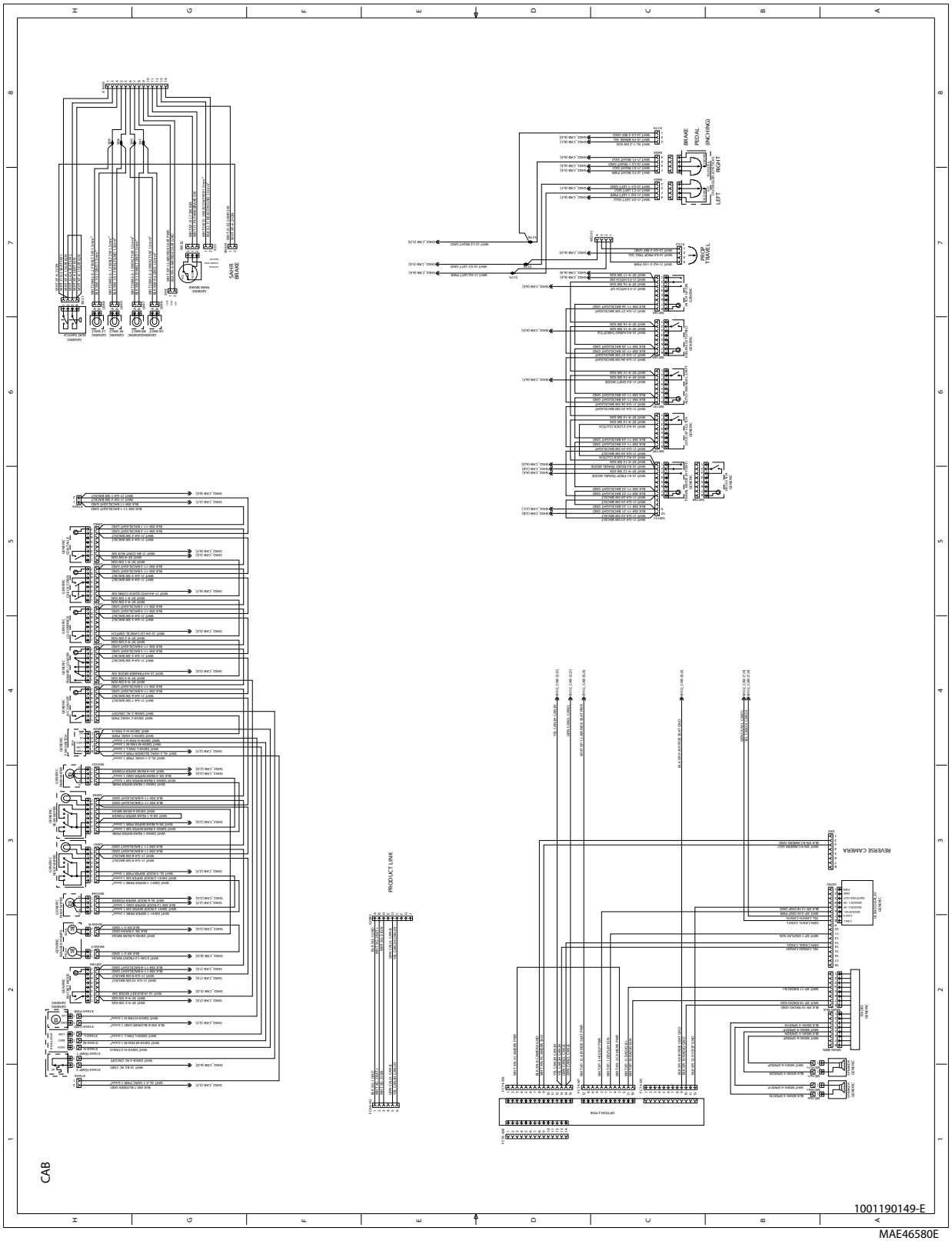
9.5 ELECTRICAL SYSTEM SCHEMATIC

a. Cab Harness (Sheet 1 of 2)



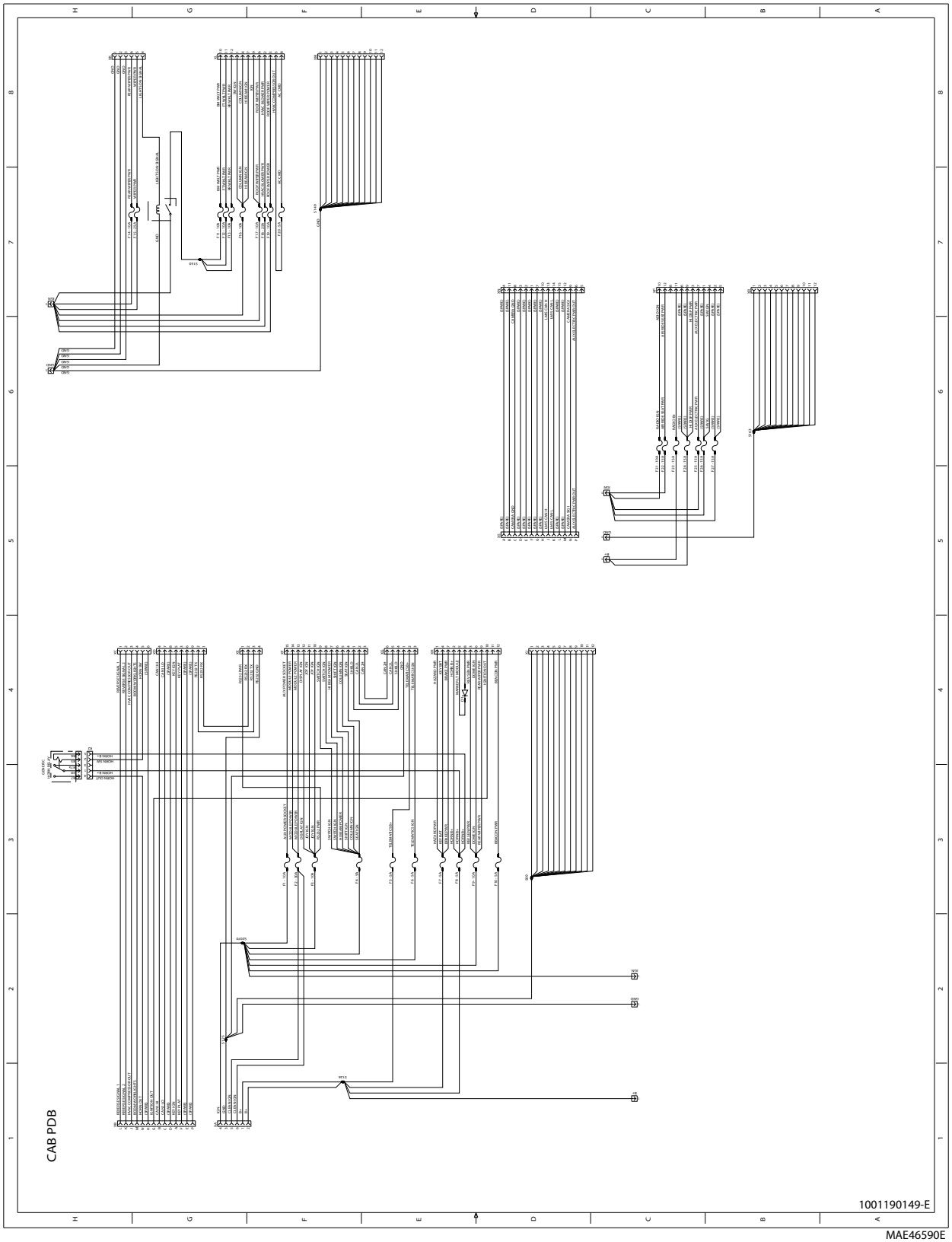
MAE46570E

b. Cab Harness (Sheet 2 of 2)



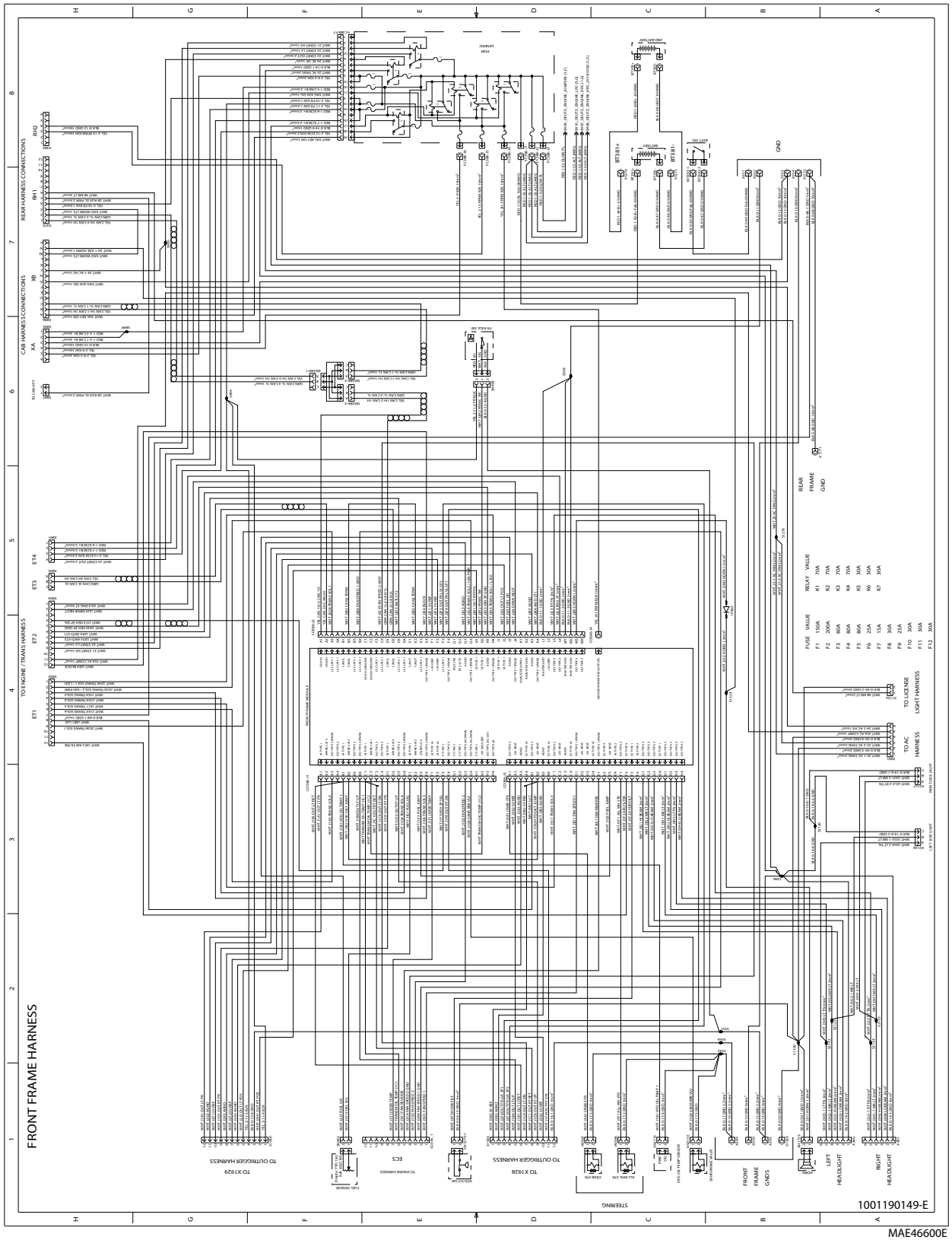
MAE46580E

c. Cab PDB



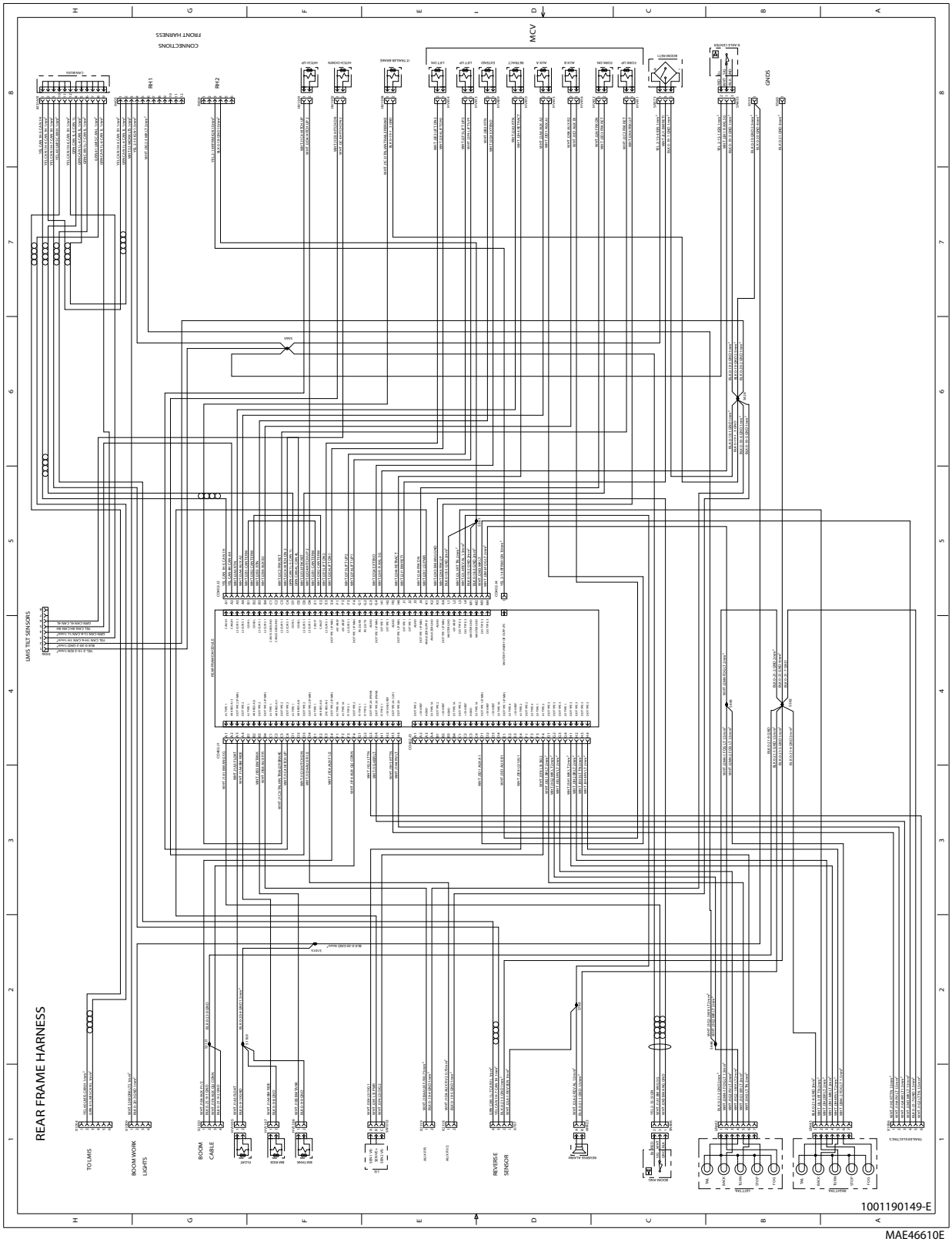
MAE46590E

d. Front Frame Harness

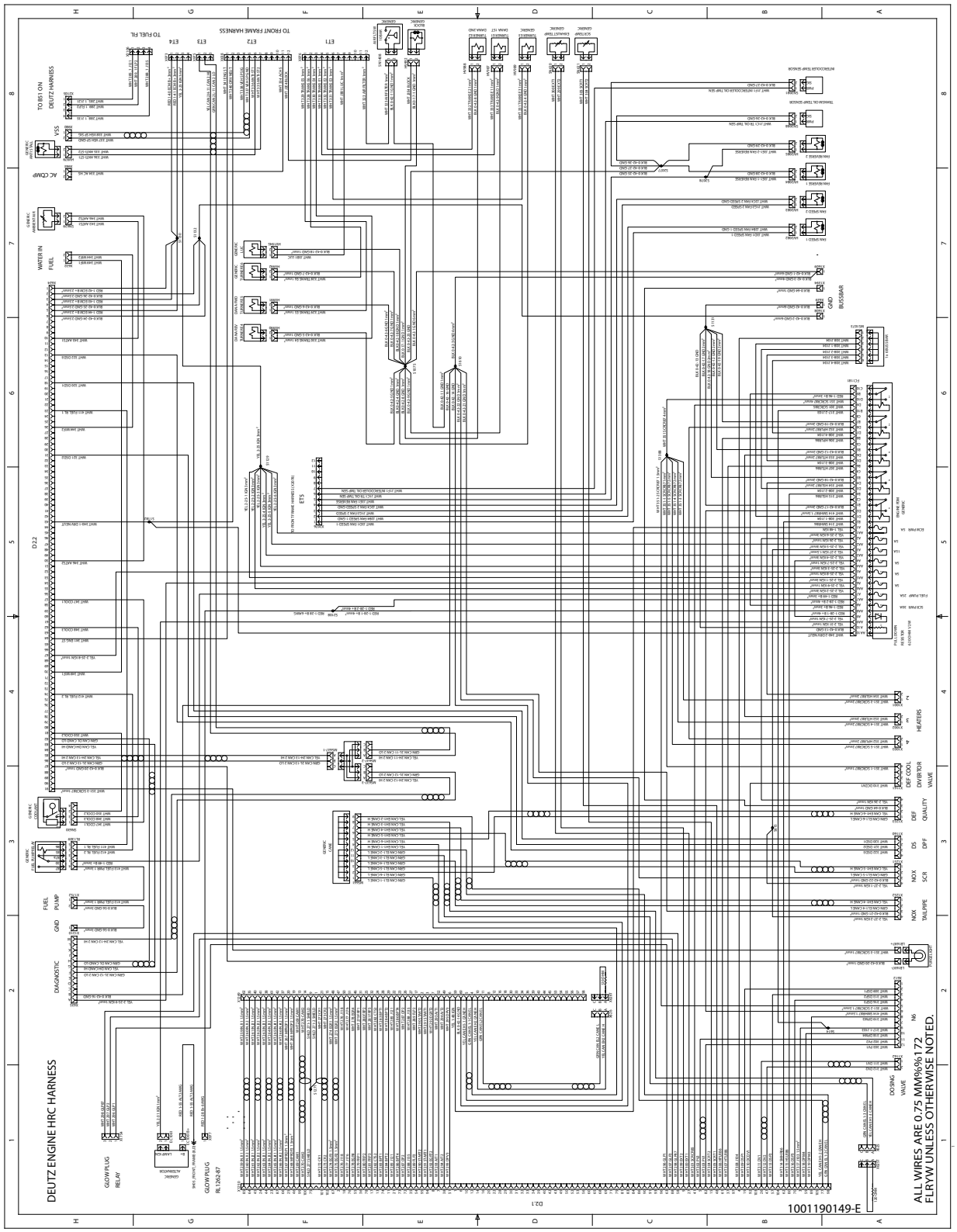


MAE46600E

e. Rear Frame Harness

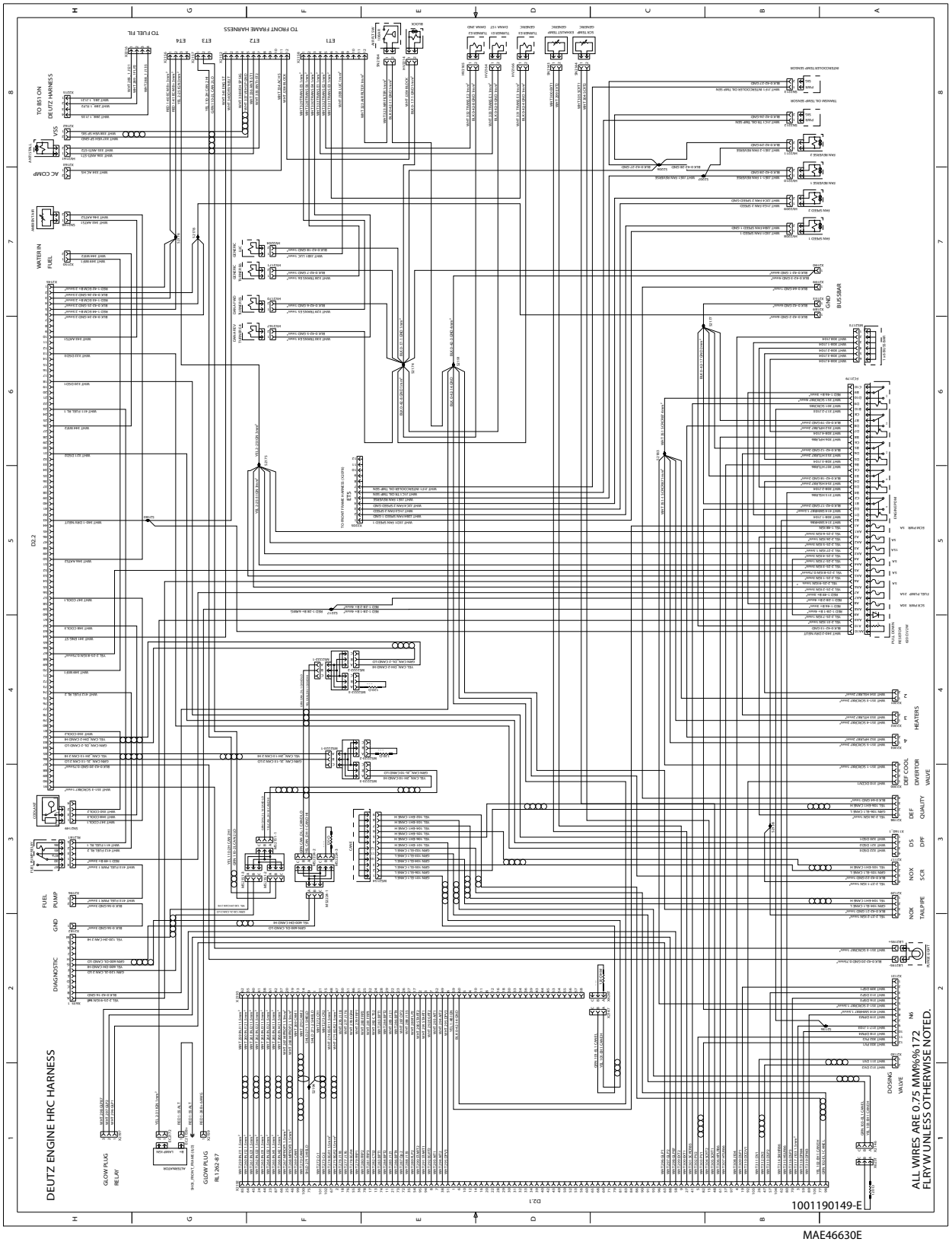


f. ULS Engine Harness



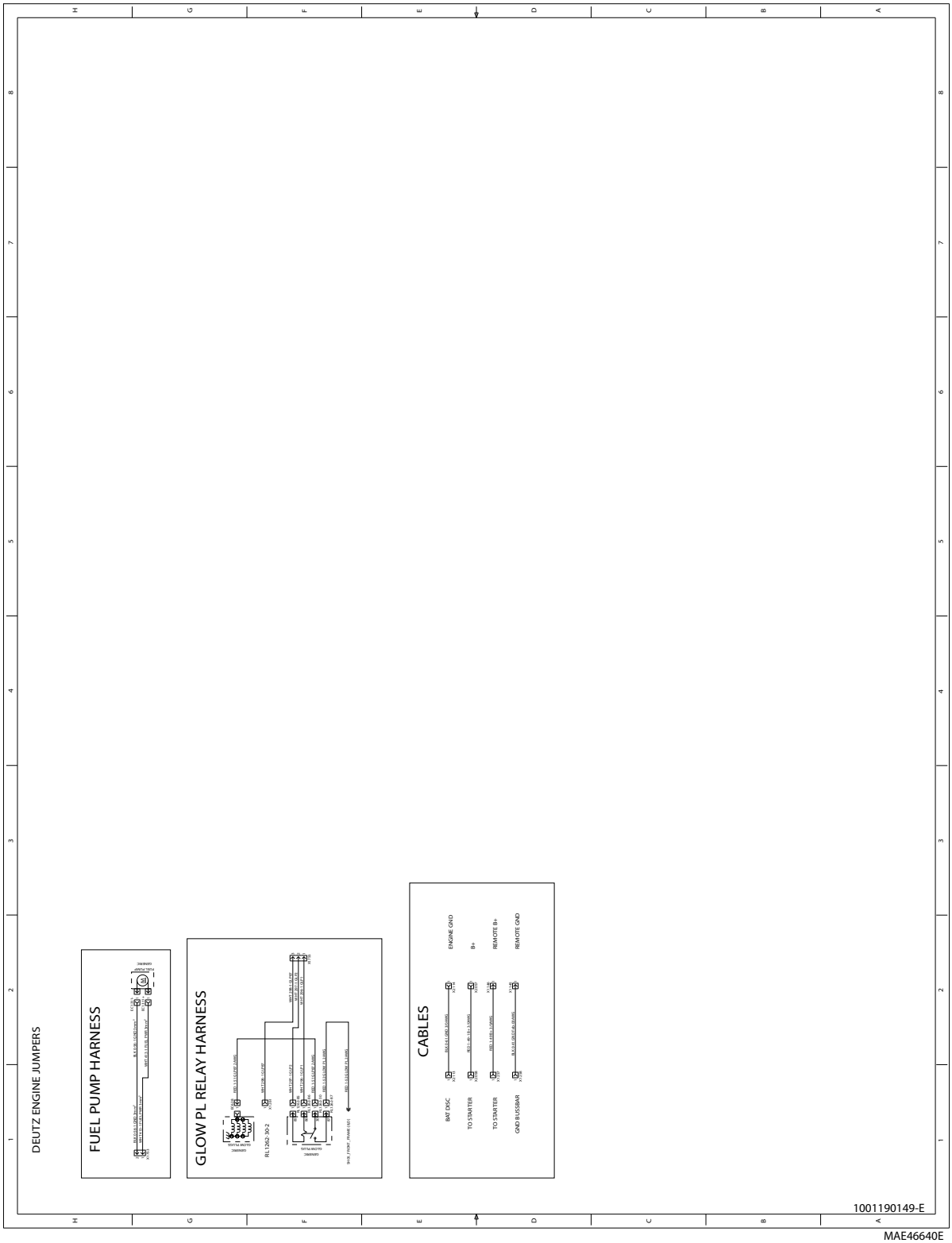
MAE46620E

g. ULS Engine Harness

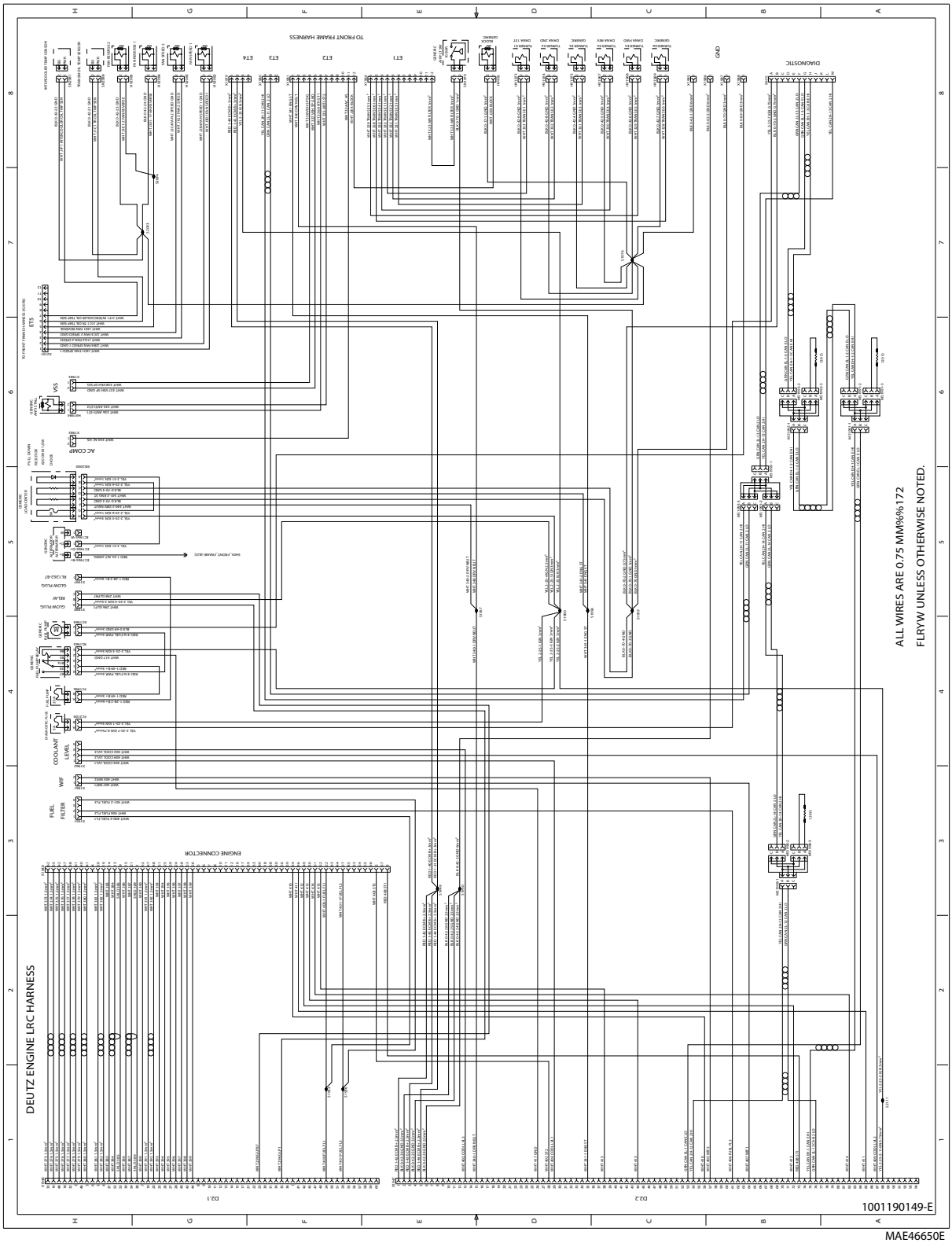


MAE46630E

h. Engine Jumpers

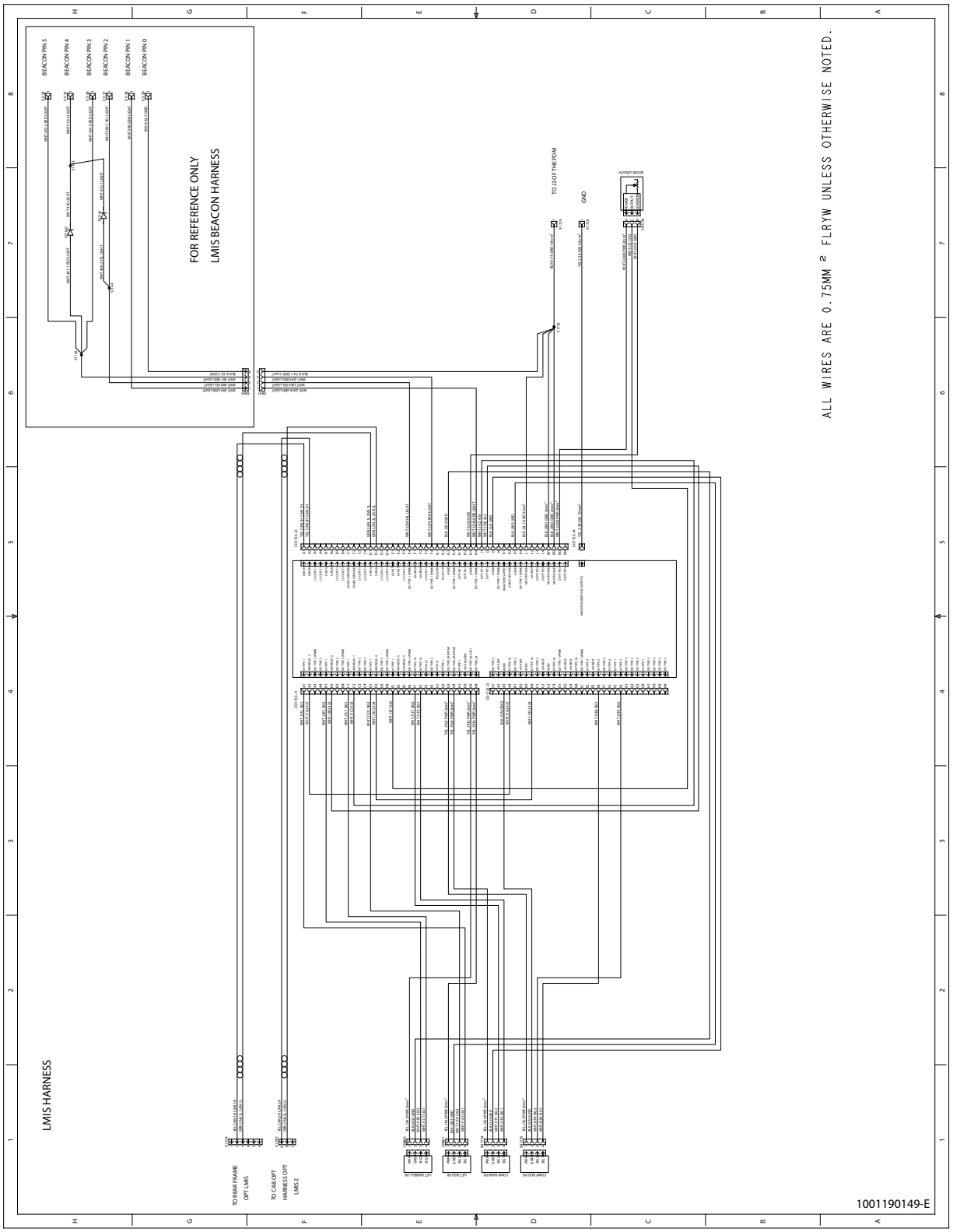


i. Engine LS Harness



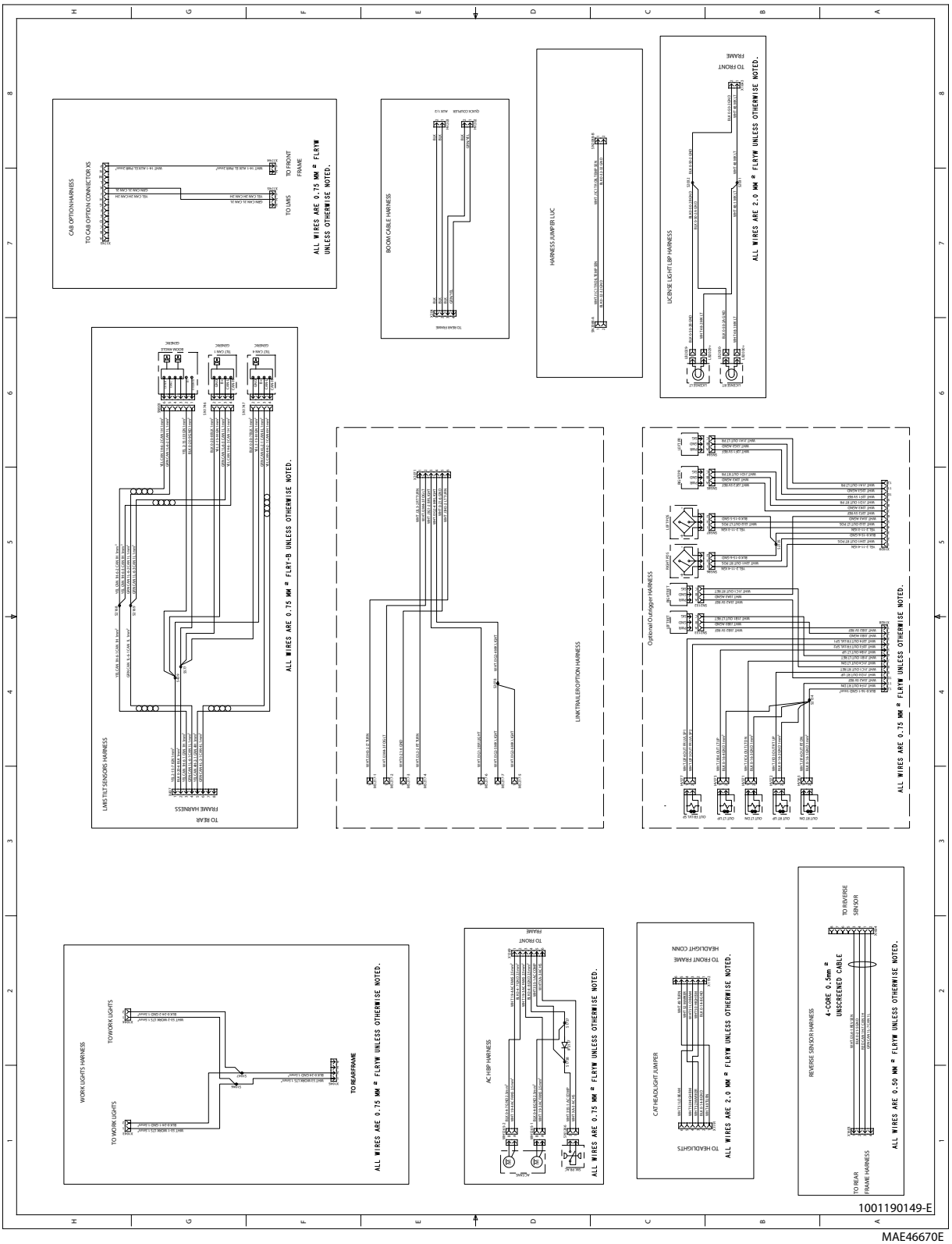
MAE46650E

j. LMIS Harness



MAE46660E

k. Boom Option Harness



MAE46670E

9.6 DIELECTRIC GREASE APPLICATION

Dielectric grease helps to prevent corrosion of electrical contacts and improper conductivity between contacts from moisture intrusion. Non-waterproof connectors benefit from the application of dielectric grease.

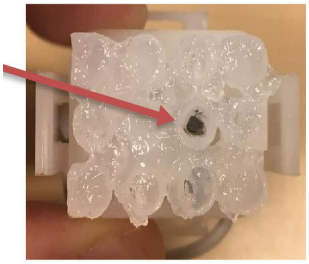
9.6.1 Installation

1. The following is general guidance for the installation of dielectric grease in a connector system.
2. Use dielectric grease in a tube for larger connection points or apply with a syringe for small connectors.
3. Apply dielectric grease to plug/male connector housing which typically contains sockets contact/female terminals.
4. Leave a layer of dielectric grease on the mating face of the connector, completely covering each connector terminal hole. Refer the pictures shown below.
5. Assemble the connector system immediately to prevent moisture ingress or dust contamination.

The following connector systems are specifically addressed because of their widespread use at JLG. However, this guidance may be applied to similar devices.

AMP Mate-N-Lok

This connector system is widely used inside enclosures for general-purpose interconnect. Follow the general guidance for installation.



Improper

Proper

AMP Faston

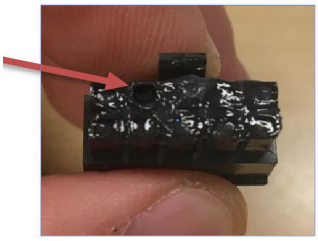
This connector system is typically used on operator switches at JLG. Follow the general guidance for installation.

Improper

Proper

AMP Micro-Fit

This connector system is typically used on control modules at JLG. Follow the general guidance for installation.

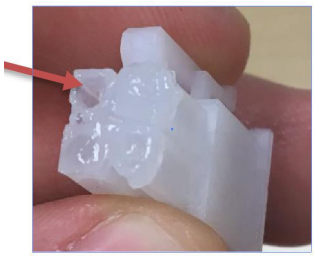


Improper

Proper

AMP Mini Fit Jr

This connector system is typically used on control modules at JLG. Follow the general guidance for installation.

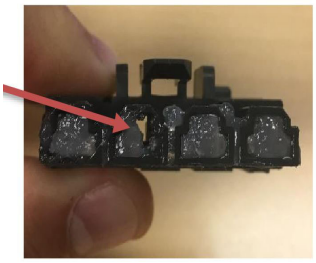


Improper

Proper

Mini Fit Sr

This connector system is typically used on control modules at JLG. Follow the general guidance for installation.

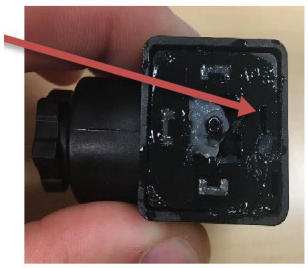


Improper

Proper

DIN Connectors

This connector is typically used on hydraulic valves. Follow the installation instructions.



Improper

Proper

Exceptions

Some waterproof connector applications do benefit from dielectric grease, and some non waterproof connectors do not benefit from dielectric grease.

In the exceptions below, we have found dielectric grease is not needed for some applications, and in some cases can interfere with the intended connection. Dielectric grease shall be used as an exception in other applications.

Enclosures

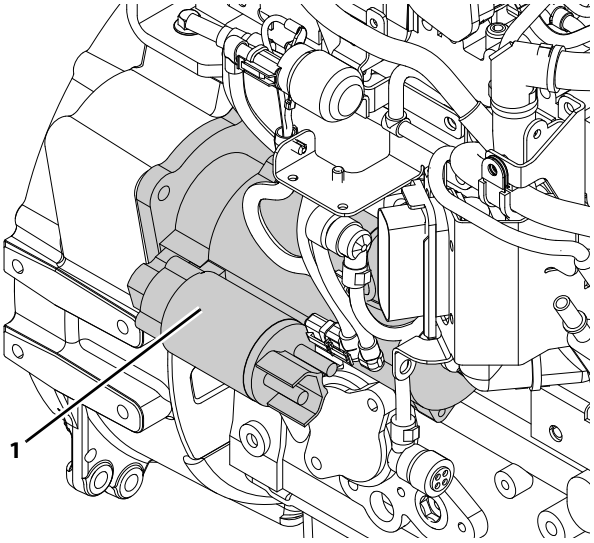
Application of dielectric grease is not required in properly sealed enclosures. To meet criteria, the enclosure must be rated to at least IP56 (dust protected; protected from powerful jets of water).

Carling Switch Connectors

Carling switches may experience high impedance, or discontinuity, due to silicone dielectric grease ingress when switching inductive loads. Therefore, dielectric grease shall not be applied to Carling switch mating connectors unless specifically noted.

9.7 ENGINE START CIRCUIT

9.7.1 Starter



a. Testing Starter on Engine

If starter (**1**) does not engage when ignition key switch is turned, check following:

1. Main fuse may be blown, requiring replacement. Check for cause of blown fuse.
2. There may be a defect in ignition key switch, ignition wiring or starter solenoid.
3. Check battery condition. Clean battery posts and connectors at each end of battery cables.
4. Check for broken wiring and damaged insulation on wiring. Replace all broken or damaged wiring.
5. Check all connections at starter solenoid, key switch and wiring harness plugs. Clean and tighten all connections.
6. If starter still does not operate after these checks have been performed, check starting circuit.

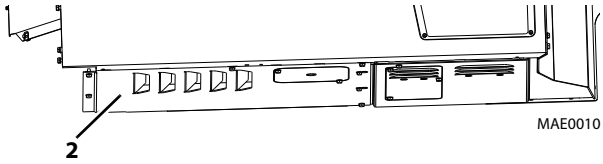
b. Starter Circuit Checks

1. Check wires and connections for looseness, corrosion, damage, etc.
2. If a "whirring" noise is heard but engine does not turn over, starter is spinning but not engaging flywheel. The starter drive or solenoid that pushes drive forward to engage flywheel may be defective. Missing or damaged teeth on flywheel can also prevent starter from cranking engine.
3. If starter only "clicks" it may indicate that battery is discharged, or that there is a loose or corroded battery cable connection. Check battery state of charge and battery condition first, then check cables and cable connections.
4. For additional information on starting circuit, refer to Section 9.5, "Electrical System Schematic".

c. Starter Removal

Remove starter only if it fails. To remove starter:

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in the (N) NEUTRAL, engage parking brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Remove belly pans (**2**).
6. Remove wires from solenoid stud. Remove positive (+) battery cable from starter. Label and disconnect wire from starter solenoid housing stud. Record how wires are installed to ensure correct installation later.
7. Loosen but **DO NOT** remove hardware securing starter. Support starter securely as it is relatively heavy and will fall if not supported.
8. Support starter and remove fasteners securing starter. Remove negative (-) ground cable from its starter mounting bolt.
9. Remove starter from 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

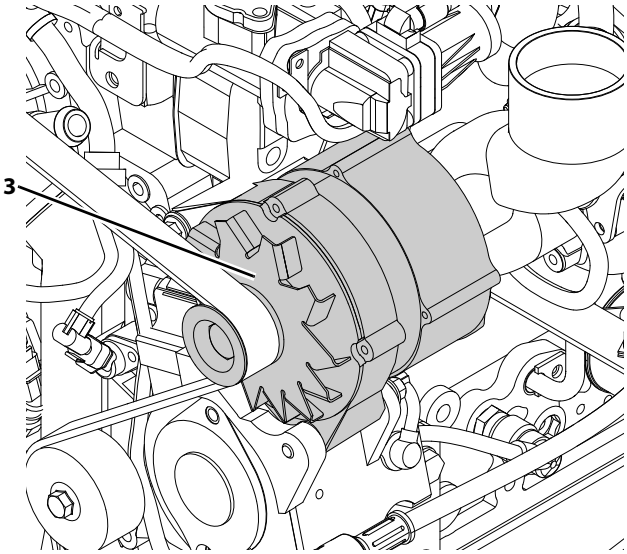
A starter requires no routine maintenance beyond the occasional inspection of the electrical connections, which must be clean and tight.

***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 starter in its mounting opening on flywheel housing. Position negative (-) ground cable over correct starter mounting bolt. Secure starter with previously used hardware.
2. Connect positive (+) battery cable to solenoid stud. Install wires to solenoid stud, and secure with lock washer and nut.
3. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
4. Install previously removed belly pans.
5. Close and secure engine cover.
6. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.7.2 Charging Circuit



Before using a battery charger, an attempt can be made to recharge battery by jump-starting machine (Refer to the appropriate Operation & Safety Manual). Allow engine to run, which will enable alternator (**3**) to charge the battery.

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

1. Check all battery cable connections at battery, and verify that they are clean and tight.
2. Check external alternator wiring and connections, and verify that they are in good condition.
3. Check A/C belt condition and tension.
4. Run engine and check 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.

9.7.3 Alternator

a. Alternator Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in the (N) NEUTRAL, engage parking brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Install a drive ratchet into square hole in serpentine belt tensioner bracket. Note Belt routing for future serpentine belt installation.
6. While lifting automatic belt tensioner away from belt, remove A/C serpentine belt.

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

7. Label and disconnect wire leads attached to alternator.
8. Remove lower mounting capscrew securing alternator to lower mounting hole on engine.
9. While supporting alternator, remove upper mounting hardware from upper alternator mount. Remove alternator from machine.

b. Alternator Installation

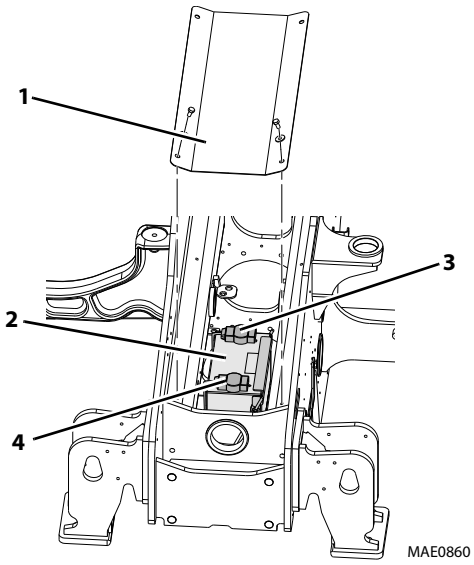
1. Position alternator and align with upper alternator mount on engine bracket. Insert upper (longer) mounting hardware through alternator mount. Thread longer capscrew into alternator front mount. **DO NOT** tighten completely at this time.
2. Align lower alternator mount hole with lower mounting bracket on engine and insert lower mounting capscrew. Tighten lower capscrew and upper capscrew securely.
3. Place a drive ratchet into square hole on serpentine belt tensioner bracket. Apply pressure against tensioner bracket and route serpentine belt onto alternator and engine pulleys. Release and check tensioner pulley to verify that it is pivoting freely in order to provide the proper tension on belt. Check for proper belt alignment. (Refer to appropriate Operation & Safety Manual)
4. Connect previously labeled wire leads to alternator.
5. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
6. Close and secure engine cover.
7. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.8 BATTERY

Note: *Eye protection is recommended before inspecting and/or replacing the battery.*

9.8.1 Battery Inspection

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.



3. Open engine cover. Allow system fluids to cool.
4. Remove bolts securing access panel (**1**) and remove panel.
5. Visually inspect the battery (**2**).
6. Check terminals for corrosion.
7. Replace the battery if it has a cracked, melted or damaged case.
8. Install access cover (**1**) and secure with previously removed bolts.
9. Close and secure engine cover.
10. Remove boom support.
11. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.8.2 Battery Removal/Installation

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lift boom, place transmission in (N) NEUTRAL, engage parking brake and shut engine OFF.
2. Properly support the boom.
3. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
4. Open engine cover. Allow system fluids to cool.
5. Turn OFF electrical master switch.
6. Remove bolts securing access panel (**1**) and remove panel.
7. Disconnect Negative battery cable (**3**).
8. Disconnect Positive battery cable (**4**).
9. Loosen and remove clamp securing battery.
10. Remove battery (**2**).

b. Installation

1. Properly install battery (**2**) and secure in place with previously removed clamp.
2. Connect Positive battery cable (**4**).
3. Connect Negative battery cable (**3**).
4. Install access cover (**1**) and secure with previously removed bolts.
5. Turn ON electrical master switch.
6. Close and secure engine cover.
7. Properly remove the support for the boom.
8. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.8.3 Battery Disconnect/Connect

a. Disconnect

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Remove bolts securing access panel (**1**) and remove panel.
5. Disconnect Negative battery cable (**3**).
6. Disconnect Positive battery cable (**4**).

b. Connect

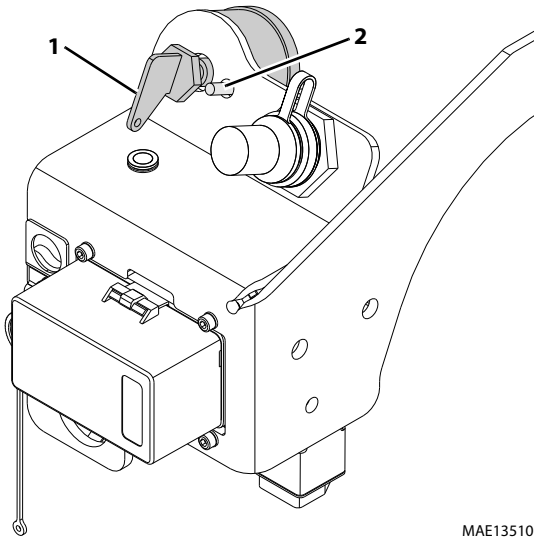
1. Connect Positive battery cable (**4**).
2. Connect Negative battery cable (**3**).
3. Install access cover (**1**) and secure with previously removed bolts.
4. Close and secure engine cover.
5. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.9 ELECTRICAL MASTER SWITCH

The electrical master switch cuts off all power to the machine without the need to disconnect the electrical cables from the battery. Refer Section 9.1.1, “General Overview” for location of electrical master switch.

9.9.1 Electrical Master Switch Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.



5. Remove master electrical switch key (**1**).
6. Label and disconnect the cables on the rear of the master electrical switch.
7. Loosen and remove the nut securing the key switch to the mounting bracket.
8. Remove the master switch.

9.9.2 Electrical Master Switch Installation

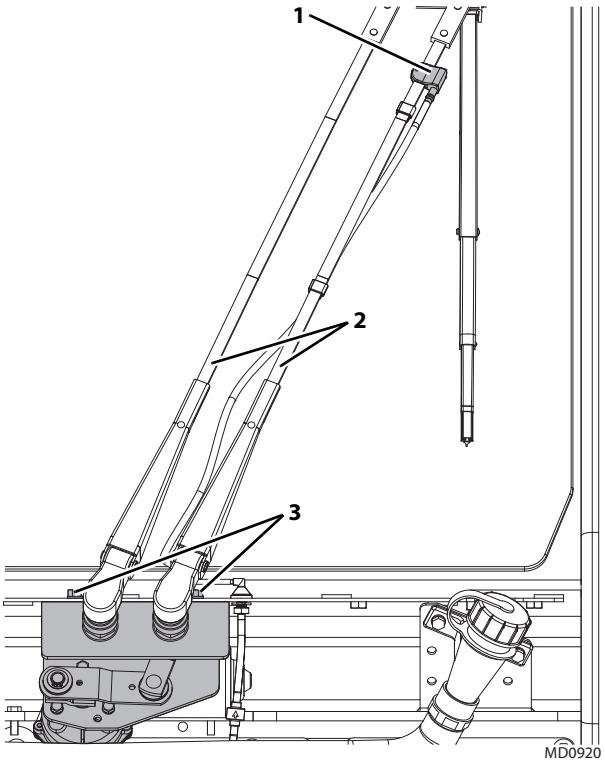
1. Install the master electrical switch to the mounting bracket and align the switch locator pin (**2**) in the mounting bracket.
2. Install previously removed master electrical switch mounting nut and torque to 7 - 20 lb-ft (9 - 27 Nm).
3. Connect previously labeled electrical cables. Secure cables if required.
4. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Close and secure engine cover.
6. Remove Do Not Operate Tag from ignition key switch and steering wheel.
7. Verify proper operation of the electrical master switch.

9.10 WINDOW WIPER SYSTEM (IF EQUIPPED)

9.10.1 Front Windshield Wiper Motor

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in the (N) NEUTRAL, engage parking brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Remove front access cover.



6. Disconnect reservoir hose from wiper linkage (**1**).
7. Remove wiper linkage (**2**).
8. Loosen and remove hardware (**3**) holding wiper assembly mounting bracket to machine.
9. Disconnect electrical harness connectors from the wiper motor.
10. Loosen and remove hardware holding wiper motor to mounting bracket.

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

11. Remove motor from wiper assembly.

b. Disassembly

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

c. Inspection and Replacement

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

d. Installation and Testing

1. Align motor with mounting holes and secure motor to mounting bracket.
2. Connect electrical harness to wiper motor.
3. Secure mounting bracket to machine with hardware (**3**) removed earlier.
4. Connect wiper linkage to the wiper motor shaft.

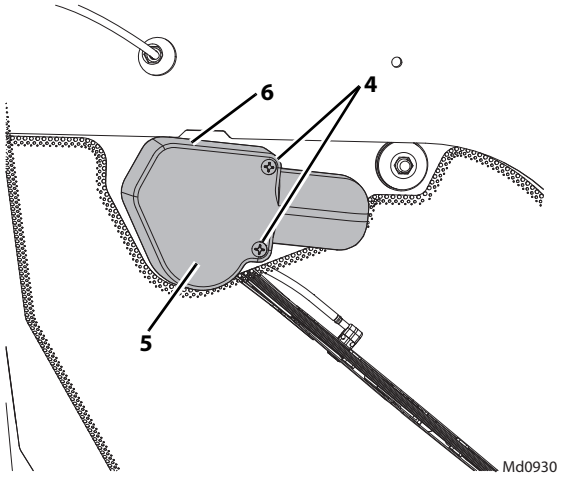
Note: *Align the wiper linkage arm with the flat on the motor shaft to ensure wiper stroke covers window area, and it does not swipe past the glass area.*

5. Connect the reservoir hose to wiper linkage.
6. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
7. Turn ignition key switch to 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 front access cover.
9. Close and secure engine cover.
10. Remove Do Not Operate Tag from ignition key switch and steering wheel.

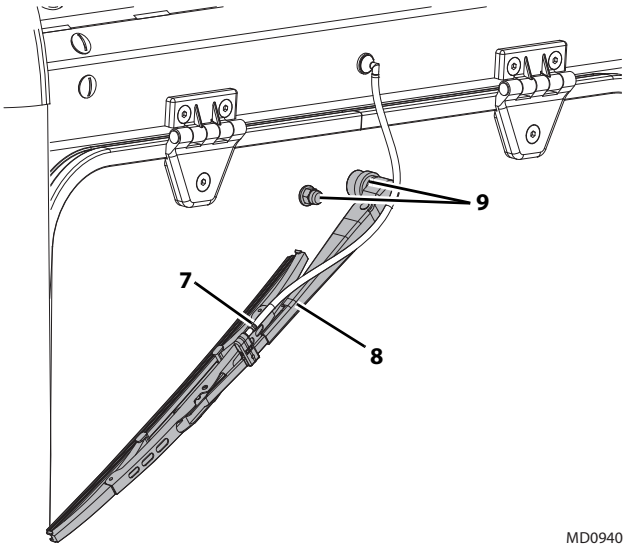
9.10.2 Rear Window Wiper Motor

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Remove hardware (**4**) securing motor access cover (**5**).
6. Disconnect electrical harness connectors from the wiper motor (**6**).



7. Disconnect reservoir hose from wiper linkage (**7**).
8. Remove wiper linkage (**8**).
9. Loosen and remove hardware (**9**) holding wiper motor assembly to window.

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

10. Remove wiper assembly from window.

b. Disassembly

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

c. Inspection and Replacement

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

Switch Position	Test for Continuity Between pin
Wash and Wipe	#1, #3 & #2
Wipe	#5 & #6

d. Installation and Testing

1. Align wiper assembly with mounting holes and secure assembly to window.
2. Connect wiper linkage to the wiper motor shaft.

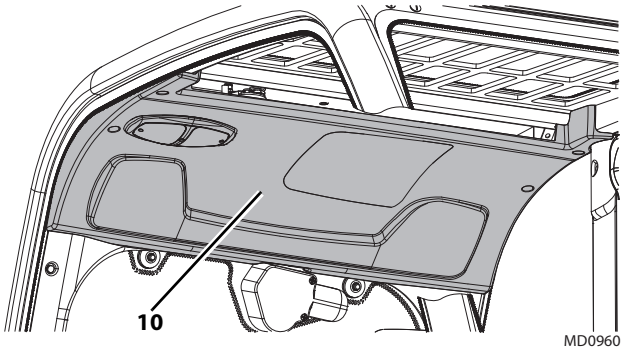
Note: *Align the wiper linkage arm with flat on motor shaft to ensure wiper stroke covers window area, and it does not swipe past the glass area.*

3. Connect reservoir hose to wiper linkage.
4. Connect electrical harness to wiper motor.
5. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
6. Turn ignition key switch to RUN position, and operate windshield wiper in both LOW and HIGH speeds to ensure proper operation and that correct wiper travel is achieved.
7. Secure motor access cover (**5**) with hardware removed earlier.
8. Close and secure engine cover.
9. Remove Do Not Operate Tag from ignition key switch and steering wheel.

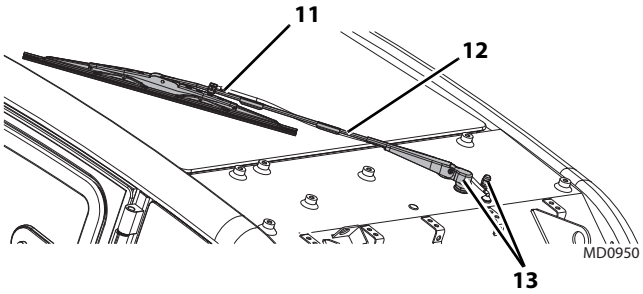
9.10.3 Roof Window Wiper Motor

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.



5. Remove hardware securing access cover (**10**).
6. Disconnect electrical harness connectors from the wiper motor.



7. Disconnect reservoir hose from wiper linkage (**11**).
8. Remove wiper linkage (**12**).
9. Loosen and remove hardware (**13**) holding wiper motor assembly to machine.

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

10. Remove wiper assembly from window.

b. Disassembly

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

c. Inspection and Replacement

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

d. Installation and Testing

1. Align wiper assembly with mounting holes and secure assembly to machine.
2. Connect wiper linkage to wiper motor shaft.

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

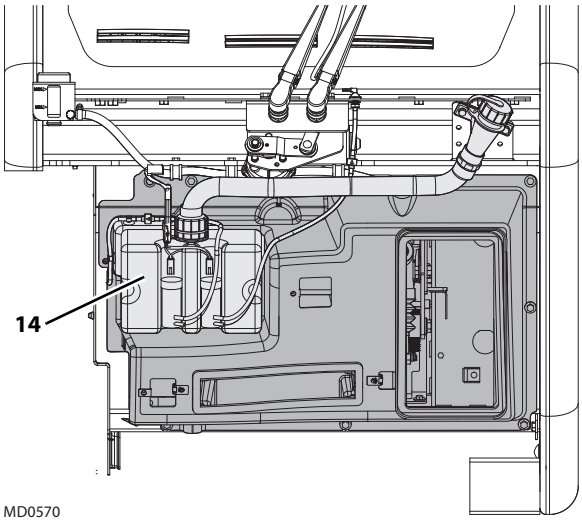
3. Connect reservoir hose to wiper linkage.
4. Connect electrical harness to wiper motor.
5. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
6. Turn ignition key switch to RUN position, and operate windshield wiper in both LOW and HIGH speeds to ensure proper operation and that correct wiper travel is achieved.
7. Secure access cover with hardware removed earlier.
8. Close and secure engine cover.
9. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.10.4 Washer Fluid Reservoir

The washer motor and reservoir (**5**) is located in cab underneath the dash. It is labeled as a unit and cannot be serviced separately.

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage parking brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Remove the outside cover at the front of the cab.



MD0570

6. Remove hardware securing tank (**14**) to machine.
7. Label and disconnect harness connectors from washer tank connectors.
8. Remove washer hoses from washer tank.
9. Remove washer tank from cab.

b. Disassembly

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

c. Inspection and Replacement

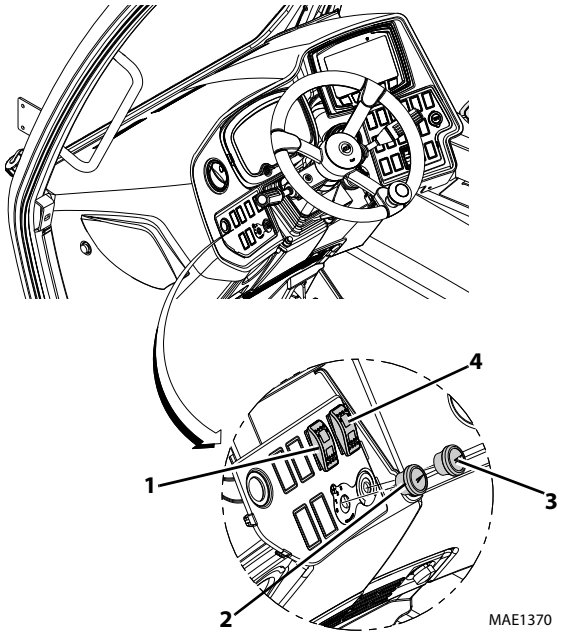
Inspect motor terminals for continuity. Replace motor if continuity is not found.

d. Installation and Testing

1. Connect windshield washer hoses to washer tank.
2. Connect cab wiring harness connectors to washer tank connectors.
3. Align washer tank with mounting holes and secure with previously used hardware.
4. Fill the washer fluid reservoir with washer fluid.
5. Install the outside cover at the front of the cab.
6. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
7. Close and secure engine cover.
8. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.11 CAB HEATER AND A/C (IF EQUIPPED)

9.11.1 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.*

Note: *Apply dielectric grease to all applicable male electrical connectors. DO NOT apply dielectric grease to module connections or cable connections unless noted otherwise.*

The cab heater/air condition controls are located on the left side of the dash panel. The control panel consists of a HVAC recycle switch, HVAC on/off switch, 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 a/c control panel must be removed from the dash panel.*

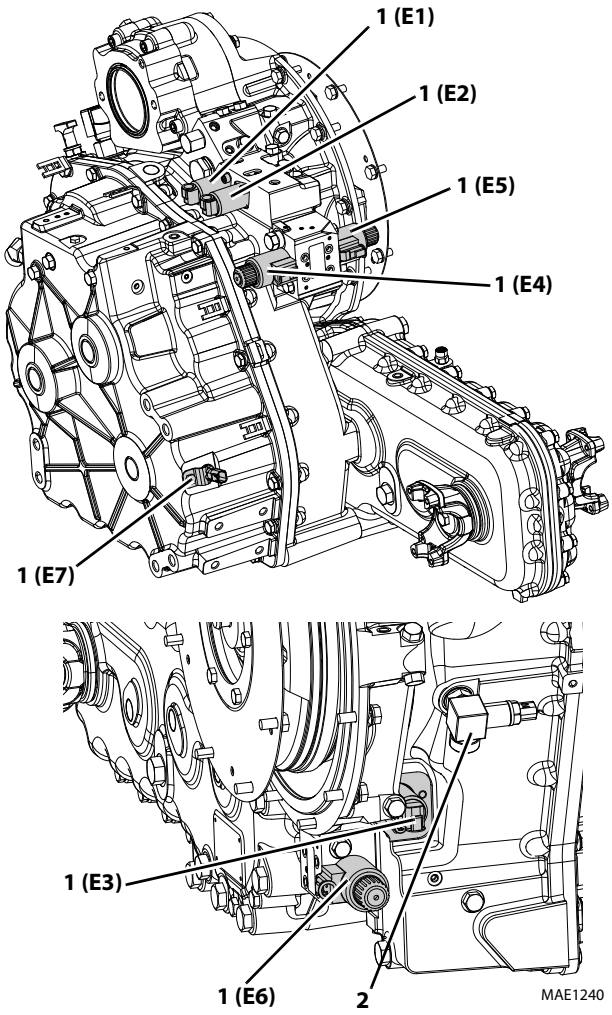
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Allow the engine and all system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Remove the HVAC recycle switch (**1**) out from left side of the dash panel and remove the HVAC actuators harness connector.
6. Remove the HVAC on/off switch (**2**) out from left side of the dash panel and remove the option 1 harness connector.
7. If removing A/C speed control (**3**), remove the cab harness connector.
8. If removing the temperature control knob (**4**), disconnect the cable connector and remove control knob.

b. Installation and Testing

1. Check that the variable speed A/C control (**3**) is in the OFF position.
2. Connect the cab harness connector to the variable speed A/C control.
3. If installing the temperature control (**4**), attach the cable connector to the back of the control.
4. Install the HVAC recycle switch (**1**) to left side of the dash panel and connect the HVAC actuators harness connector.
5. Install the HVAC on/off switch (**2**) to left side of the dash panel and connect the option 1 harness connector.
6. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
7. Close and secure the engine cover.
8. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.12 SOLENOIDS, SENSORS AND SENDERS

9.12.1 Transmission Solenoid Valves



Note: If the transmission is not shifting properly, the transmission shifter, wiring harness or transmission shift solenoids (**1**) should be checked in order to determine which component is defective. Specific information to determine which travel position and corresponding component is not responding can be found in the detailed transmission service instructions (covering repair, disassembly, reassembly and adjustment information) are provided in the following publications:

Detailed transmission parts and service information can be found in appropriate parts and/or service manuals.

The transmission should be checked, serviced and repaired only by experienced service technicians who are aware of all safety instructions and particular component features.

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

9.12.2 Transmission Oil Temperature Switch

a. Transmission Oil Temperature Switch Removal

The transmission oil temperature switch (**2**) is located next to transfer case below converter housing.

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Unplug transmission oil temperature switch connector from wiring harness connector.
6. The switch is threaded into transmission housing. Remove the switch.

b. Transmission Oil Temperature Switch Inspection and Replacement

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

c. Transmission Oil Temperature Switch Installation and Testing

1. Thread transmission oil temperature switch into transmission housing snugly, then connect switch connector to wiring harness connector.
2. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
3. Check for proper fluid level.
4. Start engine, allow it to reach operating temperature and observe operator display cluster for warning indication. If switch is not defective, problem could be elsewhere; possibly in a shorted wire, damaged transmission, improper or low fluid, etc.
5. Close and secure the engine cover.
6. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.12.3 Transmission Mounted Speed Sensor

Transmission speed sensor (**E7**) is located on the transmission housing.

a. Transmission Mounted Speed Sensor Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Unplug the speed sensor connector from the wiring harness connector.

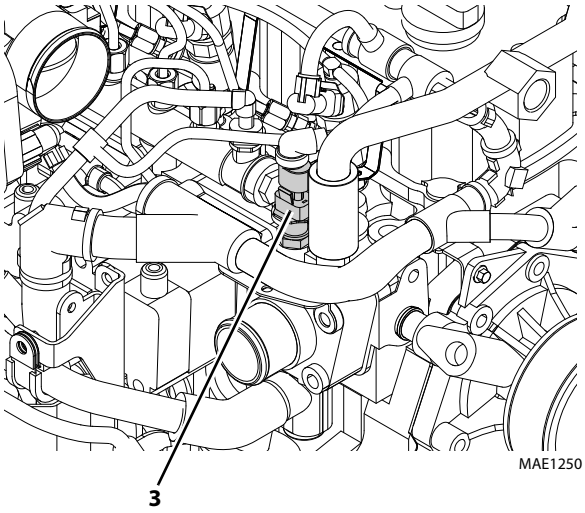
b. Transmission Mounted Speed Sensor Inspection and Replacement

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

c. Transmission Mounted Speed Sensor Installation and Testing

1. Install sensor in transmission, install clamp on sensor. Secure with screw removed earlier.
2. Connect sensor plug to wire harness.
3. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
4. Close and secure engine cover.
5. Remove Do Not Operate Tag from ignition key switch and the steering wheel.

9.12.4 Engine Coolant Temperature Sensor



Engine coolant temperature sensor (**3**) is located on left side of engine.

a. Engine Coolant Temperature Sensor Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.
5. Unplug engine coolant temperature sensor connector from wiring harness connector.
6. Loosen and remove engine coolant temperature sensor from engine block.

b. Engine Coolant Temperature Sensor Inspection and Replacement

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

c. Engine Coolant Temperature Sensor Installation and Testing

1. Apply a lubricate to o-ring on temperature sensor.
2. Thread engine coolant temperature sensor into engine block. Tighten and torque the sensor to 12.5-17 lb-ft (17-23 Nm).
3. Connect sensor connector to wiring harness connector.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Check for proper coolant level.
6. Start engine, allow it to reach operating temperature and observe operator instrument cluster for warning indication. If sensor 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 A/C belt, defective instrument display, etc.
7. Close and secure engine cover.
8. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.12.5 Fuel Level Sender

a. Fuel Level Indicator Testing

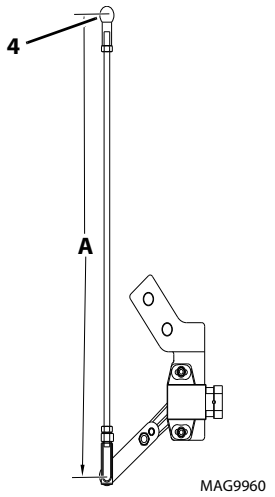
1. Fuel level sender wiring harness leads can be accessed from lowered fuel tank. Refer to Section 7.7, "Engine Exhaust System", for detailed fuel tank removal and installation.
2. Disconnect fuel level sender wiring harness leads.
3. With the help of an assistant, touch both harness leads together using jumper wire.
4. From operator cab, have assistant turn ignition key switch to RUN position. **DO NOT** start engine. Observe fuel level indicator needle on operator instrument cluster. Reading must be at FULL mark.
5. Turn ignition key switch to OFF position. Fuel level indicator needle should return to EMPTY position.

9.12.6 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 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. Refer Section 9.8, "Battery", for procedure.
5. Disconnect the boom angle sensor electrical connector.



6. Loosen and remove the nut holding the rod assembly (**4**) to the sensor arm.
7. Loosen and remove the two bolts 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 (**A**) as required.

Rod Length	14.92 - 15.00 in (379 - 381 mm)

5. Plug the electrical connector into the sensor assembly.
6. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
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. Using the analyzer, navigate to the Access Level menu.
2. Enter code 33271 to enter Access Level 1.
3. To do calibration, go to System>Diagnostics>Boom Angle Raw Counts to verify the signal from the boom angle sensor is between 440 and 3650 counts at all boom angles.
4. Navigate to Calibrations -> Boom Angle and follow the on screen instructions to calibrate the boom angle sensor.
   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.

9.12.7 Reverse Alarm

The reverse alarm is located at the rear of the machine and will automatically sound when the transmission is in (R) REVERSE.

The reverse alarm must not sound when the transmission is in (N) NEUTRAL or (F) FORWARD. With the ignition key switch in the RUN position, the reverse alarm should sound when the transmission is shifted into (R) REVERSE.

a. Disassembly

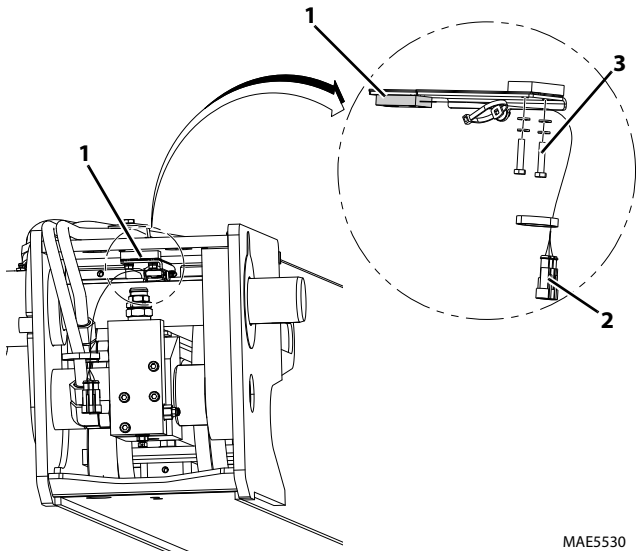
DO NOT disassemble the reverse alarm. Replace a defective or faulty alarm with a new part.

9.12.8 Boom Retract Sensor

The boom retract sensor is located at the rear of the boom.

a. Boom Retract Sensor Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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. Refer Section 9.8, “Battery”, for procedure.



5. Disconnect the boom retract sensor electrical connector (**2**).
6. Loosen and remove the two bolts (**3**) holding the boom retract sensor (**1**).
7. Remove the sensor assembly.
8. If necessary, remove the sensor bracket.

b. Boom Retract 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 Retract 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 boom retract sensor at rear side of the boom.
4. Plug the electrical connector into the sensor assembly.
5. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
6. Close and secure the engine cover.
7. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.13 DASH SWITCHES

Note: *For information on the front windshield wiper, rear window wiper and washer systems, refer to Section 9.10, "Window Wiper System (if equipped)".*

9.13.1 Ignition Key Switch

a. Ignition Key Switch Removal

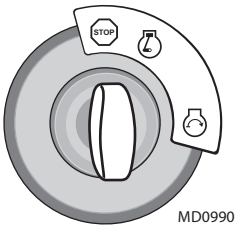
1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine should not be operated.
3. Open the engine cover. Allow the engine to cool.
4. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure.
5. Remove the screws securing the lower dash panel.
6. Remove the hex nut securing the ignition key switch to the dash.
7. Lower the dash panel to gain access to the rear of the ignition switch. Push the switch through the panel.
8. Label and disconnect the electrical connections attached to the switch.
9. Remove the switch from the machine.

b. Disassembly

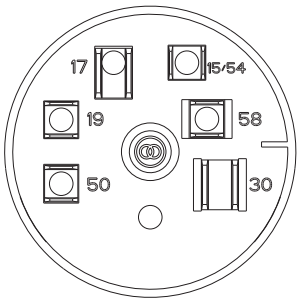
DO NOT disassemble the ignition key switch. Replace a defective switch with a new part.

c. Inspection and Replacement

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



MD0990



MZ2140

Test the ignition key switch for continuity, by checking from the power (**#30**) wire to each of the following wires in each switch position. Continuity should be present as indicated in the following chart:

Switch Position	Test for Continuity Between Wire #30 and wires:
Stop	#15 & #58
Run	#15 & #19
Start	#15, #17 & #50

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

d. Ignition Key Switch Installation

1. Connect the previously labeled electrical connections to the ignition key switch.
2. Push the ignition key switch through the hole in the dash.
3. Secure the switch to the dash with the previously used hex nut.
4. Verify that each ignition position is properly connected.
5. Install the lower dash panel.
6. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
7. Close and secure the engine cover.

8. Start engine to verify proper operation of the ignition switch.
9. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.13.2 Dash Switches

a. Switch Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission 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. Refer Section 9.8, “Battery”, for procedure.
5. 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 and shorting in both the engaged and disengaged positions. Replace a defective or faulty switch with a new switch.

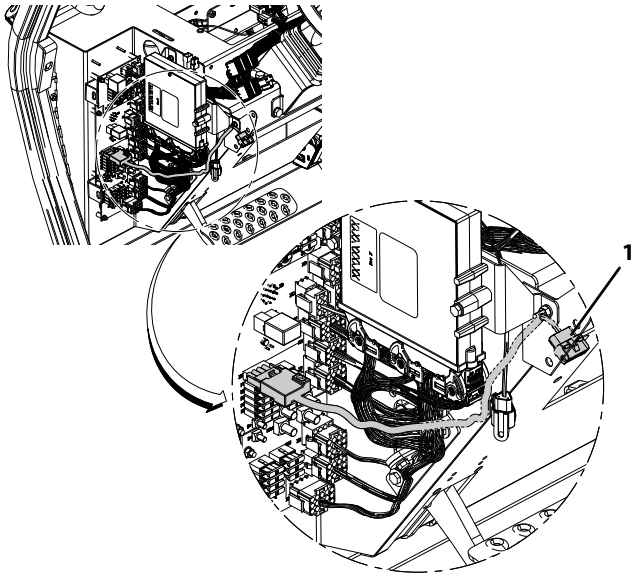
d. Switch Installation

1. Connect the switch to the cab harness connector.
2. Position the switch over the rectangular switch bezel and snap into position.
3. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
4. Start the machine and check the replaced switch for proper function.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

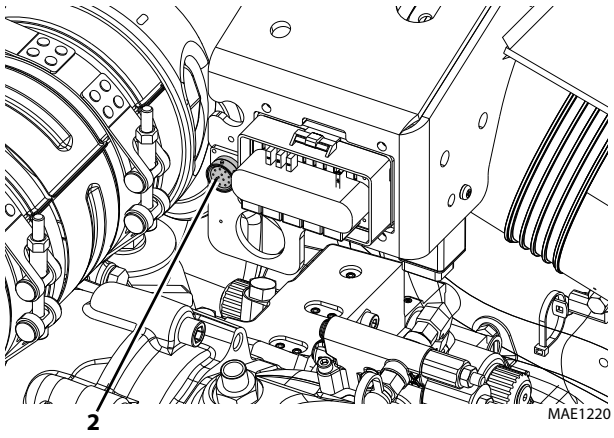
9.14 MACHINE DATA

9.14.1 Machine Data Access

Machine and engine data can be accessed by connecting to the appropriate locations shown below.



The analyzer cable plugs into the connector (**1**) located on the lower dash panel below the steering. For machine diagnostics, refer to Section 9.18, “Machine Fault Codes”.

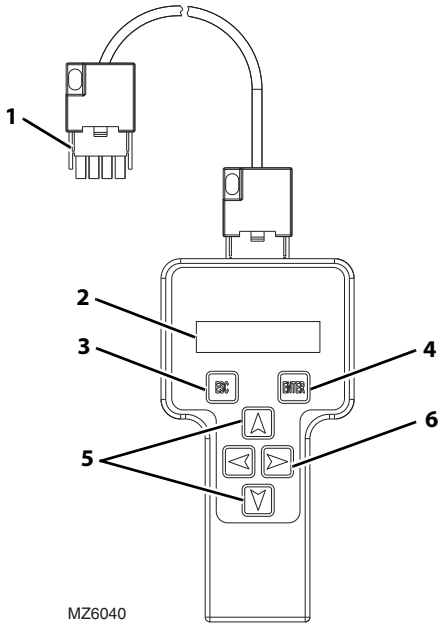


The engine data can be accessed through connector (**2**) in the engine compartment utilizing engine diagnostic tool. For engine diagnositcs, refer to Section 9.19, “Engine Diagnostic”.

9.14.2 Analyzer

a. Hand Held Analyzer

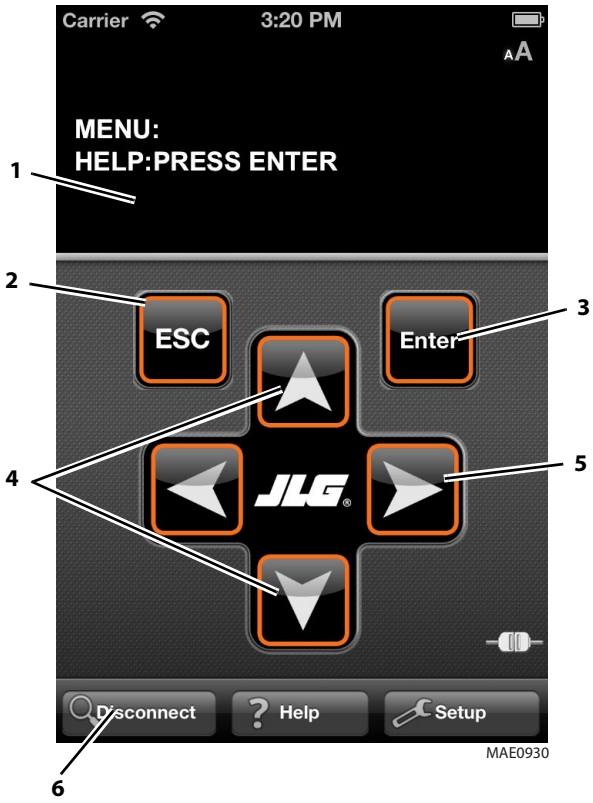
The hand held analyzer (PN 2901443) provides machine diagnostic, configuration and troubleshooting capabilities.



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.

b. Mobile Analyzer

The mobile analyzer (PN 1001147542) is a Wi-Fi enabled evolution of the hand held analyzer kit provides machine diagnostic, configuration and troubleshooting capabilities with an extended operator range of up to 150 ft (45,72 m).

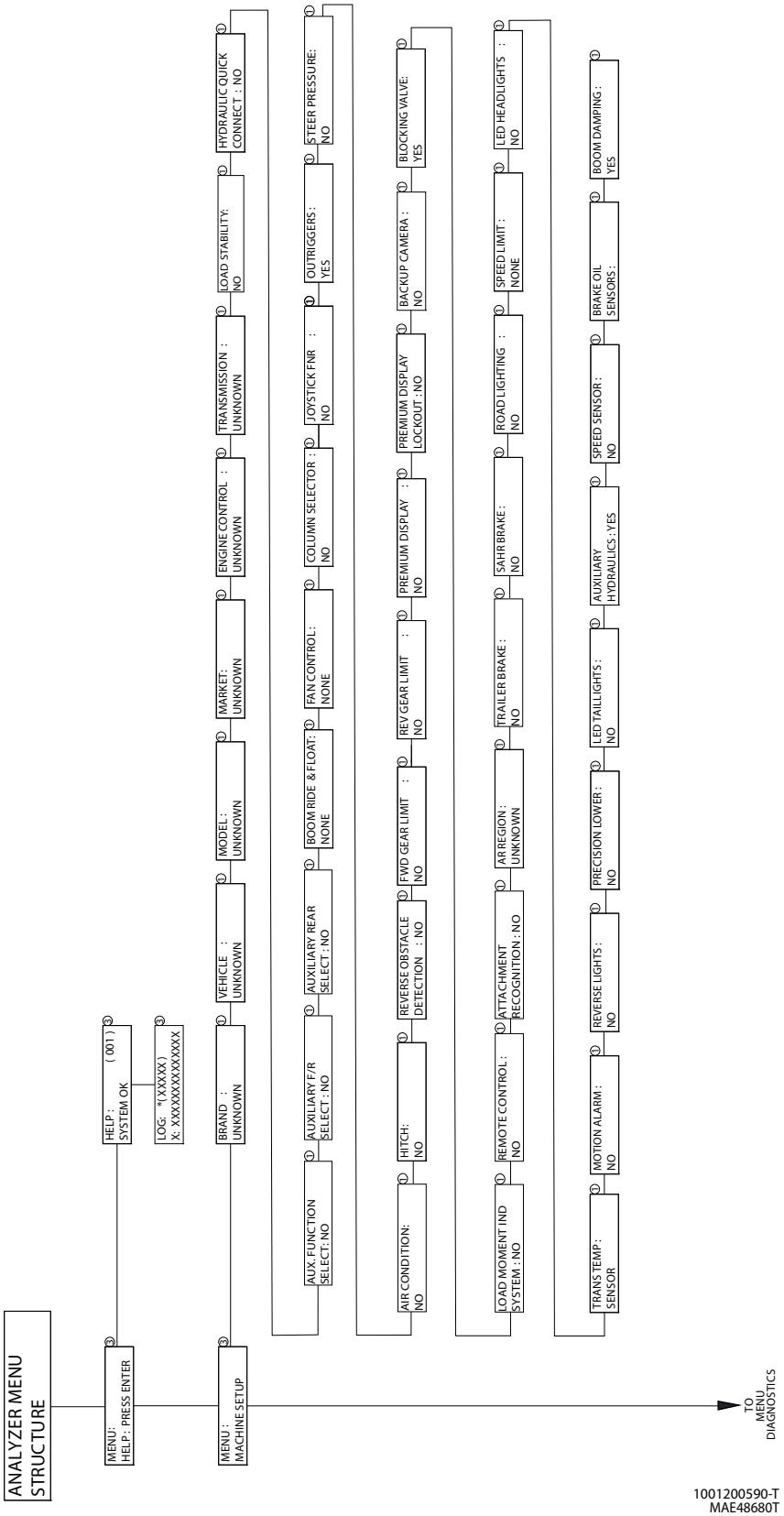


1. Analyzer Display Screen: To display full description read-outs.
2. Escape Key: To return home or access previous menu.
3. Enter Key: Stores and selects Top Level, Sub Level and Items Menus.
4. Up/Down Arrow Keys: Change adjustable values.
5. Left and Right Arrow Keys: Used to move between Top Level, Sub Levels and Item Menus.
6. Disconnect: To disconnect the connection of the mobile from the system.

9.14.3 Analyzer Software Version P.18.0

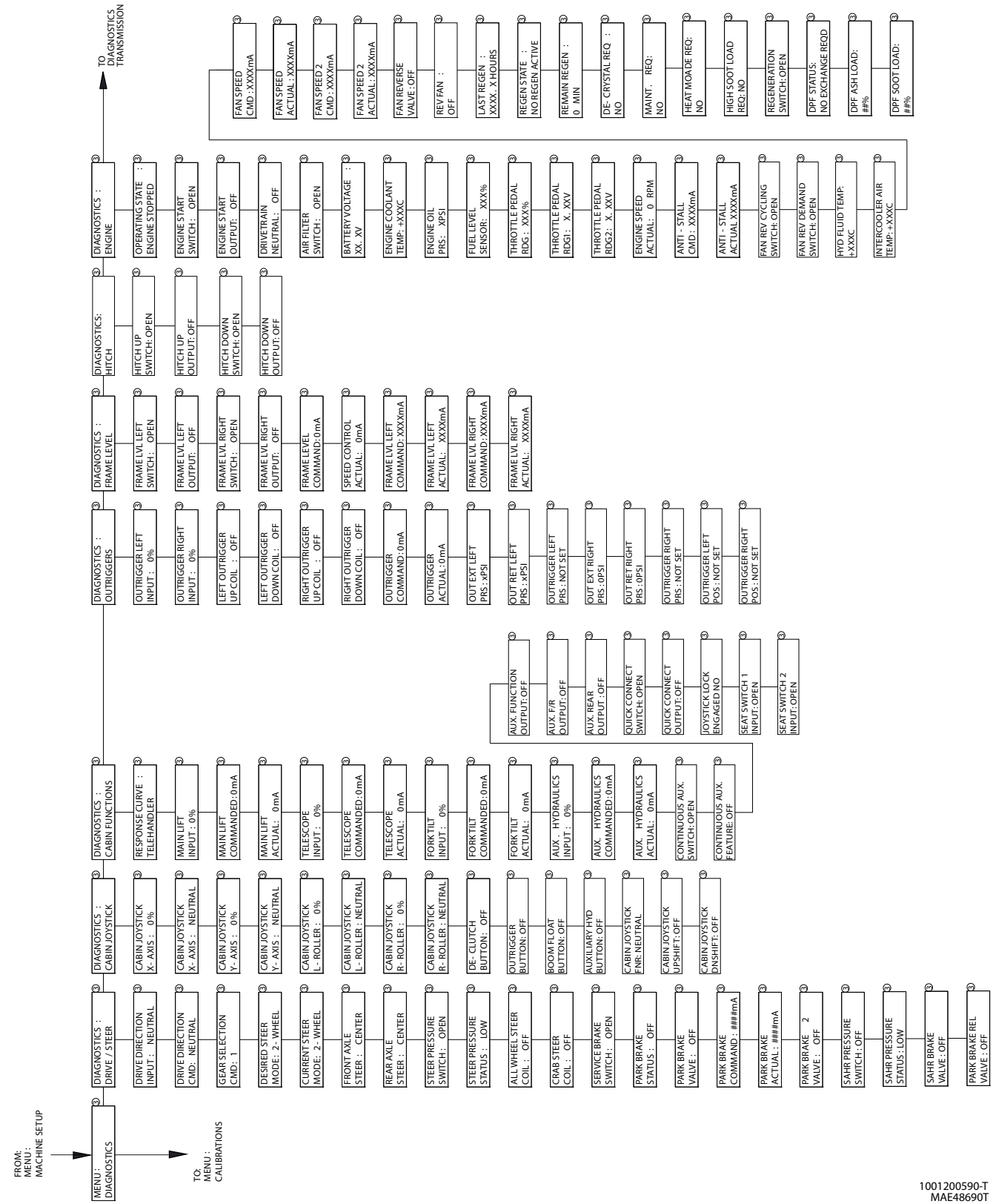
(SHEET 1 of 8)

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



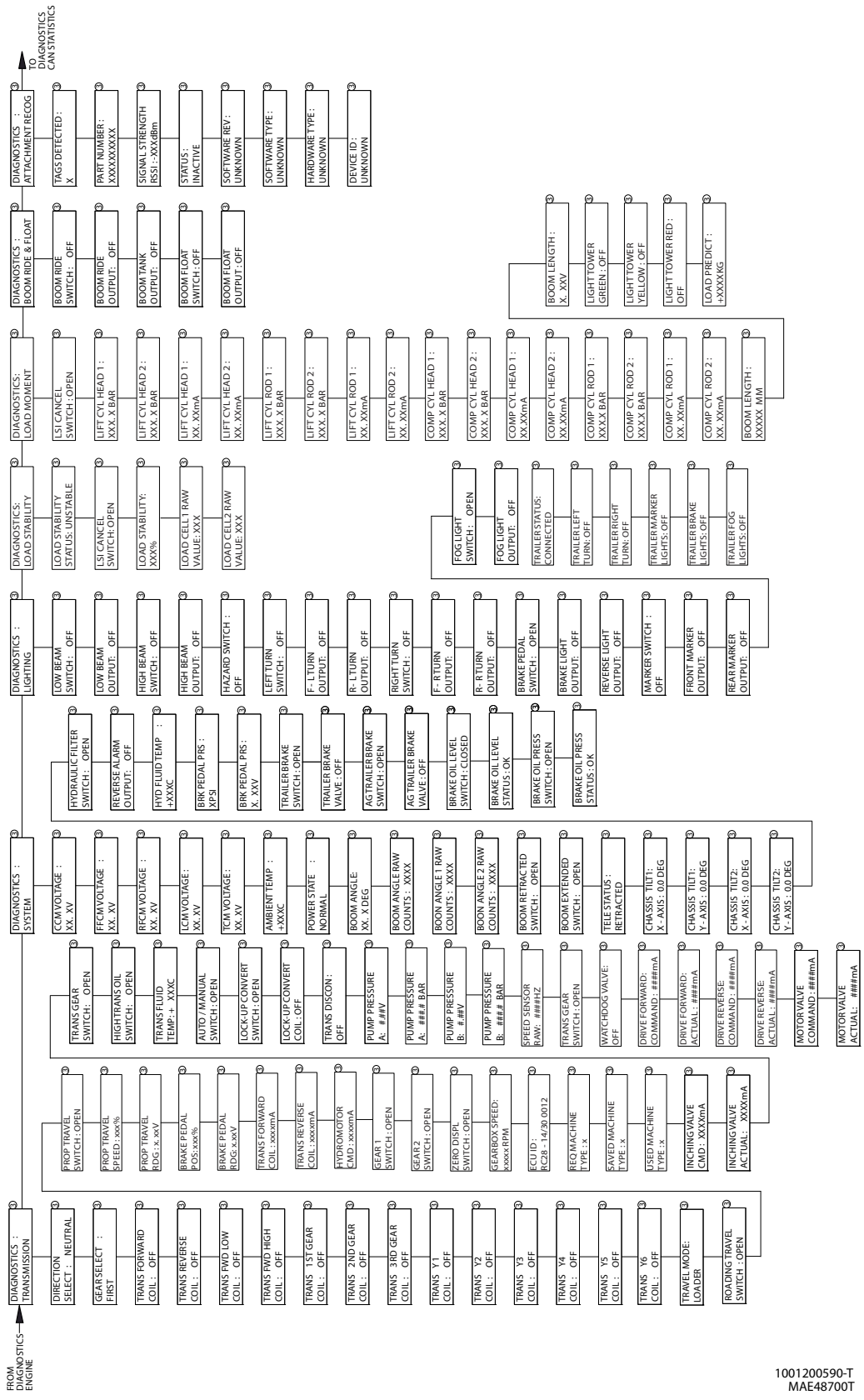
1001200590-T
MAE48680T

(SHEET 2 of 8)



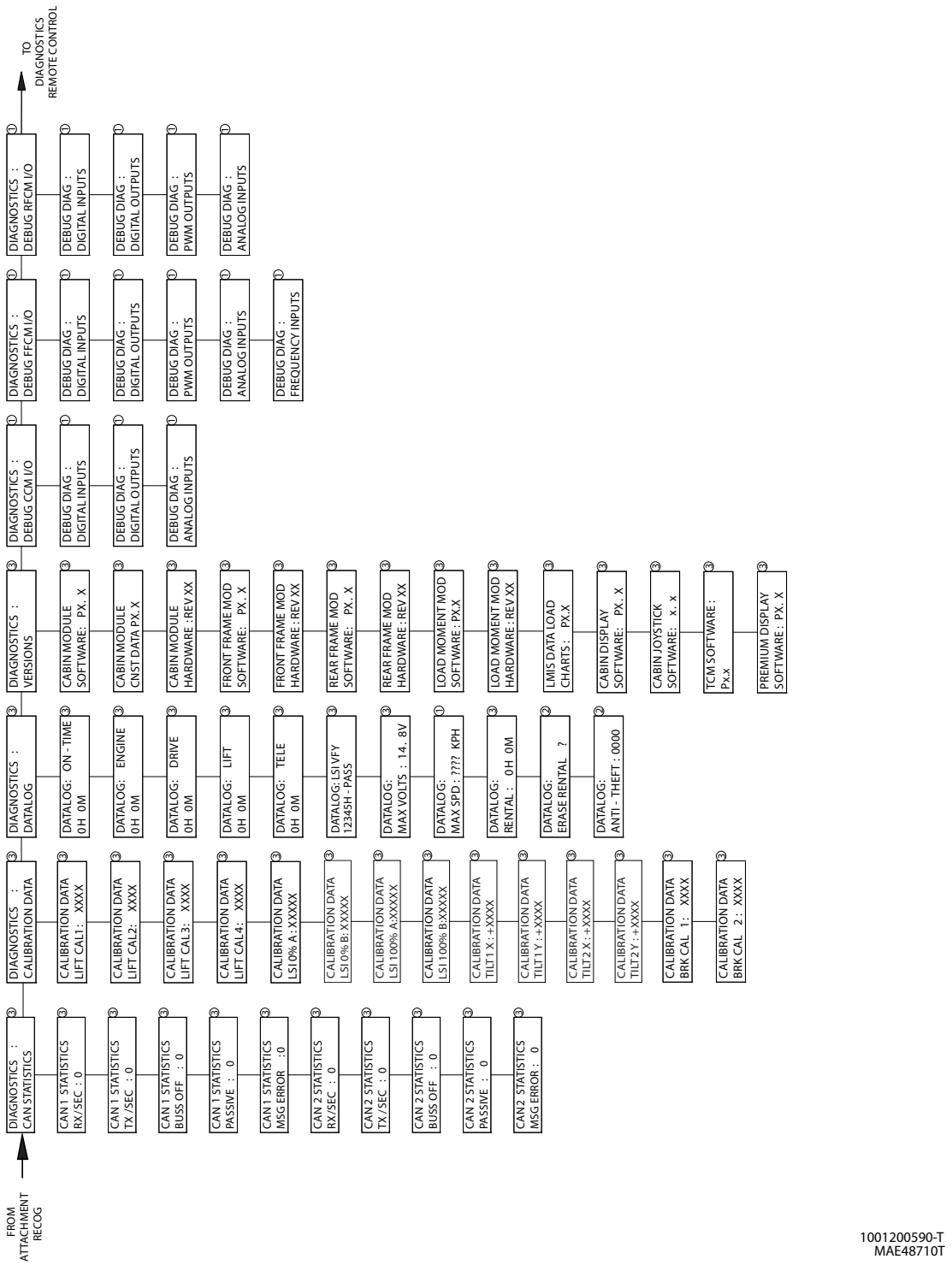
1001200590-T
MAE48690T

(SHEET 3 of 8)



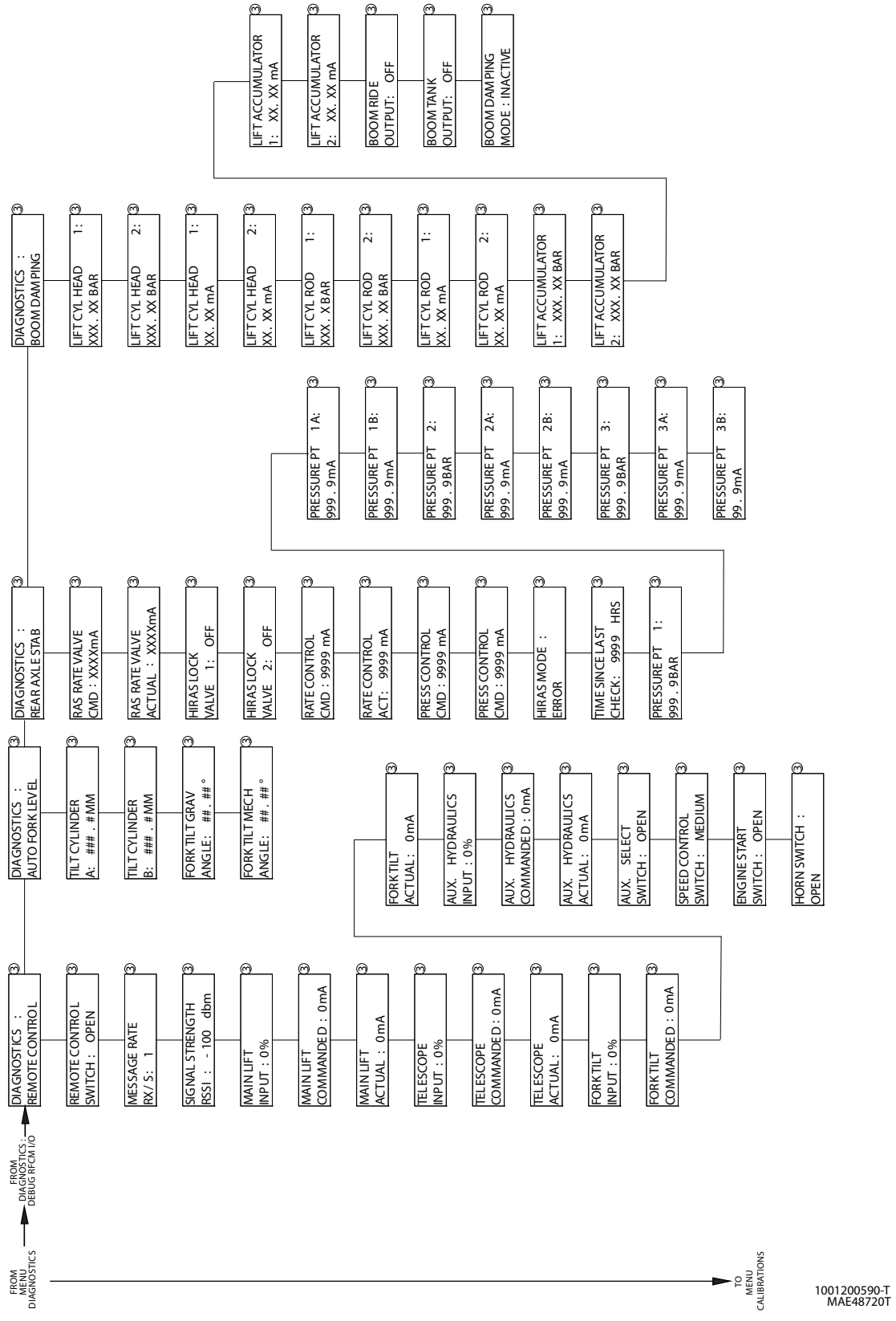
1001200590-T
MAE48700T

(SHEET 4 of 8)



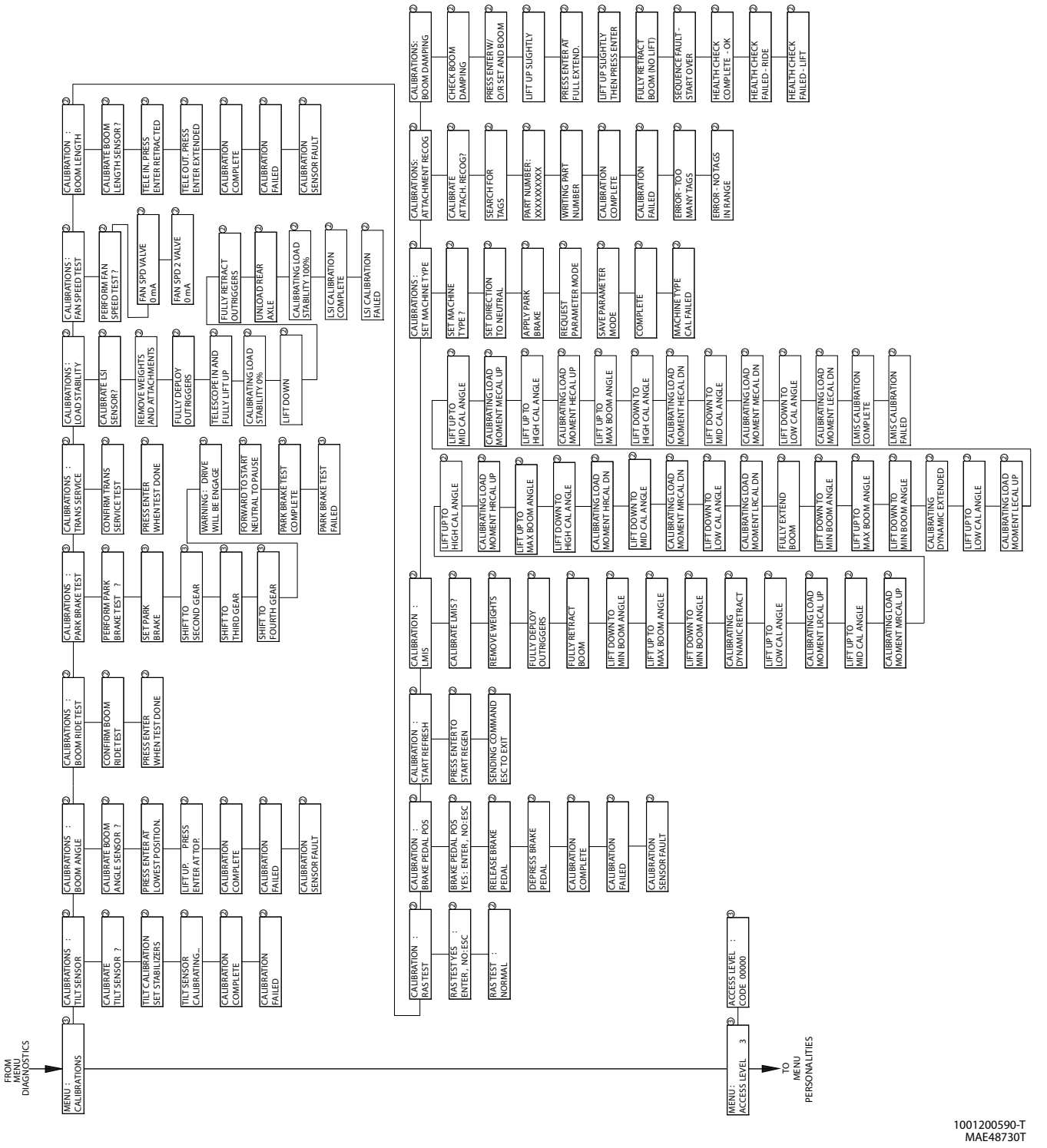
1001200590-T
MAE48710T

(SHEET 5 of 8)



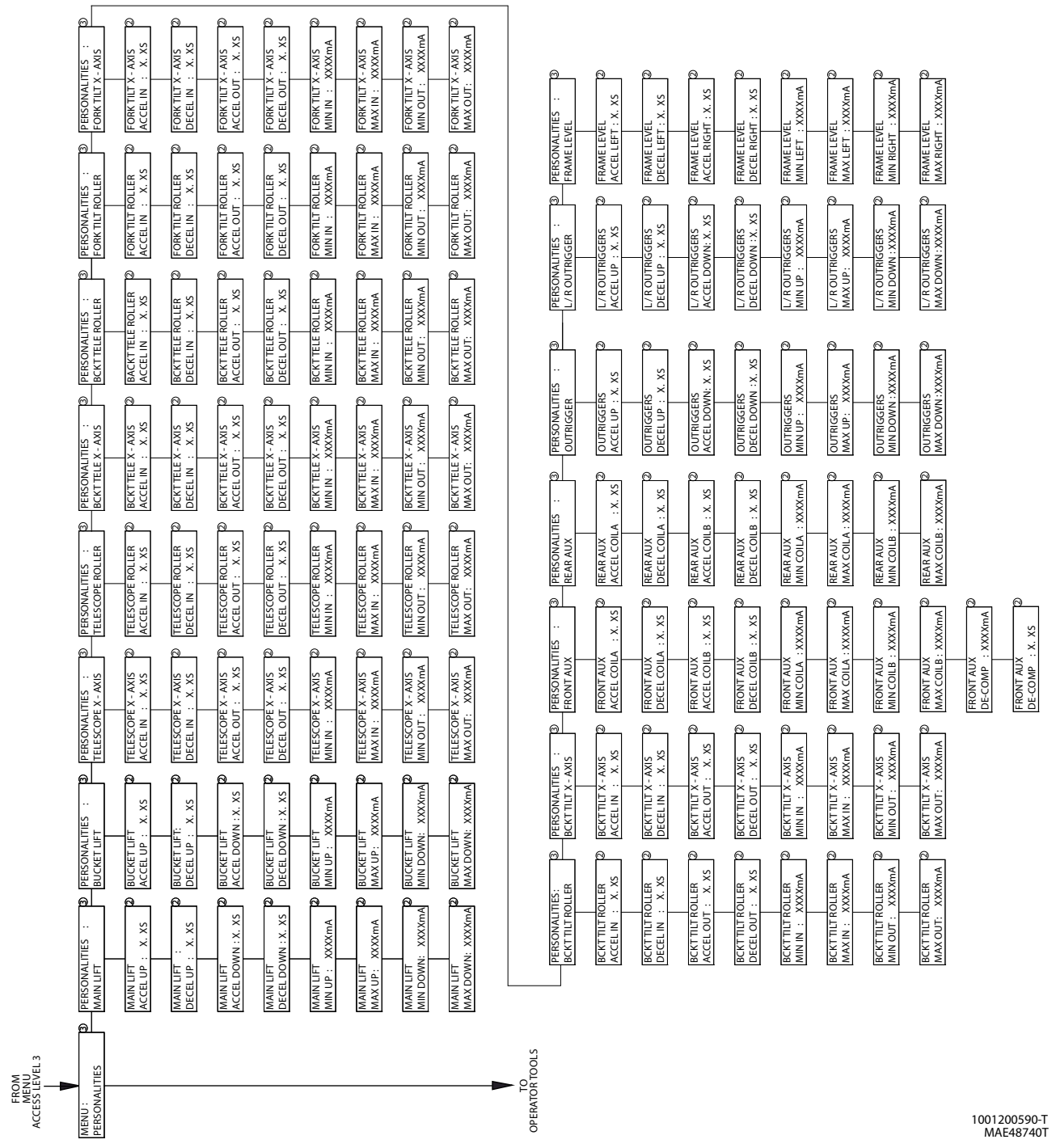
1001200590-T
MAE48720T

(SHEET 6 of 8)

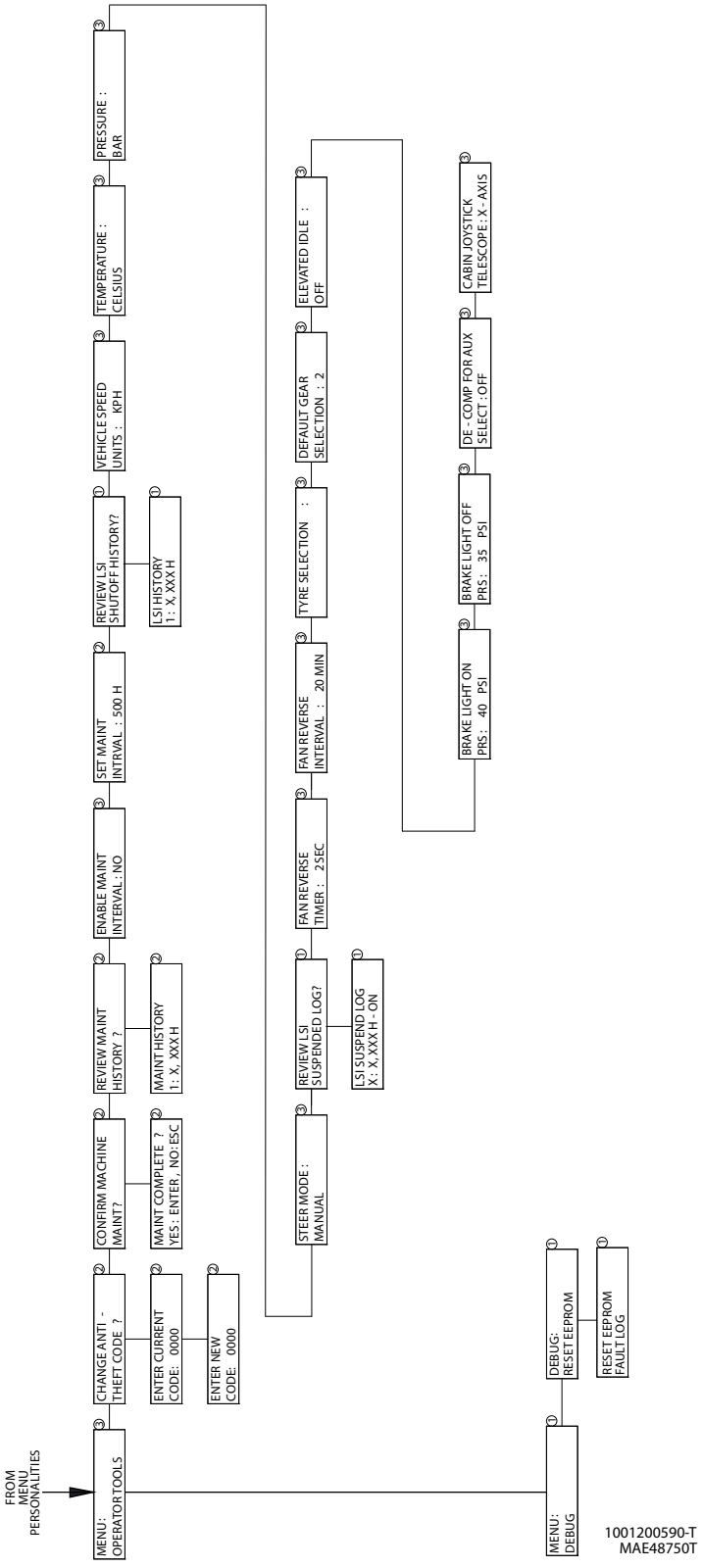


1001200590-T
MAE48730T

(SHEET 7 of 8)


FROM MENU ACCESS LEVEL 3
MENU: PERSONALITIES
PERSONALITIES : MAIN LIFT
MAIN LIFT ACCEL UP : X. XS
MAIN LIFT DECEL UP : X. XS
MAIN LIFT ACCEL DOWN : X. XS
MAIN LIFT DECEL DOWN : X. XS
MAIN LIFT MIN UP : XXXXmA
MAIN LIFT MAX UP: XXXXmA
MAIN LIFT MIN DOWN: XXXXmA
MAIN LIFT MAX DOWN: XXXXmA
PERSONALITIES : BUCKET LIFT
BUCKET LIFT ACCEL UP : X. XS
BUCKET LIFT: DECEL UP : X. XS
BUCKET LIFT ACCEL DOWN : X. XS
BUCKET LIFT DECEL DOWN : X. XS
BUCKET LIFT MIN UP : XXXXmA
BUCKET LIFT MAX UP: XXXXmA
BUCKET LIFT MIN DOWN: XXXXmA
BUCKET LIFT MAX DOWN: XXXXmA
PERSONALITIES : TELESCOPE X - AXIS
TELESCOPE X - AXIS ACCEL IN : X. XS
TELESCOPE X - AXIS DECEL IN : X. XS
TELESCOPE X - AXIS ACCEL OUT : X. XS
TELESCOPE X - AXIS DECEL OUT : X. XS
TELESCOPE X - AXIS MIN IN : XXXXmA
TELESCOPE X - AXIS MAX IN : XXXXmA
TELESCOPE X - AXIS MIN OUT : XXXXmA
TELESCOPE X - AXIS MAX OUT: XXXXmA
PERSONALITIES : TELESCOPE ROLLER
TELESCOPE ROLLER ACCEL IN : X. XS
TELESCOPE ROLLER DECEL IN : X. XS
TELESCOPE ROLLER ACCEL OUT : X. XS
TELESCOPE ROLLER DECEL OUT : X. XS
TELESCOPE ROLLER MIN IN : XXXXmA
TELESCOPE ROLLER MAX IN : XXXXmA
TELESCOPE ROLLER MIN OUT : XXXXmA
TELESCOPE ROLLER MAX OUT: XXXXmA
PERSONALITIES : BCKT TELE X - AXIS
BCKT TELE X - AXIS ACCEL IN : X. XS
BCKT TELE X - AXIS DECEL IN : X. XS
BCKT TELE X - AXIS ACCEL OUT : X. XS
BCKT TELE X - AXIS DECEL OUT : X. XS
BCKT TELE X - AXIS MIN IN : XXXXmA
BCKT TELE X - AXIS MAX IN : XXXXmA
BCKT TELE X - AXIS MIN OUT : XXXXmA
BCKT TELE X - AXIS MAX OUT: XXXXmA
PERSONALITIES : BCKT TELE ROLLER
BACKT TELE ROLLER ACCEL IN : X. XS
BCKT TELE ROLLER DECEL IN : X. XS
BCKT TELE ROLLER ACCEL OUT : X. XS
BCKT TELE ROLLER DECEL OUT : X. XS
BCKT TELE ROLLER MIN IN : XXXXmA
BCKT TELE ROLLER MAX IN : XXXXmA
BCKT TELE ROLLER MIN OUT : XXXXmA
BCKT TELE ROLLER MAX OUT: XXXXmA
PERSONALITIES : FORK TILT ROLLER
FORK TILT ROLLER ACCEL IN : X. XS
FORK TILT ROLLER DECEL IN : X. XS
FORK TILT ROLLER ACCEL OUT : X. XS
FORK TILT ROLLER DECEL OUT : X. XS
FORK TILT ROLLER MIN IN : XXXXmA
FORK TILT ROLLER MAX IN : XXXXmA
FORK TILT ROLLER MIN OUT : XXXXmA
FORK TILT ROLLER MAX OUT: XXXXmA
PERSONALITIES : FORK TILT X - AXIS
FORK TILT X - AXIS ACCEL IN : X. XS
FORK TILT X - AXIS DECEL IN : X. XS
FORK TILT X - AXIS ACCEL OUT : X. XS
FORK TILT X - AXIS DECEL OUT : X. XS
FORK TILT X - AXIS MIN IN : XXXXmA
FORK TILT X - AXIS MAX IN : XXXXmA
FORK TILT X - AXIS MIN OUT : XXXXmA
FORK TILT X - AXIS MAX OUT: XXXXmA
TO OPERATOR TOOLS
PERSONALITIES: BCKT TILT ROLLER
PERSONALITIES : BCKT TILT X - AXIS
BCKT TILT ROLLER ACCEL IN : X. XS
BCKT TILT ROLLER DECEL IN : X. XS
BCKT TILT ROLLER ACCEL OUT : X. XS
BCKT TILT ROLLER DECEL OUT : X. XS
BCKT TILT ROLLER MIN IN : XXXXmA
BCKT TILT ROLLER MAX IN : XXXXmA
BCKT TILT ROLLER MIN OUT : XXXXmA
BCKT TILT ROLLER MAX OUT: XXXXmA
PERSONALITIES : FRONT AUX
FRONT AUX ACCEL COILA : X. XS
FRONT AUX DECEL COILA : X. XS
FRONT AUX ACCEL COILB : X. XS
FRONT AUX DECEL COILB : X. XS
FRONT AUX MIN COILA : XXXXmA
FRONT AUX MAX COILA : XXXXmA
FRONT AUX MIN COILB : XXXXmA
FRONT AUX MAX COILB : XXXXmA
FRONT AUX DE-COMP : XXXXmA
FRONT AUX DE-COMP : X. XS
PERSONALITIES : REAR AUX
REAR AUX ACCEL COILA : X. XS
REAR AUX DECEL COILA : X. XS
REAR AUX ACCEL COILB : X. XS
REAR AUX DECEL COILB : X. XS
REAR AUX MIN COILA : XXXXmA
REAR AUX MAX COILA : XXXXmA
REAR AUX MIN COILB : XXXXmA
REAR AUX MAX COILB : XXXXmA
PERSONALITIES : OUTRIGGER
OUTRIGGERS ACCEL UP : X. XS
OUTRIGGERS DECEL UP : X. XS
OUTRIGGERS ACCEL DOWN: X. XS
OUTRIGGERS DECEL DOWN : X. XS
OUTRIGGERS MIN UP : XXXXmA
OUTRIGGERS MAX UP: XXXXmA
OUTRIGGERS MIN DOWN : XXXXmA
OUTRIGGERS MAX DOWN : XXXXmA
PERSONALITIES : L/R OUTRIGGER
L/R OUTRIGGERS ACCEL UP : X. XS
L/R OUTRIGGERS DECEL UP : X. XS
L/R OUTRIGGERS ACCEL DOWN: X. XS
L/R OUTRIGGERS DECEL DOWN : X. XS
L/R OUTRIGGERS MIN UP : XXXXmA
L/R OUTRIGGERS MAX UP: XXXXmA
L/R OUTRIGGERS MIN DOWN : XXXXmA
L/R OUTRIGGERS MAX DOWN : XXXXmA
PERSONALITIES : FRAME LEVEL
FRAME LEVEL ACCEL LEFT : X. XS
FRAME LEVEL DECEL LEFT : X. XS
FRAME LEVEL ACCEL RIGHT : X. XS
FRAME LEVEL DECEL RIGHT : X. XS
FRAME LEVEL MIN LEFT : XXXXmA
FRAME LEVEL MAX LEFT : XXXXmA
FRAME LEVEL MIN RIGHT : XXXXmA
FRAME LEVEL MAX RIGHT : XXXXmA
1001200590-T
MAE48740T

(SHEET 8 of 8)


FROM MENU PERSONALITIES
MENU: OPERATOR TOOLS
CHANGE ANTI - THEFT CODE ?
ENTER CURRENT CODE: 0000
ENTER NEW CODE: 0000
CONFIRM MACHINE MAINT?
MAINT COMPLETE ? YES: ENTER, NO: ESC
REVIEW MAINT HISTORY ?
MAINT HISTORY 1: X, XXX H
ENABLE MAINT INTERVAL: NO
SET MAINT INTRVAL : 500 H
REVIEW LSI SHUTOFF HISTORY?
LSI HISTORY 1: X, XXX H
VEHICLE SPEED UNITS : KPH
TEMPERATURE : CELSIUS
PRESSURE : BAR
STEER MODE : MANUAL
REVIEW LSI SUSPENDED LOG?
LSI SUSPEND LOG X : X, XXX H - ON
FAN REVERSE TIMER : 2SEC
FAN REVERSE INTERVAL : 20 MIN
TYRE SELECTION :
DEFAULT GEAR SELECTION : 2
ELEVATED IDLE : OFF
BRAKE LIGHT ON PRS: 40 PSI
BRAKE LIGHT OFF PRS: 35 PSI
DE - COMP FOR AUX SELECT : OFF
CABIN JOYSTICK TELESCOPE : X - AXIS
MENU: DEBUG
DEBUG: RESET EEPROM
RESET EEPROM FAULT LOG
1001200590-T
MAE48750T

9.15 ANALYZER SOFTWARE ACCESSIBILITY

9.15.1 Access Level

The access level screen allows to enter a five digit numeric code to qualify user capability. Code entry determines level of access.

a. Operator (Access Level 3) - No code required.

b. Service (Access Level 2) - 33271.

9.15.2 Diagnostics

Menu	Description	Access Level
Drive/Steer	Displays the parameter related to the steering system	Access Level 3
Cabin Joystick	Displays the parameter related to the joystick	Access Level 3
Cabin Functions	Displays the cabin joystick input for the auxiliary	Access Level 3
Outriggers	Displays the parameter related to the outrigger functions	Access Level 3
Frame Level	Displays the parameter related to the frame leveling	Access Level 3
Hitch	Displays the parameter related to the hitch functions	Access Level 3
Engine	Displays the parameter related to the engine	Access Level 3
Transmission	Displays parameter related to the drive/transmission	Access Level 3
System	Displays the parameter related to the control system	Access Level 3
Lighting	Displays the parameter related to the lighting	Access Level 3
Load Stability	Displays the parameters related to load stability indicator	Access Level 3
Load Moment	Displays the parameter related to the load moment	Access Level 3
Boom Ride and Float	Displays the parameters related to the boom ride & float	Access Level 3
Attachment Recog	Displays the parameters related to the attachment recog	Access Level 3
CAN Statistics	CAN statistics screen displays the parameters of the system bus and diagnostic bus	Access Level 3
Calibration Data	Allows to set the calibration values for all the calibrated sensors in the control system	Access Level 3
Datalog	Displays all the logged values defined in the global parameter database	Access Level 3
Versions	Displays the version of the software, hardware and constant data of control modules in the machine	Access Level 3
Debug CCM I/O	Displays the parameters related to the debug CCM I/O	Access Level 1
Debug FFCM I/O	Displays the parameters related to the debug FFCM I/O	Access Level 1

Menu	Description	Access Level
Debug RFCM I/O	Displays the parameters related to the debug RFCM I/O	Access Level 1
Remote Control	Displays the parameter related to the remote control	Access Level 3
Auto Fork Level	Displays the parameters related to the auto fork level	Access Level 3
Rear Axel Stab	Displays the parameters related to the rear axle stab	Access Level 3
Boom Damping	Displays the parameters related to the boom damping	Access Level 3

9.15.3 Machine Set-Up

Menu	SETTING	Description	Access Level
Brand	**JLG**	Allows to configure the brand name of the telehandler	Access Level 1
Vehicle	LBP - AG	Allows to set the type of vehicle based on boom configuration and market preferences	Access Level 1
Model	832, 925	Allows to configure the model number of the telehandler	Access Level 1
	Unknown		
	3006		
	3507PS / 823		
	4008PS / 925		
	3510PS / 832		
	3010		
Market	ANSI	Allows to set the applicable compliance standard	Access Level 1
	CE		
	AUSTRALIA		
Engine Control	**Deutz 74.4 KW HRC**	Allows to configure the vehicle's engine	Access Level 1
	Deutz 85 KW HRC		
	Deutz 90 KW HRC		
	Deutz 97 KW HRC		
	Deutz 74.47 KW LRC		
	Deutz 85 KW LRC		
	Deutz 90 KW LRC		
	Deutz 100 KW HRC		
Transmission	BOSCH HYSTAT	Allows to Configures the type of transmission.	Access Level 1
	TURNER 4SPD3		
	TURNER 6SPD		
Hydraulic Quick Connect	**NO**	Enables hydraulic quick connection functionality	Access Level 1
	YES		

Menu	SETTING	Description	Access Level
Aux. Function Select	**NO**	Enables the dual front auxiliary selection functionality	Access Level 1
	YES		
Aux. F/R Select	**NO**	Enables the front/rear auxiliary selection functionality	Access Level 1
	YES		
Aux. Rear Select	**NO**	Enables the dual rear auxiliary selection functionality	Access Level 1
	YES		
Boom Ride & Float	**None**	Enables boom ride & float functionality	Access Level 1
	Ride		
	Ride & Float		
Fan Control	Hydraulic	Enables single and dual hydraulic reversing fan functionality	Access Level 1
	Hyd w/Rev		
	Dual Hyd		
Column Selector	NO	Enables column gear and drive direction selection functionality	Access Level 1
	YES		
Joystick FNR	NO	Enables joystick gear and drive direction selection functionality	Access Level 1
	YES		
Air Condition	**NO**	Enables control of the air conditioning functionality	Access Level 1
	YES		
Hitch	**NO**	Enables hydraulic hitch functionality	Access Level 1
	YES		
Reverse Obstacle Detection	**NO**	Enables the reverse obstacle detection functionality	Access Level 1
	YES		
Fwd Gear Limit	1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, **6^{th}**	Enables a limit on forward gear selection	Access Level 1
Rev Gear Limit	NO	Enables a limit on reverse gear selection	Access Level 1
	1^{st}, 2^{nd}, **3^{rd}**		
Premium Display	**NO**	Enables multifunction display functionality	Access Level 1
	YES		
	YES W/ANTI-THEFT		
Premium Display Lockout :	**NO**	Enables multifunction display functionality	Access Level 1
	YES		
Backup Camera	NO	Enables reversing camera functionality within the multifunction display	Access Level 1
	YES		

Menu	SETTING	Description	Access Level
Blocking Valve	NO	Enables hydraulic blocking valve functionality	Access Level 1
	YES		
Trailer Brake	**NO**	Enables trailer braking functionality	Access Level 1
	ITALIAN		
	AGRICULTURAL		
SAHR Brake	**NO**	Enables spring applied hydraulic released valve functionality	Access Level 1
	MANUAL		
	AUTO		
Road Lighting	NO	Enables road lighting functionality	Access Level 1
	YES		
Speed limit	**NONE**, 20 KPH, 25 KPH, 30 KPH, 35 KPH, 40 KPH	Allows to set the Speed Limit	Access Level 1
LED Headlights	**NO**	Enables LED headlights functionality	Access Level 1
	YES		
Reverse Light	NO	Enables reverse light functionality	Access Level 1
	YES		
LED Taillights	**NO**	Enables LED taillights functionality	Access Level 1
	YES		
Brake Oil Sensors	**NO**	Enables service brake oil pressure and level monitoring functionality	Access Level 1
	YES		

Note: *Settings in BOLD are default values.*

9.15.4 Personalities

Menu/Sub-menu Items	Function	Description	Default Values		Access Level
			925	832	
Fork Tilt (Roller)	Fork Tilt Accel Up	Fork screen allows the operator to view parameters (max/min) related to fork tilt cylinder.	0.6 (0.0 - 2.0S)	0.6 (0.0 - 2.0S)	Access Level 2, 3
	Fork Tilt Decel Up		0.4 (0.0 - 1.0S)	0.4 (0.0 - 1.0S)	
	Fork Tilt Accel Down		0.4 (0.0 - 2.0S)	0.4 (0.0 - 2.0S)	
	Fork Tilt Decel Down		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Fork Tilt Min Up		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Fork Tilt Max Up		1100mA (900 - 1300mA)	1120mA (920 - 1320mA)	
	Fork Tilt Min Down		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Fork Tilt Max Down		1100mA (900 - 1300mA)	1120mA (920 - 1320mA)	
	Fork Tilt Derate		75.0% (50.0 – 100.0%)	75.0% (50.0 – 100.0%)	
Fork Tilt (X-Axis)	Fork Tilt X-Axis Accel Up	Fork screen allows the operator to view parameters (max/min) related to fork tilt cylinder.	0.6 (0.0 - 2.0S)	0.6 (0.0 - 2.0S)	Access Level 2, 3
	Fork Tilt X-Axis Decel Up		0.4 (0.0 - 1.0S)	0.4 (0.0 - 1.0S)	
	Fork Tilt X-Axis Accel Down		0.4 (0.0 - 2.0S)	0.4 (0.0 - 2.0S)	
	Fork Tilt X-Axis Decel Down		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Fork Tilt X-Axis Min Up		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Fork Tilt X-Axis Max Up		1100mA (900 - 1300mA)	1120mA (920 - 1320mA)	
	Fork Tilt X-Axis Min Down		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Fork Tilt X-Axis Max Down		1100mA (900 - 1300mA)	1120mA (920 - 1320mA)	
	Fork Tilt Derate		75.0% (50.0 – 100.0%)	75.0% (50.0 – 100.0%)	

Menu/Sub-menu Items	Function	Description	Default Values		Access Level
			925	832	
Main Lift	Main Lift Accel Up	Main lift Screen allows the operator to view parameters (max/min) related to lift/lower cylinder.	0.3 (0.0 - 2.0S)	0.3 (0.0 - 2.0S)	Access Level 2, 3
	Main Lift Decel Up		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Main Lift Accel Down		0.7 (0.0 - 2.0S)	0.7 (0.0 - 2.0S)	
	Main Lift Decel Down		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Main Lift Min Up		620mA (520 - 720mA)	620mA (520 - 720mA)	
	Main Lift Max Up		1280mA (1000 - 1500mA)	1250mA (1050 - 1450mA)	
	Main Lift Min Down		780mA (710 - 910mA)	780mA (660 - 860mA)	
	Main Lift Max Down		1150mA (1000 - 1500mA)	1150mA (900 - 1400mA)	
	Main Lift Derate		22.0% (10.0 – 100.0%)	24.0% (10.0 – 100.0%)	
Telescope (X-Axis)	Telescope X-Axis Accel In	Telescope (x-axis) screen allows the operator to view parameters (max/min) related to extend/retract cylinder.	0.3 (0.0 - 2.0S)	0.2 (0.0 - 2.0S)	Access Level 2, 3
	Telescope X-Axis Decel In		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Telescope X-Axis Accel Out		0.3 (0.0 - 2.0S)	0.7 (0.0 - 2.0S)	
	Telescope X-Axis Decel Out		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Telescope X-Axis Min In		720 mA (630 - 830mA)	700 mA (600 - 800mA)	
	Telescope X-Axis Max In		1100 mA (990 - 1200mA)	1200 mA (1000 -1500mA)	
	Telescope X-Axis Min Out		700 mA (610 - 810mA)	700 mA (600 - 800mA)	
	Telescope X-Axis Max Out		1140 mA (1100 - 1500mA)	1220 mA (1100 - 1500mA)	
	Telescope X-Axis Derate		21.0% (10.0 – 100.0%)	25.0% (20.0 – 100.0%)	

Menu/Sub-menu Items	Function	Description	Default Values		Access Level
			925	832	
Telescope (Roller)	Telescope Roller Accel In	Telescope (Roller) screen allows the operator to view parameters (max/min) related to extend/retract cylinder	0.3 (0.0 - 2.0S)	0.2 (0.0 - 2.0S)	Access Level 2, 3
	Telescope Roller Decel In		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Telescope Roller Accel Out		0.3 (0.0 - 2.0S)	0.7 (0.0 - 2.0S)	
	Telescope Roller Decel Out		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Telescope Roller Min In		720 mA (630 - 830mA)	720 mA (600 - 800mA)	
	Telescope Roller Max In		1100 mA (990 - 1200mA)	1200 mA (1000 -1500mA)	
	Telescope Roller Min Out		700 mA (610 - 810mA)	700 mA (600 - 800mA)	
	Telescope Roller Max Out		1140 mA (1100 - 1500mA)	1220 mA (1100 - 1500mA)	
	Telescope Roller Derate		21.0% (10.0 – 100.0%)	25.0% (20.0 – 100.0%)	
Front Auxiliary	Front Auxiliary Accel Coil A	Front auxiliary screen allows the operator to view the parameters (min/max values) related to front auxiliary Coil A and Coil B	0.4 (0.0 - 2.0S)	0.4 (0.0 - 2.0S)	Access Level 2, 3
	Front Auxiliary Decel Coil A		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Front Auxiliary Accel Coil B		0.4 (0.0 - 2.0S)	0.4 (0.0 - 2.0S)	
	Front Auxiliary Decel Coil B		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Front Auxiliary Min Coil A		860 mA (760 - 960mA)	860 mA (760 - 960mA)	
	Front Auxiliary Max Coil A		1320 mA (1120 - 1520mA)	1320 mA (1120 - 1520mA)	
	Front Auxiliary Min Coil B		860 mA (760 - 960mA)	860 mA (760 - 960mA)	
	Front Auxiliary Max Coil B		1320 mA (1120 - 1520mA)	1320 mA (1120 - 1520mA)	
	Front Auxiliary Derate		60.0% (50.0 – 75.0%)	60.0% (50.0 – 75.0%)	

Menu/Sub-menu Items	Function	Description	Default Values		Access Level
			925	832	
Rear Auxiliary	Rear Auxiliary Accel Coil A	Rear auxiliary screen allows the operator to view the parameters (min/max values) related to front auxiliary Coil A and Coil B	0.4 (0.0 - 2.0S)	0.4 (0.0 - 2.0S)	Access Level 2, 3
	Rear Auxiliary Decel Coil A		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Rear Auxiliary Accel Coil B		0.4 (0.0 - 2.0S)	0.4 (0.0 - 2.0S)	
	Rear Auxiliary Decel Coil B		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Rear Auxiliary Min Coil A		860 mA (760 - 960mA)	860 mA (760 - 960mA)	
	Rear Auxiliary Max Coil A		1320 mA (1120 - 1520mA)	1320 mA (1120 - 1520mA)	
	Rear Auxiliary Min Coil B		860 mA (760 - 960mA)	860 mA (760 - 960mA)	
	Rear Auxiliary Max Coil B		1320 mA (1120 - 1520mA)	1320 mA (1120 - 1520mA)	
	Rear Auxiliary Derate		60.0% (50.0 – 75.0%)	60.0% (50.0 – 75.0%)	
Bucket Lift	Bucket Lift Accel Up	Bucket lift Screen allows the operator to view parameters (max/min) related to lift/lower cylinder.	0.3 (0.0 - 2.0S)	0.3 (0.0 - 2.0S)	Access Level 2, 3
	Bucket Lift Decel Up		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Bucket Lift Accel Down		0.7 (0.0 - 2.0S)	0.7 (0.0 - 2.0S)	
	Bucket Lift Decel Down		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Bucket Lift Min Up		620 mA (520 - 720mA)	620 mA (520 - 720mA)	
	Bucket Lift Max Up		1300 mA (1000 - 1500mA)	1250 mA (1150 - 1450mA)	
	Bucket Lift Min Down		780 mA (710 - 860mA)	780 mA (660 - 860mA)	
	Bucket Lift Max Down		1150 mA (1000 - 1500mA)	1150 mA (900 - 1400mA)	
	Bucket Lift Derate		22.0% (10.0 – 100.0%)	24.0% (10.0 – 100.0%)	

Menu/Sub-menu Items	Function	Description	Default Values		Access Level
			925	832	
Bucket Tele (X-Axis)	Bucket Tele X-Axis Accel In	Bucket Tele (x-axis) screen allows the operator to view parameters (max/min) related to extend/retract cylinder.	0.3 (0.0 - 2.0S)	0.2 (0.0 - 2.0S)	Access Level 2, 3
	Bucket Tele X-Axis Decel In		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Bucket Tele X-Axis Accel Out		0.3 (0.0 - 2.0S)	0.7 (0.0 - 2.0S)	
	Bucket Tele X-Axis Decel Out		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Bucket Tele X-Axis Min In		720 mA (630 - 830mA)	720 mA (600 - 800mA)	
	Bucket Tele X-Axis Max In		1140 mA (990 - 1390mA)	1200 mA (1000 -1500mA)	
	Bucket Tele X-Axis Min Out		700 mA (610 - 810mA)	700 mA (600 - 800mA)	
	Bucket Tele X-Axis Max Out		1220 mA (1100 - 1500mA)	1220 mA (1100 - 1500mA)	
	Bucket Tele X-Axis Derate		21.0% (10.0 – 100.0%)	25.0% (20.0 – 100.0%)	
Bucket Tele (Roller)	Bucket Tele Roller Accel In	Bucket Tele (Roller) screen allows the operator to view parameters (max/min) related to extend/retract cylinder	0.3 (0.0 - 2.0S)	0.2 (0.0 - 2.0S)	Access Level 2, 3
	Bucket Tele Roller Decel In		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Bucket Tele Roller Accel Out		0.3 (0.0 - 2.0S)	0.7 (0.0 - 2.0S)	
	Bucket Tele Roller Decel Out		0.3 (0.0 - 1.0S)	0.3 (0.0 - 1.0S)	
	Bucket Tele Roller Min In		720 mA (630 - 830mA)	720 mA (600 - 800mA)	
	Bucket Tele Roller Max In		1140 mA (990 - 1390mA)	1200 mA (1000 -1500mA)	
	Bucket Tele Roller Min Out		700 mA (610 - 810mA)	700 mA (600 - 800mA)	
	Bucket Tele Roller Max Out		1220 mA (1100 - 1500mA)	1220 mA (1100 - 1500mA)	
	Bucket Tele Roller Derate		21.0% (10.0 – 100.0%)	25.0% (20.0 – 100.0%)	

Menu/Sub-menu Items	Function	Description	Default Values		Access Level
			925	832	
Bucket Tilt (Roller)	Bucket Tilt Roller Accel Up	Bucket tilt screen allows the operator to view parameters (max/min) related to bucket tilt cylinder.	0.0 (0.0 - 2.0S)	0.1 (0.0 - 2.0S)	Access Level 2, 3
	Bucket Tilt Roller Decel Up		0.3 (0.0 - 1.0S)	0.1 (0.0 - 1.0S)	
	Bucket Tilt Roller Accel Down		0.0 (0.0 - 2.0S)	0.1 (0.0 - 2.0S)	
	Bucket Tilt Roller Decel Down		0.1 (0.0 - 1.0S)	0.1 (0.0 - 1.0S)	
	Bucket Tilt Roller Min Up		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Bucket Tilt Roller Max Up		1350mA (1150 - 1550mA)	1400mA (1200 - 1600mA)	
	Bucket Tilt Roller Min Down		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Bucket Tilt Roller Max Down		1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	
	Bucket Tilt Roller Derate		75.0% (50.0 – 100.0%)	75.0% (50.0 – 100.0%)	
Bucket Tilt (X-Axis)	Bucket Tilt X-Axis Accel Up	Bucket tilt screen allows the operator to view parameters (max/min) related to bucket tilt cylinder.	0.0 (0.0 - 2.0S)	0.1 (0.0 - 2.0S)	Access Level 2, 3
	Bucket Tilt X-Axis Decel Up		0.1 (0.0 - 1.0S)	0.1 (0.0 - 1.0S)	
	Bucket Tilt X-Axis Accel Down		0.0 (0.0 - 2.0S)	0.1 (0.0 - 2.0S)	
	Bucket Tilt X-Axis Decel Down		0.1 (0.0 - 1.0S)	0.1 (0.0 - 1.0S)	
	Bucket Tilt X-Axis Min Up		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Bucket Tilt X-Axis Max Up		1350mA (1150 - 1550mA)	1400mA (1200 - 1600mA)	
	Bucket Tilt X-Axis Min Down		760mA (660 - 860mA)	760mA (660 - 860mA)	
	Bucket Tilt X-Axis Max Down		1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	
	Bucket Tilt Derate		75.0% (50.0 – 100.0%)	75.0% (50.0 – 100.0%)	

9.15.5 Operator Tools

Menu	Default values (Range)	Description	Access Level
Change Anti-theft Code	Enter current CODE: 0000	Requires the existing code to be entered before a new one.	Access Level 2
	Enter new CODE: 0000	Return to top level menu after entry.	
Confirm Machine Maintenance?	Maintenance Complete? YES:ENTER NO:ESC	Records that preventive maintenance has been performed.	Access Level 2
Review Maintenance History?	Maintenance History nn:X,XXX H	Displays the engine hours for the past fifteen maintenance intervals.	Access Level 2
Enable Maintenance Interval: No	YES NO	Enables the maintenance interval notification (DTC 874).	Access Level 3
Set Maintenance Interval: 500 hours	0 to 500 hours	Increment or decrement the engine hours before the next maintenance interval notification (DTC 874).	Access Level 2 Operator Tool's ENABLE MAINTENANCE INTERVAL is YES
Review LSI Shutoff History?	LSI History nn:X,XXX H	Displays the engine hours for the past fifteen LSI. Cancel switch uses.	Access Level 1 Machine Setup's LOAD STABILITY is YES
Vehicle Speed Units: KPH	KPH MPH	Vehicle speed units allows to set the units in KPH or MPH.	Access Level 3
Temperature: Celsius	Celsius Fahrenheit	Temperature units allows to set the units for temperature in Fahrenheit (F) or Celsius (C).	Access Level 3
Pressure: BAR	BAR PSI	Pressure units allows to set the units for pressure in BAR or PSI.	Access Level 3
Steer Mode: Automatic	Automatic Manual	Selects steering mode preference; default to AUTOMATIC when Machine Setup's VEHICLE is LBP-AG, LBP-PR, LBP-HC, or LBP-SC; MANUAL otherwise.	Access Level 3 Machine Setup's VEHICLE is LBP-AG, LBP-PR, LBP-HC or LBP-SC
Review LSI Suspended Log?	LSI Suspend LOG nn: X,XXXH - ON	Allows to display engine hours for last ten events when Load Stability is 100%. The submenu options are ON or OFF.	Access Level 1; Machine Setup's LOAD STABILITY is YES

Menu	Default values (Range)	Description	Access Level
Fan Reverse Timer: 2 sec	2 Seconds to 10 Seconds	Allows to set the length of time that the fan will be reversed (cycling or demand).	Access Level 3; Machine Setup's FAN CONTROL is HYD W/ REV, DUAL HYD or CLEANFIX
Fan Reverse Interval: 20 min	5 Minutes to 60 Minutes	Allows to set the interval between cycling fan reversals.	
Tyre Selection:	(Multiple Tyre Selections)	Allows to select the tyre fitted for proper vehicle speed calibration.	Access Level 3; Machine Setup's VEHICLE is LBP-RS, LBP-AG, LBP-PR, LBP-HC, or LBP-SC
Default Gear Selection: #	1, 2, **3**, 4	Sets the default transmission gear at power-up; required when cabin joystick is used for gear selection; six-speed powershift transmissions should default to a medium gear.	Access Level 3; Machine Setup's JOYSTICK FNR is YES; Machine Setup's TRANSMISSION is TURNER 6SPD, TURNER 6SPD L/U, or TURNER 6SPD AUTO
	1, **2**, 3, 4	Sets the default transmission gear at power-up; required when cabin joystick is used for gear selection; four-speed powershift transmissions should default to a low gear.	Access Level 3; Machine Setup's JOYSTICK FNR is YES; Machine Setup's TRANSMISSION is ZF 4SPD, TURNER 4SPD1, TURNER 4SPD2, TURNER 4SPD3
	1, **2**, 3	Sets the default transmission gear at power-up; required when cabin joystick is used for gear selection; three-speed powershift transmissions should default to a low gear.	Access Level 3; Machine Setup's JOYSTICK FNR is YES; Machine Setup's TRANSMISSION is DANA 3SPD
Elevated Idle: OFF	OFF / ON	Allows to set the elevated idle. The submenu options are OFF or ON.	Access Level 3 Machine Setup's VEHICLE is not LBP-RS
Brake Light On Pressure: 40 PSI	(10 - 150 PSI)	Allows to configure the brake light.	Access Level 3; Machine Setup's BRAKE PEDAL PRESSURE is YES
Brake Light Off Pressure: 35 PSI	(10 - 150 PSI)		

Menu	Default values (Range)	Description	Access Level
De-Compression For Auxiliary Select: OFF	OFF / ON	Allows to configure auxiliary de-compression during auxiliary select change. The submenu options are OFF or ON.	Access Level 3; Machine Setup's AUX. FUNCTION SELECT is YES or AUXLIARY F/R SELECT is YES
Cabin Joystick Telescope: X-AXIS	X-AXIS / ROLLER	Selects the cabin joystick resource to control telescope.	Access Level 3; Machine Setup's VEHICLE is LBP-RS

9.15.6 Calibrations

Menu	Sub-Menu	Description	Access Level
Tilt Sensor	Calibrate Tilt Sensor	Allows to calibrate the chassis tilt sensor. Press Enter to confirm or ESC to exit.	Access Level 2; Machine Setup's CHASSIS TILT is YES
	Tilt Calibration Set Stabilizers	Allows to calibrate the position of vehicle. Press Enter to confirm or ESC to exit	
	Tilt Sensor Calibrating	Displays while control system acquires readings	
	Calibration Complete	Displays when Calibration offset was within +/- 5.0 degrees. Press Enter to confirm or ESC to exit.	
	Calibration Failed	Displays when Calibration offset was outside +/- 5.0 degrees. Press Enter to confirm or ESC to exit.	
Boom Angle	Calibrate Boom Angle Sensor?	Allows to calibrate the boom angle sensor. Press Enter to continue or ESC to exit.	Access Level 2
	Press Enter at lowest position	Allows to lower the boom to mechanical stop. Press Enter to confirm or ESC to exit.	
	Lift Up. Press Enter at top	Allows to raise the boom to mechanical stop. Press Enter to confirm or ESC to exit.	
	Calibration Complete	Display when calibration was successful. Press ESC to exit.	
	Calibration Failed	The minimum or maximum boom angle sensor counts were improper for this vehicle. Press ESC to exit.	
	Calibration Sensor Fault	DTC 2344, 2345, 2346, 2353, or 6621 was active and calibration could not succeed. Press ESC to exit.	
Boom Ride Test	Confirm Boom Ride Test	Boom ride evaluation is required to check the hydraulic accumulator gas charge while the vehicle is parked. Press ENTER to continue or ESC to exit.	Access Level 2
	Press Enter When Test Done	Activate Boom Ride functionality. Press ENTER to return to CONFIRM BOOM RIDE TEST menu or ESC to exit.	

Menu	Sub-Menu	Description	Access Level
Park Brake Test	Perform Park Brake Test?	Park brake evaluation is required at the end of the manufacturing process, and daily by some mining customers. Press ENTER to continue or ESC to exit. Automatic shifting is prevented for the duration of this test to enable the Torque Convertor Stall Test when Machine Setup's TRANSMISSION is ZF 4SPD AUTO.	Access Level 3
	Set Park Brake	Allows to apply park brake. Press ENTER to continue or ESC to exit.	
	Shift To Third Gear	Allows to select proper gear. Press ENTER to continue or ESC to exit. Test fails if proper gear not selected.	Access Level 3 Machine Setup's TRANSMISSION is TURNER 4SPD1, 4SPD2, or 4SPD3
	Shift To Fourth Gear		Access Level 3 Machine Setup's TRANSMISSION is TURNER 6SPD, TURNER 6SPD L/U, TURNER 6SPD AUTO, or ZF 4SPD AUTO
	Shift To Second Gear		Access Level 3 Default
	Warning: Drive Will Be Engaged	Allows vehicle to drive at next step. Menu persists for 2000 mS. Press ENTER to continue or ESC to exit.	Access Level 3
	Forward To Start Neutral To Pause	Allows to select direction and begin test. Direction and gear selection permitted with park brake applied. Press ENTER to continue or ESC to exit.	
	Park Brake Test Complete	Prompt technician about results. Press ESC to exit.	
	Park Brake Test Failed	Prompt technician about results. Press ESC to exit.	
Trans Service	Confirm Transmission Service Test	Transmission service is required for diagnostics or to limp a vehicle home after a transmission solenoid issue. Press ENTER to continue or ESC to exit.	Access Levels 2; Machine Setup's TRANSMISSION is not LINDE HYSTAT
	Press Enter When Test Done	Direction and gear selection permitted despite transmission solenoid driver issues. Prevent direction and gear selection when technician leaves this menu or disconnects JLG Analyzer. Press ENTER to return to CONFIRM TRANS SERVICE TEST menu or ESC to exit	

Menu	Sub-Menu	Description	Access Level
Load Stability	Calibrate LSI Sensor?	Allows to calibrate LSI operation. Press ENTER to continue or ESC to exit. Disabled during LSI Verification.	Access Levels 2; Machine Setup's LOAD STABILITY is YES
	Remove Weights And Attachments	Allows to remove attachment and weights. Press ENTER to continue or ESC to exit.	
	Fully Deploy Outriggers	Displayed when Machine Setup's OUTRIGGERS is YES. Allows to set the outriggers. If Machine Setup's O/R DETECTION is PRESS or PRESS & PROX, automatically proceed to next calibration step when both left and right outriggers are set. Press ENTER to continue or ESC to exit.	
	Telescope In And Fully Lift Up	Allows to place vehicle in Most Stable Position. Press ENTER to continue or ESC to exit	
	Calibrating Load Stability 0%	Allows to wait for measurement stability. Press ENTER to continue or ESC to exit.	
	Lift Down	Allows to lift down for next calibration step. Press ENTER to continue or ESC to exit.	
	Fully Retract Outriggers	Displayed when Machine Setup's OUTRIGGERS is YES. Allows to pull up the outriggers. Press ENTER to continue or ESC to exit.	
	Unload Rear Axle	Allows to unload rear axle off the ground using overhead crane or jack. Press ENTER to continue or ESC to exit.	
	Calibrating Load Stability 100%	Require to wait for measurement stability. Press ENTER to continue or ESC to exit.	
	LSI Calibration Complete	Record LSI Check Point Cell A & B, Controller On-Time in non-volatile memory. Press ENTER to calibrate and leave menu, or ESC to exit.	
	LSI Calibration Failed	Calibration failed. Press ESC to exit.	
Fan Speed Test	Perform Fan Speed Test?	Used for noise testing. Press ENTER to begin or ESC to exit.	Access Levels 2; Hydraulic Variable Speed Fan Configured
	Fan Spd Valve 0 Ma	UP and DOWN keys directly adjust fan speed valve current.	
	Fan Spd2 Valve 0 Ma	UP and DOWN keys directly adjust fan speed 2 valve current in same manner as fan speed valve.	Access Levels 2; Machine Setup's FAN CONTROL is DUAL HYD

Menu	Sub-Menu	Description	Access Level
Boom Length	Calibrate Boom Length Sensor?	Allows to calibrate the boom length sensor. Press ENTER to confirm or ESC to exit;	Access Level 2 Boom Length Configured
	Extend/Retract In. Press Enter Retracted	Retract the boom completely. press ENTER to continue or ESC to exit;	
	Extend/retract Out. Press Enter Extended	Extend the boom completely. press ENTER to confirm.	
	Calibration Complete	Calibration was successful. Press ESC to exit.	
	Calibration Failed	If the minimum or maximum boom length sensor values are improper for the telehandler. Press ESC to exit.	
	Calibration Sensor Fault	DTC 845 or 846 was active and calibration could not succeed. Press ESC to exit.	
RAS Test	RAS Test Yes: Enter, No: Esc	Allows to test the Rear Axle Stability system. Press ENTER to confirm or ESC to exit.	Access Levels 2; Machine Setup's REAR AXLE STAB is SKYTRAK
	RAS Test: Normal	UP and DOWN keys select NORMAL, RAS LOCK, RAS RESTRICT, and RAS FLOAT. Default is NORMAL. Test mode override normal functionality. Default to NORMAL on test exit, JLG Analyzer disconnected, or power cycled.	
Brake Pedal POS	Brake Pedal POS Yes: Enter, No: Esc	Allows to calibrate the brake pedal position sensor. Press ENTER to confirm or ESC to exit.	Access Levels 2; Machine Setup's Brake Pedal Position Configured
	Release Brake Pedal	Allows to release brake pedal for 0%. Press ENTER to calibrate or ESC to exit.	
	Depress Brake Pedal	Allows to depress brake pedal for 100%; press ENTER to calibrate or ESC to exit.	
	Calibration Complete	If the calibration is successful. Press ESC key to exit.	
	Calibration Failed	If the calibration failed. Press ESC key to exit.	
	Calibration Sensor Fault	DTC 23167 or 23168 was active and calibration could not succeed. Press ESC key to exit.	
Start Refresh	Press Enter To START Regen	Allows to trigger aftertreatment refresh. Press ENTER to trigger regeneration.	Access Levels 2; Machine Setup's ENGINE CONTROL is DEUTZ HRC
	Sending Command ESC To Exit	Press ESC to exit.	

Menu	Sub-Menu	Description	Access Level
LMIS (Load Management Indicator System)	Calibrate Load Moment Indicator System?	Allows to calibrate the LMIS (Load Management Indicator System). Press ENTER to continue or ESC to exit. Proceed to LMIS CALIBRATION FAIL if calibration is prevented for the selected attachment.	Access Level 2
	Remove Weights	Remove load on the attachment. Press ENTER to continue or ESC to exit.	
	Fully Deploy Outriggers	Displayed when Machine Setup's OUTRIGGERS is YES; prompt technician to set the outriggers; press ENTER to continue or ESC to exit.	
	Fully Retract Boom	Retract the boom fully for next calibration point. Press ENTER to continue or ESC to exit.	
	Lift Down to Min Boom Angle	Lift the boom down for next calibration step. Press ENTER to continue or ESC to exit.	
	Lift Up to Max Boom Angle	Lift the boom up to maximum boom angle. Press ENTER to continue or ESC to exit.	
	Lift Down to Min Boom Angle	Lift the boom down to minimum boom angle. Press ENTER to continue or ESC to exit.	
	Calibrating Dynamic Retract	System saves dynamic retracted offsets for the selected attachment, then continues.	
	Lift Up to Low Cal Angle	Lift the boom up to low calibration boom angle. lift up prevented when boom angle is greater than or equal to calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment LRCAL Up	System saves Low Retracted Up Calibration for the selected attachment then continues.	

Menu	Sub-Menu	Description	Access Level
LMIS (Load Management Indicator System)	Lift Up to Mid Cal Angle	Lift the boom up to middle calibration boom angle. Press ENTER to continue or ESC to exit.	Access Level 2
	Calibrating Load Moment MRCAL Up	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Up to High Cal Angle	Lift the boom up to high calibration boom angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment HRCAL Up	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Up to Max Boom Angle	Lift the boom up to next calibration step. Press ENTER to continue or ESC to exit.	
	Lift Down to High Cal Angle	Lift the boom to down to high calibration. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment HRCAL DN	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Down to Mid Cal Angle	Lift the boom down to mid calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment MRCAL DN	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Down to Low Cal Angle	Lift the boom down to low calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment LRCAL DN	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Fully Extend Boom	Extend the boom to calibration length for next calibration step. Press ENTER to continue or ESC to exit.	
	Lift Down to Min Boom Angle	Lift the boom down for next calibration. Press ENTER to continue or ESC to exit.	
	Lift Up to Max Boom Angle	Lift the boom up to maximum boom angle. Press ENTER to continue or ESC to exit.	
	Lift Down to Min Boom Angle	Lift the boom down to minimum boom angle. Press ENTER to continue or ESC to exit.	

Menu	Sub-Menu	Description	Access Level
LMIS (Load Management Indicator System)	Calibrating Dynamic Extended	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	Access Level 2
	Lift Up to Low Cal Angle	Lift the boom up to low calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment LECAL UP	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Up to Mid Cal Angle	Lift the boom up to mid calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment MECAL UP	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Up to High Cal Angle	Lift the boom up to high calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment HECAL UP	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Up to max boom angle	Lift the boom up for next calibration step. Press ENTER to continue or ESC to exit.	
	Lift Down to High Cal Angle	Lift the boom down to high calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment HECAL DN	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Down to Mid Cal Angle	Lift the boom down to mid calibration angle. Press ENTER to continue or ESC to exit.	
	Calibrating Load Moment MECAL DN	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	
	Lift Down to Low Cal Angle	Lift the boom down to low calibration angle. Press ENTER to continue or ESC to exit.	

Menu	Sub-Menu	Description	Access Level
LMIS (Load Management Indicator System)	Calibrating Load Moment LECAL DN	Press center of the Navigation button to continue or press any other button to “Exit Calibration/ Test?”.	Access Level 2
	LMIS Calibration Complete	If the calibration is complete, the calibration offset value is recorded in non-volatile memory. Press ESC to exit.	
	LMIS Calibration Failed	If the calibration is failed, press ESC to exit.	
	LMIS Passive Disable	Hidden for suspended-load attachments such as a truss or winch; Use UP or DOWN buttons to edit; Select ENABLE to disable LMIS cutouts, alarms, and indicators for the selected attachment; press ESC to exit.	Attachment Type is not Suspended-Load
Set Machine Type	Set Machine Type?	Allows to set Machine Type. Press ENTER to continue or ESC to exit.	Access Level 2 Machine Setup’s TRANSMISSION is BOSCH HYSTAT
	Set Direction To Neutral	Allows to set direction to neutral. Press ENTER to continue or ESC to exit.	
	Apply Park Brake	Allows to apply the park brake. Press ENTER to continue or ESC to exit.	
	Request Parameter Mode	Allows to checking for preconditions. Press ENTER to continue or ESC to exit.	
	Save Parameter Mode	Allows control system to save machine type change. Press ENTER to continue or ESC to exit.	
	Complete	If the machine type change is complete. Press ENTER or ESC to exit.	
	Machine Type Calibration Failed	If the machine type change is not accepted; press ENTER or ESC to exit.	

Note: **Troubleshoot any fault codes not related to Calibration.*

Menu	Sub-Menu	Description	Access Level
Attachment Recognition	Calibrate Attachment Recognition?	Used by technicians to program RFID Tags with unique attachment part numbers; press ENTER to continue or ESC to exit	Access Levels 2; Machine Setup's ATTACHMENT RECOGNITION is YES
	Searching For Tags	Search for available tags in range; Continue when finished or press ESC to exit	
	Part Number: 0000000000	Prompt technician to enter 10-digit attachment part number from attachment serial plate; use UP/DOWN/ LEFT/RIGHT to set each digit; press ENTER to continue or ESC to exit	
	Writing Part Number	Write attachment part number to RFID Tag; Skip if multiple tags or no tags are detected; Continue when finished or press ESC to exit	
	Calibration Complete	Prompt technician that attachment part number was successfully written to the RFID Tag; press ENTER or ESC to exit	
	Calibration Failed	Prompt technician that RFID Tag could not be written due to communication error; press ENTER or ESC to exit	
	Error – Too Many Tags	Prompt technician that RFID Tag could not be written because too many tags are detected; Technician must reposition vehicle so that only one tag is detected; press ENTER or ESC to exit	
	Error – No Tags In Range	Prompt technician that RFID Tag could not be written because no tags are detected; Technician must reposition vehicle so that only one tag is detected; press ENTER or ESC to exit	

Menu	Sub-Menu	Description	Access Level
Boom Damping	Check Boom Damping Component Health?	Used by technicians to check the health of Boom Ride Valve and Lift Rod Pressure sensor which are impractical to check during normal system operation; press ENTER to confirm or ESC to exit.	Access Levels 2; Machine Setup's BOOM DAMPING is YES
	Press ENTER W O/R set and Boom Level/ Retracted.	Technician must set outriggers, fully retract boom, adjust boom angle to approximately level; press ENTER to confirm. Press ESC to exit Health Check.	
	Lift Up Slightly Then Press Enter	Technician must use lift up to rebalance pressures on the lift cylinder before completing initial step; lifting up and control system sees correct pressures resumes previous step. Press ESC to exit Health Check.	
	Press ENTER at Full Extend. Tele Extend Only (No Lift).	Techinician must fully extend boom and may not use lift function; press ENTER to confirm full boom extension. Press ESC to exit Health Check.	
	Lift Up Slightly Then Press ENTER	Technician must use lift up to rebalance pressures on the lift cylinder at full boom extension; press ENTER to confirm. Press ESC to exit Health Check.	
	Full Retract Boom (No Lift)	Technician must retract boom fully (until boom status is retracted). Press ESC to exit Health Check.	
	Sequence Fault - Start Over	Technician uses Lift Function or Tele Function at inappropriate time during evaluation or posturing steps; press ENTER or ESC to return to Check starting step.	
	Health Check Complete - OK	All component checks completed successfully; press ENTER or ESC to exit. This step clears DTCs related to health check, refer to DTCs 25101 and 25105.	
	Health Check Failed - Ride Valve	Fault detected with Boom Ride Valve, refer to DTC 25101. DTC may only be cleared by resolving related issues and completing this health check procedure.	
	Health Check Failed - Lift Rod Pressure Sensor	Fault detected with Boom Tank Valve or Lift Rod Pressure Sensor, refer to DTC 25105. DTC may only be cleared by resolving related issues and completing this health check procedure.	

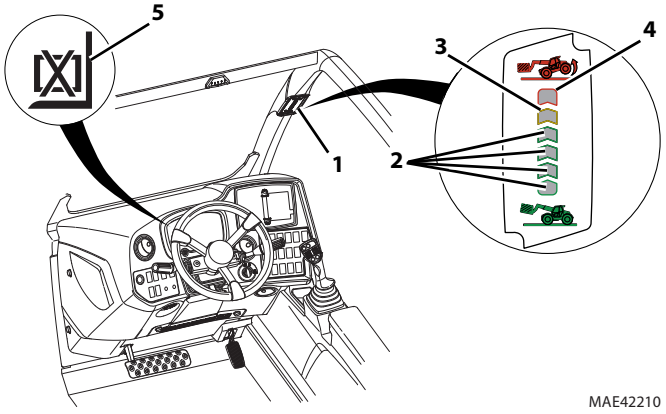
9.16 LOAD STABILITY INDICATOR (LSI) (IF EQUIPPED)

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 the local JLG dealer.*



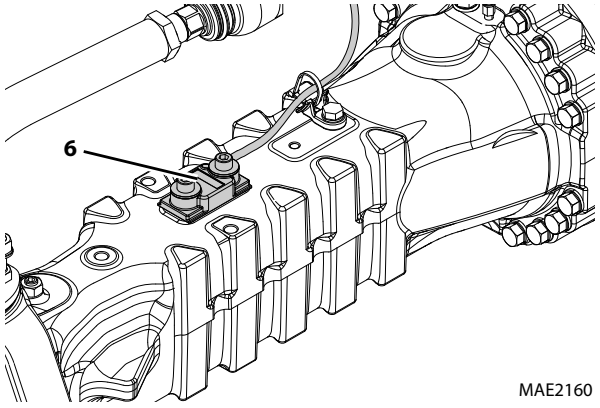
The LSI (**1**) provides visual and audible indication of forward stability limitations when machine is static on firm, level surface.

1. Green LED (**2**) will illuminate when LSI power is on.
2. When approaching forward stability limitations LEDs progressively illuminate, green (**2**), then yellow (**3**) and finally red (**4**).
3. If the red LED illuminates, the warning buzzer also sounds.
4. The yellow LED (**5**) illuminates when either of the following occurs:
   a. The boom is fully retracted.
   b. The park brake is not applied and transmission is in the forward or reverse position.
5. When approaching forward stability limitations, visual and audible indication is provided and the automatic function cut-out and/or slow down feature is disabled.
6. Travel in accordance with the requirements set forth in Section 1, “Safety Practices”.
7. When placing a load, ensure axles are not fully steered in either direction.

WARNING

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

9.16.2 LSI Sensor

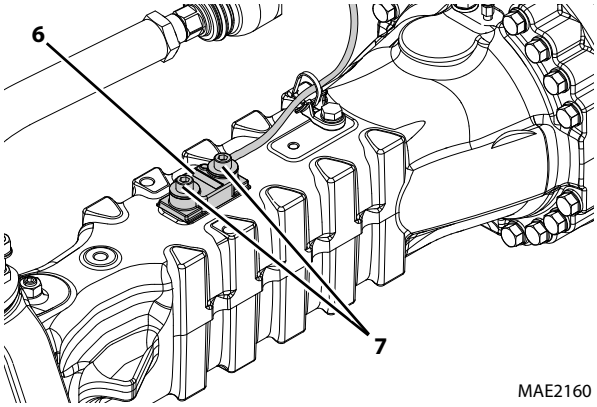


The LSI sensor (**6**) is bolted on the top left of the rear axle.

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.*

a. LSI Sensor Removal

1. Remove any attachment from the machine.
2. Park the machine on a firm, level surface, level the machine, fully retract the boom, fully raise the boom, place the transmission 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. Open the engine cover. Allow the engine to cool.
5. Properly disconnect the battery. Refer Section 9.8, "Battery", for procedure



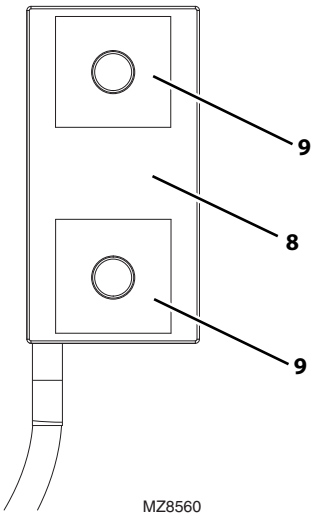
6. Disconnect the LSI electrical connector.
7. Loosen, remove and discard the two bolts (**7**) holding the LSI assembly to the rear axle.
8. Remove and discard the sensor assembly (**6**).

b. LSI Sensor Installation

Note: *The machine **MUST** remain stationary for a minimum of two (2) hours.*

Note: *If there is any difficulty preparing the axle surface to mount the sensor, contact your local JLG Dealer.*

1. Remove any adhesive and/or rust from the mounting area.
2. Make sure that the threads of both bolt holes are clean and free from rust, water and debris. If necessary, thread an M10 bottom tap through each hole. Verify holes are clean.
3. Clean the bare metal with degreasing agent, threadlocking compound. Only use the necessary amount of degreasing agent to clean the mounting area.
4. Remove any excess degreasing agent and allow to dry.

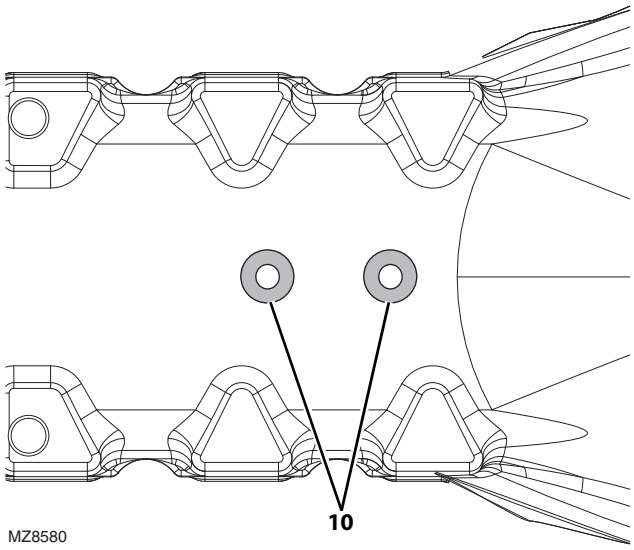


5. Inspect the bottom of the new LSI sensor (**8**) to make sure that the mounting area is clean.

Note: *Make sure that the boom must be fully retracted and fully lowered. The steering must be positioned centrally. If necessary, de-stress the tyres by rolling the machine forwards/backwards.*

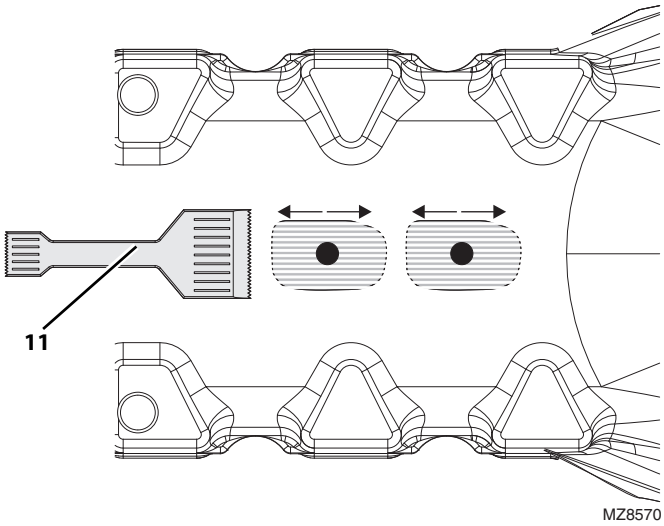
Note: *Install the sensor to the axle within one minute of applying activator and adhesive for optimum adhesion.*

6. Apply a thin film of threadlocking compound (may also be denoted as Initiator #5) activator approximately 1 in^2 (6 cm^2) to each of the metallic surfaces of the sensor, ensuring the adhesive is spread evenly over the entire surface (**9**).



7. Apply an 0.125 in (3mm) bead of threadlocking compound (F246) Adhesive to the axle surface area (**10**) around each mounting hole.

Note: *Follow manufacturer's recommendations for storage life. Other adhesives must NOT be used as a substitute for threadlocking compound (F246).*



8. Use a spatula (**11**) PN 1001203023 to evenly distribute the adhesive over the axle surface area.

Use the following sequence to minimize the amount of adhesive entering into the threaded holes and to distribute the adhesive properly.

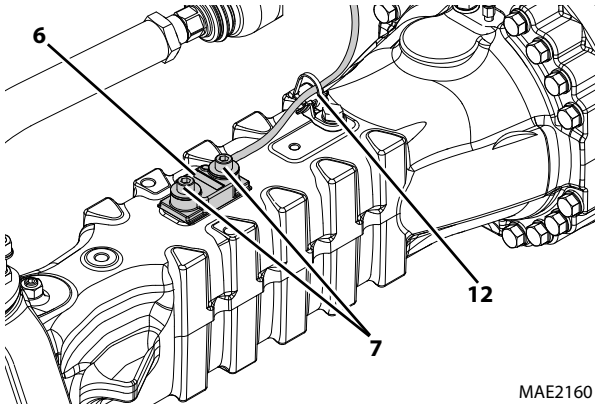
A. Position the spatula (**11**) over the threaded hole.

B. Move the spatula from the center of the hole to the left.

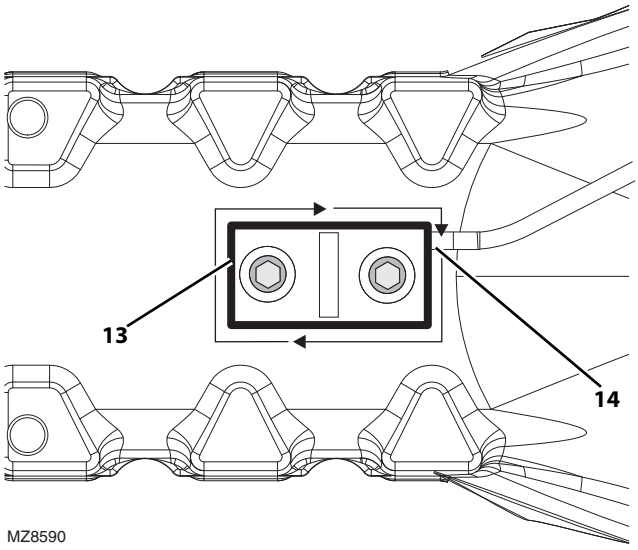
C. Remove the excess adhesive from the spatula.

D. Move the spatula from the center of the hole to the right.

E. Repeat steps A thru D on remaining hole.



9. Fit the sensor (**6**) ensuring the lead exits in the corner direction. Secure with two new Bolts (**7**) in the following sequence:
   A. Tighten each bolt finger tight.
   B. Tighten each bolt to 22-26 lb-ft (30-35 Nm).
   C. Tighten each bolt to 51-59 lb-ft (70-80 Nm).
10. Scribe a permanent mark from each bolt head onto the sensor.
11. Connect the electrical connection of the LSI sensor (**6**).
12. Install the previously removed P-Clamp (**12**) and/or any other fixing hardware.



13. Apply a Sealant (**13**) around the sensor perimeter in the following sequence:

    A. Start by positioning the nozzle under the harness lead (**14**) and apply a large bead of sealant (**13**) around the LSI sensor.

    B. Make sure that you end the bead Over The Starting Point.

14. Using a spatula and soapy water, smooth the silicone around the sensor.
15. Plug the electrical connector into the sensor assembly.

***Note: DO NOT** move the machine for a minimum of 1 hour.*

16. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
17. Close and secure the engine cover.
18. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.
19. Calibrate the LSI system, refer to Section 9.16.3, "LSI System Calibration".

9.16.3 LSI System Calibration

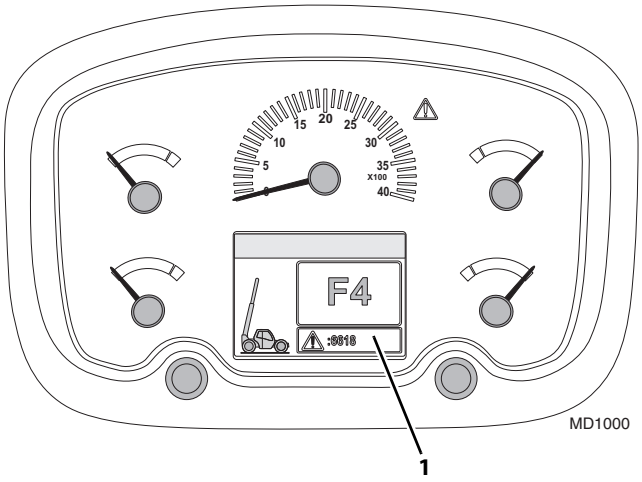
To calibrate the LSI, certain conditions must be met:

- The sensor must be installed according to Section 9.16.2, "LSI Sensor".
- The calibration procedure must be conducted with test weights. The operator must remain in the cab.
- If installed, remove the attachment from the machine.
- If equipped, fully deploy the outriggers before the calibration.
- 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 6.5 ft (2 m) 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.
- Recalibrate LSI at regular maintenance intervals or if the weight of the machine changed due to configuration update.

Calibration Procedure:

1. Start and position the machine to perform the calibration procedure.
2. Connect JLG analyzer tool.
3. Enter access level 2 passcode 33271.
4. With JLG analyzer, navigate to; Calibrations>Load Stability>Calibrate LSI Sensor.
5. If installed, remove attachments for the machine. Press Enter on analyzer.
6. If equipped, fully deploy the outriggers. Press Enter on analyzer.
7. Fully retract the boom and fully lifted up. Press Enter on analyzer.
8. Wait for Calibrating Load Stability 0% to finish.
9. Lower the boom.
10. If equipped, fully retract the outriggers. Press Enter on analyzer.
11. Verify the rear axle is unloaded by ensuring the tires are not touching the ground.
12. Press Enter on the Lift Down screen.
13. Wait for Calibrating Load Stability 100% to finish.
14. The system will display LSI Calibration Complete for successful calibration or LSI Calibration Failed for unsuccessful calibration. Press Enter on analyzer.

9.17 FAULT CODES



Faults are detected while key switch is in RUN position, during operation of machine itself. If a fault becomes active (currently detected) at this time, a fault is logged in memory and a snapshot of engine parameters is logged. The LCD display (**1**) located within the instrument panel notifies the operator.

If LCD display (**1**) shows a three to five digit fault (for example: 2124), refer to Section 9.18, “Machine Fault Codes”, for a full list of fault codes.

If LCD display (**1**) shows 520448 SPN:FMI fault, (for example: 520448), refer to Section 9.18.19, “Hardware (99x)”, for a full list of fault codes.

If LCD display (**1**) shows 437 SPN:FMI fault (for example: 437 27:2), refer to Section 9.19, “Engine Diagnostic”, for a full list of fault codes.

9.18 MACHINE FAULT CODES

Note: *Some fault codes may not be available depending upon machine configuration.*

9.18.1 Help Comment (00x)

HELP MESSAGE	DTC	CABIN ALARM	ACTIONS	TRIGGER	LATCH CONDITION
EVERYTHING OK	001	-	-	The system detects no problems exist.	-
HIGH HYDRAULIC TEMPERATURE – FUNCTIONS DERATED	0051	-	Main Lift, Telescope, Fork Tilt, and Auxiliary Hydraulics are derated	Machine Setup's HYD TEMP MGMT is YES; FFCM J1-B1 Hydraulic Oil Temperature Sensor exceeds threshold	FFCM J1-B1 Hydraulic Oil Temperature sensor falls below threshold

9.18.2 Power-Up (21x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
POWER CYCLE	211	-	-	Power was cycled ON.	-
FUNCTION ENABLE INPUTS – INVALID SIGNAL STATES	214	5000mS	Platform controls prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J2-19 Function Enable Relay energized; PLT J7-8 & RFCM J3-G4 Function Enable Switch digital inputs not complementary for 1000mS	Power cycled
JOYSTICK AXES NOT IN NEUTRAL POSITION AT POWER UP	215	5000mS	Cabin Joystick's X-Axis and Y-Axis regarded as 0%	Cabin joystick's X or Y axis is not neutral at power-up. One or more of the following events occurred: • X-Axis Left switch closed (XAxisLeft) • X-Axis Right switch closed (XAxisRight) • X-Axis Position not zero (XAxisValue) • Y-Axis Forward switch closed (YAxisForward) • Y-Axis Backward switch closed (YAxisBackward) • Y-Axis Position not zero (YAxisValue) • X-Axis Neutral switch not closed (XAxisNeutral) • Y-Axis Neutral switch not closed (YAxisNeutral)	Cabin joystick neutral 150mS
ENGINE START PREVENTED – PLATFORM START SWITCH HIGH AT POWER UP	2111	5000mS	Platform Engine Start prevented (switch regarded as open)	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-14 Engine Start Switch is closed at power-up	The switch is open momentarily
PLATFORM ROTATE LEFT PREVENTED – INPUT HIGH AT POWER UP	2112	5000mS	Platform Rotate Left & Right prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-8 Platform Rotate Left Switch is closed at power-up	Power cycled
PLATFORM ROTATE RIGHT PREVENTED – INPUT HIGH AT POWER UP	2113	5000mS	Platform Rotate Left & Right prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-7 Platform Rotate Right Switch is closed at power-up	Power cycled
PLATFORM LEVEL UP PREVENTED – INPUT HIGH AT POWER UP	2114	5000mS	Platform Level Up & Down prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-9 Platform Level Up Switch is closed at power-up	Power cycled
PLATFORM LEVEL DOWN PREVENTED – INPUT HIGH AT POWER UP	2115	5000mS	Platform Level Up & Down prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-10 Platform Level Down Switch is closed at power-up in platform mode	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
PLATFORM JOYSTICK NOT IN NEUTRAL POSITION AT POWER UP	2117	5000mS	• Platform Lift Up & Down prevented • Platform Telescope In & Out prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; platform joystick not neutral position at power-up	Platform joystick neutral momentarily (1,000mS)
FRAME LEVEL RIGHT INPUT – INVALID SIGNAL	2119	5000mS	Frame Level Left & Right prevented	• Machine Setup's FRAME LEVELING is YES or PROP; CCM J1-F3 Frame Level Right Switch is closed (energized) within 500mS of power-up • Machine Setup's FRAME LEVELING is YES or PROP; CCM J1-F3 Frame Level Right Switch detects a redundancy disagreement for 500mS	Power cycled
FRAME LEVEL LEFT INPUT – INVALID SIGNAL	2120	5000mS	Frame Level Left & Right prevented	• Machine Setup's FRAME LEVELING is YES or PROP; CCM J1-F2 Frame Level Left Switch is closed (energized) within 500mS of power-up • Machine Setup's FRAME LEVELING is YES or PROP; CCM J1-F2 Frame Level Left Switch detects a redundancy disagreement for 500mS	Power cycled
HYDRAULIC QUICK CONNECT INPUT – INVALID SIGNAL	2121	5000mS	Hydraulic Quick Connect functionality prevented (switch regarded as open)	• Machine Setup's HYDRAULIC QUICK CONNECT is YES; CCM J1-A4 Hydraulic Quick Connect Switch is high at power-up • Machine Setup's HYDRAULIC QUICK CONNECT is YES; CCM J1-A4 Hydraulic Quick Connect Switch detects a redundancy disagreement for 500mS	Power cycled
CONTINUOUS AUXILIARY HYDRAULICS SWITCH HIGH AT POWER UP	2122	5000mS	Continuous Auxiliary Hydraulics functionality prevented (switch regarded as open)	Machine Setup's VEHICLE is not LBP-RS, CCM J1-B3 Continuous Auxiliary Switch is closed at power-up	Power cycled
CONTINUOUS AUXILIARY HYDRAULICS SWITCH HIGH AT POWER UP	2122	5000mS	Continuous Auxiliary Hydraulics functionality prevented Auxiliary De-Compression functionality prevented	Machine Setup's VEHICLE is LBP-RS, AUXILIARY HYDRAULICS is YES, and Cabin Joystick Position 2 (middle pushbutton) is closed at power-up	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
JOYSTICK LEFT ROLLER NOT IN THE NEUTRAL POSITION AT POWER UP	2124	5000mS	Left Roller regarded as 0%	Left Roller not neutral at power-up. One or more of the following conditions exist: • Left Roller Forward switch closed (LeftRollerForward) • Left Roller Backward switch closed (LeftRollerBackward) • Left Roller Position not zero (LeftRollerValue) • Left Roller Neutral switch not closed (LeftRollerNeutral)	Left Roller neutral for 150mS • Left Roller Neutral switch closed (LeftRollerNeutral) • Left Roller Position zero (LeftRollerValue)
JOYSTICK RIGHT ROLLER NOT IN THE NEUTRAL POSITION AT POWER UP	2125	5000mS	Right Roller regarded as 0%	Machine Setup's AUXILARY HYDRAULICS is YES, Right Roller not neutral at power-up, and any of the following conditions exist: • Right Roller Forward switch closed (RightRollerForward) • Right Roller Backward switch closed (RightRollerBackward) • Right Roller Position not zero (RightRollerValue) • Right Roller Neutral switch not closed (RightRollerNeutral)	Right Roller neutral for 150mS • Right Roller Neutral switch closed (RightRollerNeutral) • Right Roller Position zero (RightRollerValue)
THROTTLE PEDAL NOT RELEASED AT POWER UP	2130	5000mS	Engine speed set to Close Throttle RPM	Machine Setup's VEHICLE is not LBP-RS, Primary throttle pedal position is greater than or equal to 10% at power-up	Primary throttle pedal position is less than 10%
HITCH UP INPUT – INVALID SIGNAL	2131	5000mS	Hitch Up & Down prevented	• Hitch Configured; CCM J1-F3 Hitch Up Switch is closed (energized) within 500mS of power-up • Hitch Configured; CCM J1-F3 Hitch Up Switch detects a redundancy disagreement for 500mS	Power cycled
HITCH DOWN INPUT – INVALID SIGNAL	2132	5000mS	Hitch Up & Down prevented	• Hitch Configured; CCM J1-F2 Hitch Down Switch is closed (energized) within 500mS of power-up • Hitch Configured; CCM J1-F2 Hitch Down Switch detects a redundancy disagreement for 500mS	Power cycled
OUTRIGGER LEFT JOYSTICK NOT NEUTRAL AT POWER UP	2133	5000mS	Outrigger Left Joystick regarded as 0%	Machine Setup's O/R JOYSTICKS is YES; DTC 23132 not active; DTC 23133 not active; and one of these conditions exists at power-up: • Scaled Outrigger Left Joystick (Primary) is not 0% • Scaled Outrigger Left Joystick (Backup) is not 0%	Scaled Outrigger Left Joystick (Primary) & (Backup) are 0% for 1,000mS
OUTRIGGER RIGHT JOYSTICK NOT NEUTRAL AT POWER UP	2134	5000mS	Outrigger Right Joystick regarded as 0%	Machine Setup's O/R JOYSTICKS is YES; DTC 23135 not active; DTC 23136 not active; and one of these conditions exists at power-up: • Scaled Outrigger Right Joystick (Primary) is not 0% • Scaled Outrigger Right Joystick (Backup) is not 0%	Scaled Outrigger Right Joystick (Primary) & (Backup) are 0% for 1,000mS

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUX DE-COMP SWITCH ACTIVE AT POWER UP	2135	5000mS	Auxiliary De-Compression prevented (switch regarded as open)	CCM J2-K4 Auxiliary De-Comp Switch is closed (energized) at power-up	Power cycled
OUTRIGGER SWITCH ACTIVE AT POWER-UP	2136	5000mS	Outriggers prevented (switch regarded as open)	Machine Setup's OUTRIGGERS is YES; O/R JOYSTICKS is NO; and Cabin Joystick's Outrigger Pushbutton closed at power-up (OutriggerBoomFloatPushbutton)	Power cycled
BOOM FLOAT SWITCH ACTIVE AT POWER-UP	2137	5000mS	Boom Float prevented (switch regarded as open)	Machine Setup's BOOM RIDE&FLOAT is RIDE&FLOAT and Cabin Joystick's Boom Float Pushbutton closed at power-up (OutriggerBoomFloatPushbutton)	Power cycled
AUXILIARY 1/2 SWITCH ACTIVE AT POWER-UP	2138	5000mS	Auxiliary 1/2 functionality prevented (switch regarded as open)	Machine Setup's AUX. FUNCTION SELECT is YES, VEHICLE is not HBP; Cabin Joystick's Auxiliary 1/2 Pushbutton closed at power-up (AuxiliarySelectPushbutton)	Power cycled
UPSHIFT SWITCH ACTIVE AT POWER-UP	2139	5000mS	Upshift functionality prevented (switch regarded as open)	Machine Setup's JOYSTICK FNR is YES; Cabin Joystick's Upshift Pushbutton closed at power-up (UpshiftPushbutton)	Power cycled
DOWNSHIFT SWITCH ACTIVE AT POWER-UP	2140	5000mS	Downshift functionality prevented (switch regarded as open)	Machine Setup's JOYSTICK FNR is YES; Cabin Joystick's Downshift Pushbutton closed at power-up (DownshiftPushbutton)	Power cycled
DE-CLUTCH SWITCH ACTIVE AT POWER-UP	2141	5000mS	De-Clutch functionality prevented	Cabin Joystick's De-Clutch Pushbutton closed at power-up (DeClutchPushbutton)	Power cycled
REAR AUXILIARY 1 JOYSTICK NOT NEUTRAL AT POWER UP	2143	5000mS	Rear Auxiliary 1 Joystick regarded as 0%	Machine Setup's AUXILIARY F/R SELECT is YES; DTC 23177 not active; DTC 23178 not active; and one of these conditions exists at power-up: • Scaled Rear Auxiliary 1 Joystick (Primary) is not 0% • Scaled Rear Auxiliary 1 Joystick (Backup) is not 0%	Scaled Rear Aux 1 Joystick (Primary) & (Backup) are 0% for 1,000mS
REAR AUXILIARY 2 JOYSTICK NOT NEUTRAL AT POWER UP	2144	5000mS	Rear Auxiliary 2 Joystick regarded as 0%	Machine Setup's AUXILIARY REAR SELECT is YES; DTC 23180 not active; DTC 23181 not active; and one of these conditions exists at power-up: • Scaled Rear Auxiliary 2 Joystick (Primary) is not 0% • Scaled Rear Auxiliary 2 Joystick (Backup) is not 0%	Scaled Rear Aux 2 Joystick (Primary) & (Backup) are 0% for 1,000mS
AGRICULTURAL TRAILER BRAKE SWITCH ACTIVE AT POWER-UP	2146	5000mS	Agricultural Trailer Brake Switch is regarded as open (deenergized)	Machine Setup's TRAILER BRAKE is AGRICULTURAL; CCM J2-F3 Agricultural Trailer Brake Switch is closed (energized) at powerup.	Power cycled
REGENERATION SWITCH ACTIVE AT POWER-UP	2147	5000mS	Regeneration Switch is regarded as open (deenergized)	Machine Setup's ENGINE CONTROL is DEUTZ 55KWS5 HRC; CCM J3-D2 Regeneration Switch is closed (energized) at powerup.	CCM J3-D2 Regeneration Switch is open for 1,000mS

9.18.3 Platform Controls (22x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
PLATFORM LEVEL – CONFLICTING INPUT SIGNALS	2225	5000mS	Platform Level Up & Down prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-9 Platform Level Up Switch and PLT J1-10 Platform Level Down Switch closed simultaneously	Power cycled
PLATFORM ROTATE – CONFLICTING INPUT SIGNALS	2226	5000mS	Platform Rotate Left & Right prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; PLT J1-8 Platform Rotate Left Switch and PLT J1-7 Platform Rotate Right Switch closed simultaneously	Power cycled
FUNCTION ENABLE INTERLOCK – ENABLE SWITCH NOT SELECTED FIRST	2227	5000mS	Platform controls prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; Function Enable Switch closed after any of the following events: • Platform Level Down Switch (PLT J1-10) closed • Platform Rotate Left Switch (PLT J1-8) closed • Platform Rotate Right Switch (PLT J1-7) closed • Platform Lift Joystick (PLT J5-3) not neutral • Platform Telescope Joystick (PLT J5-4) not neutral	All of the following are met: • Function Enable Switch not engaged • Platform Level Up Switch open • Platform Level Down Switch open • Platform Rotate Left Switch open • Platform Rotate Right Switch open • Platform Lift Joy-stick neutral • Platform Telescope Joystick neutral
FUNCTION ENABLE INTERLOCK – ENABLE SWITCH NOT SELECTED FIRST	2227	5000mS	Remote controls prevented	Machine Setup's REMOTE CONTROL is YES; Remote Control Mode; Remote Function Enable Switch closed after any of the following events: • Remote Control Joystick 1 not neutral • Remote Control Joystick 2 not neutral • Remote Control Joystick 3 not neutral • Remote Control Joystick 4 not neutral	All of the following are met: • Remote Function Enable Switch not engaged • Remote Control Joysticks are Neu-tral
FUNCTION ENABLE INTERLOCK – NOT SELECTED IN TIME	2228	N/A	Platform controls prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; Function Enable Switch engaged; 7,000mS expired before a hydraulic function was activated	Function Enable Switch not engaged
FUNCTION ENABLE INTERLOCK – NOT SELECTED IN TIME	2228	N/A	Remote controls prevented	Machine Setup's REMOTE CONTROL OPTION is YES; Remote Control Mode; Remote Function Enable Switch engaged; 7,000mS expired before a hydraulic function was activated	Remote Function Enable Switch not engaged

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
ENGINE START PREVENTED – FUNCTION ENABLE SWITCH ENGAGED	2229	5000mS	Platform engine start prevented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; Function Enable Switch engaged; Platform Engine Start Switch (PLT J1-14) closed	All of the following are met: • Function Enable Switch not engaged • Platform Engine Start Switch open
ENGINE START PREVENTED – FUNCTION ENABLE SWITCH ENGAGED	2229	5000mS	Remote engine start prevented	Machine Setup's REMOTE CONTROL is YES; Remote Control Mode; Remote Function Enable Switch engaged; Remote Engine Start Switch closed	All of the following are met: • Remote Function Enable Switch not engaged • Remote Engine Start Switch open
PLATFORM JOYSTICK – OUT OF RANGE HIGH	2230	5000mS	• Platform Lift Up & Down pre-vented • Platform Tele-scope In & Out pre-vented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; any of the follow events occurs: • PLT J5-3 Main Lift Joystick wiper is out of range • PLT J5-4 Main Telescope Joystick wiper is out of range	Power cycled
PLATFORM JOYSTICK – CENTER TAP BAD	2231	5000mS	• Platform Lift Up & Down pre-vented • Platform Tele-scope In & Out pre-vented	Machine Setup's PLATFORM OPTION is YES; Platform Mode; any of the follow events occurs: • PLT J5-2 Platform Lift Joystick center tap is out of range • PLT J5-5 Platform Telescope Joy-stick center tap is out of range	Power cycled

9.18.4 Ground Inputs(23x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OPERATING MODE INTERLOCK – SHIFTER NOT IN NEUTRAL	239	5000mS	• Platform Engine Start prevented • Platform controls prevented • Operating Mode transitions are prevented	• Machine Setup's PLATFORM OPTION is YES; COLUMN SELECTOR is YES; Transition to Platform Mode is requested; Drive Forward or Drive Reverse selected • Machine Setup's PLATFORM OPTION is YES; JOYSTICK FNR is YES; Transition to Platform Mode is requested; Drive Forward or Reverse selected	Column Selector set to Drive Neutral Cabin Joystick's FNR Switch set to Neutral
OPERATING MODE INTERLOCK – SHIFTER NOT IN NEUTRAL	239	5000mS	• Remote Engine Start prevented • Remote controls prevented • Operating Mode transitions are prevented	• Machine Setup's REMOTE CONTROL is YES; COLUMN SELECTOR is YES; Remote Control Mode is requested; Drive Forward or Drive Reverse selected • Machine Setup's REMOTE CONTROL is YES; JOYSTICK FNR is YES; Remote Control Mode is requested; Drive Forward or Reverse selected	Column Selector set to Drive Neutral Cabin Joystick's FNR Switch set to Neutral
PLATFORM OPTION NOT CONFIGURED	2311	5000mS	• Platform controls prevented • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is NO and any of the following occur: • RFCM J3-E2 Platform Attached is closed • Platform Module CANbus detected • CCM J2-J1 Platform Mode energized	Power cycled
OPERATING STATION SELECTION INVALID	2314	5000mS	• Hydraulic functions prevented • Direction Selection Neutral • Operating Mode transitions are prevented	CCM J2-J1 Platform Mode and CCM J2-L1 Key-On energized simultaneously	Power cycled
OPERATING MODE INTERLOCK – OUTRIGGERS NOT DEPLOYED	2315	5000mS	• Lift Up and Telescope Out prevented when the boom angle is greater than +10° • Lift Down prevented when the boom angle is greater than +10° and not fully retracted • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is YES; Keyswitch Platform; Outriggers Not Set	Outriggers Set
OPERATING MODE INTERLOCK – PLATFORM NOT ATTACHED	2316	5000mS	• Platform controls prevented • Platform Engine Start prevented • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is YES; Keyswitch Platform; RFCM J3-E2 Platform Attached is open	Platform Attached

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OPERATING MODE INTERLOCK – CHASSIS NOT LEVEL	2317	5000mS	• Main Lift Up, Lift Down, and Telescope In function speeds are derated when the chassis is tilted and the engine is running (after power-up) • Telescope Out is prevented when the chassis is tilted (after power-up) • Operating Mode transitions are prevented	Keyswitch Platform; chassis tilted	Chassis not tilted
OPERATING MODE INTERLOCK – BOOM ANGLE TOO HIGH	2318	5000mS	• Engine start prevented • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is YES; boom angle > +10°; transition from cabin to platform or platform to cabin in progress	Boom angle < +10°
OPERATING MODE INTERLOCK – BOOM NOT FULLY RETRACTED	2319	5000mS	• Engine start prevented • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is YES; boom not retracted; transition from cabin to platform or platform to cabin in progress	Boom fully retracted
OPERATING MODE INTERLOCK – PARK BRAKE NOT SET	2320	5000mS	• Engine start prevented • Hydraulic functions prevented • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is YES; Transition to Platform Mode is requested; Park Brake released	Park Brake applied
OPERATING MODE INTERLOCK – PARK BRAKE NOT SET	2320	5000mS	• Remote controls prevented • Remote engine start prevented • Operating Mode transitions are prevented	Machine Setup's REMOTE CONTROL is YES; Remote Control Mode is requested; Park Brake is released	Park Brake applied
ERRATIC PLATFORM ATTACHED SIGNAL	2321	5000mS	Platform assumed to be attached	Machine Setup's PLATFORM OPTION is YES; RFCM J3-E2 Platform Attached changes state three times within 5,000mS	Power cycled
CONFLICTING FRAME LEVEL SIGNALS	2322	5000mS	Frame Level Left & Right are prevented	Machine Setup's FRAME LEVELING is YES or PROP; CCM J1-F2 Frame Level Left Switch and CCM J1-F3 Frame Level Right Switch are closed (energized) simultaneously for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CABIN JOYSTICK – X AXIS FAULT	2323	Continuously	• Telescope In / Out prevented in Framer Mode • Fork Tilt Up / Down prevented in Loader Mode	Cabin Joystick's X-Axis circuitry has encountered one of the following issues: • DM1 (520208:2) active • DM1 (520209:2) active • DM1 (520210:2) active • XAxisValue is ERROR (1022) or N/A (1023) • XAxisNeutral, XAxisLeft, or XAxisRight is ERROR (2) or N/A (3) • XAxisNeutral, XAxisLeft, or XAxisRight are CLOSED (1) at the same time • XAxisNeutral, XAxisLeft, and XAxisRight are OPEN (0) at the same time	Power cycled
CABIN JOYSTICK – Y AXIS FAULT	2324	Continuously	Lift Up / Down prevented	Cabin Joystick's Y-Axis circuitry has encountered one of the following issues: • DM1 (520224:2) active • DM1 (520225:2) active • DM1 (520226:2) active • YAxisValue is ERROR (1022) or N/A (1023) • YAxisNeutral, YAxisForward, or YAxisBackward is ERROR (2) or N/A (3) • YAxisNeutral, YAxisForward, or YAxisBackward are CLOSED (1) at the same time • YAxisNeutral, YAxisForward, and YAxisBackward are OPEN (0) at the same time	Power cycled
CABIN JOYSTICK – AUX CONTINUOUS FAULT	2330	Continuously	• Continuous Auxiliary Hydraulics functionality prevented • Auxiliary De-Compression functionality prevented	Machine Setup's VEHICLE is LBP-RS, AUXILIARY HYDRAULICS is YES, and Cabin Joystick's Position 2 (middle) Pushbutton circuitry has encountered one of the following issues: • Cabin Joystick DM1 (520290:31) active • Position 2 Pushbutton status is ERROR (2) or N/A (3)	Power cycled
HYDRAULIC FILTER RESTRICTION	2332	5000mS	Hydraulic Filter Restriction icon is shown on Parker Cabin Display	Ten minutes after power-up, FFCM J3-F3 Hydraulic Filter Pressure Switch is closed (energized) for 3,000mS	Hydraulic Filter Pressure Switch open for 1,000mS

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BOOM ANGLE SENSOR – NOT CALIBRATED	2343	5000mS	• Boom Angle Sensor is +99° • RAS Restricted • HIRAS Mode is forced to ERROR • Start HIRAS Integrity Checks is prevented • Main Lift Derate for Automatic Fork Leveling is activated • Boom Damping prevented	Boom Angle Sensor calibration factors are defaults	Calibrate boom angle sensor
BOOM ANGLE SENSOR – OUT OF RANGE HIGH	2344	5000mS	• Boom Angle Sensor is +99° • RAS Restricted • Main Lift Derate for Automatic Fork Leveling is activated • Boom Damping prevented	Machine Setup's CAN BOOM ANGLE is NO; RFCM J1-A1 Boom Angle Sensor Signal >4.5V for 250mS	Power cycled
BOOM ANGLE SENSOR – OUT OF RANGE LOW	2345	5000mS	• Boom Angle Sensor is +99° • RAS Restricted • Main Lift Derate for Automatic Fork Leveling is activated • Boom Damping prevented	Machine Setup's CAN BOOM ANGLE is NO; RFCM J1-A1 Boom Angle Sensor Signal <0.5V for 250mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BOOM ANGLE SENSOR – NOT RESPONDING	2346	5000mS	• Boom Angle Sensor is +99° • RAS Restricted / Locked • HIRAS Mode is forced to ERROR • Start HIRAS Integrity Checks is prevented • Main Lift Derate for Automatic Fork Leveling is activated • Boom Damping prevented	All of the following conditions are present: • Engine Operating State is Engine Running • Debug's BOOM NR is NO • BOOM ANGLE SENSOR – NOT CALIBRATED (2343) fault not active • BOOM ANGLE SENSOR – OUT OF RANGE LOW (2345) fault not active • BOOM ANGLE SENSOR – OUT OF RANGE HIGH (2344) fault not active • LIFT – CURRENT FEEDBACK READING TOO LOW (33287) fault not active • Boom angle > Lower Limit (boom has not reached minimum angle) • Boom angle < Upper Limit (boom has not reached axi-mum angle) • Main Lift Up Command > Lift Up Detection or Main Lift Down Command > Stagnation Lift Down Detection (operator is commanding boom lift or lower) • Telescope Out Command < Maximum Telescope Out and Telescope In Command < Maximum Telescope In (operator is not commanding boom extend or retract) • Boom angle reading does not change > 0.5° for 4,000mS (sensor is not detecting boom motion)	Power cycled
SYSTEM INTERLOCK – SET JOYSTICK INPUTS TO NEUTRAL	2347	-	Cabin Joystick X-Axis, Y-Axis, Left Roller, and Right Roller prevented (0%)	Engine running, cabin mode, cabin joystick is not neutral, and one of the following situations occurs. • Hydraulic Quick Connect functionality de-activated • Auxiliary De-Compression Switch closed • Bucket mode active and Platform becomes attached • Joystick Lock functionality active • LSI Cancel Switch becomes closed (Cabin Joystick must be neutral prior to switch closure)	Entire cabin joystick is neutral momentarily

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
ENGINE START INPUT – INVALID SIGNAL	2348	5000mS	Engine Start prevented	CCM J1-C3 Start Switch is closed (energized) after the engine is running for more than 7,000mS	Switch is open for 1,000mS
ENGINE START INPUT – INVALID SIGNAL	2348	5000mS	Engine Start prevented	Remote Engine Start Switch is closed after the engine is running for more than 7,000mS	Switch is open for 1,000mS
LIFT ANGLE DERATED – OUTRIGGERS NOT DEPLOYED	2349	5000mS	Lift Up prevented	Machine Setup's MODEL is TH417D or 4017RS and all of the following conditions are present. • Outriggers are not set • Boom angle sensor healthy • Boom angle is greater than +60°	Cabin Joystick neutral for 150mS and any of the following conditions are present: • Outriggers are set • Boom angle is less than +55°
CABIN JOYSTICK – LEFT ROLLER FAULT	2350	Continuously	Left Roller prevented (0%)	Cabin Joystick's Left Roller circuitry has encountered one of the following issues: • DM1 (520240:2) active • DM1 (520241:2) active • DM1 (520242:2) active • LeftRollerValue is ERROR (1022) or N/A (1023) • LeftRollerNeutral, LeftRollerForward, or LeftRollerBackward is ERROR (2) or N/A (3) • LeftRollerNeutral, LeftRollerForward, or LeftRollerBackward are CLOSED (1) at the same time • LeftRollerNeutral, LeftRollerForward, and LeftRollerBackward are OPEN (0) at the same time	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CABIN JOYSTICK – RIGHT ROLLER FAULT	2351	Continuously	Right Roller prevented (0%)	Machine Setup's AUXILIARY HYDRAULICS is YES, Cabin Joystick's Right Roller circuitry has encountered one of the following issues: • DM1 (520256:2) active • DM1 (520257:2) active • DM1 (520258:2) active • RightRollerValue is ERROR (1022) or N/A (1023) • RightRollerNeutral, RightRollerForward, or RightRollerBackward is ERROR (2) or N/A (3) • RightRollerNeutral, RightRollerForward, or RightRollerBackward are CLOSED (1) at the same time • RightRollerNeutral, RightRollerForward, and RightRollerBackward are OPEN (0) at the same time	Power cycled
BOOM ANGLE SENSOR – INTERNAL FAILURE	2353	Continuously	• Boom Angle Sensor is +99° • RAS Restricted / Locked • HIRAS Mode is forced to ERROR • Start HIRAS Integrity Checks is prevented • Hydraulics prevented in Platform Mode • Main Lift Derate for Automatic Fork Leveling is activated • Boom Damping prevented	• Machine Setup's CAN BOOM ANGLE is YES; the primary and backup sensor readings disagree by more than 7 counts (2.5°) for 1,000mS • Machine Setup's CAN BOOM ANGLE is YES; the primary or backup sensor reading was greater than 250 counts (out of range)	Power cycled
OPERATING INTERLOCK – ATTACHMENT COUPLING PIN NOT ENGAGED	2354	5000mS	• Lift Up, Lift Down, Telescope In, and Telescope Out function speeds de-rated • Operating Mode transitions are prevented	Machine Setup's PLATFORM OPTION is YES; Keyswitch Platform; Hydraulic Coupler Pin Not Engaged	Hydraulic Coupler Pin Engaged for 3,000mS

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CABIN JOYSTICK – FNR SWITCH FAULT	23115	Continuously	FNR Switch prevented (Neutral)	Cabin Joystick's FNR Switch circuitry has encountered one of the following issues: • DM1 (520272:2) active • DM1 (520273:2) active • DM1 (520274:2) active • FNRSwitchValue is ERROR (1022) or N/A (1023) • FNRSwitchNeutral, FNR-SwitchForward, or FNR-SwitchReverse is ERROR (2) or N/A (3) • FNRSwitchNeutral, FNR-SwitchForward, or FNR-SwitchReverse are CLOSED (1) at the same time • FNRSwitchNeutral, FNR-SwitchForward, and FNR-SwitchReverse are OPEN (0) at the same time	Power cycled
FUNCTION PROBLEM – LSI OVERRIDE PERMANENTLY SELECTED	23116	5000mS	• LSI Cancel Switch is ignored • LSI Verification prevented	Machine Setup's LOAD STABILITY is YES; any of these conditions exist: • CCM J2-D4 LSI Cancel Switch is closed (energized) at power-up • CCM J2-D4 LSI Cancel Switch is closed for more than 30 seconds	Power cycled
HIGH HYDRAULIC TEMPERATURE WARNING	23117	5000mS	High Hydraulic Temperature Indicator is illuminated on Parker Cabin Display	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV, or DUAL HYD; Hydraulic Oil Temperature greater than +120°C for 3,000mS	Hydraulic Oil Temperature less than +100°C
HIGH HYDRAULIC TEMPERATURE WARNING	23117	5000mS	High Hydraulic Temperature Indicator is illuminated on Parker Cabin Display	Machine Setup's HYD TEMP MGMT is YES and VEHICLE is LBP-HC or LBP-SC; Hydraulic Oil Temperature greater than +95°C for 3,000mS	Hydraulic Oil Temperature less than +90°C
FAN REVERSE DEMAND SWITCH – PERMANENTLY SELECTED	23118	5000mS	Fan Reverse Demand prevented	Machine Setup's FAN CONTROL is HYD W/ REV, DUAL HYD, or CLEANFIX; and one of these conditions exist: • CCM J2-C4 Fan Reverse Switch is closed at power-up • CCM J2-C4 Fan Reverse Switch is closed for more than 10 seconds	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OPERATING MODE INTERLOCK – OPERATOR PRESENCE	23120	Continuously	• Engine Start prevented • Direction Selection is Neutral • Main Lift prevented • Telescope prevented • Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented • Auxiliary De-Compression prevented • Outriggers prevented • Frame Leveling prevented	Cabin Mode; Machine Setup's OPERATOR PRESENCE is YES; Cabin Mode; operator is not present; and at least one of these conditions exist: • Cabin joystick is not neutral • Frame Level Left Switch is closed • Frame Level Right Switch is closed • Outrigger Left Joystick is not neutral • Outrigger Right Joystick is not neutral • Park Brake is released • Rear Auxiliary 1 Joystick is not neutral • Rear Auxiliary 2 Joystick is not neutral • Engine Start Switch is closed	All of the following conditions are present: • Cabin joystick neutral • Frame Level Switches open • Outrigger joysticks neutral • Park Brake applied or Operator is Present • Rear Auxiliary 1 & 2 Joysticks neutral • Engine Start Switch is open
OUTRIGGER LEFT JOYSTICK – OUT OF RANGE HIGH	23132	5000mS	Outrigger Left Joystick position is 0%	• Machine Setup's O/R JOYSTICKS is YES; CCM J1-C1 Outrigger Left Joystick (Primary) is greater than 4.75V • Machine Setup's O/R JOYSTICKS is YES; CCM J1-D1 Outrigger Left Joystick (Backup) is greater than 4.75V	Power cycled
OUTRIGGER LEFT JOYSTICK – OUT OF RANGE LOW	23133	5000mS	Outrigger Left Joystick position is 0%	• Machine Setup's O/R JOYSTICKS is YES; CCM J1-C1 Outrigger Left Joystick (Primary) is less than 0.25V • Machine Setup's O/R JOYSTICKS is YES; CCM J1-D1 Outrigger Left Joystick (Backup) is less than 0.25V	Power cycled
OUTRIGGER LEFT JOYSTICK – VOLTAGE DISAGREEMENT	23134	5000mS	Outrigger Left Joystick position is 0%	Machine Setup's O/R JOYSTICKS is YES; Scaled Outrigger Left Joystick (Primary) and Scaled Outrigger Left Joystick (Backup) differ by more than 10% for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OUTRIGGER RIGHT JOYSTICK – OUT OF RANGE HIGH	23135	5000mS	Outrigger Right Joystick position is 0%	• Machine Setup's O/R JOYSTICKS is YES; CCM J1-E1 Outrigger Right Joystick (Primary) is greater than 4.75V • Machine Setup's O/R JOYSTICKS is YES; CCM J1-F1 Outrigger Right Joystick (Backup) is greater than 4.75V	Power cycled
OUTRIGGER RIGHT JOYSTICK – OUT OF RANGE LOW	23136	5000mS	Outrigger Right Joystick position is 0%	• Machine Setup's O/R JOYSTICKS is YES; CCM J1-E1 Outrigger Right Joystick (Primary) is less than 0.25V • Machine Setup's O/R JOYSTICKS is YES; CCM J1-F1 Outrigger Right Joystick (Backup) is less than 0.25V	Power cycled
OUTRIGGER RIGHT JOYSTICK – VOLTAGE DISAGREEMENT	23137	5000mS	Outrigger Right Joystick position is 0%	Machine Setup's O/R JOYSTICKS is YES; Scaled Outrigger Right Joystick (Primary) and Scaled Outrigger Right Joystick (Backup) differ by more than 10% for 500mS	Power cycled
CONFLICTING HITCH SIGNALS	23138	5000mS	Hitch Up & Down are prevented	Hitch Configured; CCM J1-F3 Hitch Up Switch and CCM J1-F2 Hitch Down Switch are closed (energized) simultaneously for 500mS	Power cycled
CONFLICTING STEER SIGNALS	23139	5000mS	Current Steering Mode is maintained	• All Wheel Steer Switch (CCM J1-D4), Two Wheel Steer Switch (CCM J1-G1), or Crab Steer Switch (CCM J1-H1) are energized simultaneously for 500mS • All Wheel Steer Switch (CCM J1-D4), Two Wheel Steer Switch (CCM J1-G1), and Crab Steer Switch (CCM J1-H1) are de-energized simultaneously for 500mS	Power cycled
FUNCTION PROBLEM – FRAMER MODE SWITCH CHANGED	23140	5000mS	Previous Framer / Loader Mode is maintained	CCM J2-H4 Framer Mode Switch changed state while the cabin joystick was not neutral	Cabin joystick neutral and Framer Mode Switch state is maintained for 1,000mS
FUNCTION PROBLEM – BUCKET MODE SWITCH CHANGED	23146	5000mS	Previous Bucket Mode Switch selection is maintained	CCM J2-J4 Bucket Mode Switch changed state while the cabin joystick was not neutral	Cabin joystick neutral and Bucket Mode Switch state is maintained for 1,000mS
CABIN JOYSTICK – OUTRIGGER SW FAULTY	23156	5000mS	Outrigger Pushbutton prevented (Open)	Machine Setup's OUTRIGGERS is YES, O/R JOYSTICKS is NO, and the Cabin Joystick encounters one of the following issues: • DM1 (520289:31) active • OutriggerBoomFloatPushbutton is ERROR (2) or N/A (3)	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CABIN JOYSTICK – BOOM FLOAT SW FAULTY	23157	5000mS	Boom Float Pushbutton prevented (Open)	Machine Setup's BOOM RIDE&FLOAT is RIDE&FLOAT and the Cabin Joystick encounters one of the following issues: • DM1 (520289:31) active • OutriggerBoomFloatPushbutton is ERROR (2) or N/A (3)	Power cycled
CABIN JOYSTICK – AUX 1/2 SW FAULTY	23158	5000mS	Auxiliary 1/2 Pushbutton prevented (Open)	Machine Setup's VEHICLE is not LBP-RS, AUX FUNCTION SELECT is YES, Cabin Joystick's Auxiliary 1/2 Pushbutton circuitry has encountered one of the following issues: • DM1 (520290:31) active • AuxiliarySelectPushbutton is ERROR (2) or N/A (3)	Power cycled
CABIN JOYSTICK – UPSHIFT SW FAULTY	23159	5000mS	Upshift prevented Downshift prevented	Cabin Joystick's Upshift Pushbutton circuitry has encountered one of the following issues: • DM1 (520292:31) active • UpshiftPushbutton is ERROR (2) or N/A (3)	Power cycled
CABIN JOYSTICK – DOWNSHIFT SW FAULTY	23160	5000mS	Upshift prevented Downshift prevented	Cabin Joystick's Downshift Pushbutton circuitry has encountered one of the following issues: • DM1 (520293:31) active • DownPushbutton is ERROR (2) or N/A (3)	Power cycled
CABIN JOYSTICK – DECLUTCH SW FAULTY	23161	5000mS	De-Clutch prevented	ANY of the following conditions are present: • Machine Setup's VEHICLE is not LBP-RS and JOYSTICK FNR is NO • Machine Setup's VEHICLE is LBP-RS • Machine Setup's VEHICLE is not LBP-HC or LBP-SC AND the Cabin Joystick's De-Clutch Pushbutton circuitry has encountered one of the following issues: • DM1 (520294:31) active • DeClutchPushbutton is ERROR (2) or N/A (3)	Power cycled
PROPORTIONAL TRAVEL SPEED – OUT OF RANGE LOW	23165	5000mS	Proportional Travel Speed is 0%	Machine Setup's VEHICLE is LBP-AG; TRANSMISSION is BOSCH HYSTAT; CCM J3-E4 Proportional Travel Speed < 0.25V for 500mS	Power cycled
PROPORTIONAL TRAVEL SPEED – OUT OF RANGE HIGH	23166	5000mS	Proportional Travel Speed is 0%	Machine Setup's VEHICLE is LBP-AG; TRANSMISSION is BOSCH HYSTAT; CCM J3-E4 Proportional Travel Speed > 4.75V for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BRAKE PEDAL POSITION – OUT OF RANGE LOW	23167	5000mS	Brake Pedal Position is 0%	Brake Pedal Position Configured; CCM J3-F4 Brake Pedal Position < 0.25V for 500mS	Power cycled
BRAKE PEDAL POSITION – OUT OF RANGE HIGH	23168	5000mS	Brake Pedal Position is 0%	Brake Pedal Position Configured; CCM J3-F4 Brake Pedal Position > 4.75V for 500mS	Power cycled
TRAVEL MODE SWITCH FAULTY	23169	5000mS	Loader Travel Mode selected	Machine Setup's VEHICLE is LBP-AG; TRANSMISSION is BOSCH HYSTAT; CCM J3-A1 Proportional Travel Mode and CCM J3-A2 Roading Travel Mode are both energized for 500mS	Power cycled
HAND THROTTLE SWITCH – PERMANENTLY SELECTED	23174	5000mS	Hand Throttle Switch is ignored	Machine Setup's VEHICLE is LBP-AG and one of these conditions exist: • CCM J3-A3 Hand Throttle Switch is closed at power-up • CCM J3-A3 Hand Throttle Switch is closed for more than 10 seconds	Power cycled
BRAKE PEDAL PRESSURE – OUT OF RANGE LOW	23175	5000mS	• Brake Pedal Pressure is 3000PSI • De-Clutch prevented	Machine Setup's BRAKE PEDAL PRESSURE is YES; FFCM J1-F2 Brake Pedal Pressure < 0.25V for 500mS	Power cycled
BRAKE PEDAL PRESSURE – OUT OF RANGE HIGH	23176	5000mS	• Brake Pedal Pressure is 3000PSI • De-Clutch prevented	Machine Setup's BRAKE PEDAL PRESSURE is YES; FFCM J1-F2 Brake Pedal Pressure > 4.75V for 500mS	Power cycled
REAR AUXILIARY 1 JOYSTICK – OUT OF RANGE HIGH	23177	5000mS	Rear Auxiliary 1 Joystick position is 0%	• Machine Setup's AUXILIARY F/R SELECT is YES; CCM J1-C1 Rear Auxiliary 1 Joystick (Primary) is greater than 4.75V • Machine Setup's AUXILIARY F/R SELECT is YES; CCM J1-D1 Rear Auxiliary 1 Joystick (Backup) is greater than 4.75V	Power cycled
REAR AUXILIARY 1 JOYSTICK – OUT OF RANGE LOW	23178	5000mS	Rear Auxiliary 1 Joystick position is 0%	• Machine Setup's AUXILIARY F/R SELECT is YES; CCM J1-C1 Rear Auxiliary 1 Joystick (Primary) is less than 0.25V • Machine Setup's AUXILIARY F/R SELECT is YES; CCM J1-D1 Rear Auxiliary 1 Joystick (Backup) is less than 0.25V	Power cycled
REAR AUXILIARY 1 JOYSTICK – VOLTAGE DISAGREEMENT	23179	5000mS	Rear Auxiliary 1 Joystick position is 0%	Machine Setup's AUXILIARY F/R SELECT is YES; Scaled Rear Auxiliary 1 Joystick (Primary) and Scaled Rear Auxiliary 1 Joystick (Backup) differ by more than 10% for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AUXILIARY 2 JOYSTICK – OUT OF RANGE HIGH	23180	5000mS	Rear Auxiliary 2 Joystick position is 0%	• Machine Setup's AUXILIARY REAR SELECT; CCM J1-E1 Rear Auxiliary 2 Joystick (Primary) is greater than 4.75V • Machine Setup's AUXILIARY REAR SELECT is YES; CCM J1-F1 Rear Auxiliary 2 Joystick (Backup) is greater than 4.75V	Power cycled
REAR AUXILIARY 2 JOYSTICK – OUT OF RANGE LOW	23181	5000mS	Rear Auxiliary 2 Joystick position is 0%	• Machine Setup's AUXILIARY REAR SELECT is YES; CCM J1-E1 Rear Auxiliary 2 Joystick (Primary) is less than 0.25V • Machine Setup's AUXILIARY REAR SELECT is YES; CCM J1-F1 Rear Auxiliary 2 Joystick (Backup) is less than 0.25V	Power cycled
REAR AUXILIARY 2 JOYSTICK – VOLTAGE DISAGREEMENT	23182	5000mS	Rear Auxiliary 2 Joystick position is 0%	Machine Setup's AUXILIARY REAR SELECT is YES; Scaled Rear Auxiliary 2 Joystick (Primary) and Scaled Rear Auxiliary 2 Joystick (Backup) differ by more than 10% for 500mS	Power cycled
BRAKE PEDAL POSITION – NOT CALIBRATED	23183	5000mS	Brake Pedal Position is 0%	Brake Pedal Position Configured and one of the following occurs: • Brake Pedal Position 0% Calibration set to default • Brake Pedal Position 100% Calibration set to default • Brake Pedal Position 0% Calibration out of range (0.5 to 4.5V) • Brake Pedal Position 100% Calibration out of range (0.5 to 4.5V) • Brake Pedal Position 0% Calibration – Brake Pedal Position 100% Calibration < 0.25V	Calibration successful or power cycled
OUTRIGGER LEFT EXTEND PRESSURE – OUT OF RANGE HIGH	23184	5000mS	• Outrigger Left Extend Pressure is 0 PSI / BAR • Outrigger Left Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J1-A1 > 4.75V for 500mS	Power cycled
OUTRIGGER LEFT EXTEND PRESSURE – OUT OF RANGE LOW	23185	5000mS	• Outrigger Left Extend Pressure is 0 PSI / BAR • Outrigger Left Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J1-A1 < 0.25V for 500mS	Power cycled
OUTRIGGER LEFT RETRACT PRESSURE – OUT OF RANGE HIGH	23186	5000mS	• Outrigger Left Retract Pressure is 0 PSI / BAR • Outrigger Left Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J3-E4 > 4.75V for 500mS	Power cycled
OUTRIGGER LEFT RETRACT PRESSURE – OUT OF RANGE LOW	23187	5000mS	• Outrigger Left Retract Pressure is 0 PSI / BAR • Outrigger Left Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J3-E4 < 0.25V for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OUTRIGGER RIGHT EXTEND PRESSURE – OUT OF RANGE HIGH	23188	5000mS	• Outrigger Right Extend Pressure is 0 PSI / BAR • Outrigger Right Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J1-D1 > 4.75V for 500mS	Power cycled
OUTRIGGER RIGHT EXTEND PRESSURE – OUT OF RANGE LOW	23189	5000mS	• Outrigger Right Extend Pressure is 0 PSI / BAR • Outrigger Right Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J1-D1 < 0.25V for 500mS	Power cycled
OUTRIGGER RIGHT RETRACT PRESSURE – OUT OF RANGE HIGH	23190	5000mS	• Outrigger Right Retract Pressure is 0 PSI / BAR • Outrigger Right Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J3-F4 > 4.75V for 500mS	Power cycled
OUTRIGGER RIGHT RETRACT PRESSURE – OUT OF RANGE LOW	23191	5000mS	• Outrigger Right Retract Pressure is 0 PSI / BAR • Outrigger Right Not Set	Machine Setup's O/R DETECTION is PRESS or PRESS & PROX; FFCM J3-F4 < 0.25V for 500mS	Power cycled
SERVICE BRAKE – LOW OIL LEVEL	23241	5000mS	Service Brake Fault indicator is energized on Parker Cabin Display	Machine Setup's BRAKE OIL SENSORS is YES or Machine Setup's TRAILER BRAKE is AGRICULTURAL; and all of the following conditions are present: • Engine Running for 10,000mS • CCM J2-H3 Service Brake Oil Level Switch is open for 2,000mS .	Power cycled
SERVICE BRAKE – LOW OIL PRESSURE	23242	5000mS	Service Brake Fault indicator is energized on Parker Cabin Display	Machine Setup's BRAKE OIL SENSORS is YES or Machine Setup's TRAILER BRAKE is AGRICULTURAL; and all of the following conditions are present: • Engine Running for 10,000mS • FFCM J3-E2 Service Brake Pressure Switch is closed for 2,000mS. Note: This corresponds to a pressure of <10 Bar.	Power cycled
FORK TILT SENSOR – NOT RESPONDING	23250	5000mS	• Main Lift Derate for Automatic Fork Leveling is activated • Fork Tilt Angle is assumed to be 99.99°	Machine Setup's AUTO FORK LEVEL is YES; Fork Tilt scaled input is not 0% (operator commanding fork tilt); Fork Tilt Angle does not change by more than 1.00° and any the following conditions are present for >2,500mS : • Tilt Cylinder Status is not EXTENDED and Fork Tilt Up Command is greater than 975mA • Tilt Cylinder Status is not RETRACTED and Fork Tilt Down Command is greater than 975mA	Power Cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TILT CYLINDER STROKE SENSOR – NOT RESPONDING	23251	5000mS	• Main Lift Derate for Automatic Fork Leveling is activated • Tilt Cylinder Stroke is assumed to be 999.9mm • Tilt Cylinder Status is assumed to be ERROR	Machine Setup's AUTO FORK LEVEL is YES; Tilt Cylinder Stroke does not change by more than 2.0mm and any of the following conditions are present for >2,500mS : • Tilt Cylinder Status is not EXTENDED and Fork Tilt Up Command is greater than 850mA • Tilt Cylinder Status is not RETRACTED and Fork Tilt Down Command is greater than 850mA	Power Cycled
TILT CYLINDER STROKE SENSOR – INTERNAL FAILURE	23252	5000mS	• Main Lift Derate for Automatic Fork Leveling is activated • Tilt Cylinder Stroke is assumed to be 999.9mm • Tilt Cylinder Status is assumed to be ERROR	Machine Setup's AUTO FORK LEVEL is YES and any of the following conditions are present for 1,000mS: • Channel A Position and Channel B Position disagree by more than 5mm • Channel A Error is not NO ERROR • Channel B Error is not NO ERROR	Power Cycled
RAS PRESSURE 1 – OUT OF RANGE HIGH	23254	5000mS	• HIRAS Pressure PT1 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY and any of the following conditions are present: • RFCM J1-C1 HIRAS Pressure PT1 (Primary) is greater than 23mA • RFCM J1-B1 HIRAS Pressure PT1 (Backup) is greater than 23mA	Power Cycled
RAS PRESSURE 1 – OUT OF RANGE LOW	23255	5000mS	• HIRAS Pressure PT1 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; Engine Running or Stopped and any of the following conditions are present: • RFCM J1-C1 HIRAS Pressure PT1 (Primary) is less than 2mA • RFCM J1-B1 HIRAS Pressure PT1 (Backup) is less than 2mA	Power Cycled
RAS PRESSURE 1 – DISAGREEMENT	23256	5000mS	• HIRAS Pressure PT1 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; RFCM J1-C1 HIRAS Pressure PT1 (Primary) and RFCM J1-B1 HIRAS Pressure PT1 (Backup) disagree by greater than +/-50.0BAR for 500mS.	Power Cycled
RAS PRESSURE 2 – OUT OF RANGE HIGH	23257	5000mS	• HIRAS Pressure PT2 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY and any of the following conditions are present: • RFCM J1-A1 HIRAS Pressure PT2 (Primary) is greater than 23mA • RFCM J1-D1 HIRAS Pressure PT2 (Backup) is greater than 23mA	Power Cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
RAS PRESSURE 2 – OUT OF RANGE LOW	23258	5000mS	• HIRAS Pressure PT2 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	• Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; Engine Running or Stopped and any of the following conditions are present: • RFCM J1-A1 HIRAS Pressure PT2 (Primary) is less than 2mA • RFCM J1-D1 HIRAS Pressure PT2 (Backup) is less than 2mA	Power Cycled
RAS PRESSURE 2 – DISAGREEMENT	23259	5000mS	• HIRAS Pressure PT2 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; RFCM J1-A1 HIRAS Pressure PT2 (Primary) and RFCM J1-D1 HIRAS Pressure PT2 (Backup) disagree by greater than +/-50.0BAR for 500mS.	Power Cycled
RAS PRESSURE 3 – OUT OF RANGE HIGH	23260	5000mS	• HIRAS Pressure PT3 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY and any of the following conditions are present: • RFCM J1-E1 HIRAS Pressure PT3 (Primary) is greater than 23mA • RFCM J1-F2 HIRAS Pressure PT3 (Backup) is greater than 23mA	Power Cycled
RAS PRESSURE 3 – OUT OF RANGE LOW	23261	5000mS	• HIRAS Pressure PT3 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; Engine Running or Stopped and any of the following conditions are present: • RFCM J1-E1 HIRAS Pressure PT3 (Primary) is less than 2mA • RFCM J1-F2 HIRAS Pressure PT3 (Backup) is less than 2mA	Power Cycled
RAS PRESSURE 3 – DISAGREEMENT	23262	5000mS	• HIRAS Pressure PT3 is assumed to be 600.0 BAR • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; RFCM J1-E1 HIRAS Pressure PT3 (Primary) and RFCM J1-F2 HIRAS Pressure PT3 (Backup) disagree by greater than +/-50.0BAR for 500mS.	Power Cycled

9.18.5 Other Inputs (24x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FRONT LEFT OUTRIGGER STOW SWITCH FAULTY	247	5000mS	Left Outrigger Status is assumed to be NOT SET	Machine Setup's O/R DETECTION is PRESS & PROX, Left Outrigger Position Sensor did not transition from high to low for 500mS during transition of Left Outrigger Pressure Status from STOWED to NOT SET to SET or SET to NOT SET to STOWED	Left Outrigger Position Sensor transitions from high to low for 500mS
FRONT RIGHT OUTRIGGER STOW SWITCH FAULTY	248	5000mS	Right Outrigger Status is assumed to be NOT SET	Machine Setup's O/R DETECTION is PRESS & PROX, Left Outrigger Position Sensor did not transition from high to low for 500mS during transition of Left Outrigger Pressure Status from STOWED to NOT SET to SET or SET to NOT SET to STOWED	Right Outrigger Position Sensor transitions from high to low for 500mS
LIFT ACCUMULATOR PRESSURE - OUT OF RANGE HIGH	2433	5000mS	• Lift Accumulator Pressure 1 is 600.0 BAR • Lift Accumulator Pressure 2 is 600.0 BAR	Machine Setup's BOOM DAMPING is YES and either of the following: • LCM J1-F2 Lift Accumulator Pressure 1 > 20 mA for 500 mS • LCM J1-F1 Lift Accumulator Pressure 2 > 20 mA for 500 mS	Power cycled
LIFT ACCUMULATOR PRESSURE - OUT OF RANGE LOW	2434	5000mS	• Lift Accumulator Pressure 1 is 600.0 BAR • Lift Accumulator Pressure 2 is 600.0 BAR	Machine Setup's BOOM DAMPING is YES and either of the following: • LCM J1-F2 Lift Accumulator Pressure 1 < 2 mA for 500 mS • LCM J1-F1 Lift Accumulator Pressure 2 < 2 mA for 500 mS	Power cycled
LIFT ACCUMULATOR PRESSURE - DISAGREEMENT	2435	5000mS	• Lift Accumulator Pressure 1 is 600.0 BAR • Lift Accumulator Pressure 2 is 600.0 BAR	Machine Setup's BOOM DAMPING is YES; LCM J1-F2 Lift Accumulator Pressure 1 and LCM J1-F1 Lift Accumulator Pressure 2 disagree by more than +/- 50 BAR for 500 mS	Power cycled

9.18.6 Function Prevented (25x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
MODEL CHANGED – HYDRAULICS SUSPENDED – CYCLE EMS	259	Continuously	• Hydraulic functions are prevented • Engine Start is prevented	• Machine Setup's MODEL was changed • Machine Setup's BRAND, VEHICLE, MARKET, or PERS DEFAULT was changed	Power cycle
FUNCTIONS LOCKED OUT – CONSTANT DATA VERSION IMPROPER	2520	Continuously	• Hydraulic functions are prevented • Engine Start is prevented	• CCM Application and ConstantData Versions do not match • FFCM Application and ConstantData Versions do not match • RFCM Application and ConstantData Versions do not match • LCM Application and ConstantData Versions do not match • TCM Application and ConstantData Versions do not match	Power cycled
ENGINE START PREVENTED – PARK BRAKE NOT SET	2525	5000mS	Engine Start is prevented	CCM J1-C3 Start Switch closed (energized); CCM J1-F4 Park Brake Switch released (de-energized)	Power cycle
ENGINE START PREVENTED – PARK BRAKE NOT SET	2525	5000mS	Engine Start is prevented	Machine Setup's REMOTE CONTROL is YES; Operating Station is Remote Control; Remote Engine Start Switch is closed; CCM J1-F4 Park Brake Switch released (de-energized)	Power cycle
EXCESSIVE BOOM ANGLE FOR HYDRAULIC QUICK CONNECT OPERATION	2527	5000mS	Hydraulic Quick Connect prevented	All of the following conditions exist: • Machine Setup's HYDRAULIC QUICK CONNECT is YES • Boom Angle Sensor is Healthy (no active faults related to boom angle sensor) • Boom Angle > +20° • Hydraulic Quick Connect Switch closed	Hydraulic Quick Connect Switch opened
PLATFORM ATTACHED – HYDRAULIC QUICK CONNECT CUTOUT	2528	5000mS	Hydraulic Quick Connect is prevented	Machine Setup's HYDRAULIC QUICK CONNECT is YES; Cabin Mode; platform attached; Hydraulic Quick Connect Switch is closed	Hydraulic Quick Connect Switch opened
ENGINE START PREVENTED – SHIFT LEVER NOT IN NEUTRAL	2529	5000mS	Engine Start prevented	Cabin Mode, CCM J1-C3 Start Switch digital input energized, and any one of these events occurs: • Machine Setup's COLUMN SELECTOR is YES; Column Direction Switch not neutral • Machine Setup's JOYSTICK FNR is YES; FNR Switch not neutral • Machine Setup's COLUMN SELECTOR is NO and JOYSTICK FNR is NO	Power cycle
SHORT DETECTED ON IGNITION WIRING – CHECK HARNESS	2535	Continuously	• Hydraulic functions are prevented • Engine Start is prevented	FFCM, RFCM, LCM or TCM messages detected before ignition relay is active	Power cycle

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BOOM PREVENTED - FUNCTION CUTOUT ACTIVE	2550	5000mS	• Main Lift Derate for Automatic Fork Leveling is activated • Boom Recovery Mode for Automatic Fork Leveling is activated (operator must manually adjust fork tilt to reenable main lift function)	Machine Setup's AUTO FORK LEVEL is YES and any of the following conditions are present: • Boom Angle Sensor and Fork Tilt Sensor are Unhealthy • Tilt Cylinder Stroke Sensor and Fork Tilt Sensor are Unhealthy • Boom Angle Sensor and Tilt Cylinder Stroke Sensor are Healthy (mechanical tilt correction); Mechanical Target Fork Angle and Mechanical Actual Fork Angle disagree by more than 4.0° for 500mS (Both ConstantData) Fork Tilt Sensor is Healthy (gravity tilt correction); Filtered Gravity Fork Angle and Fork Tilt Angle disagree by more than 4.0° for 500mS (Both ConstantData)	Power Cycle
BOOM RETRACTED SENSOR FAULTY – SENSING INVALID	2560	5000mS	Boom Retracted Status is Boom Not Retracted	Debug's BOOM NR is NO; Machine Setup's LOAD STABILITY is YES; RFCM J2-J1 Boom Retracted Switch unhealthy	Boom Retracted Switch healthy
OUTRIGGERS PREVENTED – LOWER BOOM	2567	5000mS	Outriggers prevented	Machine Setup's VEHICLE is LBP-PR or LBP-RS; Machine Setup's MARKET is not ANSI; Boom Angle Sensor Healthy; operator attempted to move outriggers and one of the following occurred: • Boom Not Retracted and Boom Angle > +20° • Boom Retracted and Boom Angle > +60°	Entire cabin joystick neutral for 1000mS and one of the following occurred: • Boom Not Retracted and Boom Angle < +19° • Boom Retracted and Boom Angle < +55°
OUTRIGGERS PREVENTED – LOWER BOOM	2567	5000mS	Outriggers prevented	Machine Setup's VEHICLE is LBP-PR or LBP-RS; Machine Setup's MARKET is ANSI; Boom Angle Sensor Healthy; operator attempted to move outriggers and one of the following occurred: • Boom Not Retracted and Boom Angle > +40° • Boom Retracted and Boom Angle > +60°	Entire cabin joystick neutral for 1000mS and one of the following occurred: • Boom Not Retracted and Boom Angle < +38° • Boom Retracted and Boom Angle < +55°

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OUTRIGGERS PREVENTED – LOWER BOOM	2567	5000mS	Outriggers prevented	Machine Setup's VEHICLE is LBP-SC and ALL of the following conditions are present: • Boom Angle Sensor Healthy • Outrigger Left Joystick or Outrigger Right Joystick is not neutral (operator requesting outriggers) • Boom Angle > +40°	ALL of the following conditions are present: • Outrigger Left Joystick and Outrigger Right Joystick are both neutral for 1000mS • Boom Angle < +38°
FRAME LEVELING PREVENTED – LOWER BOOM	2577	5000mS	Frame Leveling prevented	Machine Setup's VEHICLE is LBP-PR or LBP-RS and MARKET is not ANSI, or VEHICLE is LBP-HC *(any MARKET)*; Boom Angle Sensor Healthy; operator attempted to frame level and one of the following occurred: • Boom Not Retracted and Boom Angle > +20° • Boom Retracted and Boom Angle > +60°	Frame Level Left and Right Switches open for 1000mS and one of the following occurred: • Boom Not Retracted and Boom Angle < +19° • Boom Retracted and Boom Angle < +55°
FRAME LEVELING PREVENTED – LOWER BOOM	2577	5000mS	Frame Leveling prevented	Machine Setup's VEHICLE is LBP-PR or LBP-RS; Machine Setup's MARKET is ANSI; Boom Angle Sensor Healthy; operator attempted to frame level and one of the following occurred: • Boom Not Retracted and Boom Angle > +40° • Boom Retracted and Boom Angle > +60°	Frame Level Left and Right Switches open for 1000mS and one of the following occurred: • Boom Not Retracted and Boom Angle < +38° • Boom Retracted and Boom Angle < +55°
FRAME LEVELING PREVENTED – LOWER BOOM	2577	5000mS	Frame Leveling prevented	Machine Setup's VEHICLE is LBP-SC and ALL of the following conditions are present: • Boom Angle Sensor Healthy • Frame Level Left Switch or Frame Level Right Switch is closed (operator requesting frame leveling) • Boom Angle > +40°	ALL of the following conditions are present: • Frame Level Left and Right Switches open for 1000mS • Boom Angle < +38°
DRIVE PREVENTED – LOWER BOOM	2584	5000mS	Direction Selection is forced to Neutral	Machine Setup's VEHICLE is LBP-SC and ALL of the following conditions are present: • Boom Angle Sensor Healthy (no active faults) • Boom Angle > +40° • Direction Selection is not Neutral (vehicle in drive)	Boom Angle < +38°

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FUNCTIONS PREVENTED – REAR AXLE STABILIZATION ERROR	2592	5000mS	The following actions apply continuously: • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Cancel HIRAS Integrity Checks is prevented The following actions apply until the vehicle can Start HIRAS Integrity Checks: • HIRAS Mode is forced to ERROR • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • Drive Speed Restriction for RAS Error is forced	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY and HIRAS Cylinder Status is Unhealthy (cylinder failed to lock or unlock during a periodic automatic integrity check)	HIRAS Cylinder Status is Healthy Note: HIRAS cylinder must be repaired. Operator should apply park brake, fully lower and retract boom, then allow vehicle to idle until RAS indicator is off (wait approximately 2 minutes). Vehicle will automatically check the RAS cylinder for errors while idling in this position.

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FUNCTIONS PREVENTED – REAR AXLE STABILIZATION UNABLE TO CHECK INTEGRITY	2594	5000mS	The following actions apply continuously: • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Cancel HIRAS Integrity Checks is prevented The following actions apply until the vehicle can Start HIRAS Integrity Checks: • HIRAS Mode is forced to ERROR • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • Drive Speed Restriction for RAS Error is forced	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY and Time Since Last Successful Integrity Check is greater than 50 hours	Time Since Last Successful Integrity Check is less than 50 hours Note: Operator should apply park brake, fully lower and retract boom, then allow vehicle to idle until RAS indicator is off (wait approximately 2 minutes). Vehicle will automatically check the RAS cylinder for errors while idling in this position.
BOOM DAMPING PREVENTED - BOOM RIDE VALVE UNHEALTHY	25101	5000mS	Boom Damping is prevented	Machine Setup's BOOM DAMPING is YES; CALIBRATIONS > BOOM DAMPING fails at step HEALTH CHECK FAILED - RIDE VALVE (issue detected with the boom ride valve) Note: Check the boom ride hydraulics (i.e. accumulator, valves, hoses) for issues.	Maintained through Power Cycle; CALIBRATIONS > BOOM DAMPING completed
BOOM DAMPING - EXCESSIVE BOOM SETTLING	25102	5000mS	Boom Damping is prevented	Machine Setup's BOOM DAMPING is YES; Boom Damping Flag is set (active); Boom Angle < (Stored Boom Angle – Excessive Boom Settling Tolerance) for 200 mS Note: Check the boom ride hydraulics (i.e. accumulator, valves, hoses) for issues.	Power cycled
RIDE VALVE OR LIFT ACCUMULATOR PRESSURE SENSOR ERROR	25103	5000mS	Boom Damping is prevented	Machine Setup's BOOM DAMPING is YES; Boom Damping Flag is set (active); Lift Head Pressure < (Lift Accumulator Pressure - 10 BAR (Constant Data)) for 500 mS Note: Check the boom ride hydraulics (i.e. accumulator, valves, hoses) for issues.	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LIFT BORE/LIFT ACCUMULATOR PRESSURE DISAGREEMENT	25104	5000mS	Boom Damping is prevented	Machine Setup's BOOM DAMPING is YES; Boom Damping Flag is set (active) for >2000 mS (debounce), Lift Head Pressure & Lift Accumulator Pressure disagree more than +/- 50 BAR for 500 mS Note: Check the boom ride hydraulics (i.e. accumulator, valves, sensors) for issues.	Power cycled
BOOM DAMPING PREVENTED - LIFT ROD PRESSURE SENSOR OR BOOM TANK VALVE UNHEALTHY	25105	5000mS	Boom Damping is prevented	Machine Setup's BOOM DAMPING is YES; CALIBRATIONS > BOOM DAMPING fails at step HEALTH CHECK FAILED - LIFT ROD PRESSURE SENSOR (issue detected with the lift rod pressure sensor or boom tank valve) Note: Check the boom ride hydraulics (i.e. accumulator, valves, hoses) for issues.	Maintained through Power Cycle; CALIBRATIONS > BOOM DAMPING completed

9.18.7 Line Contactor Open-Circuit (31x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
IGNITION RELAY PERMANENTLY OFF	316	Continuously	Hydraulic functions are prevented	At startup, Ignition Voltage < 4.0V after CCM J1-H3 Ignition Relay is energized for 140mS	Power cycled

9.18.8 Line Contactor Short-Circuit (32x)

HELP MESSAGE	DTC	CABIN ALARM	ACTIONS	TRIGGER	LATCH CONDITION
IGNITION RELAY PERMANENTLY ON	327	Continuously	Hydraulic functions are prevented	At startup, Ignition Voltage > 6.0V before CCM J1-H3 Ignition Relay is energized	Power cycled
REMOTE CONTROL IGNITION RELAY PERMANENTLY ON	3215	Continuously	• Remote controls prevented • Remote engine start prevented	Machine Setup's REMOTE CONTROL is YES, Operating Mode is REMOTE CONTROL, and all of the following conditions are present for >2,000mS : • RCM P1-M1 Remote Control Ignition Relay digital output is deenergized (relay should be open to shut down engine) • Engine Operating State is ENGINE RUNNING (relay is stuck closed)	Power Cycled

9.18.9 Output Drivers (33x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
GROUND ALARM - SHORT TO BATTERY	3311	5000mS	CCM J1-H4 Ground Alarm is prevented	Machine Setup's VEHICLE is LBP-RS, short to battery detected on CCM J1-H4	Power cycled
GROUND ALARM - SHORT TO GROUND	3371	5000mS	CCM J1-H4 Ground Alarm is prevented	Machine Setup's VEHICLE is LBP-RS, short to ground detected on CCM J1-H4	Power cycled
MAIN LIFT UP VALVE – OPEN CIRCUIT	33181	5000mS	• RFCM J2-F4 Lift Up prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Open-circuit detected on RFCM J2-F4	Power cycled
MAIN LIFT VALVES – SHORT TO BATTERY	33182	5000mS	• RFCM J2-F4 Lift Up prevented • RFCM J2-E4 Lift Down prevented • RFCM J2-F3 / RFCM J2-E3 Main Lift Up / Down Valve disabled • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Short to battery detected on RFCM J2-F4 or RFCM J2-E4	Power cycled
MAIN LIFT UP VALVE – SHORT TO GROUND	33183	5000mS	• RFCM J2-F4 Lift Up prevented • RFCM J2-E4 Lift Down prevented • RFCM J2-F3 / RFCM J2-E3 Main Lift Up / Down Valve disabled • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Short to ground detected on RFCM J2-F4	Power cycled
MAIN LIFT DOWN VALVE – OPEN CIRCUIT	33184	5000mS	• RFCM J2-E4 Lift Down prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Open-circuit detected on RFCM J2-E4	Power cycled
MAIN LIFT DOWN VALVE – SHORT TO GROUND	33185	5000mS	• RFCM J2-F4 Lift Up prevented • RFCM J2-E4 Lift Down prevented • RFCM J2-F3 / RFCM J2-E3 Main Lift Up / Down Valve disabled • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Short to ground detected on RFCM J2-E4	Power cycled
MAIN TELESCOPE OUT VALVE – OPEN CIRCUIT	33186	5000mS	RFCM J2-G4 Telescope Out prevented	Open-circuit detected on RFCM J2-G4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
MAIN TELESCOPE VALVES – SHORT TO BATTERY	33187	5000mS	• RFCM J2-H4 Telescope In prevented • RFCM J2-G4 Telescope Out prevented • RFCM J2-A3 / RFCM J2-B3 Telescope In / Out Valve disabled • Boom Damping prevented	Short to battery detected on RFCM J2-H4 or RFCM J2-G4	Power cycled
MAIN TELESCOPE OUT VALVE – SHORT TO GROUND	33188	5000mS	• RFCM J2-H4 Telescope In prevented • RFCM J2-G4 Telescope Out prevented • RFCM J2-A3 / RFCM J2-B3 Telescope In / Out Valve disabled • Boom Damping prevented	Short to ground detected on RFCM J2-G4	Power cycled
MAIN TELESCOPE IN VALVE – OPEN CIRCUIT	33189	5000mS	• RFCM J2-H4 Telescope In prevented • Boom Damping prevented	Open-circuit detected on RFCM J2-H4	Power cycled
MAIN TELESCOPE IN VALVE – SHORT TO GROUND	33190	5000mS	• RFCM J2-H4 Telescope In prevented • RFCM J2-G4 Telescope Out prevented • RFCM J2-A3 / RFCM J2-B3 Telescope In / Out Valve disabled • Boom Damping prevented	Short to ground detected on RFCM J2-H4	Power cycled
FORK TILT UP VALVE – OPEN CIRCUIT	33191	5000mS	• RFCM J2-K4 Fork Tilt Up prevented	Machine Setup's AUTO FORK LEVEL is NO, Open-circuit detected on RFCM J2-K4	Power cycled
FORK TILT UP VALVE – OPEN CIRCUIT	33191	5000mS	• RFCM J2-K4 Fork Tilt Up prevented • Main Lift Down prevented	Machine Setup's AUTO FORK LEVEL is YES, Open-circuit detected on RFCM J2-K4	Power cycled
FORK TILT VALVES – SHORT TO BATTERY	33192	5000mS	• RFCM J2-K4 Fork Up prevented • RFCM J2-J4 Fork Down prevented • RFCM J2-C3 / RFCM J2-D3 Fork Tilt Up / Down Valve disabled	Machine Setup's AUTO FORK LEVEL is NO, Short to battery detected on RFCM J2-K4 or RFCM J2-J4	Power cycled
FORK TILT VALVES – SHORT TO BATTERY	33192	5000mS	• RFCM J2-K4 Fork Up prevented • RFCM J2-J4 Fork Down prevented • RFCM J2-C3 / RFCM J2-D3 Fork Tilt Up / Down Valve disabled • Main Lift Up prevented • Main Lift Down prevented	Machine Setup's AUTO FORK LEVEL is YES, Short to battery detected on RFCM J2-K4 or RFCM J2-J4	Power cycled
FORK TILT UP VALVE – SHORT TO GROUND	33193	5000mS	• RFCM J2-K4 Fork Up prevented • RFCM J2-J4 Fork Down prevented • RFCM J2-C3 / RFCM J2-D3 Fork Tilt Up / Down Valve disabled	Machine Setup's AUTO FORK LEVEL is NO, Short to ground detected on RFCM J2-K4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FORK TILT UP VALVE – SHORT TO GROUND	33193	5000mS	• RFCM J2-K4 Fork Up prevented • RFCM J2-J4 Fork Down prevented • RFCM J2-C3 / RFCM J2-D3 Fork Tilt Up / Down Valve disabled • Main Lift Up prevented • Main Lift Down prevented	Machine Setup's AUTO FORK LEVEL is YES, Short to ground detected on RFCM J2-K4	Power cycled
FORK TILT DOWN VALVE – OPEN CIRCUIT	33194	5000mS	• RFCM J2-J4 Fork Tilt Down prevented	Machine Setup's AUTO FORK LEVEL is NO, Open-circuit detected on RFCM J2-J4	Power cycled
FORK TILT DOWN VALVE – OPEN CIRCUIT	33194	5000mS	• RFCM J2-J4 Fork Tilt Down prevented • Main Lift Up prevented	Machine Setup's AUTO FORK LEVEL is YES, Open-circuit detected on RFCM J2-J4	Power cycled
FORK TILT DOWN VALVE – SHORT TO GROUND	33195	5000mS	• RFCM J2-K4 Fork Up prevented • RFCM J2-J4 Fork Down prevented • RFCM J2-C3 / RFCM J2-D3 Fork Tilt Up / Down Valve disabled	Machine Setup's AUTO FORK LEVEL is NO, Short to ground detected on RFCM J2-J4	Power cycled
FORK TILT DOWN VALVE – SHORT TO GROUND	33195	5000mS	• RFCM J2-K4 Fork Up prevented • RFCM J2-J4 Fork Down prevented • RFCM J2-C3 / RFCM J2-D3 Fork Tilt Up / Down Valve disabled • Main Lift Up prevented • Main Lift Down prevented	Machine Setup's AUTO FORK LEVEL is YES, Short to ground detected on RFCM J2-J4	Power cycled
AUXILIARY FUNCTION-A VALVE – OPEN CIRCUIT	33196	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY HYDRAULICS is YES, Open-circuit detected on RFCM J3-D1 / RFCM J2-A4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUXILIARY FUNCTION-A/B VALVES – SHORT TO BATTERY	33197	Continuously	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY HYDRAULICS is YES, Short to battery detected on RFCM J3-D1 / RFCM J3-E1	Power cycled
AUXILIARY FUNCTION-A VALVE – SHORT TO GROUND	33198	Continuously	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY HYDRAULICS is YES, Short to ground detected on RFCM J3-D1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUXILIARY FUNCTION-B VALVE – OPEN CIRCUIT	33199	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY HYDRAULICS is YES, Open-circuit detected on RFCM J3-E1	Power cycled
AUXILIARY FUNCTION-B VALVE – SHORT TO GROUND	33200	Continuously	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY HYDRAULICS is YES, Short to ground detected on RFCM J3-E1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
HYDRAULIC QUICK CONNECT SELECT – OPEN CIRCUIT	33204	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's HYDRAULIC QUICK CONNECT is YES; open-circuit is detected on RFCM J1-F4 Hydraulic Quick Connect Valve for 500mS	Power cycled
HYDRAULIC QUICK CONNECT SELECT – SHORT TO BATTERY	33205	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's HYDRAULIC QUICK CONNECT is YES; short to battery is detected on RFCM J1-F4 Hydraulic Quick Connect Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
HYDRAULIC QUICK CONNECT SELECT – SHORT TO GROUND	33206	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's HYDRAULIC QUICK CONNECT is YES; short to ground is detected on RFCM J1-F4 Hydraulic Quick Connect Valve	Power cycled
HORN – OPEN CIRCUIT	33207	5000mS	• FFCM J2-M3 Horn prevented	Platform or Remote Control Mode; open-circuit is detected on FFCM J2-M3 Horn	Power cycled
HORN – SHORT TO BATTERY	33208	5000mS	• FFCM J2-M3 Horn prevented	Platform or Remote Control Mode; short to battery is detected on FFCM J2-M3 Horn	Power cycled
HORN – SHORT TO GROUND	33209	5000mS	• FFCM J2-M3 Horn prevented	Platform or Remote Control Mode; short to ground is detected on FFCM J2-M3 Horn	Power cycled
AUXILIARY FUNCTION SELECT – OPEN CIRCUIT	33216	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUX. FUNCTION SELECT is YES; Cabin Mode; open-circuit is detected on RFCM J1-E4 Auxiliary Front 1/2 Valve for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUXILIARY FUNCTION SELECT – SHORT TO BATTERY	33217	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUX. FUNCTION SELECT is YES; Cabin Mode; short to battery is detected on RFCM J1-E4 Auxiliary Front 1/2 Valve	Power cycled
AUXILIARY FUNCTION SELECT – SHORT TO GROUND	33218	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUX. FUNCTION SELECT is YES; Cabin Mode; short to ground is detected on RFCM J1-E4 Auxiliary Front 1/2 Valve	Power cycled
FRAME LEVEL LEFT VALVE – OPEN CIRCUIT	33234	5000mS	• Frame Level Left is prevented	Machine Setup's FRAME LEVELING is YES; open circuit is detected on FFCM J1-A4	Power cycled
FRAME LEVEL LEFT VALVE – OPEN CIRCUIT	33234	5000mS	• Frame Level Left is prevented	Machine Setup's FRAME LEVELING is PROP; open circuit is detected on FFCM J1-B4 / FFCM J2-E3	Power cycled
FRAME LEVEL LEFT VALVE – SHORT TO BATTERY	33235	5000mS	• Outriggers are prevented • Frame Level is prevented	Machine Setup's FRAME LEVELING is YES; short to battery is detected on FFCM J1-A4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FRAME LEVEL LEFT VALVE – SHORT TO BATTERY	33235	5000mS	• FFCM J1-B4 Frame Level Left Valve prevented • FFCM J2-F4 Frame Level Right Valve prevented • FFCM J2-E3 / FFCM J2-F3 Frame Level Left / Right Valve prevented	Machine Setup's FRAME LEVELING is PROP; short to battery is detected on FFCM J1-B4 / FFCM J2-E3	Power cycled
FRAME LEVEL LEFT VALVE – SHORT TO GROUND	33236	5000mS	• Frame Level Left is prevented	Machine Setup's FRAME LEVELING is YES; short to ground is detected on FFCM J1-A4	Power cycled
FRAME LEVEL LEFT VALVE – SHORT TO GROUND	33236	5000mS	• Frame Level Left is prevented	Machine Setup's FRAME LEVELING is PROP; short to ground is detected on FFCM J1-B4 / FFCM J2-E3	Power cycled
FRAME LEVEL RIGHT VALVE – OPEN CIRCUIT	33237	5000mS	• Frame Level Right is prevented	Machine Setup's FRAME LEVELING is YES; open circuit is detected on FFCM J1-B3	Power cycled
FRAME LEVEL RIGHT VALVE – OPEN CIRCUIT	33237	5000mS	• Frame Level Right is prevented	Machine Setup's FRAME LEVELING is PROP; open circuit is detected on FFCM J2-F4 / FFCM J2-F3	Power cycled
FRAME LEVEL RIGHT VALVE – SHORT TO BATTERY	33238	5000mS	• Outriggers are prevented • Frame Level is prevented	Machine Setup's FRAME LEVELING is YES; short to battery is detected on FFCM J1-B3	Power cycled
FRAME LEVEL RIGHT VALVE – SHORT TO BATTERY	33238	5000mS	FFCM J1-B4 Frame Level Left Valve prevented FFCM J2-F4 Frame Level Right Valve prevented FFCM J2-E3 / FFCM J2-F3 Frame Level Left / Right Valve prevented	Machine Setup's FRAME LEVELING is PROP; short to battery is detected on FFCM J2-F4 / FFCM J2-F3	Power cycled
FRAME LEVEL RIGHT VALVE – SHORT TO GROUND	33239	5000mS	Frame Level Right is prevented	Machine Setup's FRAME LEVELING is YES; short to ground is detected on FFCM J1-B3	Power cycled
FRAME LEVEL RIGHT VALVE – SHORT TO GROUND	33239	5000mS	Frame Level Right is prevented	Machine Setup's FRAME LEVELING is PROP; short to ground is detected on FFCM J2-F4 / FFCM J2-F3	Power cycled
CRAB STEER VALVE – OPEN CIRCUIT	33270	5000mS	Steer Mode Change prevented	Open-circuit is detected on FFCM J3-A1	Power cycled
CRAB STEER VALVE – SHORT TO BATTERY	33271	5000mS	Steer Mode Change prevented	Short to battery is detected on FFCM J3-A1	Power cycled
CRAB STEER VALVE – SHORT TO GROUND	33272	5000mS	Steer Mode Change prevented	Short to ground is detected on FFCM J3-A1	Power cycled
ALL WHEEL STEER VALVE – OPEN CIRCUIT	33273	5000mS	Steer Mode Change prevented	Open-circuit is detected on FFCM J3-F1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
ALL WHEEL STEER VALVE – SHORT TO BATTERY	33274	5000mS	Steer Mode Change prevented	Short to battery is detected on FFCM J3-F1	Power cycled
ALL WHEEL STEER VALVE – SHORT TO GROUND	33275	5000mS	Steer Mode Change prevented	Short to ground is detected on FFCM J3-F1	Power cycled
APU PUMP RELAY – OPEN CIRCUIT	33276	5000mS	Platform Auxiliary Pump Relay prevented	Machine Setup's PLATFORM OPTION is YES; open-circuit detected on FFCM J3-B1 Platform Auxiliary Pump Relay	Power cycled
APU PUMP RELAY – SHORT TO BATTERY	33277	Continuously	Platform Auxiliary Pump Relay prevented	Machine Setup's PLATFORM OPTION is YES; short to battery detected on FFCM J3-B1 Platform Auxiliary Pump Relay	Power cycled
APU PUMP RELAY – SHORT TO GROUND	33278	5000mS	Platform Auxiliary Pump Relay prevented	Machine Setup's PLATFORM OPTION is YES; short to ground detected on FFCM J3-B1 Platform Auxiliary Pump Relay	Power cycled
ENGAGE STARTER OUTPUT – SHORT TO BATTERY	33283	Continuously	Engine Start is prevented	Short to battery is detected on FFCM J2-L4	Power cycled
ENGAGE STARTER OUTPUT – SHORT TO GROUND	33284	5000mS	Engine Start is prevented	Short to ground is detected on FFCM J2-L4	Power cycled
FRONT MOTOR - CURRENT FEEDBACK READING TOO LOW	33286	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J2-K4 / J2-D3 Motor Displacement Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT and one of the following occur: • TCM J2-K4 / J2-D3 Motor Displacement Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • TCM J2-K4 / J2-D3 Motor Displacement Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power Cycled
LIFT – CURRENT FEEDBACK READING TOO LOW	33287	5000mS	• RFCM J2-F4 Lift Up prevented • RFCM J2-E4Lift Down prevented • RFCM J2-F3 / RFCM J2-E3 Main Lift Up / Down Valve disabled • Boom Ride prevented • Boom Damping prevented	Current Feedback Faults are enabled and one of the following occurs: • RFCM J2-F3 / RFCM J2-E3 Main Lift Up / Down Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • RFCM J2-F3 / RFCM J2-E3 Main Lift Up / Down Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TELESCOPE – CURRENT FEEDBACK READING TOO LOW	33288	5000mS	• Telescope In prevented • Telescope Out prevented • RFCM J2-A3 / B3 Telescope In / Out Valve disabled • Boom Damping prevented	Current Feedback Faults are enabled and one of the following occurs: • RFCM J2-A3 / B3 Telescope In / Out Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • RFCM J2-A3 / B3 Telescope In / Out Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
FORK TILT – CURRENT FEEDBACK READING TOO LOW	33290	5000mS	• Fork Up prevented • Fork Down prevented • RFCM J2-K4 / J4 Fork Up / Down Valve disabled	Machine Setup's AUTO FORK LEVEL is NO, Current Feedback Faults are enabled and one of the following occurs: • RFCM J2-K4 / J4 Fork Up / Down Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • RFCM J2-K4 / J4 Fork Up / Down Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
FORK TILT – CURRENT FEEDBACK READING TOO LOW	33290	5000mS	Fork Up prevented Fork Down prevented RFCM J2-K4 / J4 Fork Up / Down Valve disabled Main Lift Up prevented Main Lift Down prevented	Machine Setup's AUTO FORK LEVEL is YES, Current Feedback Faults are enabled and one of the following occurs: • RFCM J2-K4 / J4 Fork Up / Down Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • RFCM J2-K4 / J4 Fork Up / Down Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
AUXILIARY HYDRAULICS – CURRENT FEEDBACK READING TOO LOW	33291	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY HYDRAULICS is YES, Current Feedback Faults are enabled and one of the following occurs: • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
FRONT MOTOR SWIVEL ANGLE - OPEN CIRCUIT	33292	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J2-K4 / J2-D3 Motor Displacement Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, open circuit detected on TCM J2-K4 / J2-D3 Motor Displacement Valve	Power Cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FRONT MOTOR SWIVEL ANGLE - SHORT TO BATTERY	33293	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J2-K4 / J2-D3 Motor Displacement Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to battery detected on TCM J2-K4 / J2-D3 Motor Displacement Valve	Power Cycled
FRONT MOTOR SWIVEL ANGLE - SHORT TO GROUND	33294	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J2-K4 / J2-D3 Motor Displacement Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to ground detected on TCM J2-K4 / J2-D3 Motor Displacement Valve	Power Cycled
DRIVE FORWARD VALVE - OPEN CIRCUIT	33317	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, open circuit detected on TCM J2-F4 / J2-F3 Drive Forward Valve	Power Cycled
DRIVE FORWARD VALVE - SHORT TO BATTERY	33318	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to battery detected on TCM J2-F4 / J2-F3 Drive Forward Valve	Power Cycled
DRIVE FORWARD VALVE - SHORT TO GROUND	33319	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to ground detected on TCM J2-F4 / J2-F3 Drive Forward Valve	Power Cycled
DRIVE REVERSE VALVE - OPEN CIRCUIT	33320	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, open circuit detected on TCM J2-H4 / J2-B3 Drive Reverse Valve	Power Cycled
DRIVE REVERSE VALVE - SHORT TO BATTERY	33321	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to battery detected on TCM J2-H4 / J2-B3 Drive Reverse Valve	Power Cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
DRIVE REVERSE VALVE - SHORT TO GROUND	33322	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to ground detected on TCM J2-H4 / J2-B3 Drive Reverse Valve	Power Cycled
FRAME LEVEL – CURRENT FEEDBACK READING TOO LOW	33336	5000mS	FFCM J1-B4 Frame Level Left Valve prevented FFCM J2-F4 Frame Level Right Valve prevented FFCM J2-E3 / FFCM J2-F3 Frame Level Left / Right Valve prevented	Machine Setup's FRAME LEVEL is PROP, Current Feedback Faults are enabled, and one of the following occur: • FFCM J2-E3 / FFCM J2-F3 Frame Level Left / Right Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J2-E3 / FFCM J2-F3 Frame Level Left / Right Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
BOOM RIDE VALVE – SHORT TO BATTERY	33337	5000mS	• Main Lift Up prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE or RIDE&FLOAT; short to battery is detected on RFCM J1-A4	Power cycled
BOOM RIDE VALVE – SHORT TO GROUND	33338	5000mS	• Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE or RIDE&FLOAT; short to ground is detected on RFCM J1-A4	Power cycled
BOOM RIDE VALVE – OPEN CIRCUIT	33339	5000mS	• Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE or RIDE&FLOAT; open-circuit is detected on RFCM J1-A4	Power cycled
BOOM TANK VALVE – SHORT TO BATTERY	33343	5000mS	• Main Lift Up prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE or RIDE&FLOAT; short to battery is detected on RFCM J1-B3	Power cycled
BOOM TANK VALVE – SHORT TO GROUND	33344	5000mS	• Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE or RIDE&FLOAT; short to ground is detected on RFCM J1-B3	Power cycled
BOOM TANK VALVE – OPEN CIRCUIT	33345	5000mS	• Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE or RIDE&FLOAT; open-circuit is detected on RFCM J1-B3	Power cycled
BOOM FLOAT VALVE – SHORT TO BATTERY	33340	5000mS	• Main Lift Up prevented • Boom Ride prevented • Boom Float prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE&FLOAT; short to battery is detected on RFCM J1-A3	Power cycled
BOOM FLOAT VALVE – SHORT TO GROUND	33341	5000mS	• Boom Ride prevented • Boom Float prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE&FLOAT; short to ground is detected on RFCM J1-A3	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BOOM FLOAT VALVE – OPEN CIRCUIT	33342	5000mS	• Boom Ride prevented • Boom Float prevented	Machine Setup's BOOM RIDE&FLOAT is RIDE&FLOAT; open-circuit is detected on RFCM J1-A3	Power cycled
ANTI-STALL VALVE – SHORT TO BATTERY	33426	5000mS	• FFCM J2-K4 Anti-Stall Valve prevented • FFCM J2-D3 Anti-Stall Valve prevented • Anti-Stall Valve Command is 0mA • Anti-Stall Valve Actual is 0mA If Machine Setup's MODEL is TL943 and ENGINE CONTROL is CAT C36 S5 55KW: • Engine De-Rate for Pump Overspeed Protection is enforced (engine speed restricted to 2250RPM)	GEN3 HP Management configured; short to battery is detected on FFCM J2-D3 / FFCM J2-K4	Power cycled
ANTI-STALL VALVE – OPEN CIRCUIT	33427	5000mS	• FFCM J2-K4 Anti-Stall Valve prevented • FFCM J2-D3 Anti-Stall Valve prevented • Anti-Stall Valve Command is 0mA • Anti-Stall Valve Actual is 0mA If Machine Setup's MODEL is TL943 and ENGINE CONTROL is CAT C36 S5 55KW: • Engine De-Rate for Pump Overspeed Protection is enforced (engine speed restricted to 2250RPM)	GEN3 HP Management configured; open-circuit is detected on FFCM J2-D3 / FFCM J2-K4	Power cycled
ANTI-STALL VALVE – SHORT TO GROUND	33428	5000mS	• FFCM J2-K4 Anti-Stall Valve prevented • FFCM J2-D3 Anti-Stall Valve prevented • Anti-Stall Valve Command is 0mA • Anti-Stall Valve Actual is 0mA If Machine Setup's MODEL is TL943 and ENGINE CONTROL is CAT C36 S5 55KW: • Engine De-Rate for Pump Overspeed Protection is enforced (engine speed restricted to 2250RPM)	GEN3 HP Management configured; short to ground is detected on FFCM J2-D3 / FFCM J2-K4	Power cycled
BACKLIGHTING – SHORT TO GROUND	33488	5000mS	CCM J1-G4 Backlighting digital output is prevented	Short to ground detected on CCM J1-G4 Backlighting	Power cycled
FRONT MARKER LIGHT – SHORT TO GROUND	33489	5000mS	• FFCM J3-G2 Left Marker Light prevented • FFCM J3-H1 Right Marker Light prevented	Short to ground detected on FFCM J3-G2 or FFCM J3-H1	Power cycled
FOG LIGHTS – SHORT TO GROUND	33491	5000mS	• RFCM J2-M4 Fog Lights digital output is prevented	Short to ground on RFCM J2-M4 Fog Lights	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CCM ANALOG GROUND – SHORT TO BATTERY	33493	5000mS	• Throttle Position is 0% • Outrigger Left Joystick is 0% • Outrigger Right Joystick is 0% • Rear Auxiliary 1 Joystick is 0% • Rear Auxiliary 2 Joystick is 0% • Proportional Travel Speed is 0% • Brake Pedal Position is 0%	Current limit detected on protected FET for CCM analog ground Note: Check that CCM J1-B1, J2-G1, and J2-L3 Analog Ground are 0+/-0.1V.	Power cycled
FFCM ANALOG GROUND – SHORT TO BATTERY	33494	5000mS	• Hydraulic Oil Temperature is +150°C • Intercooler Air Temperature is +150°C • Transmission Oil Temperature is +150°C • Intercooler Air Temperature is +150°C • Outrigger Left Extend Pressure is 0 PSI / BAR • Outrigger Left Retract Pressure is 0 PSI / BAR • Outrigger Left Not Set • Outrigger Right Extend Pressure is 0 PSI / BAR • Outrigger Right Retract Pressure is 0 PSI / BAR • Outrigger Right Not Set • Fuel Level assumed to be Empty (0.0%) • Brake Pedal Pressure is 3000PSI • De-Clutch prevented • Service Brake Relay Pressure is 3000 PSI (max)	Current limit detected on protected FET for FFCM analog ground Note: Check that FFCM J2-G3, J2-H3, J2-J3, J2-K3, J3-A3, J3-B3, and J3-C3 Analog Ground are 0+/-0.1V.	Power cycled
RFCM ANALOG GROUND – SHORT TO BATTERY	33495	5000mS	• Boom Angle Sensor is +99° • Lift Up speed de-rated • Load Stability assumed to be 100% • HIRAS Mode is forced to ERROR • Start HIRAS Integrity Checks is prevented • HIRAS Pressure PT1 is assumed to be 600.0 BAR • HIRAS Pressure PT2 is assumed to be 600.0 BAR • HIRAS Pressure PT3 is assumed to be 600.0 BAR • Boom Damping prevented	Current limit detected on protected FET for RFCM analog ground Note: Check that RFCM J2-G3, J2-H3, J2-J3, J2-K3, J3-A3, J3-B3, and J3-C3 Analog Ground are 0+/-0.1V.	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LCM ANALOG GROUND – SHORT TO BATTERY	33496	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Length Measurement is maximum (Lmax)	Machine Setup's LOAD MOMENT IND SYSTEM is YES, PLATFORM OPTION is YES, or WEIGH LOAD is YES; current limit detected on protected FET for LCM analog ground Note: Check that LCM J2-G3, J2-H3, J2-J3, J2-K3, J3-A3, J3-B3, and J3-C3 Analog Ground are 0+/-0.1V.	Power cycled
OUTRIGGER LEFT UP VALVE – SHORT TO BATTERY	33500	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; short to battery is detected on FFCM J1-B4	Power cycled
OUTRIGGER LEFT UP VALVE – SHORT TO GROUND	33501	5000mS	• Outrigger Left Up prevented	Machine Setup's OUTRIGGERS is YES; short to ground is detected on FFCM J1-B4	Power cycled
OUTRIGGER LEFT UP VALVE – OPEN CIRCUIT	33502	5000mS	• Outrigger Left Up prevented	Machine Setup's OUTRIGGERS is YES; open circuit is detected on FFCM J1-B4	Power cycled
OUTRIGGER LEFT DOWN VALVE – SHORT TO BATTERY	33503	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; short to battery is detected on FFCM J1-C4	Power cycled
OUTRIGGER LEFT DOWN VALVE – SHORT TO GROUND	33504	5000mS	• Outrigger Left Down prevented	Machine Setup's OUTRIGGERS is YES; short to ground is detected on FFCM J1-C4	Power cycled
OUTRIGGER LEFT DOWN VALVE – OPEN CIRCUIT	33505	5000mS	• Outrigger Left Down prevented	Machine Setup's OUTRIGGERS is YES; open circuit is detected on FFCM J1-C4	Power cycled
OUTRIGGER RIGHT UP VALVE – SHORT TO BATTERY	33506	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; short to battery is detected on FFCM J1-D3	Power cycled
OUTRIGGER RIGHT UP VALVE – SHORT TO GROUND	33507	5000mS	• Outrigger Right Up prevented	Machine Setup's OUTRIGGERS is YES; short to ground is detected on FFCM J1-D3	Power cycled
OUTRIGGER RIGHT UP VALVE – OPEN CIRCUIT	33508	5000mS	• Outrigger Right Up prevented	Machine Setup's OUTRIGGERS is YES; open circuit is detected on FFCM J1-D3	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OUTRIGGER RIGHT DOWN VALVE – SHORT TO BATTERY	33509	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; short to battery is detected on FFCM J1-F4	Power cycled
OUTRIGGER RIGHT DOWN VALVE – SHORT TO GROUND	33510	5000mS	• Outrigger Right Down prevented	Machine Setup's OUTRIGGERS is YES; short to ground is detected on FFCM J1-F4	Power cycled
OUTRIGGER RIGHT DOWN VALVE – OPEN CIRCUIT	33511	5000mS	• Outrigger Right Down prevented	Machine Setup's OUTRIGGERS is YES; open circuit is detected on FFCM J1-F4	Power cycled
LOW BEAM – SHORT TO GROUND	33512	5000mS	• Low Beam digital output prevented	Short to ground detected on FFCM J3-G3 or FFCM J3-H4	Power cycled
HIGH BEAM – SHORT TO GROUND	33513	5000mS	• High Beam digital output prevented	Short to ground detected on FFCM J3-G1 or FFCM J3-H2	Power cycled
ANTI-STALL VALVE – CURRENT FEEDBACK READING TOO LOW	33514	5000mS	• FFCM J2-K4 Anti-Stall Valve prevented • FFCM J2-D3 Anti-Stall Valve prevented • Anti-Stall Valve Command is 0mA • Anti-Stall Valve Actual is 0mA If Machine Setup's MODEL is TL943 and ENGINE CONTROL is CAT C36 S5 55KW: • Engine De-Rate for Pump Overspeed Protection is enforced (engine speed restricted to 2250RPM)	GEN3 HP Management configured, Current Feedback Faults are enabled, and one of the following conditions exist: • FFCM J2-K4 / FFCM J2-D3 Anti-Stall Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J2-K4 / FFCM J2-D3 Anti-Stall Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
OUTRIGGER/ FRAME LEVEL SPEED VALVE – SHORT TO BATTERY	33515	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; short to battery is detected on FFCM J2-F3 / FFCM J2-F4	Power cycled
OUTRIGGER/ FRAME LEVEL SPEED VALVE – SHORT TO GROUND	33516	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; short to ground is detected on FFCM J2-F3 / FFCM J2-F4	Power cycled
OUTRIGGER/ FRAME LEVEL SPEED VALVE – OPEN CIRCUIT	33517	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES; open-circuit is detected on FFCM J2-F3 / FFCM J2-F4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OUTRIGGER/ FRAME LEVEL SPEED VALVE – CURRENT FEEDBACK READING TOO LOW	33518	5000mS	• Outriggers prevented • Frame Level prevented	Machine Setup's OUTRIGGERS is YES, Current Feedback Faults are enabled, and one of the following occur: FFCM J2-F4 / FFCM J2-F3 Outrigger / Frame Level Speed Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS FFCM J2-F4 / FFCM J2-F3 Outrigger / Frame Level Speed Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
FRONT LEFT TURN LIGHT – SHORT TO BATTERY	33645	5000mS	• Left Turn Indicator flashes at increased rate	Short to battery detected on FFCM J3-H3	Power cycled
FRONT LEFT TURN LIGHT – SHORT TO GROUND	33519	5000mS	• Left Turn Light digital output prevented (FFCM) • Left Turn Indicator flashes at increased rate	Short to ground detected on FFCM J3-H3	Power cycled
FRONT LEFT TURN LIGHT – OPEN CIRCUIT	33646	5000mS	• Left Turn Indicator flashes at increased rate	Machine Setup's ROAD LIGHTING is YES; open circuit detected on FFCM J3-H3	Power cycled
FRONT RIGHT TURN LIGHT – SHORT TO BATTERY	33647	5000mS	• Right Turn Indicator flashes at increased rate	Short to battery detected on FFCM J2-L3	Power cycled
FRONT RIGHT TURN LIGHT – SHORT TO GROUND	33520	5000mS	• Right Turn Light digital output prevented (FFCM) • Right Turn Indicator flashes at increased rate	Short to ground detected on FFCM J2-L3	Power cycled
FRONT RIGHT TURN LIGHT – OPEN CIRCUIT	33648	5000mS	• Right Turn Indicator flashes at increased rate	Machine Setup's ROAD LIGHTING is YES; open circuit detected on FFCM J2-L3	Power cycled
REAR LEFT TURN LIGHT – SHORT TO BATTERY	33649	5000mS	• Left Turn Indicator flashes at increased rate	Short to battery detected on RFCM J3-H3	Power cycled
REAR LEFT TURN LIGHT – SHORT TO GROUND	33527	5000mS	• Left Turn Light digital output prevented (RFCM) • Left Turn Indicator flashes at increased rate	Short to ground detected on RFCM J3-H3	Power cycled
REAR LEFT TURN LIGHT – OPEN CIRCUIT	33650	5000mS	• Left Turn Indicator flashes at increased rate	Machine Setup's ROAD LIGHTING is YES and LED TAILLIGHT is NO; open circuit detected on RFCM J3-H3	Power cycled
REAR RIGHT TURN LIGHT – SHORT TO BATTERY	33651	5000mS	• Right Turn Indicator flashes at increased rate	Short to battery detected on RFCM J2-L3	Power cycled
REAR RIGHT TURN LIGHT – SHORT TO GROUND	33528	5000mS	• Right Turn Light digital output prevented (RFCM) • Right Turn Indicator flashes at increased rate	Short to ground detected on RFCM J2-L3	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR RIGHT TURN LIGHT – OPEN CIRCUIT	33652	5000mS	• Right Turn Indicator flashes at increased rate	Machine Setup's ROAD LIGHTING is YES and LED TAILLIGHT is NO; open circuit detected on RFCM J2-L3	Power cycled
REAR MARKER LIGHT – SHORT TO GROUND	33529	5000mS	• Marker Light digital output prevented (RFCM)	Short to ground detected on RFCM J3-G2 or RFCM J3-H1	Power cycled
BRAKE LIGHTS – SHORT TO GROUND	33530	5000mS	• RFCM J3-G1 Left Brake Light digital output prevented • RFCM J3-H2 Right Brake Light digital output prevented	Short to ground detected on RFCM J3-G1 or RFCM J3-H2	Power cycled
REVERSE LIGHTS – SHORT TO GROUND	33531	5000mS	• RFCM J3-G3 Left Reverse Light digital output prevented • RFCM J3-H4 Right Reverse Light digital output prevented	Short to ground detected on RFCM J3-G3 or RFCM J3-H4	Power cycled
REVERSE ALARM – SHORT TO GROUND	33532	5000mS	• RFCM J2-L4 Reverse Alarm digital output prevented	Short to ground detected on RFCM J2-L4	Power cycled
REAR AXLE STAB 1 VALVE – SHORT TO BATTERY	33521	5000mS	• RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve prevented • RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve prevented	Machine Setup's REAR AXLE STAB is G-SERIES; short to battery is detected on RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve	Power cycled
REAR AXLE STAB 1 VALVE – SHORT TO GROUND	33522	5000mS	• RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve prevented • RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve prevented	Machine Setup's REAR AXLE STAB is G-SERIES; short to ground is detected on RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve	Power cycled
REAR AXLE STAB 1 VALVE – OPEN CIRCUIT	33523	5000mS	• RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve prevented • RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve prevented	Machine Setup's REAR AXLE STAB is G-SERIES; open-circuit is detected on RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve	Power cycled
REAR AXLE STAB 2 VALVE – SHORT TO BATTERY	33524	5000mS	• RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve prevented • RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve prevented	Machine Setup's REAR AXLE STAB is G-SERIES; short to battery is detected on RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve	Power cycled
REAR AXLE STAB 2 VALVE – SHORT TO GROUND	33525	5000mS	• RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve prevented • RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve prevented	Machine Setup's REAR AXLE STAB is G-SERIES; short to ground is detected on RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve	Power cycled
REAR AXLE STAB 2 VALVE – OPEN CIRCUIT	33526	5000mS	• RFCM J1-C4 / RFCM J2-D4 RAS Float 1 Valve prevented • RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve prevented	Machine Setup's REAR AXLE STAB is G-SERIES; open-circuit is detected on RFCM J1-D3 / RFCM J2-C4 RAS Float 2 Valve	Power cycled
IGNITION RELAY – SHORT TO BATTERY	33533	Continuously	• Hydraulic functions are prevented • Engine start prevented	Short to battery detected on CCM J1-H3 Ignition Relay at power-up	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BLOCKING VALVE – SHORT TO BATTERY	33534	Continuously	• Hydraulic functions are prevented • Blocking Valve prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BLOCKING VALVE is YES; Short to battery detected on FFCM J2-E4	Power cycled
BLOCKING VALVE – SHORT TO GROUND	33535	Continuously	• Hydraulic functions are prevented • Blocking Valve prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BLOCKING VALVE is YES; Short to ground detected on FFCM J2-E4	Power cycled
BLOCKING VALVE – OPEN CIRCUIT	33536	Continuously	• Hydraulic functions are prevented • Blocking Valve prevented • Boom Ride prevented • Boom Float prevented • Boom Damping prevented	Machine Setup's BLOCKING VALVE is YES; Open-circuit detected on FFCM J2-E4	Power cycled
AUXILIARY FRONT / REAR SELECT – OPEN CIRCUIT	33569	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY F/R SELECT is YES; open-circuit is detected on RFCM J1-B4 Auxiliary Front / Rear Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUXILIARY FRONT / REAR SELECT – SHORT TO BATTERY	33570	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY F/R SELECT is YES; short to battery is detected on RFCM J1-B4 Auxiliary Front / Rear Valve	Power cycled
AUXILIARY FRONT / REAR SELECT – SHORT TO GROUND	33571	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY F/R SELECT is YES; short to ground is detected on RFCM J1-B4 Auxiliary Front / Rear Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUXILIARY REAR SELECT – OPEN CIRCUIT	33572	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY REAR SELECT is YES; open-circuit is detected on RFCM J1-D4 Auxiliary Rear 1/2 Valve	Power cycled
AUXILIARY REAR SELECT – SHORT TO BATTERY	33573	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY REAR SELECT is YES; short to battery is detected on RFCM J1-D4 Auxiliary Rear 1/2 Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
AUXILIARY REAR SELECT – SHORT TO GROUND	33574	5000mS	• RFCM J3-D1 Auxiliary A prevented • RFCM J3-E1 Auxiliary B prevented • RFCM J2-A4 / RFCM J2-B4 Auxiliary A / Auxiliary B Valve prevented • RFCM J1-E4 Auxiliary Front 1/2 Valve prevented • RFCM J1-D4 Auxiliary Rear 1/2 Valve prevented • RFCM J1-B4 Auxiliary Front / Rear Valve prevented • Auxiliary De-Compression prevented • Continuous Auxiliary Hydraulics prevented • Hydraulic Quick Connect prevented	Machine Setup's AUXILIARY REAR SELECT is YES; short to ground is detected on RFCM J1-D4 Auxiliary Rear 1/2 Valve	Power cycled
LIGHT TOWER GREEN – SHORT TO BATTERY	33581	5000mS	LCM J2-H4 Light Tower Green prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES; short to battery is detected on LCM J2-H4	Power cycled
LIGHT TOWER GREEN – SHORT TO GROUND	33582	5000mS	LCM J2-H4 Light Tower Green prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES; short to ground is detected on LCM J2-H4	Power cycled
LIGHT TOWER YELLOW – SHORT TO BATTERY	33583	5000mS	LCM J2-E4 Light Tower Yellow prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES; short to battery is detected on LCM J2-E4	Power cycled
LIGHT TOWER YELLOW – SHORT TO GROUND	33584	5000mS	LCM J2-E4 Light Tower Yellow prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES; short to ground is detected on LCM J2-E4	Power cycled
LIGHT TOWER RED – SHORT TO BATTERY	33585	5000mS	LCM J2-F4 Light Tower Red prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES; short to battery is detected on LCM J2-F4	Power cycled
LIGHT TOWER RED – SHORT TO GROUND	33586	5000mS	LCM J2-F4 Light Tower Red prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES; short to ground is detected on LCM J2-F4	Power cycled
PLATFORM PRESSURE REDUCING VALVE – OPEN CIRCUIT	33587	5000mS	• LCM J2-K4 Platform Pressure Reducing Valve prevented • Transition to Platform Mode prevented	Machine Setup's PLATFORM OPTION is YES; MARKET is ANSI or ANSI EXPORT; open circuit detected on LCM J2-K4	Power cycled
PLATFORM PRESSURE REDUCING VALVE – SHORT TO BATTERY	33588	5000mS	• LCM J2-K4 Platform Pressure Reducing Valve prevented • Transition to Platform Mode prevented	Machine Setup's PLATFORM OPTION is YES; MARKET is ANSI or ANSI EXPORT; short to battery detected on LCM J2-K4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
PLATFORM PRESSURE REDUCING VALVE – SHORT TO GROUND	33589	5000mS	• LCM J2-K4 Platform Pressure Reducing Valve prevented • Transition to Platform Mode prevented	Machine Setup's PLATFORM OPTION is YES; MARKET is ANSI or ANSI EXPORT; short to ground detected on LCM J2-K4	Power cycled
REAR AXLE RATE 1 VALVE – SHORT TO BATTERY	33590	5000mS	• RAS Mode is forced to RAS Lock • RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve prevented • RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve prevented • Frame Level Left / Right prevented	Machine Setup's REAR AXLE STAB is SKYTRAK; short to battery is detected on RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve	Power cycled
REAR AXLE RATE 1 VALVE – SHORT TO GROUND	33591	5000mS	• RAS Mode is forced to RAS Lock • RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve prevented • RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve prevented • Frame Level Left / Right prevented	Machine Setup's REAR AXLE STAB is SKYTRAK; short to ground is detected on RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve	Power cycled
REAR AXLE RATE 1 VALVE – OPEN CIRCUIT	33592	5000mS	• RAS Mode is forced to RAS Lock • RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve prevented • RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve prevented • Frame Level Left / Right prevented	Machine Setup's REAR AXLE STAB is SKYTRAK; open-circuit is detected on RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve (only detected at power-up)	Power cycled
REAR AXLE RATE 2 VALVE – SHORT TO BATTERY	33593	5000mS	• RAS Mode is forced to RAS Lock • RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve prevented • RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve prevented • Frame Level Left / Right prevented	Machine Setup's REAR AXLE STAB is SKYTRAK; short to battery is detected on RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve	Power cycled
REAR AXLE RATE 2 VALVE – SHORT TO GROUND	33594	5000mS	• RAS Mode is forced to RAS Lock • RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve prevented • RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve prevented • Frame Level Left / Right prevented	Machine Setup's REAR AXLE STAB is SKYTRAK; short to ground is detected on RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE RATE 2 VALVE – OPEN CIRCUIT	33595	5000mS	• RAS Mode is forced to RAS Lock • RFCM J1-B4 / RFCM J2-C4 RAS Rate 1 Valve prevented • RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve prevented • Frame Level Left / Right prevented	Machine Setup's REAR AXLE STAB is SKYTRAK; open-circuit is detected on RFCM J1-D4 / RFCM J2-D4 RAS Rate 2 Valve (only detected at power-up)	Power cycled
HITCH UP VALVE – OPEN CIRCUIT	33599	5000mS	• RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve prevented • RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve prevented	Hitch Configured; open circuit detected on RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve	Power cycled
HITCH UP VALVE – SHORT TO BATTERY	33600	5000mS	• RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve prevented • RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve prevented	Hitch Configured; short to battery detected on RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve	Power cycled
HITCH UP VALVE – SHORT TO GROUND	33601	5000mS	• RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve prevented • RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve prevented	Hitch Configured; short to ground detected on RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve	Power cycled
HITCH DOWN VALVE – OPEN CIRCUIT	33602	5000mS	• RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve prevented • RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve prevented	Hitch Configured; open circuit detected on RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve	Power cycled
HITCH DOWN VALVE – SHORT TO BATTERY	33603	5000mS	• RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve prevented • RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve prevented	Hitch Configured; short to battery detected on RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve	Power cycled
HITCH DOWN VALVE – SHORT TO GROUND	33604	5000mS	• RFCM J1-C4 / RFCM J2-D4 Hitch Up Valve prevented • RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve prevented	Hitch Configured; short to ground detected on RFCM J1-D3 / RFCM J2-C4 Hitch Down Valve	Power cycled
REAR AXLE LOCK CONTROL VALVE 1 – SHORT TO BATTERY	33612	5000mS	• FFCM J1-H3 HIRAS Lock Control Valve 1 is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to battery is detected on FFCM J1-H3 HIRAS Lock Control Valve 1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE LOCK CONTROL VALVE 1 – SHORT TO GROUND	33613	5000mS	• FFCM J1-H3 HIRAS Lock Control Valve 2 is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to ground is detected on FFCM J1-H3 HIRAS Lock Control Valve 1	Power cycled
REAR AXLE LOCK CONTROL VALVE 1 – OPEN CIRCUIT	33614	5000mS	• FFCM J1-H3 HIRAS Lock Control Valve 2 is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; open circuit is detected on FFCM J1-H3 HIRAS Lock Control Valve 1	Power cycled
REAR AXLE LOCK CONTROL VALVE 1 – CURRENT FEEDBACK READING TOO LOW	33615	5000mS	• LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 prevented • LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 prevented	Machine Setup's REAR AXLE STAB is RALP and one of the following occur: LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 measured current is 250mA less than command when command is greater than 500mA for 1000mS LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
REAR AXLE LOCK CONTROL VALVE 2 – SHORT TO BATTERY	33616	5000mS	• FFCM J1-H4 HIRAS Lock Control Valve 2 is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to battery is detected on FFCM J1-H4 HIRAS Lock Control Valve 2	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE LOCK CONTROL VALVE 2 – SHORT TO GROUND	33617	5000mS	• FFCM J1-H4 HIRAS Lock Control Valve 2 is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to ground is detected on FFCM J1-H4 HIRAS Lock Control Valve 2	Power cycled
REAR AXLE LOCK CONTROL VALVE 2 – OPEN CIRCUIT	33618	5000mS	• FFCM J1-H4 HIRAS Lock Control Valve 2 is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; open circuit is detected on FFCM J1-H4 HIRAS Lock Control Valve 2	Power cycled
REAR AXLE LOCK CONTROL VALVE 2 – CURRENT FEEDBACK READING TOO LOW	33619	5000mS	• LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 prevented • LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 prevented	Machine Setup's REAR AXLE STAB is RALP and one of the following occur: LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 measured current is 250mA less than command when command is greater than 500mA for 1000mS LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
REAR AXLE TANK VALVE – SHORT TO BATTERY	33620	5000mS	• LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 prevented • LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 prevented • LCM J3-E1 / LCM J2-E3 RALP Tank Valve prevented	Machine Setup's REAR AXLE STAB is RALP; short to battery is detected on LCM J3-E1 / LCM J2-E3 RALP Tank Valve	Power cycled
REAR AXLE TANK VALVE – SHORT TO GROUND	33621	5000mS	• LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 prevented • LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 prevented • LCM J3-E1 / LCM J2-E3 RALP Tank Valve prevented	Machine Setup's REAR AXLE STAB is RALP; short to ground is detected on LCM J3-E1 / LCM J2-E3 RALP Tank Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE TANK VALVE – OPEN CIRCUIT	33622	5000mS	• LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 prevented • LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 prevented • LCM J3-E1 / LCM J2-E3 RALP Tank Valve prevented	Machine Setup's REAR AXLE STAB is RALP; open-circuit is detected on LCM J3-E1 / LCM J2-E3 RALP Tank Valve	Power cycled
REAR AXLE TANK VALVE – CURRENT FEEDBACK READING TOO LOW	33623	5000mS	• LCM J2-J4 / LCM J2-A3 RALP Lock Control Valve 1 prevented • LCM J3-D1 / LCM J2-C3 RALP Lock Control Valve 2 prevented • LCM J3-E1 / LCM J2-E3 RALP Tank Valve prevented	Machine Setup's REAR AXLE STAB is RALP and one of the following occur: • LCM J3-E1 / LCM J2-E3 RALP Tank Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • LCM J3-E1 / LCM J2-E3 RALP Tank Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
TRAILER BRAKE VALVE – SHORT TO BATTERY	33630	5000mS	Trailer Brake Valve prevented	Machine Setup's TRAILER BRAKE is ITALIAN; short to battery is detected on RFCM J1-C3	Power cycled
TRAILER BRAKE VALVE – SHORT TO GROUND	33631	5000mS	Trailer Brake Valve prevented	Machine Setup's TRAILER BRAKE is ITALIAN; short to ground is detected on RFCM J1-C3	Power cycled
TRAILER BRAKE VALVE – OPEN CIRCUIT	33632	5000mS	Trailer Brake Valve prevented	Machine Setup's TRAILER BRAKE is ITALIAN; open-circuit is detected on RFCM J1-C3	Power cycled
TRAILER LEFT TURN LIGHT – SHORT TO BATTERY	33659	5000mS	Trailer Turn Indicator flashes at increased rate	Machine Setup's VEHICLE is LBP-AG; short to battery detected on RFCM J1-G3 Trailer Left Turn Light	Power cycled
TRAILER LEFT TURN LIGHT – SHORT TO GROUND	33660	5000mS	• RFCM J1-G3 Trailer Left Turn Light digital output prevented • Trailer Turn Indicator flashes at increased rate	Machine Setup's VEHICLE is LBP-AG; short to ground detected on RFCM J1-G3 Trailer Left Turn Light	Power cycled
TRAILER LEFT TURN LIGHT – OPEN CIRCUIT	33661	5000mS	Trailer Turn Indicator flashes at increased rate	Machine Setup's VEHICLE is LBP-AG; trailer connected; open circuit detected on RFCM J1-G3 Trailer Left Turn Light for 3000mS	Power cycled
TRAILER RIGHT TURN LIGHT – SHORT TO BATTERY	33662	5000mS	Trailer Turn Indicator flashes at increased rate	Machine Setup's VEHICLE is LBP-AG; short to battery detected on RFCM J1-H3 Trailer Right Turn Light	Power cycled
TRAILER RIGHT TURN LIGHT – SHORT TO GROUND	33663	5000mS	• RFCM J1-H3 Trailer Right Turn Light digital output prevented • Trailer Turn Indicator flashes at increased rate	Machine Setup's VEHICLE is LBP-AG; short to ground detected on RFCM J1-H3 Trailer Right Turn Light	Power cycled
TRAILER RIGHT TURN LIGHT – OPEN CIRCUIT	33664	5000mS	Trailer Turn Indicator flashes at increased rate	Machine Setup's VEHICLE is LBP-AG; trailer connected; open circuit detected on RFCM J1-H3 Trailer Right Turn Light for 3000mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRAILER MARKER LIGHTS – SHORT TO GROUND	33666	5000mS	RFCM J2-M3 Trailer Marker Lights digital output prevented	Machine Setup's VEHICLE is LBP-AG; short to ground detected on RFCM J2-M3 Trailer Marker Lights	Power cycled
TRAILER BRAKE LIGHTS – SHORT TO GROUND	33669	5000mS	RFCM J1-G4 Trailer Brake Lights digital output prevented	Machine Setup's VEHICLE is LBP-AG; short to ground detected on RFCM J1-G4 Trailer Brake Lights	Power cycled
TRAILER FOG LIGHTS – SHORT TO GROUND	33672	5000mS	RFCM J1-H4 Trailer Fog Lights digital output prevented	Machine Setup's VEHICLE is LBP-AG; short to ground detected on RFCM J1-H4 Trailer Fog Lights	Power cycled
AGRICULTURAL TRAILER BRAKE VALVE – OPEN CIRCUIT	33742	5000mS	RFCM J3-A1 Agricultural Trailer Brake Valve digital output prevented	Machine Setup's TRAILER BRAKE is AGRICULTURAL; open circuit detected on RFCM J3-A1 Agricultural Trailer Brake Valve	Power cycled
AGRICULTURAL TRAILER BRAKE VALVE – SHORT TO BATTERY	33743	5000mS	RFCM J3-A1 Agricultural Trailer Brake Valve digital output prevented	Machine Setup's TRAILER BRAKE is AGRICULTURAL; short to battery detected on RFCM J3-A1 Agricultural Trailer Brake Valve	Power cycled
AGRICULTURAL TRAILER BRAKE VALVE – SHORT TO GROUND	33744	5000mS	RFCM J3-A1 Agricultural Trailer Brake Valve digital output prevented	Machine Setup's TRAILER BRAKE is AGRICULTURAL; short to ground detected on RFCM J3-A1 Agricultural Trailer Brake Valve	Power cycled
CONTINUOUS AUXILIARY HYDRAULICS INDICATOR – SHORT TO BATTERY	33760	5000mS	CCM J2-M3 RS Continuous Auxiliary Hydraulics Indicator prevented	Machine Setup's VEHICLE is LBP-RS, AUXILIARY HYDRAULICS is YES; short to battery detected on CCM J2-M3 RS Continuous Auxiliary Hydraulics Indicator	Power cycled
CONTINUOUS AUXILIARY HYDRAULICS INDICATOR – SHORT TO GROUND	33761	5000mS	CCM J2-M3 RS Continuous Auxiliary Hydraulics Indicator prevented	Machine Setup's VEHICLE is LBP-RS, AUXILIARY HYDRAULICS is YES; short to ground detected on CCM J2-M3 RS Continuous Auxiliary Hydraulics Indicator	Power cycled
OUTRIGGERS DEPLOYED INDICATOR – OPEN CIRCUIT	33762	5000mS	FFCM J1-H3 Outriggers Deployed Indicator is prevented	Machine Setup's VEHICLE is LBP-RS, O/R DETECTION is PRESS or PRESS & PROX, open circuit detected on FFCM J1-H3 Outriggers Deployed Indicator	Power cycled
OUTRIGGERS DEPLOYED INDICATOR – SHORT TO BATTERY	33763	5000mS	FFCM J1-H3 Outriggers Deployed Indicator is prevented	Machine Setup's VEHICLE is LBP-RS, O/R DETECTION is PRESS or PRESS & PROX, short to battery detected on FFCM J1-H3 Outriggers Deployed Indicator	Power cycled
OUTRIGGERS DEPLOYED INDICATOR – SHORT TO GROUND	33764	5000mS	FFCM J1-H3 Outriggers Deployed Indicator is prevented	Machine Setup's VEHICLE is LBP-RS, O/R DETECTION is PRESS or PRESS & PROX, short to ground detected on FFCM J1-H3 Outriggers Deployed Indicator	Power cycled
OUTRIGGERS STOWED INDICATOR – OPEN CIRCUIT	33765	5000mS	FFCM J1-H4 Outriggers Stowed Indicator is prevented	Machine Setup's VEHICLE is LBP-RS, O/R DETECTION is PRESS or PRESS & PROX, open circuit detected on FFCM J1-H4 Outriggers Stowed Indicator	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
OUTRIGGERS STOWED INDICATOR – SHORT TO BATTERY	33766	5000mS	FFCM J1-H4 Outriggers Stowed Indicator is prevented	Machine Setup's VEHICLE is LBP-RS, O/R DETECTION is PRESS or PRESS & PROX, short to battery detected on FFCM J1-H4 Outriggers Stowed Indicator	Power cycled
OUTRIGGERS STOWED INDICATOR – SHORT TO GROUND	33767	5000mS	FFCM J1-H4 Outriggers Stowed Indicator is prevented	Machine Setup's VEHICLE is LBP-RS, O/R DETECTION is PRESS or PRESS & PROX, short to ground detected on FFCM J1-H4 Outriggers Stowed Indicator	Power cycled
EMISSIONS SYSTEM MALFUNCTION INDICATOR – SHORT TO BATTERY	33769	5000mS	CCM J2-M4 Emissions System Malfunction Indicator is prevented	Machine Setup's ENGINE CONTROL is DEUTZ 55KWS5 HRC, short to battery detected on CCM J2-M4 Emissions System Malfunction Indicator	Power cycled
EMISSIONS SYSTEM MALFUNCTION INDICATOR – SHORT TO GROUND	33770	5000mS	CCM J2-M4 Emissions System Malfunction Indicator is prevented	Machine Setup's ENGINE CONTROL is DEUTZ 55KWS5 HRC, short to ground detected on CCM J2-M4 Emissions System Malfunction Indicator	Power cycled
TCM ANALOG GROUND – SHORT TO BATTERY	33771	5000mS	• Pump Pressure A is assumed as 600.0 BAR • Pump Pressure B is assumed as 600.0 BAR	Machine Setup's TRANSMISSION is LINDE HYSTAT; current limit detected on protected FET for TCM analog ground Note: Check that TCM J2-G3, J2-H3, J2-J3, J2-K3, J3-A3, J3-B3, and J3-C3 Analog Ground are 0+/-0.1V.	Power Cycled
WATCHDOG VALVE – OPEN CIRCUIT	33798	5000mS	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, open circuit detected on TCM J1-A4 Watchdog Valve	Power Cycled
WATCHDOG VALVE – SHORT TO BATTERY	33799	5000mS	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to battery detected on TCM J1-A4 Watchdog Valve	Power Cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
WATCHDOG VALVE – SHORT TO GROUND	33800	5000mS	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT, short to ground detected on TCM J1-A4 Watchdog Valve	Power Cycled
DRIVE FORWARD VALVE – CURRENT FEEDBACK TOO LOW	33801	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT and one of the following occur: • TCM J2-F4 / J2-F3 Drive Forward Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • TCM J2-F4 / J2-F3 Drive Forward Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power Cycled
DRIVE REVERSE VALVE – CURRENT FEEDBACK TOO LOW	33802	5000mS	• Direction Selection is forced to Neutral (drive prevented) • TCM J1-A4 Watchdog Valve is prevented • TCM J2-F4 / J2-F3 Drive Forward Valve is prevented • TCM J2-H4 / J2-B3 Drive Reverse Valve is prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT and one of the following occur: • TCM J2-H4 / J2-B3 Drive Reverse Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • TCM J2-H4 / J2-B3 Drive Reverse Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power Cycled
REAR AXLE PRESSURE CONTROL VALVE – SHORT TO BATTERY	33806	5000mS	• FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to battery is detected on FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE PRESSURE CONTROL VALVE – SHORT TO GROUND	33807	5000mS	• FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to ground is detected on FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve	Power cycled
REAR AXLE PRESSURE CONTROL VALVE – OPEN CIRCUIT	33808	5000mS	• FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; open circuit is detected on FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve	Power cycled
REAR AXLE RATE CONTROL VALVE – SHORT TO BATTERY	33809	5000mS	• FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to battery is detected on FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE RATE CONTROL VALVE – SHORT TO GROUND	33810	5000mS	• FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; short to ground is detected on FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve	Power cycled
REAR AXLE RATE CONTROL VALVE – OPEN CIRCUIT	33811	5000mS	• FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; open circuit is detected on FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve	Power cycled
REAR AXLE RATE CONTROL VALVE – CURRENT FEEDBACK READING TOO LOW	33812	5000mS	• FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; Current Feedback Faults are enabled and any of the following conditions are present: • FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J2-H4 / J2-A3 HIRAS Rate Control Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
REAR AXLE PRESSURE CONTROL VALVE – CURRENT FEEDBACK READING TOO LOW	33813	5000mS	• FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve is prevented • Main Lift Up is prevented when Boom Angle is greater than 40° • Frame Leveling Left/Right are prevented • Rear Axle Stabilization Indicator flashes (fast) on Parker Cabin Display • HIRAS Mode is forced to ERROR • Drive Speed Restriction for RAS Error is forced • Start HIRAS Integrity Checks is prevented	Machine Setup's REAR AXLE STAB is HIGH INTEGRITY; Current Feedback Faults are enabled and any of the following conditions are present: • FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J1-G3 / J2-C4 HIRAS Pressure Control Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled

9.18.10 Engine (43x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FUEL SENSOR – SHORT TO BATTERY OR OPEN CIRCUIT	431	5000mS	Fuel Level assumed to be Empty (0.0%)	FFCM J1-E1 Fuel Sensor Signal measures >4.77V for 1,000mS	Power cycled
FUEL SENSOR – SHORT TO GROUND	432	5000mS	Fuel Level assumed to be Empty (0.0%)	FFCM J1-E1 Fuel Sensor Signal measures <0.05V for 1,000mS	Power cycled
ENGINE TROUBLE CODE: *SPN:FMI*	437	5000mS	–	ECM annunciates a fault using J1939's DM1	J1939 DM1 request terminates
HIGH ENGINE COOLANT TEMPERATURE WARNING	4316	Continuously	High Engine Temperature Indicator is shown on Parker Cabin Display	ECM annunciates High Engine Coolant Warning via DM1	High Engine Coolant Warning not active
HIGH ENGINE COOLANT TEMPERATURE CRITICAL	4317	Continuously	• Engine De-Rate is activated (engine speed restricted) • High Engine Temperature Indicator is shown on Parker Cabin Display	ECM annunciates High Engine Coolant Critical via DM1	High Engine Coolant Critical not active
LOW ENGINE OIL PRESSURE WARNING	4318	Continuously	Low Engine Oil Pressure Indicator is shown on Parker Cabin Display	ECM annunciates Low Engine Oil Pressure Warning via DM1	Power cycled
LOW ENGINE OIL PRESSURE CRITICAL	4319	Continuously	• Engine De-Rate is activated (engine speed restricted) • Low Engine Oil Pressure Indicator is shown on Parker Cabin Display	ECM annunciates Low Engine Oil Pressure Critical via DM1	Power cycled
AIR FILTER RESTRICTION	4321	5000mS	Air Filter Restriction icon is shown on Parker Cabin Display	Machine Setup's ENGINE CONTROL is not CUMMINS, Engine Running for 10,000mS, and FFCM J3-F2 Air Filter Pressure Switch is closed (grounded) for 3,000mS	Power cycled
AIR FILTER RESTRICTION	4321	5000mS	Air Filter Restriction icon is shown on Parker Cabin Display	Machine Setup's ENGINE CONTROL is CUMMINS, and either of the following conditions is present: • ECM indicates differential pressure exceeds 25" of water column (DM1 107:15) • ECM indicates differential pressure exceeds 45" of water column (DM1 107:16)	Power cycled
THROTTLE PEDAL – VOLTAGE OUT OF RANGE	4337	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is not LBP-RS, and any of the following conditions are present: • CCM J1-A1 Throttle Pedal Position (Primary) or CCM J1-A2 Throttle Pedal Position (Backup) is less than 0.25V for 500mS • CCM J1-A1 Throttle Pedal Position (Primary) or CCM J1-A2 Throttle Pedal Position (Backup) is greater than 4.75V for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
THROTTLE PEDAL – VOLTAGE DISAGREEMENT	4338	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is not LBP-RS, and all of the following conditions are present: • DTC 4337 not active • Scaled Throttle Pedal Position (Primary) and Scaled Throttle Pedal Position (Secondary) differ more than 10% for 500mS	Power cycled
FAN SPEED VALVE – SHORT TO BATTERY	4339	5000mS	• Fan Speed Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV, or DUAL HYD; short to battery detected on FFCM J3-D1 / FFCM J2-B4 Fan Speed Valve	Power cycled
FAN SPEED VALVE – SHORT TO GROUND	4340	5000mS	• Fan Speed Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV, or DUAL HYD; short to ground detected on FFCM J3-D1 / FFCM J2-B4 Fan Speed Valve	Power cycled
FAN SPEED VALVE – OPEN CIRCUIT	4341	5000mS	• Fan Speed Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV, or DUAL HYD; open-circuit detected on FFCM J3-D1 / FFCM J2-B4 Fan Speed Valve	Power cycled
FAN SPEED VALVE – CURRENT FEEDBACK READING TOO LOW	4342	5000mS	• Fan Speed Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV, or DUAL HYD; Current Feedback Faults are enabled; and one the following occur: • FFCM J3-D1 / FFCM J2-B4 Fan Speed Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J3-D1 / FFCM J2-B4 Fan Speed Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
FAN REVERSE VALVE – SHORT TO BATTERY	4343	5000mS	• Fan Speed Valve prevented • Fan Speed 2 Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYD W/ REV, or DUAL HYD; short to battery detected on FFCM J3-E1 Fan Reversing Valve	Power cycled
FAN REVERSE VALVE – SHORT TO GROUND	4344	5000mS	• Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYD W/ REV, or DUAL HYD; short to ground detected on FFCM J3-E1 Fan Reversing Valve	Power cycled
FAN REVERSE VALVE – OPEN CIRCUIT	4345	5000mS	• Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is HYD W/ REV, or DUAL HYD; open-circuit detected on FFCM J3-E1 Fan Reversing Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
DRIVETRAIN NEUTRAL – SHORT TO BATTERY	4346	5000mS	• Drivetrain Neutral prevented • Engine Start is prevented	Machine Setup's ENGINE CONTROL is DEUTZ; short to battery detected on FFCM J2-J4	Power cycled
DRIVETRAIN NEUTRAL – SHORT TO GROUND	4347	5000mS	• Drivetrain Neutral prevented • Engine Start is prevented	Machine Setup's ENGINE CONTROL is DEUTZ; short to ground detected on FFCM J2-J4	Power cycled
DRIVETRAIN NEUTRAL – OPEN CIRCUIT	4348	5000mS	• Drivetrain Neutral prevented • Engine Start is prevented	Machine Setup's ENGINE CONTROL is DEUTZ; open-circuit detected on FFCM J2-J4	Power cycled
A/C COMMAND – SHORT TO BATTERY	4349	5000mS	• A/C Command prevented	Machine Setup's AIR CONDITION is YES; short to battery detected on CCM J2-L4	Power cycled
A/C COMMAND – SHORT TO GROUND	4350	5000mS	• A/C Command prevented	Machine Setup's AIR CONDITION is YES; short to ground detected on CCM J2-L4	Power cycled
A/C COMMAND – OPEN-CIRCUIT	4351	5000mS	• A/C Command prevented	Machine Setup's AIR CONDITION is YES; open-circuit detected on CCM J2-L4	Power cycled
FAN SPEED 2 VALVE – SHORT TO BATTERY	4354	5000mS	• Fan Speed 2 Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is DUAL HYD; short to battery detected on FFCM J1-G3 / FFCM J2-C4 Fan Speed 2 Valve	Power cycled
FAN SPEED 2 VALVE – SHORT TO GROUND	4355	5000mS	• Fan Speed 2 Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is DUAL HYD; short to ground detected on FFCM J1-G3 / FFCM J2-C4 Fan Speed 2 Valve	Power cycled
FAN SPEED 2 VALVE – OPEN CIRCUIT	4356	5000mS	• Fan Speed 2 Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is DUAL HYD; open-circuit detected on FFCM J1-G3 / FFCM J2-C4 Fan Speed 2 Valve	Power cycled
FAN SPEED 2 VALVE – CURRENT FEEDBACK READING TOO LOW	4357	5000mS	• Fan Speed 2 Valve prevented • Fan Reverse Valve prevented	Machine Setup's FAN CONTROL is DUAL HYD; Current Feedback Faults are enabled; and one the following occur: • FFCM J1-G3 / FFCM J2-C4 Fan Speed 2 Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J1-G3 / FFCM J2-C4 Fan Speed 2 Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
SCR CLEAN ENABLE – SHORT TO BATTERY	4361	5000ms	SCR Clean Enable prevented	Machine Setup's ENGINE CONTROL is CAT34 Engine Configured or CAT44 Engine Configured; short to battery detected on FFCM J2-J4	Power cycled
SCR CLEAN ENABLE – SHORT TO GROUND	4362	5000mS	SCR Clean Enable prevented	Machine Setup's ENGINE CONTROL is CAT34 Engine Configured or CAT44 Engine Configured; short to ground detected on FFCM J2-J4	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's ENGINE CONTROL is CUMMINS 55KW, DEUTZ 55KW HRC, or DEUTZ 55KWS5 HRC; SPN166 Engine Rated Power <53KW or >57KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's ENGINE CONTROL is DEUTZ 75KWRS LRC SPN166 Engine Rated Power <73KW or >77KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is LBP-AG; ENGINE CONTROL is CAT C36 S5 100KW and TRANSMISSION is not TURNER 6SPD L/U (only one transmission selection is permitted with this vehicle/engine)	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is LBP-AG; ENGINE CONTROL is CAT C36 S5 90KW and TRANSMISSION is not TURNER 6SPD AUTO (only one transmission selection is permitted with this vehicle/engine)	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is LBP-AG; ENGINE CONTROL is CAT C36 S3A 90KW and TRANSMISSION is not TURNER 6SPD (only one transmission selection is permitted with this vehicle/engine)	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's ENGINE CONTROL is CUMMINS 119KWHRC; SPN166 Engine Rated Power <124KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's ENGINE CONTROL is CUMMINS 119KWLRC; SPN166 Engine Rated Power <118KW or >124KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT34 75KW HRC; SPN166 Engine Rated Power <75.0KW or >76.0KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT34 83KW HRC; SPN166 Engine Rated Power <82.5KW or >84KW	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT C36 S5 55KW; SPN166 Engine Rated Power <54KW or >56KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT C36 S5 100KW or CAT C36 S5 83KW; SPN166 Engine Rated Power <98KW or >102KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT44 74.5KW LRC; SPN166 Engine Rated Power <74.0KW or >74.5KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT44 82.1KW LRC; SPN166 Engine Rated Power <81KW or >82.5KW	Power cycled
WRONG ENGINE SELECTED	4367	5000mS	Throttle Engine Speed is set to Closed Throttle RPM	Machine Setup's VEHICLE is HBP; Machine Setup's ENGINE CONTROL is CAT44 106KW HRC or CAT44 106KW LRC SPN166 Engine Rated Power <102KW or >107KW	Power cycled
REVERSING FAN – OPEN CIRCUIT	4369	5000mS	Cleanfix Reversing Fan prevented	Machine Setup's FAN CONTROL is CLEANFIX, VEHICLE is not LBP-SC; open-circuit detected on FFCM J3-E1 Reversing Fan digital output	Power cycled
REVERSING FAN – OPEN CIRCUIT	4369	5000mS	Cleanfix Reversing Fan prevented	Machine Setup's FAN CONTROL is CLEANFIX, VEHICLE is LBP-SC; open-circuit detected on FFCM J1-G4 Reversing Fan digital output	Power cycled
REVERSING FAN – SHORT TO BATTERY	4370	5000mS	Cleanfix Reversing Fan prevented	Machine Setup's FAN CONTROL is CLEANFIX, VEHICLE is not LBP-SC; short to battery detected on FFCM J3-E1 Reversing Fan digital output	Power cycled
REVERSING FAN – SHORT TO BATTERY	4370	5000mS	Cleanfix Reversing Fan prevented	Machine Setup's FAN CONTROL is CLEANFIX, VEHICLE is LBP-SC; short to battery detected on FFCM J1-G4 Reversing Fan digital output	Power cycled
REVERSING FAN – SHORT TO GROUND	4371	5000mS	Cleanfix Reversing Fan prevented	Machine Setup's FAN CONTROL is CLEANFIX, VEHICLE is not LBP-SC; short to ground detected on FFCM J3-E1 Reversing Fan digital output	Power cycled
REVERSING FAN – SHORT TO GROUND	4371	5000mS	Cleanfix Reversing Fan prevented	Machine Setup's FAN CONTROL is CLEANFIX, VEHICLE is not LBP-SC; short to ground detected on FFCM J1-G4 Reversing Fan digital output	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
WATER IN FUEL	4375	Continuously	–	Machine Setup's ENGINE CONTROL is DEUTZ 100KW LRC or DEUTZ 115KW LRC; ECM annunciates Water In Fuel Issue via DM1 (SPN 97, any FMI)	Water In Fuel Issue not active
DPF EXCHANGE REQUIRED – HIGH ASH LOAD	4383	5000mS	–	Machine Setup's ENGINE CONTROL is DEUTZ 55KWS5 HRC and DPF Status is EXCHANGE REQD (Engine requesting exchange of Diesel Particulate Filter)	Power cycled
DPF EXCHANGE REQUIRED – WARNING LEVEL 1	4384	Continuously	–	Machine Setup's ENGINE CONTROL is DEUTZ 55KWS5 HRC and DPF Status is EXCH REQD WL1 (Engine requesting urgent exchange of Diesel Particulate Filter)	Power cycled
DPF EXCHANGE REQUIRED –ENGINE DERATED	4385	Continuously	Note: The engine will derate itself during this situation, exchange the DPF immediately!	Machine Setup's ENGINE CONTROL is DEUTZ 55KWS5 HRC and DPF Status is EXCH REQD WL2 (Engine derates itself, immediate exchange of Diesel Particulate Filter is required)	Power cycled

9.18.11 Battery Supply (44x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BATTERY VOLTAGE LOW	445	5000mS	Battery Voltage Low icon is shown on Parker Cabin Display	Engine running; CCM battery voltage < 11.00V for 3,000mS	Either of the following conditions are presen for 10,000mS: Engine Operating State is not ENGINE RUNNING CCM battery voltage >11.25V
REFERENCE VOLTAGE OUT OF RANGE – PLATFORM	448	5000mS	Platform functions prevented	Machine Setup's PLATFORM OPTION is YES; keyswitch platform; PLT detects reference voltage is out of range (>5.4V or <4.6V) for 1,000mS	Power cycled
CCM BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	4435	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	Engine not cranking; CCM J1-H3 Ignition Relay has been energized for >140mS; CCM battery voltage < 9.0V for 500mS	Power cycled
CCM BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	4436	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	CCM battery voltage exceeds Maximum Supply Voltage for 250mS	Power cycled
FFCM BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	4438	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	Engine not cranking; FFCM battery voltage < 9.0V for 500mS	Power cycled
FFCM BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	4439	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	FFCM battery voltage exceeds Maximum Supply Voltage for 250mS	Power cycled
RFCM BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	4441	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	Engine not cranking; RFCM battery voltage < 9.0V for 500mS	Power cycled
RFCM BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	4442	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	RFCM battery voltage exceeds Maximum Supply Voltage for 250mS	Power cycled
TCM BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	4449	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	Engine not cranking; TCM battery voltage < 9.0V for 500mS	Power cycled
TCM BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	4450	5000mS	• Hydraulic functions are prevented • Power State is ERROR for power-up or SAFE for run-time	TCM battery voltage exceeds Maximum Supply Voltage for 250mS	Power cycled
LCM BATTERY VOLTAGE TOO LOW – SYSTEM SHUTDOWN	4469	5000mS	Hydraulic functions are prevented	Engine not cranking; LCM battery voltage < 9.0V for 500mS	Power cycled
LCM BATTERY VOLTAGE TOO HIGH – SYSTEM SHUTDOWN	4470	5000mS	Hydraulic functions are prevented	LCM battery voltage exceeds Maximum Supply Voltage for 250mS	Power cycled

9.18.12 Transmission and Drive System (46x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
HIGH TRANSMISSION OIL TEMPERATURE CRITICAL	461	Continuously	Transmission Temperature Critical icon is shown on Parker Cabin Display	Machine Setup's TRANS TEMP is SWITCH, SENSOR, or BOSCH HYSTAT and one of the following situations occur: • Machine Setup's TRANSMISISON is HC HYSTAT and Transmission Oil Temperature > 102°C for 250mS • (Default) Transmission Oil Temperature >120°C for 250mS	• Machine Setup's TRANSMISSION is HC HYSTAT and Transmission Oil Temperature < 100°C • (Default) Transmission Oil Temperature < 110°C
HIGH TRANSMISSION OIL TEMPERATURE CRITICAL	461	Continuously	Transmission Temperature Critical icon is shown on Parker Cabin Display	Machine Setup's TRANS TEMP is HYSTAT SENSOR; Direction Selection is Forward or Reverse; Transmission Oil Temperature ≥75°C for 250mS	One of the following occur: • Drive Selection is Forward or Reverse; Transmission Oil Temp < 73°C • Drive Selection is Neutral for 5 minutes • Power cycled
CONFLICTING DRIVE DIRECTION SIGNALS	462	5000mS	• Column Direction Switch position is regarded as neutral • Engine Start prevented	Machine Setup's COLUMN SELECTOR is YES; Drive Forward Switch (CCM J1-D3), Drive Neutral Switch (CCM J1-E3), or Drive Reverse Switch (CCM J1-E4) are energized simultaneously for 500mS	Power cycled
DRIVE DIRECTION SIGNAL LOST	463	5000mS	• Column Direction Switch position is regarded as neutral • Engine Start prevented	Cabin Mode; Machine Setup's COLUMN SELECTOR is YES; Drive Forward Switch (CCM J1-D3), Drive Neutral Switch (CCM J1-E3), and Drive Reverse Switch (CCM J1-E4) are de-energized for 500mS	Power cycled
CONFLICTING GEAR SELECTION SIGNALS	464	5000mS	Last valid gear selection is maintained	Cabin Mode; Machine Setup's COLUMN SELECTOR is YES; Machine Setup's JOYSTICK FNR is NO; and one of the following occur: • Machine Setup's TRANSMISISON is HC HYSTAT, BOSCH HYSTAT or LINDE HYSTAT; Gear Select 1 Switch (CCM J2-G3) and Gear Select 2 Switch (CCM J2-F4) are energized simultaneously for 500mS • Default; Gear Select 1 Switch (CCM J2-G3), Gear Select 2 Switch (CCM J2-F4), Gear Select 3 Switch (CCM J2-E3), or Gear Select 4 Switch (CCM J2-K3) are energized simultaneously for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
GEAR SELECTION SIGNAL LOST	465	5000mS	Last valid gear selection is maintained	Cabin Mode; Machine Setup's COLUMN SELECTOR is YES; Machine Setup's JOYSTICK FNR is NO; and one of the following occur: • Machine Setup's TRANSMISSION is HC HYSTAT, BOSCH HYSTAT or LINDE HYSTAT; Gear Select 1 Switch (CCM J2-G3) and Gear Select 2 Switch (CCM J2-F4) are de-energized for 500mS • Default; Gear Select 1 Switch (CCM J2-G3), Gear Select 2 Switch (CCM J2-F4), Gear Select 3 Switch (CCM J2-E3), and Gear Select 4 Switch (CCM J2-K3) are de-energized for 500mS	Power cycled
TRANSMISSION TROUBLE CODE: *SPN:FMI*	467	5000mS	–	Machine Setup's TRANSMISSION is BOSCH HYSTAT; DRC annunciates a fault using J1939's DM1	J1939 DM1 request terminates
VEHICLE SPEED SENSOR – NOT RESPONDING	468	5000mS	The following restrictions apply continuously: • Vehicle Speed is "99" The following restrictions apply until power cycle: • Gear selection restricted to present state • Direction selection restricted to present state and neutral The following restrictions apply after power cycle: • Gear and Direction Selection restricted to F2, N2, and R2	Machine Setup's VEHICLE is not HBP Machine Setup's TRANSMISSION is TURNER 4SPD2 or TURNER 4SPD3, and all of the following conditions are present: • Direction Selection is Forward or Reverse • Park Brake is released • Service Brake Status is Released • Engine RPM >1200 RPM • FFCM J1-F3 Vehicle Speed counts not detected for 40,000mS	Retained through power cycle; Vehicle Speed counts detected for 5,000mS

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
VEHICLE SPEED SENSOR – NOT RESPONDING	468	5000mS	The following restrictions apply continuously: • Vehicle Speed is "99" • Lock-Up Convertor prevented The following restrictions apply until power cycle: • Gear selection restricted to last valid state • Direction selection restricted to present state and neutral The following restrictions apply after power cycle: • Gear and Direction Selection restricted to F3, N3, and R2	Machine Setup's VEHICLE is not HBP; Machine Setup's TRANSMISSION is Turner 6 Speed Transmission Configured, all of the following conditions are present: • Direction Selection is Forward or Reverse • Park Brake is released • Service Brake Status is Released • Engine RPM >1200 RPM AND any of the following conditions are present: • Manual Transmission Mode is selected and FFCM J1-F3 Vehicle Speed counts not detected for 40,000mS • Automatic Transmission Mode is selected, Gear Selection is st, 2^{nd} or 3^{rd} gear, and FFCM J1-F3 Vehicle Speed counts not detected for 40,000mS • Automatic Transmission Mode is selected, Gear Selection is 4^{th}, 5^{th}, or 6^{th} gear, and FFCM J1-F3 Vehicle Speed counts not detected for 3000mS	Retained through power cycle; Vehicle Speed counts detected for 5,000mS
VEHICLE SPEED SENSOR – NOT RESPONDING	468	5000mS	The following restrictions apply continuously: • Vehicle Speed is "99" The following restrictions apply until power cycle: • Gear selection restricted to last valid state • Direction selection restricted to present state and neutral The following restrictions apply after power cycle: • Gear and Direction Selection restricted to F2, N2, and R2	Machine Setup's TRANSMISSION is ZF 4SPD AUTO and all of the following conditions are present: • Direction Selection is Forward or Reverse • Park Brake is released • Service Brake Status is Released • Engine RPM >1200 RPM • FFCM J1-F3 Vehicle Speed counts not detected for 3000mS	Retained through power cycle; Vehicle Speed counts detected for 5,000mS

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
VEHICLE SPEED SENSOR – NOT RESPONDING	468	5000mS	The following restrictions apply continuously: • Vehicle Speed is "99" The following restrictions apply if Engine Speed > 1050 RPM or Service Brake Status is Released: • Gear selection restricted to present state • Direction selection restricted to present state and neutral	Machine Setup's TRANSMISSION is HC HYSTAT or LINDE HYSTAT and all of the following conditions are present: • Direction Selection is Forward or Reverse • Park Brake is released • Service Brake Status is Released • Engine RPM >1400 RPM • FFCM J1-F3 Vehicle Speed counts not detected for 5000mS • FFCM J2-H1 Transmission Gear Switch is energized (gearbox engaged in drive)	Retained through power cycle; Vehicle Speed counts detected for 5,000mS
VEHICLE SPEED SENSOR – NOT RESPONDING	468	5000mS	The following restrictions apply continuously: • Vehicle Speed is "99" The following restrictions apply until power cycle: • Gear selection restricted to present state • Direction selection restricted to present state and neutral The following restrictions apply after power cycle: • Gear and Direction Selection restricted to F3, N3, and R3	Machine Setup's TRANSMISSION is DANA 3SPD and all of the following conditions are present: • Direction Selection is Forward or Reverse • Park Brake is released • Service Brake Status is Released • Engine RPM >1400 RPM • FFCM J1-H1 Vehicle Speed counts not detected for 40,000mS	Retained through power cycle; Vehicle Speed counts detected for 5,000mS
VEHICLE OVERSPEED	469	Continuously	Flash Vehicle Speed (1Hz) on Parker Cabin Display	Machine Setup's TRANSMISSION is BOSCH HYSTAT, TURNER 4SPD2, TURNER 4SPD3, or Turner 6 Speed Transmission Configured and either of the following occur: • Engine Speed $\geq$ 2,700 RPM • Vehicle Speed > 43 KPH	Engine Speed < 2700RPM and Vehicle Speed < 43KPH for 1000mS
VEHICLE OVERSPEED	469	Continuously	Flash Vehicle Speed (1Hz) on Parker Cabin Display	Machine Setup's TRANSMISSION is ZF 4SPD AUTO and either of the following occur: • Engine Speed $\geq$ 3250 RPM • FFCM J1-F3 Vehicle Speed Frequency > 3270Hz	Engine Speed < 3250 RPM and FFCM J1-F3 Vehicle Speed Frequency < 3270Hz

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
VEHICLE OVERSPEED	469	Continuously	Flash Vehicle Speed (1Hz) on Parker Cabin Display	Machine Setup's TRANSMISSION is HC HYSTAT and either of the following occur: • Engine Speed ≥ 2,700RPM • FFCM J1-F3 Vehicle Speed frequency • ≥ 1498Hz	Engine Speed < 2700RPM and FFCM J1-F3 Vehicle Speed Frequency < 1498Hz for 1000mS
VEHICLE OVERSPEED	469	Continuously	Flash Vehicle Speed (1Hz) on Parker Cabin Display	Machine Setup's TRANSMISSION is LINDE HYSTAT and any of the following occur: • Engine Speed ≥ 2,900RPM • Gear Selection is 1st Gear and FFCM J1-F3 Vehicle Speed frequency ≥ 785Hz for 2000mS . *Note: this corresponds to a motor speed of 3700 RPM and vehicle speed of 6.8 MPH.* • Gear Selection is 2nd Gear FFCM J1-F3 Vehicle Speed frequency ≥ 2208Hz for 2,000mS . *Note: this corresponds to a motor speed of 3575 RPM and vehicle speed of 19.3 MPH.*	All trigger conditions are removed for 1000mS
HYD FLUID TEMP SENSOR – SHORT TO BATTERY OR OPEN CIRCUIT	4640	5000mS	Hydraulic Fluid Temperature is +150°C	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV or DUAL HYD and FFCM J1-B1 Hydraulic Fluid Temperature is >4.73V for 500mS	Power cycled
HYD FLUID TEMP SENSOR – SHORT TO BATTERY OR OPEN CIRCUIT	4640	5000mS	Hydraulic Fluid Temperature is +150°C	Machine Setup's HYD TEMP MGMT is YES and FFCM J1-B1 Hydraulic Fluid Temperature is >4.73V for 500mS	Power cycled
TRANS FLUID TEMP SENSOR – SHORT TO BATTERY OR OPEN CIRCUIT	4641	5000mS	Transmission Oil Temperature is +150°C	Machine Setup's TRANS TEMP is SENSOR; FFCM J1-C1 is >4.73V for 500mS	Power cycled
INTERCOOLER AIR TEMP SENSOR – SHORT TO BATTERY OR OPEN CIRCUIT	4642	5000mS	Intercooler Air Temperature is +150°C	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV or DUAL HYD; Machine Setup's ENGINE CONTROL is not CAT C36 Engine Configured; and FFCM J1-F1 is >4.73V for 500mS	Power cycled
HYD FLUID TEMP SENSOR – SHORT TO GROUND	4643	5000mS	Hydraulic Fluid Temperature is +150°C	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV or DUAL HYD; and FFCM J1-B1 Hydraulic Fluid Temperature is <0.1V for 500mS	Power cycled
HYD FLUID TEMP SENSOR – SHORT TO GROUND	4643	5000mS	Hydraulic Fluid Temperature is +150°C	Machine Setup's HYD TEMP MGMT is YES and FFCM J1-B1 is <0.1V for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS FLUID TEMP SENSOR – SHORT TO GROUND	4644	5000mS	Transmission Oil Temperature is +150°C	Machine Setup's TRANS TEMP is SENSOR; FFCM J1-C1 is <0.1V for 500mS	Power cycled
INTERCOOLER AIR TEMP SENSOR – SHORT TO GROUND	4645	5000mS	Intercooler Air Temperature is +150°C	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV or DUAL HYD; Machine Setup's ENGINE CONTROL is not CAT C36 Engine Configured; and FFCM J1-F1 is <0.1V for 500mS	Power cycled
PARK BRAKE VALVE – SHORT TO BATTERY	4646	5000mS	• Direction Selection is Neutral • Park Brake Valve prevented • Energize Park Brake Indicator on Parker Cabin Display	Machine Setup's VEHICLE is HBP or LBP-SC; short to battery detected on FFCM J3-D1 Park Brake Valve, FFCM J2-B4 Park Brake Valve Return, or FFCM J3-E1 Park Brake 2 Valve	Power cycled
PARK BRAKE VALVE – SHORT TO GROUND	4647	5000mS	• Direction Selection is Neutral • Park Brake Valve prevented • Energize Park Brake Indicator on Parker Cabin Display	Machine Setup's VEHICLE is HBP or LBP-SC; short to ground detected on FFCM J3-D1 Park Brake Valve, FFCM J2-B4 Park Brake Valve Return, or FFCM J3-E1 Park Brake 2 Valve	Power cycled
PARK BRAKE VALVE – OPEN CIRCUIT	4648	5000mS	• Direction Selection is Neutral • Park Brake Valve prevented • Energize Park Brake Indicator on Parker Cabin Display	Machine Setup's VEHICLE is HBP or LBP-SC; open-circuit detected on FFCM J3-D1 Park Brake Valve, FFCM J2-B4 Park Brake Valve Return, or FFCM J3-E1 Park Brake 2 Valve	Power cycled
TRANS FWD LOW COIL – SHORT TO BATTERY	4649	Continuously	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to battery detected on FFCM J2-H4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS FWD LOW COIL – SHORT TO GROUND	4650	5000mS	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to ground detected on FFCM J2-H4	Power cycled
TRANS FWD LOW COIL – OPEN CIRCUIT	4651	5000mS	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; open-circuit detected on FFCM J2-H4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS FWD HIGH COIL – SHORT TO BATTERY	4652	Continuously	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to battery detected on FFCM J2-G4	Power cycled
TRANS FWD HIGH COIL – SHORT TO GROUND	4653	5000mS	The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to ground detected on FFCM J2-G4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS FWD HIGH COIL – OPEN CIRCUIT	4654	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; open-circuit detected on FFCM J2-G4	Power cycled
TRANS REVERSE COIL – SHORT TO BATTERY	4655	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to battery detected on FFCM J1-E4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS REVERSE COIL – SHORT TO BATTERY	4655	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to battery detected on FFCM J1-E4	Power cycled
TRANS REVERSE COIL – SHORT TO BATTERY	4655	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to battery detected on FFCM J1-E4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS REVERSE COIL – SHORT TO GROUND	4656	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to ground detected on FFCM J1-E4	Power cycled
TRANS REVERSE COIL – SHORT TO GROUND	4656	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to ground detected on FFCM J1-E4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS REVERSE COIL – SHORT TO GROUND	4656	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to ground detected on FFCM J1-E4	Power cycled
TRANS REVERSE COIL – OPEN CIRCUIT	4657	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; open-circuit detected on FFCM J1-E4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS REVERSE COIL – OPEN CIRCUIT	4657	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; open-circuit detected on FFCM J1-E4	Power cycled
TRANS REVERSE COIL – OPEN CIRCUIT	4657	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; open-circuit detected on FFCM J1-E4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 1ST GEAR COIL – SHORT TO BATTERY	4658	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to battery detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – SHORT TO BATTERY	4658	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to battery detected on FFCM J1-D4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 1ST GEAR COIL – SHORT TO BATTERY	4658	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to battery detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – SHORT TO BATTERY	4658	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT; short to battery detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – SHORT TO GROUND	4659	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to ground detected on FFCM J1-D4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 1ST GEAR COIL – SHORT TO GROUND	4659	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to ground detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – SHORT TO GROUND	4659	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to ground detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – SHORT TO GROUND	4659	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT; short to ground detected on FFCM J1-D4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 1ST GEAR COIL – OPEN CIRCUIT	4660	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; open-circuit detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – OPEN CIRCUIT	4660	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; open-circuit detected on FFCM J1-D4	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 1ST GEAR COIL – OPEN CIRCUIT	4660	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; open-circuit detected on FFCM J1-D4	Power cycled
TRANS 1ST GEAR COIL – OPEN CIRCUIT	4660	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT; open-circuit detected on FFCM J1-D4	Power cycled
TRANS 2ND GEAR COIL – SHORT TO BATTERY	4661	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to battery detected on FFCM J3-C1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 2ND GEAR COIL – SHORT TO BATTERY	4661	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to battery detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – SHORT TO BATTERY	4661	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to battery detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – SHORT TO BATTERY	4661	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT; short to battery detected on FFCM J3-C1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 2ND GEAR COIL – SHORT TO GROUND	4662	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to ground detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – SHORT TO GROUND	4662	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to ground detected on FFCM J3-C1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 2ND GEAR COIL – SHORT TO GROUND	4662	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to ground detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – SHORT TO GROUND	4662	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT; short to ground detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – OPEN CIRCUIT	4663	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; open-circuit detected on FFCM J3-C1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 2ND GEAR COIL – OPEN CIRCUIT	4663	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; open-circuit detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – OPEN CIRCUIT	4663	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; open-circuit detected on FFCM J3-C1	Power cycled
TRANS 2ND GEAR COIL – OPEN CIRCUIT	4663	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is LINDE HYSTAT; open-circuit detected on FFCM J3-C1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 3RD GEAR COIL – SHORT TO BATTERY	4664	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to battery detected on FFCM J1-A3	Power cycled
TRANS 3RD GEAR COIL – SHORT TO GROUND	4665	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; short to ground detected on FFCM J1-A3	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS 3RD GEAR COIL – OPEN CIRCUIT	4666	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Turner Transmission Configured; open-circuit detected on FFCM J1-A3	Power cycled
TRANS Y1 COIL – SHORT TO BATTERY	4667	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to battery detected on FFCM J2-H4 Transmission Y1 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y1 COIL – SHORT TO GROUND	4668	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to ground detected on FFCM J2-H4 Transmission Y1 Solenoid	Power cycled
TRANS Y1 COIL – OPEN CIRCUIT	4669	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; open-circuit detected on FFCM J2-H4 Transmission Y1 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y2 COIL – SHORT TO BATTERY	4670	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to battery detected on FFCM J2-G4 Transmission Y2 Solenoid	Power cycled
TRANS Y2 COIL – SHORT TO GROUND	4671	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to ground detected on FFCM J2-G4 Transmission Y2 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y2 COIL – OPEN CIRCUIT	4672	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; open-circuit detected on FFCM J2-G4 Transmission Y2 Solenoid	Power cycled
TRANS Y3 COIL – SHORT TO BATTERY	4673	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to battery detected on FFCM J1-E4 Transmission Y3 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y3 COIL – SHORT TO GROUND	4674	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to ground detected on FFCM J1-E4 Transmission Y3 Solenoid	Power cycled
TRANS Y3 COIL – OPEN CIRCUIT	4675	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; open-circuit detected on FFCM J1-E4 Transmission Y3 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y4 COIL – SHORT TO BATTERY	4676	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to battery detected on FFCM J1-D4 Transmission Y4 Solenoid	Power cycled
TRANS Y4 COIL – SHORT TO GROUND	4677	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to ground detected on FFCM J1-D4 Transmission Y4 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y4 COIL – OPEN CIRCUIT	4678	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; open-circuit detected on FFCM J1-D4 Transmission Y4 Solenoid	Power cycled
TRANS Y5 COIL – SHORT TO BATTERY	4679	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to battery detected on FFCM J3-C1 Transmission Y5 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y5 COIL – SHORT TO GROUND	4680	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to ground detected on FFCM J3-C1 Transmission Y5 Solenoid	Power cycled
TRANS Y5 COIL – OPEN CIRCUIT	4681	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; open-circuit detected on FFCM J3-C1 Transmission Y5 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y6 COIL – SHORT TO BATTERY	4682	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to battery detected on FFCM J1-A3 Transmission Y6 Solenoid	Power cycled
TRANS Y6 COIL – SHORT TO GROUND	4683	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; short to ground detected on FFCM J1-A3 Transmission Y6 Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS Y6 COIL – OPEN CIRCUIT	4684	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Y1 Solenoid prevented • FFCM J2-G4 Transmission Y2 Solenoid prevented • FFCM J1-E4 Transmission Y3 Solenoid prevented • FFCM J1-D4 Transmission Y4 Solenoid prevented • FFCM J3-C1 Transmission Y5 Solenoid prevented • FFCM J1-A3 Transmission Y6 Solenoid prevented	Machine Setup's TRANSMISSION is ZF Transmission Configured; open-circuit detected on FFCM J1-A3 Transmission Y6 Solenoid	Power cycled
TRANS FORWARD COIL – SHORT TO BATTERY	4685	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to battery detected on FFCM J2-H4 Transmission Forward Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS FORWARD COIL – SHORT TO BATTERY	4685	Continuously	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to battery detected on FFCM J2-G4 Transmission Forward Solenoid	Power cycled
TRANS FORWARD COIL – SHORT TO GROUND	4686	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; short to ground detected on FFCM J2-H4 Transmission Forward Solenoid	Power cycled
TRANS FORWARD COIL – SHORT TO GROUND	4686	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to ground detected on FFCM J2-G4 Transmission Forward Solenoid	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANS FORWARD COIL – OPEN CIRCUIT	4687	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is DANA 3SPD; open-circuit detected on FFCM J2-H4 Transmission Forward Solenoid	Power cycled
TRANS FORWARD COIL – OPEN CIRCUIT	4687	5000mS	• The following actions shall occur when Calibration's TRANS SERVICE is NO: • Direction Selection forced to Neutral • FFCM J2-G4 Transmission Forward Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented	Machine Setup's TRANSMISSION is HC HYSTAT; open-circuit detected on FFCM J2-G4 Transmission Forward Solenoid	Power cycled
TRANSMISSION HWFS1 – SHORT TO BATTERY	46114	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; short to battery detected on FFCM J2-H4 Transmission HWFS1	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANSMISSION HWFS1 – SHORT TO GROUND	46115	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; short to ground detected on FFCM J2-H4 Transmission HWFS1	Power cycled
TRANSMISSION HWFS1 – OPEN CIRCUIT	46116	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; open-circuit detected on FFCM J2-H4 Transmission HWFS1	Power cycled
TRANSMISSION HWFS2 – SHORT TO BATTERY	46117	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; short to battery detected on FFCM J2-A3 Transmission HWFS2	Power cycled
TRANSMISSION LOGIC SUPPLY – SHORT TO BATTERY	46127	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-G4 Transmission Logic Supply de-energized • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; short to battery detected on FFCM J2-G4 Transmission Logic Supply	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANSMISSION LOGIC SUPPLY – SHORT TO GROUND	46128	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-G4 Transmission Logic Supply de-energized • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; short to ground detected on FFCM J2-G4 Transmission Logic Supply	Power cycled
TRANSMISSION LOGIC SUPPLY – OPEN CIRCUIT	46129	5000mS	• The following conditions apply when Calibration's TRANS SERVICE is NO: • Direction Selection is Neutral • FFCM J2-G4 Transmission Logic Supply de-energized • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; open-circuit detected on FFCM J2-G4 Transmission Logic Supply	Power cycled
TRANSMISSION LOCK-UP CONVERTOR – SHORT TO BATTERY	46131	5000mS	• FFCM J3-B1 Lock-Up Convertor prevented • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Machine Setup's TRANSMISSION is TURNER 6SPD L/U; short to battery detected on FFCM J3-B1 Lock-Up Convertor	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
TRANSMISSION LOCK-UP CONVERTOR – SHORT TO GROUND	46132	5000mS	• FFCM J3-B1 Lock-Up Convertor prevented • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Machine Setup's TRANSMISSION is TURNER 6SPD L/U; short to ground detected on FFCM J3-B1 Lock-Up Convertor	Power cycled
TRANSMISSION LOCK-UP CONVERTOR – OPEN CIRCUIT	46133	5000mS	• FFCM J3-B1 Lock-Up Convertor prevented • Direction Selection forced to Neutral • FFCM J2-H4 Transmission Fwd Low Solenoid prevented • FFCM J2-G4 Transmission Fwd High Solenoid prevented • FFCM J1-E4 Transmission Reverse Solenoid prevented • FFCM J1-D4 Transmission 1ST Gear Solenoid prevented • FFCM J3-C1 Transmission 2ND Gear Solenoid prevented • FFCM J1-A3 Transmission 3RD Gear Solenoid prevented	Machine Setup's TRANSMISSION is TURNER 6SPD L/U; open-circuit detected on FFCM J3-B1 Lock-Up Convertor	Power cycled
SAHR BRAKE VALVE – SHORT TO BATTERY	46138	5000mS	• FFCM J1-G4 SAHR Brake Valve prevented • Direction Selection is Neutral	Machine Setup's SAHR BRAKE is AUTO; short to battery detected on FFCM J1-G4 SAHR Brake Valve	Power cycled
SAHR BRAKE VALVE – SHORT TO GROUND	46139	5000mS	• FFCM J1-G4 SAHR Brake Valve prevented • Direction Selection is Neutral	Machine Setup's SAHR BRAKE is AUTO; short to ground detected on FFCM J1-G4 SAHR Brake Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
SAHR BRAKE VALVE – OPEN CIRCUIT	46140	5000mS	• FFCM J1-G4 SAHR Brake Valve prevented • Direction Selection is Neutral	Machine Setup's SAHR BRAKE is AUTO; open-circuit detected on FFCM J1-G4 SAHR Brake Valve	Power cycled
SAHR PRESSURE SWITCH – OPEN CIRCUIT	46141	5000mS	• FFCM J1-G4 SAHR Brake Valve prevented • Direction Selection is Neutral	Machine Setup's SAHR BRAKE is MANUAL or AUTO; engine running; park brake released; CCM J3-E2 SAHR Pressure Switch de-energized for 5000mS	Power cycled
HIGH TRANSMISSION OIL TEMPERATURE – ENGINE DERATED	46142	Continuously	• Transmission Temperature Critical icon is shown on Parker Cabin Display • Engine De-Rate is activated (engine speed restricted) while Direction Selection is Forward or Reverse	Machine Setup's TRANS TEMP is SENSOR or HYSTAT SENSOR; Transmission Oil Temperature ≥125°C for 3000mS (both ConstantData)	Transmission Oil Temperature < 110°C for 250mS (both ConstantData)
INCHING VALVE – SHORT TO BATTERY	46143	5000mS	FFCM J1-G3 / FFCM J2-C4 Inching Valve prevented	Machine Setup's TRANSMISSION is HC HYSTAT; short to battery detected on FFCM J1-G3 / FFCM J2-C4 Inching Valve	Power cycled
INCHING VALVE – SHORT TO GROUND	46144	5000mS	FFCM J1-G3 / FFCM J2-C4 Inching Valve prevented	Machine Setup's TRANSMISSION is HC HYSTAT ; short to ground detected on FFCM J1-G3 / FFCM J2-C4 Inching Valve	Power cycled
INCHING VALVE – OPEN CIRCUIT	46145	5000mS	FFCM J1-G3 / FFCM J2-C4 Inching Valve prevented	Machine Setup's TRANSMISSION is HC HYSTAT; open-circuit detected on FFCM J1-G3 / FFCM J2-C4 Inching Valve	Power cycled
INCHING VALVE – CURRENT FEEDBACK READING TOO LOW	46146	5000mS	FFCM J1-G3 / FFCM J2-C4 Inching Valve prevented	Machine Setup's TRANSMISSION is HC HYSTAT; Current Feedback Faults are enabled; and one of the following occur: • FFCM J1-G3 / FFCM J2-C4 Inching Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J1-G3 / FFCM J2-C4 Inching Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power cycled
PARK BRAKE RELEASE VALVE – SHORT TO BATTERY	46156	5000mS	• FFCM J1-G4 Park Brake Release Valve prevented • Direction Selection is Neutral	Machine Setup's TRANSMISSION is HC HYSTAT; HC Park Brake Release configured; short to battery detected on FFCM J1-G4 Park Brake Release Valve	Power cycled
PARK BRAKE RELEASE VALVE – SHORT TO GROUND	46157	5000mS	• FFCM J1-G4 Park Brake Release Valve prevented • Direction Selection is Neutral	Machine Setup's TRANSMISSION is HC HYSTAT; HC Park Brake Release configured; short to ground detected on FFCM J1-G4 Park Brake Release Valve	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
PARK BRAKE RELEASE VALVE – OPEN CIRCUIT	46158	5000mS	• FFCM J1-G4 Park Brake Release Valve pre-vented • Direction Selection is Neutral	Machine Setup's TRANSMISSION is HC HYSTAT; HC Park Brake Release configured; open-circuit detected on FFCM J1-G4 Park Brake Release Valve	Power cycled
PUMP PRESSURE SENSOR A – OUT OF RANGE HIGH	46159	5000mS	Pump Pressure A is assumed as 600.0 BAR	Machine Setup's TRANSMISSION is LINDE HYSTAT; TCM J1-C1 Pump Pressure A is >4.73V for 500mS	Power cycled
PUMP PRESSURE SENSOR A – OUT OF RANGE LOW	46160	5000mS	Pump Pressure A is assumed as 600.0 BAR	Machine Setup's TRANSMISSION is LINDE HYSTAT; TCM J1-C1 Pump Pressure A is <0.10V for 500mS	Power cycled
PUMP PRESSURE SENSOR B – OUT OF RANGE HIGH	46161	5000mS	Pump Pressure B is assumed as 600.0 BAR	Machine Setup's TRANSMISSION is LINDE HYSTAT; TCM J1-B1 Pump Pressure B is >4.73V for 500mS	Power cycled
PUMP PRESSURE SENSOR B – OUT OF RANGE LOW	46162	5000mS	Pump Pressure B is assumed as 600.0 BAR	Machine Setup's TRANSMISSION is LINDE HYSTAT; TCM J1-B1 Pump Pressure B is <0.10V for 500mS	Power cycled
PARK BRAKE VALVE – CURRENT FEEDBACK TOO LOW	46165	5000mS	• Direction Selection is Neutral • Park Brake Valve pre-vented • Energize Park Brake Indicator on Parker Cabin Display	Machine Setup's VEHICLE is LBP-SC and one of the following occur: • FFCM J3-D1/J2-B4 Park Brake Valve measured current is 250mA less than command when command is greater than 500mA for 1000mS • FFCM J3-D1/J2-B4 Park Brake Valve measured current is less than 255mA when PWM is greater than 40% for 500mS	Power Cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
PUMP PRESSURE SENSORS – INVALID READING	46206	5000mS	• Pump Pressure A is assumed as 600.0 BAR • Pump Pressure B is assumed as 600.0 BAR • Hydrostatic Speed Limit is set to 14.0 KPH	Machine setup's TRANSMISSION is LINDE HYSTAT and all of the following conditions are present for >30,000mS : • Engine Operating State is ENGINE RUNNING • Direction Selection is Neutral (transmission disengaged) • Vehicle Speed is 0 KPH (vehicle not moving) • Park Brake is Applied • Hystat Gear Change Status is IDLE (no gear change) AND THEN any of the following conditions are present for >5,000mS : • Pump Pressure A and Pump Pressure B disagree by >25bar • Pump Pressure A or Pump Pressure B is >65bar	Power Cycled
SERVICE BRAKE RELAY PRESSURE SENSOR - OUT OF RANGE LOW	46207	5000mS	Service Brake Relay Pressure is assumed as 3000 PSI (max)	Machine Setup's MODEL is 12010H / 2733, Brake Relay Pressure Flag is ENABLED, and FFCM J1-C1 Service Brake Relay Pressure < 0.25V for 500mS	Power Cycled
SERVICE BRAKE RELAY PRESSURE SENSOR - OUT OF RANGE HIGH	46208	5000mS	Service Brake Relay Pressure is assumed as 3000 PSI (max)	Machine Setup's MODEL is 12010H / 2733, Brake Relay Pressure Flag is ENABLED, and FFCM J1-C1 Service Brake Relay Pressure > 4.75V for 500mS	Power Cycled
SERVICE BRAKE RELAY VALVE - PRESSURE DISAGREEMENT	46209	5000mS	Fast flash Service Brake Fault Indicator	Machine Setup's MODEL is 12010H / 2733, and all of the following conditions are present for 2500mS: • Engine is running • Brake Pedal Pressure & Service Brake Relay Pressure are both <700 PSI (ConstantData, sensors are healthy) • Brake Pedal Pressure & Service Brake Relay Pressure disagree greater than +/-58 PSI	Maintain through Power Cycle; all of the following conditions are present for 2500mS: • Engine is Running • Brake Pedal Positon >85.0% • Brake Pedal Pressure & Service Brake Relay Pressure agree within +/-58 PSI

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
SERVICE BRAKE RELAY VALVE – PRESSURE TOO LOW	46210	5000mS	Fast flash Service Brake Fault Indicator	Machine Setup's MODEL is 12010H / 2733, and all of the following conditions are present for 2500mS: • Engine is running • Brake Pedal Position is >85.0% (ConstantData, pedal is depressed) • Brake Pedal Pressure OR Service Brake Relay Pressure is <290 PSI (ConstantData, insufficient pressure, cannot apply brakes)	Maintain through Power Cycle; all of the following conditions are present for 2500mS: • Engine is Running • Brake Pedal Position >85.0% • Brake Pedal Pressure & Service Brake Relay Pressure are both >290 PSI
SERVICE BRAKE RELAY VALVE – PRESSURE TOO HIGH	46211	5000mS	Fast flash Service Brake Fault Indicator	Machine Setup's MODEL is 12010H / 2733, and all of the following conditions are present for 2500mS: • Engine is running • Service Brake Relay Pressure is <3000 PSI (healthy sensor) • Service Brake Relay Pressure is >1160 PSI (ConstantData, excessive brake pressure, cannot release brakes)	Maintain through Power Cycle; all of the following conditions are present for 2500mS: • Engine is Running • Brake Pedal Position >99.0% • Brake Pedal Pressure & Service Brake Relay Pressure are both <1160 PSI

9.18.13 Communications (66x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CANBUS FAILURE – PLATFORM MODULE	662	Continuously	• Function Enable Switch disengaged	Platform Mode; Machine Setup's PLATFORM OPTION is YES; Engine Running or Stopped for 1000mS; PLT messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – ENGINE CONTROLLER	666	Continuously	• Hydraulic functions prevented • Engine Start prevented • Lock-Up Convertor prevented • Fan Speed Valve prevented • Fan Speed 2 Valve prevented • Fan Reverse Valve prevented • Engine Hours assumed to be 9999.9 hours ECM defaults to Closed Throttle RPM on loss of J1939 TSC1 without interaction from the System Modules	Cabin or Platform Mode; Engine Running or Stopped; ECM messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – EXCESSIVE CANBUS ERRORS	6613	Continuously	–	• CCM detects 500 Bus-Off conditions since power-up • CCM detects 22 Bus-Off conditions within 1,000mS	Power cycled
CANBUS FAILURE – TRANSMISSION CONTROLLER	6616	5000mS	• Direction Selection is Neutral • FFCM J2-H4 Transmission HWFS1 de-energized • FFCM J2-A3 Transmission HWFS2 de-energized	Machine Setup's TRANSMISSION is BOSCH HYSTAT; DRC messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – TRANSMISSION CONTROLLER	6616	5000mS	• Pump Pressure A is assumed as 600.0 BAR • Pump Pressure B is assumed as 600.0 BAR • Direction Selection is Neutral • Power State is ERROR for power-up or SAFE for run-time	Machine Setup's TRANSMISSION is LINDE HYSTAT; TCM messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – CABIN JOYSTICK	6617	Continuously	Hydraulic functions are prevented	Cabin Mode; Engine Running or Stopped; Cabin Joystick CANbus not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – CABIN DISPLAY	6618	Continuously	–	Machine Setup's VEHICLE is not LBP-RS; Cabin Mode; Engine Running or Stopped; Parker Cabin Display messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – CABIN DISPLAY	6618	Continuously	–	Machine Setup's VEHICLE is LBP-RS; Cabin Mode; Stoneridge Cabin Display messages not detected within CANbus Timeout Interval	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CANBUS FAILURE – BOOM ANGLE SENSOR	6621	Continuously	• Boom angle sensor assumed to be +99° • HIRAS Mode is forced to ERROR • Start HIRAS Integrity Checks is prevented • LMIS / Weigh Load Predicted Load is 32,767 • Lift Up prevented in Platform Mode • Lift Up prevented while platform attached • Lift Up and Down de-rated in Cabin Mode • Boom Damping prevented	Machine Setup's CAN BOOM ANGLE is YES; Engine Running or Stopped for 1000mS; CANbus Boom Angle Sensor (BMA) messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – FORK SENSOR	6625	5000mS	• Fork Tilt Angle is assumed to be worst case (+99.99°)	Machine Setup's AUTO FORK LEVEL is YES and all of the following conditions are present: • Powerup Delay has expired • Fork Tilt Sensor messages not detected within CANbus Time-out Interval	Power Cycled
CANBUS FAILURE – CHASSIS TILT	6635	5000mS	Worst case tilt readings (+25.00°, +25.00°) assumed	Machine Setup's CHASSIS TILT is YES; Engine Running or Stopped; TILT1 or TILT2 messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – REMOTE INPUT MODULE	6642	5000mS	• Remote controls prevented • Remote engine start prevented	Machine Setup's REMOTE CONTROL is YES; Remote Control Mode Switch is closed and powerup delay expired; RCM messages not detected within CANbus Timeout Interval	Power Cycled
CANBUS FAILURE – FRONT FRAME CONTROL MODULE	6647	Continuously	• Hydraulic functions prevented • Engine Start prevented • Throttle Engine Speed set to Closed Throttle RPM • Direction Selection Neutral • Transmission Solenoids pre-vented • Fuel Level assumed to be Empty (0.0%) • Auxiliary De-Compression pre-vented • Power State is ERROR for power-up or SAFE for run-time	FFCM messages not detected within CANbus Timeout Interval	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CANBUS FAILURE – REAR FRAME CONTROL MODULE	6648	Continuously	• Hydraulics functions prevented • Engine Start prevented • Throttle Engine Speed set to Closed Throttle RPM • Load Stability Reading assumed 100% • Auxiliary De-Compression prevented • Power State is ERROR for power-up or SAFE for run-time	RFCM messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – LCM MODULE	6649	Continuously	• Hydraulics functions prevented • Engine Start prevented • Throttle Engine Speed set to Closed Throttle RPM • LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Length Measurement is maximum (Lmax) • Lift Accumulator Pressure is 600.0 BAR • Boom Damping is Prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES, PLATFORM OPTION is YES, WEIGH LOAD is YES, or BOOM DAMPING is YES; LCM messages not detected within CANbus Timeout Interval	Power cycled
CANBUS FAILURE – REVERSE OBSTACLE SENSOR	6658	5000mS	• Reverse Obstacle Detection Sensor is Unhealthy • Detection Zone 1 is assumed	Cabin Mode; Engine Running or Stopped for 1000mS; Machine Setup's REVERSE OBSTACLE DETECTION is YES; ROD message not detected within 350mS CANbus Timeout Interval when Direction Selection is Reverse	Power cycled
CANBUS FAILURE – PREMIUM DISPLAY	6659	5000mS	• LMIS Attachment Selection Change is prevented	Machine Setup's PREMIUM DISPLAY is YES or YES W/ ANTI-THEFT; PRM messages not detected within CANbus Timeout Interval	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CANBUS FAILURE – CABIN CONTROL MODULE	6662	Continuously	• Hydraulics functions prevented • Engine Start prevented • Throttle Engine Speed set to Closed Throttle RPM	CCM messages to FFCM, RFCM, LCM, or TCM not detected within CANbus Timeout Interval	Power cycled
RS232 FAILURE – ATTACHMENT RECOGNITION	6670	5000mS	Attachment Recognition functionality is prevented, operator must manually select attachment to reenable boom functions after attachment change.	Machine Setup's ATTACH RECOG is YES; Powerup delay has expired and either of the following conditions is present for 5000mS : • RFID reader does not respond to new Inventory requests on RS232. • Inventory Sessions are not successful (STATUS byte is not 0x00/OK or 0x01/NO TAGS DETECTED).	Power Cycled
CANBUS FAILURE – TILT CYLINDER STROKE SENSOR	6684	5000mS	• Tilt Cylinder Stroke is assumed to be 999.9mm • Tilt Cylinder Status is assumed to be ERROR	Machine Setup's AUTO FORK LEVEL is YES and all of the following conditions are present: • Powerup Delay has expired • Tilt Cylinder Stroke Sensor messages not detected within CANbus Timeout Interval	Power Cycled

9.18.14 Envelope Control (84x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
BOOM LENGTH SWITCH / SENSOR DISAGREEMENT	843	5000mS	• Boom Length Measurement is maximum (Lmax) • LMIS / Weigh Load Predicted Load is 32,767	Boom Length Configured; Boom Length Calibrated; Boom Retract Switch Closed; LCM J1-E1 Boom Length Signal is not within ±0.45V of the Boom Length Minimum Calibration for 500mS	Power cycled
BOOM LENGTH SENSOR NOT DETECTING LENGTH CHANGE	844	5000mS	• Boom Length Measurement is maximum (Lmax) • LMIS / Weigh Load Predicted Load is 32,767	Boom Length Configured, Debug's BOOM NR is NO, Main Lift Up Command <900mA, Main Lift Down Command <900mA, LCM J1-E1 Boom Length (Signal) is not changing more than +/- 0.05V over 5,000mS and either of the following conditions are present: • Telescope In Command > 950mA and LCM J1-E1 Boom Length (Signal) > Boom Length Minimum Calibration + 0.25V • Telescope Out Command >950mA and LCM J1-E1 Boom Length (Signal) < Boom Length Maximum Calibration – 0.25V	Power cycled
BOOM LENGTH SENSOR – OUT OF RANGE HIGH	845	5000mS	• Boom Length Measurement is maximum (Lmax) • LMIS / Weigh Load Predicted Load is 32,767	Boom Length Configured; LCM J1-E1 Boom Length Signal > 4.9V for 500mS	Power cycled
BOOM LENGTH SENSOR – OUT OF RANGE LOW	846	5000mS	• Boom Length Measurement is maximum (Lmax) • LMIS / Weigh Load Predicted Load is 32,767	Boom Length Configured; LCM J1-E1 Boom Length Signal < 0.1V for 500mS	Power cycled
BOOM LENGTH SENSOR – NOT CALIBRATED	8464	5000mS	• Boom Length Measurement is maximum (Lmax) • LMIS / Weigh Load Predicted Load is 32,767	Boom Length Configured and Boom Length Not Calibrated	Boom Length Calibrated

9.18.15 Tilt Sensor (81x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
CHASSIS TILT SENSOR NOT CALIBRATED	813	5000mS	Worst case tilt readings (+25.00°, +25.00°) assumed	Machine Setup's CHASSIS TILT is YES; TILT1 and TILT2 not calibrated	Power cycled
CHASSIS TILT SENSOR DISAGREEMENT	815	5000mS	Worst case tilt readings (+25.00°, +25.00°) assumed	Machine Setup's CHASSIS TILT is YES; TILT1 and TILT2 calibrated; TILT1 and TILT2 disagree more than +/- 2.0 Degrees for 1000mS while Park Brake is applied	Power cycled

9.18.16 Load Moment (85x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LSI NOT CALIBRATED	8514	5000mS	Load Stability assumed to be 100%	Machine Setup's LOAD STABILITY is YES; Load Stability has not been calibrated or calibration factors out of range	LSI calibrated
LSI LOAD CELL A – OUT OF RANGE	8516	5000mS	Load Stability assumed to be 100%	Machine Setup's LOAD STABILITY is YES; RFCM J3-E4 LSI Sensor Signal 1 reading out of range or short to battery	Power cycled for short to battery; LSI Sensor Signal 1 in range for 3000mS
LSI LOAD CELL B – OUT OF RANGE	8517	5000mS	Load Stability assumed to be 100%	Machine Setup's LOAD STABILITY is YES; RFCM J3-F4 LSI Sensor Signal 2 reading out of range or short to battery	Power cycled for short to battery; LSI Sensor Signal 2 in range for 3000mS
LSI OUT OF CALIBRATION	8519	5000mS	Load Stability assumed to be 100%	Machine Setup's LOAD STABILITY is YES; LSI Verification Failed	LSI Verification Passed (Retained through power cycles)
LSI LOAD CELL A & B – DISAGREEMENT	8520	5000mS	Load Stability assumed to be 100%	Machine Setup's LOAD STABILITY is YES; Load Stability Primary % & Backup % difference excessive	Difference in tolerance for 3000mS
LIFT CYLINDER HEAD PRESSURE 1 – OUT OF RANGE HIGH	8523	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • $_{LOW}$ protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-C1 Lift Cylinder Head Pressure 1 > 20mA for 500mS	Power cycled
LIFT CYLINDER HEAD PRESSURE 1 – OUT OF RANGE LOW	8524	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Head Pressure 1 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-C1 Lift Cylinder Head Pressure 1 < 2mA for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LIFT CYLINDER HEAD PRESSURE 2 – OUT OF RANGE HIGH	8525	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • LOW protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-B1 Lift Cylinder Head Pressure 2 > 20mA for 500mS	Power cycled
LIFT CYLINDER HEAD PRESSURE 2 – OUT OF RANGE LOW	8526	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Head Pressure 2 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-B1 Lift Cylinder Head Pressure 2 < 2mA for 500mS	Power cycled
LIFT CYLINDER HEAD PRESSURE – DISAGREEMENT	8527	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Head Pressure 1 & 2 are 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-C1 Lift Cylinder Head Pressure 1 and LCM J1-B1 Lift Cylinder Cylinder Head Pressure 2 disagree by more than +/- 50BAR for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LIFT CYLINDER ROD PRESSURE 1 – OUT OF RANGE HIGH	8528	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • $_{LOW}$ protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-A1 Lift Cylinder Rod Pressure 1 > 20mA for 500mS	Power cycled
LIFT CYLINDER ROD PRESSURE 1 – OUT OF RANGE LOW	8529	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-A1 Lift Cylinder Rod Pressure 1 < 2mA for 500mS	Power cycled
LIFT CYLINDER ROD PRESSURE 2 – OUT OF RANGE HIGH	8530	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • $_{LOW}$ protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-D1 Lift Cylinder Rod Pressure 2 > 20mA for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LIFT CYLINDER ROD PRESSURE 2 – OUT OF RANGE LOW	8531	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-D1 Lift Cylinder Rod Pressure 2 < 2mA for 500mA	Power cycled
LIFT CYLINDER ROD PRESSURE – DISAGREEMENT	8532	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Rod Pressure 1 & 2 are 600.0 BAR • Boom Damping prevented	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES or BOOM DAMPING is YES; LCM J1-A1 Lift Cylinder Rod Pressure 1 and LCM J1-D1 Lift Cylinder Rod Pressure 2 disagree by more than +/- 50BAR for 500mS	Power cycled
COMP CYLINDER HEAD PRESSURE 1 – OUT OF RANGE HIGH	8533	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • $_{LOW}$ protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J1-F2 Compensation Cylinder Head Pressure 1 > 20mA for 500mS	Power cycled
COMP CYLINDER HEAD PRESSURE 1 – OUT OF RANGE LOW	8534	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Compensation Cylinder Head Pressure 1 is 600.0 BAR	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J1-F2 Compensation Cylinder Head Pressure 1 < 2mA for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
COMP CYLINDER HEAD PRESSURE 2 – OUT OF RANGE HIGH	8535	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • LOW protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J1-F1 Compensation Cylinder Head Pressure 2 > 20mA for 500mS	Power cycled
COMP CYLINDER HEAD PRESSURE 2 – OUT OF RANGE LOW	8536	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Compensation Cylinder Head Pressure 2 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J1-F1 Compensation Cylinder Head Pressure 2 < 2mA for 500mS	Power cycled
COMP CYLINDER HEAD PRESSURE – DISAGREEMENT	8537	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Compensation Cylinder Head Pressure 1 & 2 are 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J1-F2 Compensation Cylinder Head Pressure 1 and LCM J1-F1 Compensation Cylinder Head Pressure 2 disagree by more than +/- 50BAR for 500mS	Power cycled
COMP CYLINDER ROD PRESSURE 1 – OUT OF RANGE HIGH	8538	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • LOW protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J3-E4 Compensation Cylinder Rod Pressure 1 > 20mA for 500mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
COMP CYLINDER ROD PRESSURE 1 – OUT OF RANGE LOW	8539	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Compensation Cylinder Rod Pressure 1 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J3-E4 Compensation Cylinder Rod Pressure 1 < 2mA for 500mS	Power cycled
COMP CYLINDER ROD PRESSURE 2 – OUT OF RANGE HIGH	8540	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • LCM V • LOW protected FET disabled • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J3-F4 Compensation Cylinder Rod Pressure 2 > 20mA for 500mS	Power cycled
COMP CYLINDER ROD PRESSURE 2 – OUT OF RANGE LOW	8541	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Compensation Cylinder Rod Pressure 2 is 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J3-F4 Compensation Cylinder Rod Pressure 2 < 2mA for 500mS	Power cycled
COMP CYLINDER ROD PRESSURE – DISAGREEMENT	8542	5000mS	• LMIS / Weigh Load Predicted Load is 32,767 • Compensation Cylinder Rod Pressure 1 & 2 are 600.0 BAR	Machine Setup's VEHICLE is not LBP-SC; Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM J3-E4 Compensation Cylinder Rod Pressure 1 and LCM J3-F4 Compensation Cylinder Rod Pressure 2 disagreed by more than +/- 50BAR for 500mS	Power cycled
LMIS / WEIGH LOAD ATTACHMENT SELECTION – DISAGREEMENT	8543	5000mS	• LMIS / Weigh Load Predicted Load is 32,767	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LCM and PRM Attachment Selected do not agree for 3000mS	Power cycled
LMIS NOT CALIBRATED	8544	5000mS	• LMIS / Weigh Load Predicted Load is 32,767	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES; LMIS Passive Mode is DISABLE; LMIS Calibration Mode is MANUAL; At least one LMIS calibration offset is out of range for the selected attachment	All calibration offsets are in range for selected attachment (LMIS calibration must be successfully completed)

9.18.17 Steering (86x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
LOW STEERING PRESSURE	8638	Continuously	Low Steering Pressure Indicator is shown on Parker Cabin Display	Machine Setup's STEER PRESSURE is YES; Machine Setup's VEHICLE is not LBP-RS; Engine running >5,000mS; CCM J3-C3 Steering Pressure Switch is de-energized (open) for 3,000mS	Steering Pressure Switch energized (closed) for 3,000mS
LOW STEERING PRESSURE	8638	Continuously	Low Steering Pressure Indicator is shown on Stoneridge Cabin Display	Machine Setup's STEER PRESSURE is YES; Machine Setup's VEHICLE is LBP-RS; Engine running >5,000mS; CCM J3-C3 Steering Pressure Switch is de-energized (open) for 3,000mS	Steering Pressure Switch energized (closed) for 3,000mS

9.18.18 Service Required (87x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
MAINTENANCE INTERVAL	874	5000mS	–	Machine Setup's PREMIUM DISPLAY is NO; Operator Tools' ENABLE MAINT INTERVAL is YES; Maintenance Interval has been reached	Maintenance Interval reset by user 10 Minutes elapses
OIL CHANGE REQUIRED DUE TO STANDSTILL REFRESH	875	5000mS	–	Machine Setup's ENGINE CONTROL is Deutz Engine Configured and any one of the following occur: • DM1 (524194:8) active • DM1 (524193:2) active • Oil Exchange Request active	All of trigger conditions removed

9.18.19 Hardware (99x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
EEPROM FAILURE – CHECK ALL SETTINGS	998	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	EEPROM checksum issue detected EEPROM cannot be synchronized at power-up	Configure and calibrate vehicle Power cycled
FUNCTION LOCKED OUT – PLATFORM MODULE SOFTWARE VERSION IMPROPER	9910	Continuously	• Platform functions prevented	Machine Setup's PLATFORM OPTION is YES; keyswitch platform; PLT Software Major is not 0x04	Power cycled
FUNCTIONS LOCKED OUT – MACHINE NOT CONFIGURED	9924	5000mS	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • All other faults are masked	Machine Setup's MODEL is UNKNOWN	Adjust Machine Setup's MODEL Power cycled
PLATFORM MODULE HARDWARE FAILURE	9948	Continuously	• Platform functions prevented	Machine Setup's PLATFORM OPTION is YES; keyswitch platform; PLT reports Low Side FET failure	Power cycled
MACHINE CONFIGURATION OUT OF RANGE – CHECK ALL SETTINGS	9949	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	CCM, FFCM, RFCM, LCM or TCM detects one of these issues: Machine Setup parameter out of range Machine Setup checksum improper	Configure Machine Setup Power cycled
CABIN JOYSTICK - INTERNAL FAILURE	9976	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Direction Selection is Neutral when Machine Setup's JOYSTICK FNR is YES	CABIN JOYSTICK DM1 (520193:12) active CABIN JOYSTICK DM1 (520194:12) active CABIN JOYSTICK DM1 (520197:12) active CABIN JOYSTICK provides undocumented DM1 CABIN JOYSTICK Main and Supervisor feedback improper	Power cycled
EEPROM VALUE – OUT OF RANGE	9978	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	CCM, FFCM, or RFCM detects one of these issues: Personality parameter out of range Personality checksum improper	Configure Personalities Power cycled
FUNCTIONS LOCKED OUT – CAB JOYSTICK SOFTWARE VERSION IMPROPER	9985	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	Machine Setup's SAFETY JOYSTICK is YES; CCM Software Type is Production; Cabin Mode; JoystickSWMajor is not 0x02	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FUNCTIONS LOCKED OUT – CAB JOYSTICK SOFTWARE VERSION IMPROPER	9985	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	Machine Setup's VEHICLE is LBP-RS, SAFETY JOYSTICK is NO; CCM Software Type is Production; Cabin Mode; JoystickSWMajor is not 0x01	Power cycled
FUNCTIONS LOCKED OUT – TCM SOFTWARE VERSION IMPROPER	99163	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	TCM Type, Major, & Minor Software Versions do not match CCM	Power cycled
FUNCTIONS LOCKED OUT – FFCM SOFTWARE VERSION IMPROPER	99173	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	FFCM Type, Major, & Minor Software Versions do not match CCM	Power cycled
FUNCTIONS LOCKED OUT – RFCM SOFTWARE VERSION IMPROPER	99174	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	RFCM Type, Major, & Minor Software Versions do not match CCM	Power cycled
FUNCTIONS LOCKED OUT – LCM SOFTWARE VERSION IMPROPER	99175	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	LCM Type, Major, & Minor Software Versions do not match CCM	Power cycled
FUNCTIONS LOCKED OUT – CABIN DISPLAY SOFTWARE VERSION IMPROPER	99176	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	Machine Setup's VEHICLE is not LBP-RS; CCM Software Type is Production and one of the following occurred: CabinDisplaySWType is not 0x50 (Production) CabinDisplaySWMajor is not 0x01	Power cycled
FFCM CURRENT FEEDBACK GAINS OUT OF RANGE	99177	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	FFCM current feedback calibration is out of range	Power cycled
RFCM CURRENT FEEDBACK GAINS OUT OF RANGE	99178	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	RFCM current feedback calibration is out of range	Power cycled
FFCM CURRENT FEEDBACK CALIBRATION CHECKSUM INCORRECT	99179	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	FFCM current feedback calibration checksum is improper	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
RFCM CURRENT FEEDBACK CALIBRATION CHECKSUM INCORRECT	99180	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	RFCM current feedback calibration checksum is improper	Power cycled
CCM ANALOG REFERENCE OUT OF RANGE	99181	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Throttle Position is 0% • Outrigger Left Joystick is 0% • Outrigger Right Joystick is 0% • Rear Auxiliary 1 Joystick is 0% • Rear Auxiliary 2 Joystick is 0% • Proportional Travel Speed is 0% • Brake Pedal Position is 0%	CCM detects one of these issues for 1,000mS: +5V analog reference is >5.1V or <4.9V +3.3V analog reference is >3.4V or <3.2V Note: Check that pins CCM J1-H2, J2-F1, and J2-F2 Analog Reference Voltage are +5+/-0.1V.	Power cycled
FFCM ANALOG REFERENCE OUT OF RANGE	99182	Continuously	• Hydraulic Fluid Temperature is +150°C • If Machine Setup's TRANS TEMP is SENSOR or HYSTAT SENSOR; Transmission Oil Temperature is +150°C • Intercooler Air Temperature is +150°C • Outrigger Left Extend Pressure is 0 PSI / BAR • Outrigger Left Retract Pressure is 0 PSI / BAR • Outrigger Left Not Set • Outrigger Right Extend Pressure is 0 PSI / BAR • Outrigger Right Retract Pressure is 0 PSI / BAR • Outrigger Right Not Set • Fuel Level assumed to be Empty (0.0%) • Brake Pedal Pressure is 3000PSI • De-Clutch prevented • Service Brake Relay Pressure is 3000 PSI (max)	FFCM detects one of these issues for 1,000mS: +5V analog reference is >5.1V or <4.9V +3.3V analog reference is >3.4V or <3.2V Note: Check that pins FFCM J1-H2, J2-F1, J2-F2, J2-L2, J3-A2, J3-B2, J3-C2, J3-D2, J3-D3, and J3-E3 Analog Reference Voltage are +5+/-0.1V.	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
RFCM ANALOG REFERENCE OUT OF RANGE	99183	Continuously	• Boom Angle Sensor is +99° • HIRAS Mode is forced to ERROR • Start HIRAS Integrity Checks is prevented • Lift Up de-rated • Load Stability assumed to be 100% • Boom Damping prevented	RFCM detects one of these issues for 1,000mS: +5V analog reference is >5.1V or <4.9V +3.3V analog reference is >3.4V or <3.2V Note: Check that pins RFCM J1-H2, J2-F1, J2-F2, J2-L2, J3-A2, J3-B2, J3-C2, J3-D2, J3-D3, and J3-E3 Analog Reference Voltage are +5+/-0.1V.	Power cycled
LCM ANALOG REFERENCE OUT OF RANGE	99184	Continuously	• LMIS / Weigh Load Predicted Load is 32,767 • Lift Cylinder Head Pressure 1 is 600.0 BAR • Lift Cylinder Head Pressure 2 is 600.0 BAR • Lift Cylinder Rod Pressure 1 is 600.0 BAR • Lift Cylinder Rod Pressure 2 is 600.0 BAR • Compensation Cylinder Head Pressure 1 is 600.0 BAR • Compensation Cylinder Head Pressure 2 is 600.0 BAR • Compensation Cylinder Rod Pressure 1 is 600.0 BAR • Compensation Cylinder Rod Pressure 2 is 600.0 BAR • Boom Length Measurement is maximum (Lmax)	Machine Setup's LOAD MOMENT IND SYSTEM is YES, PLATFORM OPTION is YES, or WEIGH LOAD is YES; LCM detects one of these issues for 1,000mS: +5V analog reference is >5.1V or <4.9V +3.3V analog reference is >3.4V or <3.2V Note: Check that pins LCM J1-H2, J2-F1, J2-F2, J2-L2, J3-A2, J3-B2, J3-C2, J3-D2, J3-D3, and J3-E3 Analog Reference Voltage are +5+/-0.1V.	Power cycled
CCM INTERNAL ERROR	99203	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Power State is ERROR for power-up or SAFE for run-time	CCM failed integrity tests at power-up or run-time	Power cycled
FFCM INTERNAL ERROR	99204	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Power State is ERROR for power-up or SAFE for run-time	FFCM failed integrity tests at power-up or run-time	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
RFCM INTERNAL ERROR	99205	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Power State is ERROR for power-up or SAFE for run-time	RFCM failed integrity tests at power-up or run-time	Power cycled
LCM INTERNAL ERROR	99278	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Load Moment assumed to be 100% • Power State is ERROR for power-up or SAFE for run-time • LMIS / Weigh Load Predicted Load is 32,767 • Boom Length Measurement is maximum (Lmax)	LCM failed integrity tests at power-up or run-time	Power cycled
LCM CURRENT FEEDBACK GAINS OUT OF RANGE	99279	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	LCM current feedback calibration is out of range	Power cycled
LCM CURRENT FEEDBACK CALIBRATION CHECKSUM INCORRECT	99280	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM	LCM current feedback calibration checksum is improper	Power cycled
RFCM ANALOG ENABLE OUTPUT NOT ON	99283	Continuously	• Load Stability assumed to be 100%	Machine Setup's LOAD STABILITY is YES; RFCM's Q4 and Q5 current sampling switches (Analog Input Type 2) are enabled but do not respond	Power cycled
LCM LOAD CHART CHECKSUM INCORRECT	99284	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • LMIS / Weigh Load Predicted Load is 32,767	Machine Setup's LOAD MOMENT IND SYSTEM is YES or WEIGH LOAD is YES and either of the following conditions are present: • Calculated and embedded Data Load Charts checksums do not match • Calculated and Premium Display's Data Load Charts checksums do not match	Power cycled
SAHR BRAKE CONFIGURATION INCORRECT	99287	5000mS	–	Machine Setup's VEHICLE is not LBP-SC or LBP-HC; Machine Setup's SAHR BRAKE is NO or MANUAL; CCM's Power Management State is Normal; normal valve impedance detected on FFCM J1-G4 SAHR Brake Valve for 2000mS	Power cycled

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
FUNCTIONS LOCKED OUT – SYSTEM IN SAFE MODE	99294	Continuously	–	CCM's Power Management State is Safe	Power cycled
TRANSMISSION TEMPERATURE SENSOR CONFIGURATION INCORRECT	99295	5000mS	Transmission Oil Temperature is +150°C	Machine Setup's FAN CONTROL is HYDRAULIC, HYD W/ REV, or DUAL HYD and Machine Setup's TRANS TEMP is SWITCH	Power cycled
TRANSMISSION TEMPERATURE SENSOR CONFIGURATION INCORRECT	99295	5000mS	Transmission Oil Temperature is +150°C	Machine Setup's VEHICLE is HBP, TRANS TEMP is SWITCH; FFCM J1-C1 Transmission Oil Temperature (Sensor) is greater than 0.1V and less than 4.73V for 1,000mS. Note: Change TRANS TEMP to SENSOR and cycle power to clear faults.	Power cycled
TRANSMISSION MACHINE TYPE CONFIGURATION INCORRECT	99297	5000mS	Engine speed set to closed throttle RPM	Machine Setup's TRANSMISSION is BOSCH HYSTAT; reported Machine Type does not match configuration	Power cycled
ATTACHMENT RECOGNITION CONFIGURATION INCORRECT	99317	5000mS	Attachment Recognition functionality is prevented, operator must manually select attachment to reenable boom functions after attachment change.	Machine Setup's ATTACH RECOG is YES; Reader Configuration was not successful after engine start.	Power Cycled
TCM ANALOG REFERENCE OUT OF RANGE	99334	Continuously	• Pump Pressure A is assumed as 600.0 BAR • Pump Pressure B is assumed as 600.0 BAR	Machine Setup's TRANSMISSION is LINDE HYSTAT; TCM detects one of these issues for 1,000mS: • +5V analog reference is >5.1V or <4.9V • +3.3V analog reference is >3.4V or <3.2V Note: Check that pins TCM J1-H2, J2-F1, J2-F2, J2-L2, J3-A2, J3-B2, J3-C2, J3-D2, J3-D3, and J3-E3 Analog Reference Voltage are +5+/-0.1V.	Power Cycled
TCM INTERNAL ERROR	99335	Continuously	• Hydraulic functions are prevented • Engine Start is prevented • Engine speed set to closed throttle RPM • Direction Selection is Neutral • Pump Pressure A is assumed as 600.0 BAR • Pump Pressure B is assumed as 600.0 BAR • Power State is ERROR for power-up or SAFE for run-time	Machine Setup's TRANSMISSION is LINDE HYSTAT and any of the following conditions exist: • TCM failed integrity tests at power-up or run-time • TCM current feedback calibration is out of range • TCM current feedback calibration checksum is improper	Power cycled

9.19 ENGINE DIAGNOSTIC

Note: *For more information, contact your local authorized engine service distributor.*

SPN	FMI	Description
51	3	Intake Throttle Flap, H-Bridge, short circuit to battery (A02)
51	3	Intake Throttle Flap, H-Bridge, short circuit to battery (A67)
51	3	Intake Throttle Flap, H-Bridge, short circuit to battery oder broken wiring harness
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground (A02)
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground (A67)
51	4	Intake Throttle Flap, H-Bridge, short circuit to ground
51	5	Intake Throttle Flap, H-Bridge, wiring harness broken at connected actuator
51	6	Intake Throttle Flap, H-Bridge, current above maximum threshold
51	7	Intake Throttle Flap, H-Bridge, position of actuator not plausible (deviation from set point more than 7%)
91	3	Sensor error accelerator pedal; signal range check high
91	4	Sensor error accelerator pedal; signal is below the range
94	1	Low fuel pressure; warning threshold exceeded
94	1	Low fuel pressure; shut off threshold exceeded
94	3	Sensor error low fuel pressure; signal range check high
94	4	Sensor error low fuel pressure; signal range check low
97	3	Sensor error water in fuel; signal range check high
97	4	Sensor error water in fuel; signal range check low
97	12	Water in fuel level prefilter; maximum value exceeded
100	0	
100	0	High oil pressure; shut off threshold exceeded
100	1	Low oil pressure; warning threshold exceeded
100	1	Low oil pressure; shut off threshold exceeded
100	3	Sensor error oil pressure; signal range check high
100	4	Sensor error oil pressure sensor; signal range check low
102	1	Physical Range high error for Charged Air cooler down stream pressure No detail information!
102	2	Charged air pressure above warning threshold
102	2	Charged air pressure above shut off threshold; system reaction initiated
102	2	Sensor error exhaust gas back pressure burner; signal range check low
102	3	Signal error for Charged air cooler pressure from CAN (down stream) No detail information!
102	4	Sensor error charged air pressure; signal range check low
105	0	Charged air cooler temperature; system reaction initiated High charged air cooler temperature; warning threshold exceeded
105	0	High charged air cooler temperature; shut off threshold exceeded

SPN	FMI	Description
105	1	Physical Range Check low for Charged Air cooler down stream temperature No detail information!
105	3	Sensor error charged air temperature; signal range check high
105	4	Sensor error charged air temperature; signal range check low
105	11	Diagnostic fault check for charged air cooler downstream temperature sensor No detail information!
107	0	Sensor error air filter differential pressure; short circuit to ground
107	0	Air filter differential pressure; short circuit to ground
107	3	Sensor error air filter differential pressure; short circuit to battery
108	3	Sensor error ambient air pressure; signal range check high
108	4	Sensor error ambient air pressure; signal range check low
110	0	Physical Range Check high for Coolant temperature
110	0	High coolant temperature; warning threshold exceeded
110	0	Coolant temperature; system reaction initiated
110	1	Physical Range Check low for Coolant temperature
110	3	Sensor error coolant temperature; signal range check high
110	4	Sensor error coolant temperature; signal range check low
111	1	Coolant level too low
157	3	Sensor error rail pressure; signal range check high
157	4	Sensor error rail pressure; signal range check low
164	2	Rail pressure safety function is not executed correctly
168	0	Physical range check high for battery voltage
168	1	Physical range check low for battery voltage
168	2	High battery voltage; warning threshold exceeded Battery voltage; system reaction initiated
168	2	
168	3	Sensor error battery voltage; signal range check high
168	4	Sensor error battery voltage; signal range check low
171	0	Physical Range Check high for Environment Temperature No detail information!
171	1	Physical Range Check low for Environment Temperature No detail information!
171	3	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check high
171	4	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check low
172	0	Environment temperature above maximum physical value
172	1	DFC Air Inlet filter out of physical range check
172	1	Environment temperature below minimum level
172	2	DFC Air Inlet filter plausibility check failed
172	3	Air flow temperature sensor; short circuit to battery or open load

SPN	FMI	Description
172	4	Air flow temperature sensor; short circuit to ground
175	0	High oil temperature; warning threshold exceeded
175	0	High oil temperature; shut off threshold exceeded
175	2	Customer oil temperature: signal implausible
175	3	Sensor error oil temperature; signal range check high
175	4	Sensor error oil temperature; signal range check low
190	0	Engine speed above warning threshold (FOC-Level 1) Overspeed detection in component engine protection
190	0	Engine speed above warning threshold (FOC-Level 1)
190	2	Offset angle between crank- and camshaft sensor is too large
190	8	Sensor camshaft speed; disturbed signal
190	8	Speed detection; out of range, signal disrupted Sensor crankshaft speed; disturbed signal
190	11	Engine speed above warning threshold (FOC-Level 2)
190	12	Speed detection; out of range, signal disrupted Sensor camshaft speed; no signal
190	12	Speed detection; out of range, signal disrupted Sensor crankshaft speed; no signal
190	14	Engine speed above warning threshold (Overrun Mode)
190	14	Camshaft- and Crankshaft speed sensor signal not available on CAN
411	0	signal range check low error of pressure control valve AD-channel No detail information!
411	3	Sensor differential pressure Venturi unit (EGR); CAN signal invalid
411	4	Physical range check low for EGR differential pressure
411	4	Sensor error differential pressure Venturi unit (EGR); signal range check high
411	11	Physical range check low for differential pressure Venturi unit (EGR)
412	3	Sensor error EGR cooler downstream temperature; signal range check high
412	4	Sensor error EGR cooler downstream temperature; signal range check low
520	9	Timeout Error of CAN-Receive-Frame TSC1TR; control signal
624	3	SVS lamp; short circuit to battery
624	4	SVS lamp; short circuit to ground
624	5	SVS lamp; open load
624	12	SVS lamp; power stage over temperature
630	12	Access error EEPROM memory (delete)
630	12	Access error EEPROM memory (read)
630	12	Access error EEPROM memory (write)
639	14	CAN-Bus 0 “Bus Off-Status”
651	3	Injector 1 (in firing order); short circuit
651	5	Injector 1 (in firing order); interruption of electric connection
652	3	Injector 2 (in firing order); short circuit
652	5	Injector 2 (in firing order); interruption of electric connection

SPN	FMI	Description
653	3	Injector 3 (in firing order); short circuit
653	5	Injector 3 (in firing order); interruption of electric connection
654	3	Injector 4 (in firing order); short circuit
654	5	Injector 4 (in firing order); interruption of electric connection
655	3	Injector 5 (in firing order); short circuit
655	5	Injector 5 (in firing order); interruption of electric connection
656	3	Injector 6 (in firing order); short circuit
656	5	Injector 6 (in firing order); interruption of electric connection
676	11	Cold start aid relay error
676	11	Cold start aid relay open load
677	3	Starter relay high side; short circuit to battery
677	3	Starter relay; short circuit
677	4	Starter relay; short circuit
677	4	Starter relay; short circuit
677	5	Starter relay; no load error
729	3	Intake Air Heater Device; Short circuit to battery
729	4	Air intake heater; Short circuit to ground error for power stage on CJ945.
729	5	Cold start aid relay open load
729	12	Cold start aid relay; over temperature error
898	9	Timeout Error of CAN-Receive-Frame TSC1TE; Set point
975	3	Fan actuator (PWM output); short circuit to battery
975	4	Fan actuator (PWM output); short circuit to ground
975	5	Fan actuator (PWM output); open load
1079	13	Sensor supply voltage monitor 1 error (ECU)
1080	13	Sensor supply voltage monitor 2 error (ECU)
1109	2	Engine shut off demand ignored
1136	0	Physical range check high for ECU temperature
1176	0	Multiple Stage Switch engine torque limitation curve; plausibility error
1176	2	Pressure sensor upstream turbine, plausibility error
1176	3	Physical Range Check low for turbine upstream pressure sensor No detail information!
1176	4	Sensor error pressure sensor upstream turbine; signal range check high
1180	0	Physical range check high for exhaust gas temperature upstream turbine
1180	1	Physical range check low for exhaust gas temperature upstream turbine
1180	3	Sensor error exhaust gas temperature upstream turbine; signal range check high
1180	4	Sensor error exhaust gas temperature upstream turbine; signal range check low
1188	0	Turbocharger Wastegate CAN; temperature too high
1188	2	Wastegate; status message from ECU missing

SPN	FMI	Description
1188	2	Turbocharger Wastegate CAN; CAN Error
1188	3	Turbocharger Wastegate CAN; Supply voltage too high
1188	4	Turbocharger Wastegate CAN; Supply voltage too low
1188	6	Turbocharger Wastegate CAN; current above limit
1188	7	Wastegate actuator; blocked
1188	7	Turbocharger Wastegate CAN; mechanical blocking detected
1188	7	Turbocharger Wastegate CAN; Spring break detected
1188	11	Wastegate actuator; internal error
1188	11	Wastegate actuator; EOL calibration not performed correctly
1188	11	Wastegate actuator; over temperature (> 145°C)
1188	11	Wastegate actuator; over temperature (> 135°C)
1188	11	Wastegate actuator; operating voltage error
1188	12	Turbocharger Wastegate CAN; Internal electrical error
1188	13	Wastegate actuator calibration deviation too large, recalibration required
1188	13	Turbocharger Wastegate CAN; EOL learning error
1188	13	Turbocharger Wastegate CAN; Error during position learning process detected
1188	13	Turbocharger Wastegate CAN; Error during learning process detected
1231	14	CAN-Bus 1 “Bus Off-Status”
1235	14	CAN-Bus 2 = CAN_C reports Bus-error (for engines <8L and CV52 it is the engine-CAN@250kbaud) CAN Bus error passive; warning CAN C - engine CAN
1235	14	CAN-Bus 2 = engine bus “Bus Off-Status”
1237	2	Override switch; plausibility error
1322	12	Too many recognized misfires in more than one cylinder
1323	12	Too many recognized misfires in cylinder 1 (in firing order)
1324	12	Too many recognized misfires in cylinder 2 (in firing order)
1325	12	Too many recognized misfires in cylinder 3 (in firing order)
1326	12	Too many recognized misfires in cylinder 4 (in firing order)
1327	12	Too many recognized misfires in cylinder 5 (in firing order)
1328	12	Too many recognized misfires in cylinder 6 (in firing order)
1639	0	Sensor error fan speed; signal range check high
1639	1	Sensor error fan speed; signal range check low
1761	0	Urea tank level to high
1761	1	DEF tank level to low
1761	2	Urea tank level outside of plausible thresholds
1761	14	Urea tank level; warning threshold exceeded
1761	14	Urea Tank Signal to HMI for indicating the Urea Tank-Level (Urea tank volume ratio low threshold 1)
1761	14	Urea tank level is below level 2
1761	14	Urea tank level is below level 3

SPN	FMI	Description
1761	14	Urea tank level is below level 4
2659	0	Exhaust Gas Recirculation AGS Sensor; Sensed exhaust mass value above maximum physical value
2659	1	Exhaust Gas Recirculation AGS Sensor; Sensed exhaust mass value below minimum physical value
2659	2	Exhaust Gas Recirculation AGS Sensor; signal not plausible
2659	2	Exhaust Gas Recirculation AGS Sensor; Temperature of EGR mass not plausible
2659	12	Exhaust Gas Recirculation AGS Sensor; plausibility error, AGS sensor has not passed the burn off process
2791	0	EGR actuator; temperature critical high
2791	2	EGR actuator; CAN error
2791	3	EGR Actuator CAN; Supply Voltage too high
2791	4	EGR Actuator CAN; Supply Voltage too low
2791	6	EGR actuator; power over limit
2791	7	SCR monitoring; EGR actuator recognized blocking
2791	7	EGR actuator; spring break detected
2791	12	Actuator EGR Valve; power stage over temperature
2791	12	EGR Actuator CAN; Internal electrical fault
2791	13	EGR actuator; EOL learn error
2791	13	EGR actuator; learn aborted
2791	13	EGR actuator; learn error
2791	16	EGR actuator; temperature high
2797	4	Timeout of ground short circuit monitoring Zyl. Bank 0; _IVDiaShCirGndToutBnk_0
2797	4	Injector diagnostic; Short circuit to ground cylinder bank 0
2798	4	Timeout of ground short circuit monitoring Zyl. Bank 1; _IVDiaShCirGndToutBnk_1
2798	4	Injector diagnostic; Short circuit to ground cylinder bank 1
3031	0	Urea tank temperature to high
3031	1	Urea tank temperature to low
3224	1	DFC for plausibility error Max for NOx sensor upstream of SCR Cat No detail information!
3224	2	DLC Error of CAN-Receive-Frame AT1IG1 NOX Sensor (SCR-system upstream cat; DPF-system downstream cat); length of frame incorrect
3224	2	DLC Error of CAN-Receive-Frame AT1IG1Vol NOX Sensor (SCR-system upstream cat; DPF-system downstream cat); length of frame incorrect
3224	9	Timeout Error of CAN-Receive-Frame AT1IG1; NOX sensor upstream
3224	9	Timeout Error of CAN-Receive-Frame AT1IG1Vol; NOX sensor (SCR-system upstream cat; DPF-system downstream cat)
3234	2	DLC Error of CAN-Receive-Frame AT1O1Vol NOX Sensor (SCR-system downstream cat; DPF-system downstream cat); length of frame incorrect

SPN	FMI	Description
3234	9	Timeout Error of CAN-Receive-Frame AT1OG1; NOX sensor (SCR-system downstream cat; DPF-system downstream cat)
3234	9	Timeout Error of CAN-Receive-Frame AT1OG1Vol; NOX sensor (SCR-system downstream cat; DPF-system downstream cat)
3234	11	DFC for plausibility error Min for NOx sensor downstream of SCR Cat No detail information!
3241	0	SCR plausibility, OBD and diagnosis; Error SCR catalyst upstream temperature sensor plausibility max threshold Error ECU temperature static plausibility No detail information!
3248	4	Sensor error particle filter downstream temperature; signal range check low
3251	0	The difference pressure exceeds the upper shutoff threshold
3251	0	Differential pressure sensor DPF, physical range Check high
3251	1	The difference pressure exceeds the lower shutoff threshold
3251	1	Differential pressure sensor DPF, physical range Check low
3253	2	The Difference pressure is not plausible
3253	2	Sensor differential pressure (DPF); plausibility error
3253	3	Physical range Check low of DFP differential pressure sensor (Dz specific warning system reaction) No detail information!
3253	4	Sensor error differential pressure (DPF); signal range check high
3361	3	Urea dosing valve; short circuit to battery on high side
3361	3	Urea dosing valve; short circuit to battery or open load on high side
3361	4	Urea dosing valve; short circuit to ground or open load on low side
3361	4	Urea dosing valve; short circuit on high side
3361	6	Urea dosing valve; power at the end of injection too high
3361	7	SCR plausibility, OBD and diagnosis; Dosing Valve is blocked Error SCR catalyst upstream temperature sensor static plausibility No detail information!
3519	3	UQS Temperature Sensor has detected a short circuit to battery
3519	4	UQS Temperature Sensor has detected a short circuit to ground
3519	12	DEF Tank Temperature too high
3519	13	Temperature at UQS invalid
3520	2	Wrong DEF quality detected or no DEF measuring possible
3520	3	Urea Quality sensor, short circuit to battery
3520	4	Urea Quality sensor, short circuit to ground
3520	8	Urea Quality monitoring; measurement conditions not fulfilled
3520	13	Urea quality at UQS invalid
3532	3	Sensor error urea tank level; signal range check high
3532	3	Quality at UQS out of max. physical range
3532	4	Sensor error urea tank level; signal range check low
3532	4	Quality at UQS out of min. physical range
3699	0	Maximum standstill time reached; oil exchange request ignored

SPN	FMI	Description
3699	2	Passive regeneration of the DPF; plausibility error DPF differential pressure sensor and a sensor or actuator Further CRT system defective
3699	2	Passive regeneration of the DPF; DOC error Temperature sensor us. and ds. DOC Simultaneously defect
3711	12	Demolition of regeneration;
3936	14	Standstill time based escalation requests Inducement step 1
3936	14	Standstill time based escalation requests Inducement step 2
4243	11	Heater SCR; Pressure line heater error and temperature condition to perform at after run (Group fault heater diagnosis) SCR system heater diagnostic reports error; shut off SCR system
4334	0	Urea supply module pressure sensor; physical range check high (defect pressure sensor)
4334	0	Urea pump pressure sensor; high signal not plausible
4334	1	Urea supply module pressure sensor; physical range check low (defect pressure sensor)
4334	1	Urea pump pressure sensor; low signal not plausible
4334	2	Supply module pressure not plausible
4341	3	SCR-heater urea supply line; short circuit to battery
4341	4	SCR-heater urea supply line; short circuit to ground
4341	5	SCR heater relay urea supply line secondary side; open load
4341	5	SCR heater relay urea supply line primary side; open load
4343	3	SCR heater urea pressure line; short circuit to battery
4343	4	SCR heater urea pressure line; short circuit to ground
4343	5	SCR heater relay urea pressure line secondary side; open load
4343	5	SCR heater relay urea pressure line primary side; open load
4343	11	Sensor backflow line pressure (SCR); plausibility error
4345	3	SCR heater urea return line; short circuit to battery
4345	4	SCR heater urea return line; short circuit to ground
4345	5	SCR heater relay urea return line secondary side; open load
4345	5	SCR heater relay urea return line primary side; open load
4345	11	DFC for Monitoring of the SCR fill level governor No detail information!
4360	0	Exhaust temperature before SCR-Cat is greater than maximum
4360	1	Exhaust temperature before SCR-Cat is less than minimum
4360	2	Exhaust temperature before SCR-Cat not plausible
4361	3	Sensor error urea catalyst exhaust gas temperature upstream; signal range check high
4361	4	Sensor error urea catalyst exhaust gas temperature upstream; signal range check low
4365	0	SCR plausibility, OBD and diagnosis; Error Urea tank temperature is overheated Monitoring of Pressure Reduction Malfunction Max No detail information!
4365	3	Sensor error urea tank temperature; short circuit to battery
4365	4	Sensor error urea tank temperature; short circuit to ground
4366	3	SCR Tank heating valve; short circuit to battery

SPN	FMI	Description
4366	4	SCR Tank heating valve; short circuit to ground
4366	5	SCR main relay (secondary side): open load
4366	5	SCR main relay (secondary side); Shortcut to battery
4366	5	SCR main relay (secondary side); shortcut to ground
4366	5	SCR Tank heating valve secondary side: open load
4366	5	SCR tank heating valve primary side; open load
4374	13	SCR Monitoring; Pressure stabilization error General pressure check error (SCR)
4375	3	Urea pump motor; short circuit to battery
4375	4	Urea pump motor; short circuit to ground
4375	5	Urea pump motor; open load
4376	3	SCR reversing valve; short circuit to battery
4376	4	SCR reversing valve; short circuit to ground
4376	4	SCR reverting valve; short circuit to ground
4376	5	SCR reversing valve; open load
4376	5	SCR reverting valve; open load
4376	12	SCR reverting valve; over temperature
4765	0	Temperature before diesel oxidation cat (DOC) is above the shutoff threshold
4765	0	Temperature before diesel oxidation cat (DOC) is above the warning threshold
4766	0	Temperature after diesel oxidation cat (DOC) is above the upper shutoff threshold
4766	0	Temperature after diesel oxidation cat (DOC) is above the upper warning threshold
4768	2	Temperature before diesel oxidation cat (DOC) is not plausible
4768	2	Plausibility check for swapped sensors (before- and after diesel oxidation cat) is failed
4768	3	Sensor error exhaust gas temperature upstream (DOC); signal range check high
4768	4	Sensor error exhaust gas temperature upstream (DOC); signal range check low
4769	2	Temperature after diesel oxidation cat (DOC) is not plausible
4769	2	Sensor exhaust gas temperature OxiCat downstream (normal operation); plausibility error
4769	2	Sensor exhaust gas temperature OxiCat downstream (regeneration); plausibility error
4769	3	Sensor error exhaust gas temperature downstream (DOC); signal range check high
4769	4	Sensor error exhaust gas temperature downstream (DOC); signal range check low
5763	0	Warning threshold for an internal actuator error exceeded, < 4L EGR. actuator und >4L Air Intake Flap
5763	1	Shut off threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L Air Intake Flap
5763	3	Position sensor error of actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check high
5763	3	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery (A02)

SPN	FMI	Description
5763	3	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to battery (A67)
5763	4	Position sensor error actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low
5763	4	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground (A02)
5763	4	EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); short circuit to ground (A67)
5763	4	Actuator error EGR-Valve (2.9; 3.6) or Throttle Valve (4.1; 6.1; 7.8); Voltage below threshold 3.6) Throttle-Valve (4.1; 6.1; 7.8); Voltage below threshold;
5763	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low
5763	5	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check low
5763	5	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); open load
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check high
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); signal range check high
5763	6	Actuator EGR-Valve (2.9;3.6) or Throttle-Valve (6.1,7.8); over current
5763	6	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); Overload by short-circuit
5763	7	Actuator position for EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8) not plausible
5763	11	Actuator error EGR-Valve (2.9;3.6) or Throttle-Valve (4.1;6.1;7.8); Power stage over temperature due to high current (3.6) Throttle-Valve (4.1; 6.1; 7.8); Power stage over temperature by excessive Storm;
523008	1	Manipulation control was triggered
523008	2	Timeout error in Manipulation control
523009	9	Pressure Relief Valve (PRV) reached maximum allowed opening count SRC low for PFltUs pressure sensor No detail information!
523009	10	Pressure relief valve (PRV) reached maximum allowed open time Rail pressure out of tolerance range
523090	2	Engine Brake Pre-Selection switch; Plausibility Error
523212	9	Timeout Error of CAN-Receive-Frame ComEngPrt; Engine Protection
523216	9	Timeout Error of CAN-Receive-Frame PrHtEnCmd; pre-heat command, engine command
523240	9	Timeout CAN-message FunModCtl; Function Mode Control
523330	14	Immobilizer status; fuel blocked
523350	4	Injector cylinder-bank 1; short circuit
523352	4	Injector cylinder-bank 2; short circuit
523354	12	Injector power stage output defect
523470	2	Pressure Relief Valve (PRV) reached maximum allowed opening count
523470	2	Pressure Relief Valve (PRV) forced to open; performed by pressure increase
523470	7	Maximum rail pressure in limp home mode exceeded (PRV) rail pressure raw value is below minimum offset No detail information!

SPN	FMI	Description
523470	11	Pressure Relief Valve (PRV) error; Rail pressure out of tolerance range Pressure Relief Valve (PRV) is open
523470	11	Rail pressure out of tolerance range The PRV can not be opened at this operating point with a pressure shock
523470	12	Pressure Relief Valve (PRV) forced to open; performed by pressure shock
523470	12	Open Pressure Relief Valve (PRV); shut off condition Pressure Relief Valve (PRV) forced to open; system reaction initiated
523470	14	Open Pressure Relief Valve (PRV); warning condition
523550	12	T50 start switch active for too long
523601	13	Sensor supply voltage monitor 3 error (ECU)
523602	0	High fan speed; warning threshold exceeded
523602	0	High fan speed; shut off threshold exceeded
523603	9	Timeout Error of CAN-Receive-Frame AMB; Ambient Temperature Sensor
523612	3	Reported OverVoltage of Supply No detail information!
523612	4	Reported Under Voltage of Supply No detail information!
523612	12	Internal software error ECU; injection cut off Internal software error ECU
523612	12	Internal ECU monitoring detection reported error
523612	12	ECU reported internal software error Internal ECU monitoring detection reported error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	ECU reported internal software error
523612	12	Diagnostic fault check to report the accelerator pedal position error
523612	12	Diagnostic fault check to report the engine speed error
523612	12	Error in the plausibility of the injection energizing time
523612	12	Error in the plausibility of the start of energizing angles
523612	12	Diagnostic fault check to report the error due to non plausibility in ZFC

SPN	FMI	Description
523612	12	Diagnosis fault check to report the demand for normal mode due to an error in the PoI2 quantity No detail information!
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI2 shut-off No detail information!
523612	12	Diagnosis fault check to report the error to demand for an ICO due to an error in the PoI3 efficiency factor No detail information!
523612	12	Internal ECU monitoring detection reported error
523612	12	Monitoring of Fuel Quantity Correction
523612	12	Diagnostic fault check to report the plausibility error in rail pressure monitoring No detail information!
523612	12	Diagnostic fault check to report the error due to torque comparison No detail information!
523612	12	Diagnosis of curr path limitation forced by ECU monitoring level 2 No detail information!
523612	12	Diagnosis of lead path limitation forced by ECU monitoring level 2 No detail information!
523612	12	Diagnosis of set path limitation forced by ECU monitoring level 2 No detail information!
523612	12	Diagnostic fault check to report WDA active due to errors in query-response communication No detail information!
523612	12	Diagnostic fault check to report ABE active due to under voltage detection No detail information!
523612	12	Diagnostic fault check to report ABE active due to overvoltage detection No detail information!
523612	12	Diagnostic fault check to report WDA/ABE active due to unknown reason No detail information!
523612	12	ECU reported internal software error Internal software error ECU
523612	12	Error in the plausibility of Starter Release Condition
523612	14	Soft ware reset CPU SWReset_0
523612	14	Soft ware reset CPU SWReset_1
523612	14	Soft ware reset CPU SWReset_2
523613	0	Rail pressure disrupted minimum rail pressure exceeded No detail information!
523613	0	Rail pressure disrupted Maximum positive deviation of rail pressure exceeded (RailMeUn0)
523613	0	Rail pressure disrupted Maximum positive deviation of rail pressure in metering unit exceeded (RailMeUn1)
523613	0	Rail pressure disrupted Rail system leakage detected (RailMeUn10)
523613	0	Minimum rail pressure exceeded (RailMeUn3)
523613	1	Minimum rail pressure exceeded (RailMeUn3) Negative deviation of rail pressure second stage (RailMeUn22)

SPN	FMI	Description
523613	2	Set point of metering unit in overrun mode not plausible maximum rail pressure exceeded (second stage) No detail information!
523615	3	Metering unit (Fuel-System); short circuit to battery high side
523615	3	Metering unit (Fuel-System); short circuit to battery low side
523615	3	Metering unit, short circuit to battery
523615	4	Metering unit (Fuel-System); short circuit to ground high side
523615	4	Metering Unit (Fuel-System); short circuit to ground low side
523615	4	Metering unit, short circuit to ground
523615	5	Metering unit (Fuel-System); open load
523615	12	Metering unit (Fuel-System); power stage over temperature
523618	3	Gearbox oil temperature; Short circuit to battery or broken harness
523618	4	Gearbox oil temperature; Short circuit to ground
523619	2	Physical range check high for exhaust gas temperature up stream (SCR-CAT)
523632	0	SCR Monitoring; Monitoring of over pressure Pump pressure SCR metering unit too low
523632	1	SCR Monitoring; Monitoring of Pressure Build Up Malfunction Max Pressure overload of SCR-System
523632	3	Sensor error urea pump pressure; signal range check high
523632	4	Sensor error urea pump pressure; signal range check low
523632	11	Pump motor not available for actuation No detail information!
523632	16	SCR Monitoring; Monitoring of Metering Control Malfunction Max Detection of AdBlue filled SCR system in Init-State
523632	18	SCR Monitoring; Monitoring of Metering Control Malfunction Min Pump pressure SCR metering unit too high
523633	11	Lonterm adaption factor below threshold No detail information!
523633	11	Nox conversion rate insufficient (SCR-Cat defect, bad AdBule quality)
523633	11	Nox conversion rate insufficient (SCR-Cat defect, bad AdBule quality); temperature range 1
523698	11	Shut off request from supervisory monitoring function
523704	12	Timeout Error of CAN-Transmit-Frame EEC3 No detail information
523717	12	Timeout Error of CAN-Transmit-Frame AmbCon; Weather environments
523718	3	SCR main relay (primary side); short circuit to battery
523718	3	SCR main relay; short circuit to battery (only CV56B)
523718	4	SCR main relay (primary side); short circuit to ground
523718	4	SCR main relay; short circuit to ground (only CV56B)
523718	5	SCR main relay (primary side); open load
523718	5	SCR main relay; open load (only CV56B)
523718	12	SCR main relay (primary side); power stage over temperature
523719	3	SCR heater urea supply module; short circuit to battery
523719	4	SCR heater urea supply module; short circuit to ground
523719	5	SCR heater relay urea supply module secondary side; open load

SPN	FMI	Description
523719	5	SCR heater relay urea supply module primary side; open load
523720	2	SCR plausibility, OBD and diagnosis; Error urea supply module heater temperature sensor dynamic plausibility Error supply module heater plausibility No detail information!
523720	2	SCR plausibility, OBD and diagnosis; Error urea supply module heater temperature sensor cold start plausibility Sensor urea supply module heater temperature; plausibility error (cold start condition)
523720	8	Urea supply module heater temperature; duty cycle in failure range
523720	8	Urea supply module heater temperature; duty cycle in invalid range
523721	2	SCR plausibility, OBD and diagnosis; Error urea supply module heater temperature sensor dynamic plausibility Sensor urea supply module temperature; plausibility error (normal condition)
523721	2	SCR plausibility, OBD and diagnosis; Error urea supply module temperature sensor cold start plausibility Sensor urea supply module temperature; plausibility error (cold start condition)
523721	8	Urea supply module temperature; duty cycle in failure range
523721	8	Urea supply module temperature; duty cycle in invalid range SCR: Duty cycle Temperature Supply module not valid DEF supply module temperature; duty cycle in failure range
523721	11	Urea supply module temperature measurement not available
523722	8	Urea supply module PWM signal; period outside valid range
523722	8	Detect faulty PWM signal from Supply Module
523776	9	Timeout Error of CAN-Receive-Frame TSC1TE - active
523788	0	Wastegate; _ComTrbChActrPlaus
523788	0	Timeout Error of CAN-Receive-Frame ComTrbChActr; Wastegate
523788	12	Timeout Error of CAN-Transmit-Frame TrbCH; Status Wastegate
523793	9	Timeout Error of CAN-Receive-Frame UAA10; AGS sensor service message
523794	9	Timeout Error of CAN-Receive-Frame UAA11; AGS sensor data
523803	9	Timeout error of CAN Receive Message RxEngPres; Status Burner Air Pump
523858	12	Timeout Error of CAN-Transmit-Frame UAA11 No detail information!
523867	12	Control burner air pump; _timeout Error of CAN Transmit frame UAA1 on CAN A
523895	13	Check of missing injector adjustment value programming (IMA) injector 1 (in firing order)
523896	13	Check of missing injector adjustment value programming (IMA) injector 2 (in firing order)
523897	13	Check of missing injector adjustment value programming (IMA) injector 3 (in firing order)
523898	13	Check of missing injector adjustment value programming (IMA) injector 4 (in firing order)
523899	13	Check of missing injector adjustment value programming (IMA) injector 5 (in firing order)
523900	13	Check of missing injector adjustment value programming (IMA) injector 6 (in firing order)
523906	3	Electrical fuel pre - supply pump; short circuit to battery Electrical fuel pre - supply pump; power stage over temperature
523906	4	Electrical fuel pre - supply pump; short circuit to battery
523906	5	Electrical fuel pre - supply pump; open load Pressure relief valve (PRV) reached maximum allowed open time

SPN	FMI	Description
523906	12	Electrical fuel pre - supply pump; power stage over temperature open load
523910	0	Air Pump; operating voltage error
523910	6	Air Pump; over current
523910	7	Air pump; CAN communication interrupted no purge function available
523910	9	Burner Control; Air Pump - CAN Lost Air Pump; CAN communication lost
523910	12	Air Pump; internal error
523910	14	Air pump doesn't achieve air mass flow set point Burner Control - burner air pump
523911	0	Burner dosing valve (DV2); over current at the end of the injection phase
523911	3	Burner dosing valve (DV2); short circuit to battery
523911	4	Burner dosing valve (DV2); short circuit to ground
523911	11	Burner dosing valve (DV2); short circuit high side power stage
523911	12	Burner dosing valve (DV2); power stage over temperature
523912	0	Physical range check high for burner dosing valve (DV2) downstream pressure; Shut off regeneration
523912	1	Physical range check low for burner dosing valve (DV2) downstream pressure; shut off regeneration. When burner injector is actuated, the measured pressure does not rise above ca. 1250mbar abs (expected: ca. 2400mbar).
523912	2	Burner dosing valve (DV2) downstream pressure sensor; plausibility error
523912	3	Sensor error burner dosing valve (DV2) downstream pressure sensor; signal range check high
523912	4	@ CRT < 4l: Throttle valve error, Open Load or Short cut to Battery, blocked valve or wrong control signal for valve. @ engines with Burner T4i: Pressure Sensor error after valve (DV2), lower limit reached
523913	3	Sensor error glow plug control diagnostic line voltage; signal range check high
523913	4	Sensor error glow plug control diagnostic line voltage; signal range check low
523914	3	Glow plug control; short circuit to battery
523914	4	Glow plug control; short circuit to ground
523914	5	Glow plug control; open load
523914	12	Glow plug control; power stage over temperature
523915	0	HCI dosing valve (DV1); over current at the end of the injection phase
523915	3	HCI dosing valve (DV1); short circuit to battery
523915	3	HCI dosing valve (DV1); short circuit to battery high side
523915	4	HCI dosing valve (DV1); short circuit to ground
523915	7	HCI dosing valve (DV1); blocked open
523915	11	HCI dosing valve (DV1); short circuit high side power stage
523915	12	HCI dosing valve (DV1); power stage over temperature
523916	0	Physical range check high for HCI dosing valve (DV1) downstream pressure; shut off regeneration
523916	1	Physical range check low for HCI dosing valve (DV1) downstream pressure; shut off regeneration
523916	2	Sensor HCI dosing valve (DV1) downstream pressure; plausibility error
523916	3	Sensor error HCI dosing valve (DV1) downstream pressure; signal range check high

SPN	FMI	Description
523916	4	Sensor error HCl dosing valve (DV1) downstream pressure; signal range check low
523917	3	Sensor error DV1 & DV2 upstream pressure; signal range check high
523917	4	Sensor error DV1 & DV2 upstream pressure; signal range check low
523918	3	Sensor error DV1 & DV2 upstream temperature; signal range check high
523918	4	Sensor error DV1 & DV2 upstream temperature; signal range check low
523919	0	Physical Range Check high for Burner Air Pump Pressure Sensor No detail information!
523919	1	Physical Range Check low for Burner Air Pump Pressure Sensor No detail information!
523919	2	High air filter differential pressure; warning threshold exceeded
523919	2	Sensor air pump air pressure; plausibility error
523919	3	Signal error for CAN message No detail information!
523919	4	Sensor error air pump pressure; signal range check high
523920	0	Diagnostic fault physical range check high of burner pressure sensor No detail information!
523920	2	Sensor error air pump pressure; signal range check low
523920	2	Sensor exhaust gas back pressure burner; plausibility error
523920	3	Diagnostic fault physical range check low of burner pressure sensor (Dz specify warning system reaction) No detail information!
523920	4	Sensor error exhaust gas back pressure burner; signal range check high
523921	0	Physical range check high for burner temperature
523921	1	Physical range check low for burner temperature
523921	2	Burner temperature sensor; Plausibility Check for burner temperature sensor Sensor burner temperature; plausibility error
523921	3	Sensor error burner temperature; signal range check high
523921	4	Sensor error burner temperature; signal range check low
523922	3	Burner shut of valve; short circuit to battery
523922	4	Burner Shut Off Valve; short circuit to ground
523922	5	Burner Shut Off Valve; open load
523922	7	Burner Control; Shut-off Valve - Blocked closed Burner Shut Off Valve; blocked closed
523922	7	Burner Shut Off Valve; blocked open
523922	12	Burner Shut Off Valve; power stage over temperature
523924	3	UB2; Short circuit to battery error of actuator relay 2
523924	4	UB2; Short circuit to ground actuator relay 2
523925	3	UB3; Short circuit to battery error of actuator relay 3
523925	4	UB3; Short circuit to ground actuator relay 3
523926	4	UB4; Short circuit to ground actuator relay 4
523927	3	UB5; Short circuit to battery error of actuator relay 5
523935	12	Timeout Error of CAN-Transmit-Frame EEC3VOL1; Engine send messages

SPN	FMI	Description
523936	12	Timeout Error of CAN-Transmit-Frame EEC3VOL2; Engine send messages
523938	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1IGCVol1 information; factors & Sensor calibration for NOX Sensor (SCR-system upstream cat; DPF-system downstream cat)
523939	9	Timeout Error (BAM to BAM) for CAN-Receive-Frame AT1IGCVol1 information; factors & Sensor calibration for NOX Sensor (SCR-system upstream cat; DPF-system downstream cat)
523940	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1IGCVol1 information; factors & Sensor calibration for NOX Sensor (SCR-system upstream cat; DPF-system downstream cat)
523941	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1OGCVol2 information; factors & Sensor calibration for NOX Sensor (SCR-system downstream cat; DPF-system downstream cat)
523942	9	Timeout Error (BAM to BAM) for CAN-Receive-Frame AT1OGCVol2 information; factors & Sensor calibration for NOX Sensor (SCR-system downstream cat; DPF-system downstream cat)
523943	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1OGCVol2 information; factors & Sensor calibration for NOX Sensor (SCR-system downstream cat; DPF-system downstream cat)
523946	0	Zero fuel calibration injector 1 (in firing order); maximum value exceeded
523946	1	Zero fuel calibration injector 1 (in firing order); minimum value exceeded
523947	0	Zero fuel calibration injector 2 (in firing order); maximum value exceeded
523947	1	Zero fuel calibration injector 2 (in firing order); minimum value exceeded
523948	0	Zero fuel calibration injector 3 (in firing order); maximum value exceeded
523948	1	Zero fuel calibration injector 3 (in firing order); minimum value exceeded
523949	0	Zero fuel calibration injector 4 (in firing order); maximum value exceeded
523949	1	Zero fuel calibration injector 4 (in firing order); minimum value exceeded
523950	0	Zero fuel calibration injector 5 (in firing order); maximum value exceeded
523950	1	Zero fuel calibration injector 5 (in firing order); minimum value exceeded
523951	0	Zero fuel calibration injector 6 (in firing order); maximum value exceeded
523960	0	Physical range check high for EGR cooler downstream temperature
523960	0	_High exhaust gas temperature EGR cooler downstream; warning threshold exceeded
523973	14	SCR Tamper detection; derating timer below limit 1
523974	14	SCR Tamper detection; derating timer below limit 2
523975	14	Urea quality; derating timer below limit 1
523976	14	Urea quality; derating timer below limit 2
523977	14	Urea tank level; derating timer below limit 1
523978	14	Urea tank level; derating timer below limit 2
523981	11	SCR plausibility, OBD and diagnosis; Stuck in range check of Urea tank temperature sensor Urea-tank without heating function (heating phase)
523982	0	Power stage diagnosis disabled; high battery voltage
523982	1	Power stage diagnosis disabled; low battery voltage
523984	3	UB6; Short circuit to battery error of actuator relay 6
523986	4	Relay SCR-Heater, Short Circuit to Ground (High Side Control side)
523987	4	UB6; Short circuit to ground actuator relay 6

SPN	FMI	Description
523995	13	Check of missing injector adjustment value programming (IMA) injector 7 (in firing order)
523996	13	check of missing injector adjustment value programming (IMA) injector 8 (in firing order)
523997	4	Injector cylinder bank 1 slave; short circuit
523998	4	Injector cylinder bank 2 slave; short circuit
523999	12	Injector power stage output Slave defect
524000	3	Injector 7 (in firing order); short circuit
524000	5	Injector 7 (in firing order); interruption of electric connection
524001	3	Injector 8 (in firing order); short circuit
524001	5	Injector 8 (in firing order); interruption of electric connection
524013	7	Burner Control; burner Flame; Burner does not start after x trials (burner flame lost detection) Burner flame unintentional deleted
524013	7	Burner Control; Flame lost max Burner operation is interrupted too often
524014	1	Air inlet EPV - pressure too low Air pressure glow plug flush line; below limit
524016	2	Burner Control; HFM - plausibility error 1 Amount of air is not plausible to pump speed
524016	11	Burner Control; HFM - Electrical Fault HFM sensor; electrical fault
524018	14	HMI engine derate service state DPF wasn't regenerated, power reduction phase 1 (manual regeneration request)
524019	11	Burner Control; Air Line - Blocked us pAir Air Pump; air lines blocked
524020	14	Burner Control: power reduction due to low lambda Engine power; Not enough oxygen for regeneration
524021	11	Burner Control; Fuel line ShutOff downstream - broken Burner fuel line pipe leak behind Shut Off Valve
524022	14	HMI engine derate stop state DPF wasn't regenerated, power reduction phase 2 (manual regeneration request)
524024	11	Deviation of the exhaust gas temperature set point to actual value downstream (DOC) too high
524025	5	DPF system; operating voltage error
524025	14	Short circuit to ground error No detail information!
524025	14	The standstill-regeneration mode time exceeds the long-limit. Vehicle was too long or too often in standstill mode.
524025	14	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode.
524028	2	CAN message PROEGRActr; plausibility error
524029	2	Timeout Error of CAN-Receive-Frame ComEGRActr - exhaust gas recirculation positioner
524030	7	EGR actuator; internal error
524031	13	EGR actuator; calibration error
524032	2	EGR actuator; status message "EGRCust" is missing
524033	7	EGR actuator; due to overload in Save Mode
524034	3	Disk separator; mass shorting
524034	4	Disc separator; short circuit to ground
524034	5	Disc Separator; open load
524034	12	Disc Separator; power stage over temperature

SPN	FMI	Description
524036	12	Injector diagnostics Slave; time out error in the SPI communication
524038	9	Timeout error of CAN-Receive-Frame ComMS_Sys1TO (error memory Slave); Master-Slave internal CAN message
524039	9	Timeout error of CAN-Receive-Frame ComMS_Sys2TO (error memory Slave); Master-Slave internal CAN message
524040	9	Timeout error of CAN-Receive-Frame ComMS_Sys3TO (error memory Slave); Master-Slave internal CAN message
524041	9	Timeout error of CAN-Receive-Frame ComMS_Sys4TO (error memory Slave); Master-Slave internal CAN message
524042	9	Timeout error of CAN-Receive-Frame ComMS_Sys5TO (error memory Slave); Master-Slave internal CAN message
524043	9	Timeout error of CAN-Receive-Frame ComMS_Sys6TO (error memory Slave); Master-Slave internal CAN message
524044	9	CAN message ComMS_Sys7 not received from slave
524045	9	Master Slave, Error of message counter CAN receive message ComMSMoFOvR; ComMSMoFOvR1CNT
524046	9	Master-Slave CAN; Error Checksum of CAN-Receive Message
524047	9	Master-Slave CAN; Error of message length of CAN receive message ComMSMoFOvR;_ComMSMoFOvR1DLC
524048	9	Timeout error CAN message ComMSMoFOvR1TO error memory Slave
524050	11	
524051	11	ComRxCustSysReacMin
524052	11	Error memory Slave reports FID MSMonFC2; Shut-Off Path test error of fuel injection system
524052	11	Error memory Slave reports FID MSMonFC3; timeout of engine state messages (ComMS_Sys1-7) from master ECU
524052	11	Master ECU and Slave ECU data sets or software are not identical
524057	2	Fuel low pressure pump; error pressure build up
524063	3	SCR heater main relay; short circuit battery
524063	4	SCR heater main relay; short circuit ground
524063	5	SCR heater return line; openload
524063	5	SCR main relay not connected
524063	5	SCR heater pressure line; openload
524063	5	SCR relay for suction line not connected
524063	5	SCR heater supply module; open load
524063	5	SCR heater tank; open load
524063	12	Defrosting of the supply module takes to long
524063	12	Defrosting of the urea tank takes to long
524065	0	Pressure sensor upstream of SCR catalysator; physical range check high
524065	0	Pressure sensor upstream SCR-Cat; Pressure above maximum physical value
524065	1	Pressure sensor upstream of SCR catalysator; physical range check low
524065	2	Pressure before SCR-Cat not plausible
524065	3	Pressure sensor upstream of SCR catalysator; shot circuit battery or open load
524065	4	Pressure sensor upstream of SCR catalysator; short circuit ground
524067	0	Supply module heater temperature out of physical range
524067	0	Urea supply module temperature; physical range check high
524067	1	Supply module heater temperature out of physical range
524067	1	Urea supply module temperature; physical range check low

SPN	FMI	Description
524067	2	Supply module heater temperature not plausible
524067	2	Supply module temperature not plausible
524068	2	Master ECU and Slave ECU have been identified as the same types
524069	9	Timeout Error of CAN-Receive-Frame MSMon_FidFCCTO; Master-Slave CAN communication faulty
524074	2	Nox sensor downstream catalysator
524074	9	Open circuit NOx sensor downstream SCR-CAT
524075	11	Diagnostic Fault Check for open circuit in the upstream NOx sensor (DFC set by Deutz-SW)
524076	9	Diagnostic Fault Check for open circuit in the upstream NOx sensor (DFC set by Deutz-SW)
524077	11	Short circuit NOx sensor Upstream SCR-CAT
524078	9	NOx-Sensor downstream SCR-CAT, Lambda value above maximum value.
524079	9	NOx-Sensor downstream SCR-CAT, Lambda value below minimum value.
524080	9	NOx-Sensor upstream SCR-CAT, Lambda value above maximum value.
524081	9	NOx-Sensor upstream SCR-CAT, Lambda value below minimum value.
524083	9	NOx-Sensor downstream SCR-CAT, NOx value below minimum value.
524084	9	NOx-Sensor upstream SCR-CAT, NOx value above maximum value.
524085	9	(Upstream NOx-Sensor) Diagnostic Fault Check for upstream NOx value under minimum limit (DFC set by Deutz-SW) Upstream Nox sensor value range low
524087	3	Urea Error Lamp; short circuit battery
524087	4	Urea Error Lamp; short circuit ground
524087	5	Urea Error Lamp; open load
524087	12	Urea Error Lamp; temperature over limit
524096	14	Control of the SCR system; If the start stop counter (EPA-Counter) exceeds the threshold SCRCtl_ctEngStrtStopThresh_C. This counter will increment only once in each driving cycle in case of an SCR error. If the counter reaches the threshold, the DTC will be set to inhibit the engine start Engine will not be started, because of EPA-Counter
524097	9	Timeout error of CAN-Transmit-Frame DPFBrnAirPmpCtl
524098	9	Timeout error of CAN-Transmit-Frame ComDPFBrnPT
524099	9	Timeout error of CAN-Transmit-Frame ComDPFC1
524100	9	Timeout error of CAN-Transmit-Frame ComDPFHisDat
524101	9	Timeout error of CAN-Transmit-Frame ComDPFTstMon
524102	9	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmpCtl
524103	9	Timeout error of CAN-Receive-Frame ComRxDPFBrnAirPmp
524104	9	Timeout error of CAN-Receive-Frame ComRxDPFCtl
524105	9	Timeout error of CAN-Transmit-Frame ComEGRMsFlw
524106	9	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw1
524107	9	Timeout error of CAN-Receive-Frame ComRxEGRMsFlw2
524108	9	Timeout error of CAN-Transmit-Frame ComEGRTVActr
524109	9	Timeout error of CAN-Receive-Frame ComRxEGRTVActr
524110	9	
524111	9	Timeout error of CAN-Receive-Frame ComRxETVActr
524112	9	Timeout ComITVActr
524113	9	Timeout error of CAN-Receive-Frame ComRxITVActr

SPN	FMI	Description
524114	9	Timeout error of CAN-Transmit-Frame A1DOC
524115	9	Timeout error of CAN-Transmit-Frame AT1S
524116	9	Timeout error of CAN-Transmit-Frame SCR2
524117	9	Timeout error of CAN-Transmit-Frame SCR3
524118	9	Timeout error of CAN-Receive-Frame ComRxCM1
524119	9	Timeout error of CAN-Receive-Frame ComRxCustSCR3
524120	9	Timeout error of CAN-Receive-Frame ComRxSCRHtDiag
524121	9	Timeout error of CAN-Receive-Frame ComRxTrbChActr
524122	9	Timeout error of CAN-Receive-Frame ComRxUQSens
524123	9	Timeout error of CAN-Receive-Frame ComSCRHtCtl
524124	9	Timeout error of CAN-Receive-Frame ComTxAT1IMG
524125	9	Timeout error of CAN-Receive-Frame ComTxTrbChActr
524132	0	Fuel low pressure upstream fuel low pressure pump, pressure above maximum warning threshold
524132	0	Fuel low pressure upstream fuel low pressure pump, pressure above maximum shut off threshold
524132	1	Fuel low pressure upstream fuel low pressure pump, pressure below minimum shut off threshold
524132	1	Fuel low pressure upstream fuel low pressure pump, pressure below minimum warning threshold
524132	2	Fuel low pressure upstream fuel low pressure pump not plausible
524133	2	HMI system; set if restore button blocked
524134	0	The calculated ash load exceeds the shutoff threshold
524134	0	The calculated ash load exceeds the warning threshold
524135	0	The soot load exceeds the shutoff threshold
524135	0	DPF; The soot load exceeds the warning threshold
524135	14	The soot load exceeds the service request threshold
524141	7	SCR monitoring; urea dosing valve recognized blocking
524147	7	SCR monitoring, reverting valve blocked --> Urea Pump Pressure increases (compared with frozen Pressure). During SCR-Coordinator-State Emptying: The Urea Pump pressure will be frozen and compared with act. Pump Pressure when Rev. Valve is switched.
524147	13	SCR Coordinator; Init fill lines; In the Solution a Timer is running. If Timer is elapsed. The Init-Function wasn't executed successfully --> go to emptying the pressure fill lines periodically (see Polarion SCR-363) Urea pressure build up problem
524149	2	Plausibility error between pressure downstream turbine (PTrbnDs) and ambient air pressure (EnvP)
524149	2	Plausibility error between pressure downstream turbine (PTrbnDs) and ASMod module
524152	2	Urea Quality Sensor; Timeout CAN-Message
524153	2	SCR Heater diagnostic message; Timeout CAN-Message
524156	9	Time out error for wheel speed information
524175	0	SCR monitoring; Nox-Value downstream catalysator Emission high range is reached

SPN	FMI	Description
524177	7	SCR System pressure monitoring; suction line recognized blocking
524178	7	SCR System pressure monitoring; Urea pressure control error
524190	14	Inducement Level Step 1
524191	14	Inducement Level Step 2 Not enough urea in tank or low urea quality or hardware tampering failure is detected or hardware failure is detected
524193	8	The standstill-regeneration mode time exceeds the long-limit. Vehicle was too long or too often in standstill mode.
524194	8	The standstill-regeneration mode time exceeds the short-limit. Vehicle was too long or too often within a short time in standstill mode.
524195	14	Standstill request due to crystalization ignored too long
524196	2	Variant handling, Synchronisation error
524196	13	Variant handling,
524197	7	Urea back flow line is blocked

Corporate Office
JLG Industries, Inc.
1 JLG Drive
McConnellsburg, PA 17233-9533 USA
(717) 485-5161 (Corporate)
(877) 554-5438 (Customer Support)
(717) 485-6417

Visit our website for JLG Worldwide Locations.
www.jlg.com