Service Manual

Models
742, 943, 1043,
1055, 1255

PVC 1911
PVC 2005

31211369

July 28, 2021 - Rev C

An Oshkosh Corporation Company

EFFECTIVITY PAGE

DATE	REVISION	DESCRIPTION
November 11, 2019	A	Original Issue Of Manual.
July 17, 2020	B	Revised
July 28, 2021	C	Revised

READ THIS FIRST

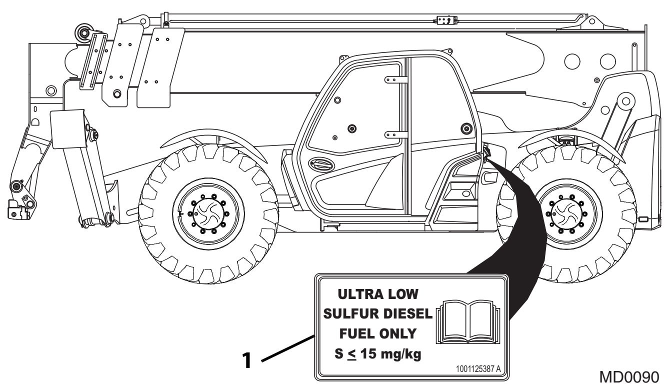
Modifications

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

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Section 1
Safety Practices

Contents

1.1 INTRODUCTION

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

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

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

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

Appropriate service methods and proper repair procedures are essential for the safety of the individual doing the work, for the safety of the operator, and for the safe, reliable operation of the machine. All references to the right side, left side, front and rear are given from the operator 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 750 psi (52 bar) 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.

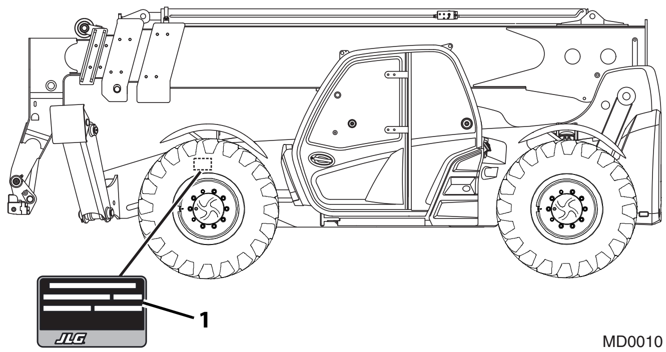
1.7 SAFETY DECALS

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

2.1 REPLACEMENT PARTS AND WARRANTY INFORMATION



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 (miles per hour)			
	742 74HP (54kW)	**943** 110HP (82kW)	**1043** 110HP (82kW)	**1055, 1255** 130 HP (97 kW)
First Gear	3.3	3.1	3.1	3.2
Second Gear	6.3	5.9	5.9	6.2
Third Gear	14.1	13.5	13.5	14.2
Fourth Gear	19.5	18.5	18.5	20.5

TRANSMISSION	AVERAGE MAXIMUM SPEED - REVERSE (miles per hour)			
	742 74HP (54kW)	**943** 110HP (82kW)	**1043** 110HP (82kW)	**1055, 1255** 130 HP (97 kW)
First Gear	3.3	3.0	3.0	3.2
Second Gear	6.3	5.9	5.9	6.2
Third Gear	14.2	13.5	13.5	14.2

2.2.2 Cylinder Drift

Cylinder	Maximum Rod Travel (loaded or unloaded)
Lift/Lower Cylinder	0.125 in (3,2 mm) per hour
Extend/Retract Cylinder	0.125 in (3,2 mm) per hour
Attachment Tilt Cylinder	0.125 in (3,2 mm) per hour

2.2.3 Steering Angle Specifications

Model	Angle (in Degree)
742, 943,1043	55
1055, 1255	45

2.2.4 Hydraulic Cylinder Performance

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

Function	Approximate Times (Seconds)					
	742 74HP (54kW)	**943** 74HP (54kW)	**943** 110HP (82kW)	**1043** 110HP (82kW)	**1055** 130 HP (97 kW)	**1255** 130 HP (97 kW)
Boom Extend (Boom Level)	9 - 13	15.9 - 17.9	14.4 - 18.5	14.4 - 18.5	17 - 22.5	17 - 22.6
Boom Retract (Boom Level)	9.5 - 13.5	14.2 - 16.2	12.5 - 16.1	12.5 - 16.1	12.5 - 18.1	12.5 - 18.1
Boom Lift	11.3 - 13.3	10.7 - 13	9 -11	9 - 11	12.9 -17.3	14.2 -19.9
Boom Lower	8 - 10*	9.5 - 12.7*	8 - 10	8 - 10	12.4 - 13.8**	13.7 -16.0**
Boom Lower w/50% rated load (Boom Level)	-	-	-	-	8.5 - 10.5	10 - 13
Attachment - Tilt Forward	3.4 - 5.4	3.5 - 5.5	3.5 - 5.5	3.5 - 5.5	4.9 - 5.8	5.2 - 6.1
Attachment - Tilt Rearward	3.3 - 5.3	3.5 - 5.5	3.5 - 5.5	3.5 - 5.5	5.1 - 6.0	5.4 - 6.3
Frame Level - Full Right to Left	8.5 - 10.7	9 - 12.7	9 - 12.7	9 - 12.7	8.8 - 10.3	8.8 - 10.3
Frame Level - Full Left to Right	8.5 - 10.7	9 - 12.7	9 - 12.7	9 - 12.7	8.8 - 10.3	8.8 - 10.3
Outrigger - Both Down **(if equipped)**	-	-	-	4 - 4.7	4 - 4.7	4 - 4.7
Outrigger - Both Up **(if equipped)**	-	-	-	3.9 - 4.5	3.9 - 4.5	3.9 - 4.5
Outrigger - Single Down **(if equipped)**	-	-	-	2.3 - 3.0	2.3 - 3.0	2.3 - 3.0
Outrigger - Single Up **(if equipped)**	-	-	-	2.5 - 3.5	2.5 - 3.5	2.5 - 3.5

* Function speed achieved at engine idle.
**With standard fork tilt carriage installed.

2.2.5 Electrical System

a. 742

Description	Standard	Arctic
Battery		
Type, Rating	12 V, Negative (-) Ground, Tapered Top Post, Maintenance Free	12 V, Negative (-) Ground, Dual Posts (5/16" studs and Tapered top posts), Maintenance Free
Quantity	2	2
Reserve Capacity Minutes @ 80°F (27°C)	205	310
Cold Cranking Amps @ 0°F (-18°C)	950	750
Cranking Amps @ 32°F (-18°C)	1100	1000
Group/Series	BCI Group 31	BCI Group 31
Alternator	12 V, 135 Amps	12 V, 135 Amps
Starter	12 V, 4.8 kW	12 V, 4.8 kW

b. 943, 1043, 1055, 1255

Description	Standard	Arctic
Battery		
Type, Rating	12 V, Negative (-) Ground, Tapered Top Post, Maintenance Free	12 V, Negative (-) Ground, Dual Posts (5/16" studs and Tapered top posts), Maintenance Free
Quantity	1	2
Reserve Capacity Minutes @ 80°F (27°C)	205	310
Cold Cranking Amps @ 0°F (-18°C)	950	750
Cranking Amps @ 32°F (-18°C)	1100	1000
Group/Series	BCI Group 31	BCI Group 31
Alternator	14 V, 135 Amps	14 V, 135 Amps
Starter	12 V, 4.8 kW	12 V, 4.8 kW

2.2.6 Engine Performance Specifications

Description	Specifications	
	943, 1043	1055, 1255
Engine Make/Model	Cummins QSF3.8	Cummins QSF3.8
Displacement	229 in^3 (3,8 liters)	229 in^3 (3,8 liters)
Low Idle	1000 rpm	1000 rpm
High Idle (Max. no load)	2675 rpm	2675 rpm
Horsepower	110 HP (82 kW) @ 2500 rpm	130 HP (97 kW) @ 2500 rpm
Peak Torque	348 lb-ft (472 Nm) @ 1600 rpm	360 lb-ft (488 Nm) @ 1600 rpm
Fuel Delivery	High Pressure Common Rail (HPCR) Fuel Injection	High Pressure Common Rail (HPCR) Fuel Injection
Air Cleaner	Dry Type, Replaceable Primary and Safety Elements	Dry Type, Replaceable Primary and Safety Elements

Description	Specifications
	742, 943
Engine Make/Model	Cummins QSF3.8
Displacement	229 in^3 (3,8 liters)
Low Idle	1000 rpm
High Idle (Max. no load)	2675 rpm
Horsepower	74 HP (55 kW) @ 2500 rpm
Peak Torque	295 lb-ft (400 Nm) @ 1300 rpm
Fuel Delivery	High Pressure Common Rail (HPCR) Fuel Injection
Air Cleaner	Dry Type, Replaceable Primary and Safety Elements

2.2.7 Transmission Performance Specifications

a. 742, 943, 1043

Engine	kW (Horsepower)	Transmission	Stall Speed	
Cummins QSF3.8	110 HP (82 kW)	4 Speed	2040 rpm	2100 rpm

b. 742, 943

Engine	kW (Horsepower)	Transmission	Stall Speed	
Cummins QSF3.8	74 HP (55 kW)	4 Speed	1680 rpm	1830 rpm

c. 1055, 1255

Engine	kW (Horsepower)	Transmission	Stall Speed	
Cummins QSF3.8	130 HP (97 kW)	4 Speed	2040 rpm	2100 rpm

2.2.8 Tires

Note: *Wheel lug nut torque is 350-400 lb-ft (475-542 Nm)*

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

a. 742

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
370/75-28	DuraForce MH	14 Ply	Foam	Approx 464 lb (210 kg)
			Pneumatic	76 psi (5,25 Bar)
13.00-24	G-2	16 Ply	Pneumatic	80 psi (5,52 Bar)
13.00-24	G-2	12 Ply	Foam	Approx 542 lb (246 kg)
315/95-28	-	-	Solid	-
370/75-28	OTR (Non Marking)	14 Ply	Foam	Approx 464 lb (210 kg)
			Pneumatic	73 psi (5 Bar)
18 X 625	OTR (Sand/Turf)	16 Ply	Pneumatic	76 psi (5,25 Bar)

b. 943

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
370/75-28	DuraForce MH	14 Ply	Foam	Approx 464 lb (210 kg)
			Pneumatic	76 psi (5,25 Bar)
14.00-24	G-2	16 Ply	Pneumatic	80 psi (5,52 Bar)
14.00-24	G-2	12 Ply	Foam	Approx 720 lb (327 kg)
315/95-28	-	-	Solid	-
370/75-28	OTR (Non Marking)	14 Ply	Foam	Approx 464 lb (210 kg)
			Pneumatic	73 psi (5 Bar)
18 X 625	OTR (Sand/Turf)	16 Ply	Pneumatic	76 psi (5,25 Bar)

c. 1043

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
400/75-28	DuraForce MH	16 Ply	Foam	Approx 570 lb (259 kg)
			Pneumatic	76 psi (5,25 Bar)
14.00-24	G-2	16 Ply	Pneumatic	80 psi (5,52 Bar)
14.00-24	G-2	12 Ply	Foam	Approx 720 lb (327 kg)
360/85-28	-	-	Solid	-
400/75-28	OTR (Non Marking)	16 Ply	Foam	Approx 570 lb (259 kg)
			Pneumatic	76 psi (5,25 Bar)
18 X 625	OTR (Sand/Turf)	16 Ply	Pneumatic	100 psi (6,89 Bar)

d. 1055

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
400/75-28	DuraForce MH	16 Ply	Foam	Approx 570 lb (259 kg)
			Pneumatic	76 psi (5,25 Bar)
14.00-24	G-2	16 Ply	Pneumatic	80 psi (5,52 Bar)
14.00-24	G-2	12 Ply	Foam	Approx 720 lb (327 kg)
360/85-28	-	-	Solid	-
400/75-28	OTR (Non Marking)	16 Ply	Foam	Approx 570 lb (259 kg)
			Pneumatic	76 psi (5,25 Bar)
18 X 625	OTR (Sand/Turf)	16 Ply	Pneumatic	100 psi (6,89 Bar)

e. 1255

Size	Tire Type	Minimum Ply/ Star Rating	Fill Type	Pressure
400/75-28	DuraForce MH	16 Ply	Pneumatic	76 psi (5,25 Bar)
			Foam	Approx 570 lb (259 kg)
17.50-25	L2	16 Ply	Pneumatic	69 psi (4,75 Bar)
17.50-25	L2	12 Ply	Foam	Approx 785 lb (356 kg)
360/85-28	-	-	Solid	-
400/75-28	OTR (Non Marking)	16 Ply	Foam	Approx 570 lb (259 kg)
			Pneumatic	76 psi (5,25 Bar)
18 X 625	OTR (Sand/Turf)	16 Ply	Pneumatic	100 psi (6,89 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	API CJ-4 CES-20081 Fully Synthetic*	SAE 5W-40	-13	115	-25	46
		SAE 15W-40	15	115	-9	46
		SAE 10W-30	10	104	-12	40
		SAE 5W-30	-13	104	-25	40
		SAE 0W-30	-40	104	-40	40
Transmission and Transfer Case	Mobilfluid 424	10W-30	0	115	-20	46
	Refer to ZF TE-ML-03 for additional fluids.					
Axle Differential and Wheel End	API GL5 with LS Additives	80W-90 LS	-4	115	-20	46
		85W-90 LS	-4	115	-20	46
		75W-90 LS	-40	115	-40	46
Hydraulic System	Mobilfluid 424	10W-30	6	115	-15	46
	Exxon Univis HVI		-40	100	-40	40
Boom Wear Pad Grease	Extreme Pressure Grease	NLGI Grade 000	-31	122	-35	50
Grease Fittings	Extreme Pressure Grease	NLGI Grade 2 EP with Moly Additive or NLGI Grade 3 EP with Moly Additive	5	122	-15	50
Boom Chain Lubricant	Gear Oil	80W-90	-40	115	-40	46
Engine Coolant	Ethylene Glycol and Water	50/50 Mix	Standard			
		60/40 Mix	Cold Weather			
Fuel	EN 590 ASTM D 975 Grade 1-D ASTM D 975 Grade 2-D (Maximum B5 Biodiesel)	Ultra Low Sulfur (S ≤15mg/kg)				
Diesel Exhaust Fluid (DEF) 110 HP (82 kW) 130 HP (97 kW)	ISO22241-1	32.5% Urea				
Brake Fluid	Mobil ATF-D/M		-40	115	-40	46
Air Conditioning	Refrigerant R-134-a	Tetrafluoroethane				

Note: **See Note on page 2-19 for details.*

2.3.2 Fluids (if equipped for LS)

<table>
<tr><th rowspan="3">Compartment or System</th><th rowspan="3">Type and Classification</th><th rowspan="3">Viscosities</th><th colspan="4">Ambient Temperature Range</th></tr>
<tr><th colspan="2">°F</th><th colspan="2">°C</th></tr>
<tr><th>Min</th><th>Max</th><th>Min</th><th>Max</th></tr>
<tr><td rowspan="5">Engine Crankcase</td><td rowspan="5">API CI-4
CES-20078</td><td>SAE 5W-40</td><td>-7</td><td>115</td><td>-25</td><td>46</td></tr>
<tr><td>SAE 15W-40</td><td>15</td><td>115</td><td>-9</td><td>46</td></tr>
<tr><td>SAE 10W-30</td><td>10</td><td>104</td><td>-12</td><td>40</td></tr>
<tr><td>SAE 5W-30</td><td>-13</td><td>104</td><td>-25</td><td>40</td></tr>
<tr><td>SAE 0W-30</td><td>-40</td><td>104</td><td>-40</td><td>40</td></tr>
<tr><td rowspan="2">Transmission and Transfer Case</td><td>Mobilfluid 424</td><td>10W-30</td><td>0</td><td>115</td><td>-20</td><td>46</td></tr>
<tr><td colspan="6">Refer to ZF TE-ML-03 for additional fluids.</td></tr>
<tr><td rowspan="3">Axle Differential and Wheel End</td><td rowspan="3">API GL5 with
LS Additives</td><td>80W-90 LS</td><td>-4</td><td>115</td><td>-20</td><td>46</td></tr>
<tr><td>85W-90 LS</td><td>-4</td><td>115</td><td>-20</td><td>46</td></tr>
<tr><td>75W-90 LS</td><td>-40</td><td>115</td><td>-40</td><td>46</td></tr>
<tr><td rowspan="2">Hydraulic System</td><td>Mobilfluid 424</td><td>10W-30</td><td>6</td><td>115</td><td>-15</td><td>46</td></tr>
<tr><td>Exxon Univis HVI</td><td></td><td>-40</td><td>100</td><td>-40</td><td>40</td></tr>
<tr><td>Boom Wear Pad Grease</td><td>Extreme Pressure Grease</td><td>NLGI Grade 000</td><td>-31</td><td>122</td><td>-35</td><td>50</td></tr>
<tr><td>Grease Fittings</td><td>Extreme Pressure Grease</td><td>NLGI Grade 2 EP with Moly Additive or NLGI Grade 3 EP with Moly Additive</td><td>5</td><td>122</td><td>-15</td><td>50</td></tr>
<tr><td>Boom Chain Lubricant</td><td>Gear Oil</td><td>80W-90</td><td>-40</td><td>115</td><td>-40</td><td>46</td></tr>
<tr><td rowspan="2">Engine Coolant</td><td rowspan="2">Ethylene Glycol
and Water</td><td>50/50 Mix</td><td colspan="4">Standard</td></tr>
<tr><td>60/40 Mix</td><td colspan="4">Cold Weather</td></tr>
<tr><td>Fuel</td><td>EN 590
ASTM D 975 Grade 1-D
ASTM D 975 Grade 2-D
(Maximum B5 Biodiesel)</td><td colspan="5">Low Sulfur
(S ≤ 500 mg/kg)</td></tr>
<tr><td>Brake Fluid</td><td>Mobil ATF-D/M</td><td></td><td>-40</td><td>115</td><td>-40</td><td>46</td></tr>
<tr><td>Air Conditioning</td><td>Refrigerant R-134-a</td><td colspan="5">Tetrafluoroethane</td></tr>
</table>

2.3.3 Capacities

a. 742

Engine Crankcase Oil

Capacity with Filter Change	14 quarts (13,2 liters)

Fuel Tank

Capacity	38.3 gallons (145 liters)

Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS 110 HP (82 kW) 130 HP (97 kW))

Capacity	5.7 gallons (21,5 liters)

Cooling System

System Capacity	5.2 gallons (19,7 liters)

Hydraulic System

System Capacity	
742	
No Outriggers	40.2 gallons (152 liters)
Reservoir Capacity to Full Mark	23.8 gallons (90 liters)

Transmission System

Capacity including Cooler and Lines	17 quarts (16,1 liters)
Capacity with Filter Change	14 quarts (13,2 liters)

Transfer Case

Capacity	1.5 quarts (1,4 liters)

Axles

Differential Housing Capacity	
Front	7.6 quarts (7,2 liters)
Rear	7 quarts (6,6 liters)
Friction Modifier - May be added to axle differentials (Must be premixed with axle fluid)	Not to Exceed 12.2 ounce (360 milliliter)
Wheel End Capacity	
Front	1.2 quarts (1,1 liters)
Rear	1.4 quarts (1,3 liters)

Air Conditioning System (if equipped)

System Capacity	2.6 lb (1,2 kilogram)

Brake Fluid

Capacity	1.1 quarts (1,0 liter)

b. 943, 1043

Engine Crankcase Oil

Capacity with Filter Change	14 quarts (13,2 liters)

Fuel Tank

Capacity	38.3 gallons (145 liters)

Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS 110 HP (82 kW) 130 HP (97 kW))

Capacity	5.7 gallons (21,5 liters)

Cooling System

System Capacity	5.2 gallons (19,7 liters)

Hydraulic System

System Capacity	
943	46.5 gallons (177,0 liters)
1043	48.6 gallons (184,0 liters)
Reservoir Capacity to Full Mark	23.8 gallons (90 liters)

Transmission

Capacity including Cooler and Lines	17 quarts (16,1 liters)
Capacity with Filter Change	14 quarts (13,2 liters)

Transfer Case

Capacity	1.5 quarts (1,4 liters)

Axles

Differential Housing Capacity	
Front	13.2 quarts (12,5 liters)
Rear	12.8 quarts (12,1 liters)
Friction Modifier - May be added to axle differentials (Must be premixed with axle fluid)	Not to Exceed 24 ounce (709 milliliter)
Wheel End Capacity	
Front	1.8 quarts (1,7 liters)
Rear	1.7 quarts (1,6 liters)

Air Conditioning System (if equipped)

System Capacity	2.6 lb (1,2 kilogram)

Brake Fluid

Capacity	1.1 quarts (1,0 liter)

c. 1055, 1255

Engine Crankcase Oil

Capacity with Filter Change	14 quarts (13,2 liters)

Fuel Tank

Capacity	38.3 gallons (145 liters)

Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS)

Capacity	5.7 gallons (21,5 liters)

Cooling System

System Capacity	5.2 gallons (19,7 liters)

Hydraulic System

System Capacity	
1055	48.6 gallons (184 liters)
1255	49.9 gallons (189 liters)
Reservoir Capacity to Full Mark	23.8 gallons (90 liters)

Transmission

Capacity including Cooler and Lines	17 quarts (16,1 liters)
Capacity with Filter Change	14 quarts (13,2 liters)

Transfer Case

Capacity	1.6 quarts (1,5 liters)

Axles

Differential Housing Capacity	
Front	15 quarts (14,2 liters)
Rear	14.1 quarts (13,3 liters)
Friction Modifier - May be added to axle differentials (Must be premixed with axle fluid)	Not to Exceed 24 ounce (709 milliliter)
Wheel End Capacity	
Front	1.8 quarts (1,7 liters)
Rear	1.5 quarts (1,4 liters)

Air Conditioning System (if equipped)

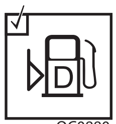
System Capacity	2.6 lb (1,2 kilogram)

Brake Fluid

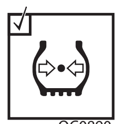
Capacity	1.1 quarts (1,0 liter)

2.4 SERVICE AND MAINTENANCE SCHEDULES

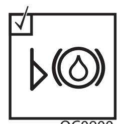
2.4.1 Every 10 Hours


OC0880

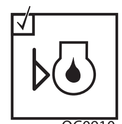
Check Fuel Level


OC0890

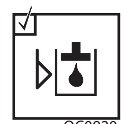
Check Tire Condition and Pressure


OC0900

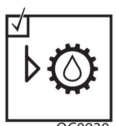
Check Brake Fluid Level


OC0910

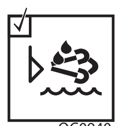
Check Engine Oil Level


OC0920

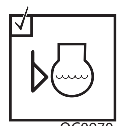
Check Hydraulic Oil Level


OC0930

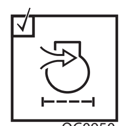
Check Transmission Oil Level


OC0940

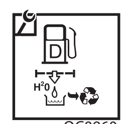
Check DEF Level and Inspect DEF Strainer (if equipped for ULS 110 HP (82 kW) 130 HP (97 kW))


OC0970

Check Engine Coolant Level

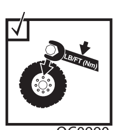

OC0950

Check Air Cleaner

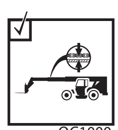

OC0960

Drain Fuel/Water Separator

2.4.2 First 50 Hours


OC0990

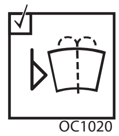
Check Wheel Lug Nut Torque


OC1000

Check Boom Chain Tension

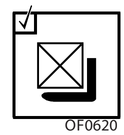
2.4.3 Every 50 Hours

Lubrication Schedule



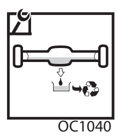
Check Washer Fluid

Check Cab Filter

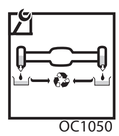


Check LSI Systemt

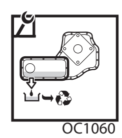
2.4.4 First 250 Hours



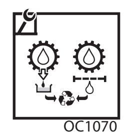
Change Axle Oil



Change Wheel End Oil



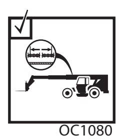
Change Transfer Case Fluid



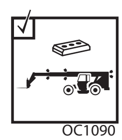
Change Transmission Fluid and Filter

2.4.5 Every 250 Hours

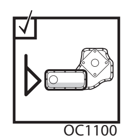
Lubrication Schedule



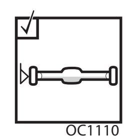
Check Boom Chains



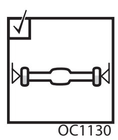
Check Boom Wear Pads



Check Transfer Case Fluid Level

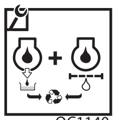


Check Axle Oil Level



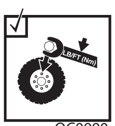
Check Wheel End Oil Level

2.4.6 First 500 Hours or 1 Year


OC1140

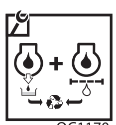
Change Engine Oil
and Filter
(if equipped for ULS,
see note)

2.4.7 Every 500 Hours

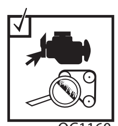


OC0990

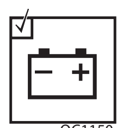
Check Wheel Lug
Nut Torque


OC1170

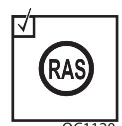
Change Engine Oil
and Filter
(if equipped for LS)


OC1160

Check Fan Belt


OC1150

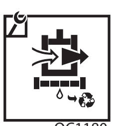
Check Battery



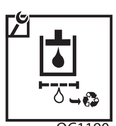
OC1120

Check RAS System

2.4.8 Every 750 Hours

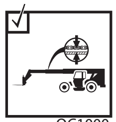

OC1180

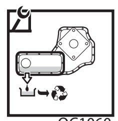
Change Hydraulic
Tank Breather

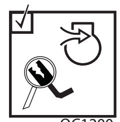

OC1190

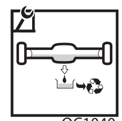
Change Hydraulic
Filters

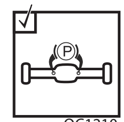
2.4.9 Every 1000 Hours

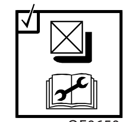

OC1000
Check Boom Chain Tension

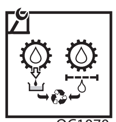

OC1060
Change Transfer Case Fluid

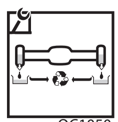

OC1200
Check Air Intake System

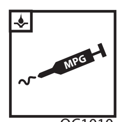

OC1040
Change Axle Oil


OC1210
Check Park Brake

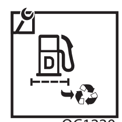

OF0650
Check LSI Calibration


OC1070
Change Transmission Fluid and Filter

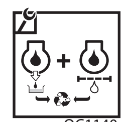

OC1050
Change Wheel End Oil



OC1010
Lubrication Schedule

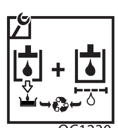


OC1220
Change Fuel Filters

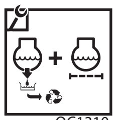

OC1140
Change Engine Oil and Filter (if equipped for ULS, see note)

Note: *If using fully synthetic oil, metal engine oil filter and fuel consumption is less than 11.4 liter per hour (3 gallon per hour), oil change intervals are 1,000 hours or 1 year. If any of the following are present, conventional oil, plastic engine oil filter or fuel consumption is greater than 11.4 liter per hour (3 gallon per hour), oil change intervals are 500 hours or 6 months.*

2.4.10 Every 1500 Hours


OC1230
Change Hydraulic Fluid and Filters

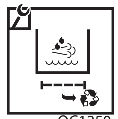
2.4.11 Every 2000 Hours



OC1310

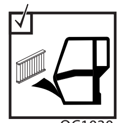
Change Engine Coolant and Clean Engine Coolant Strainer

(Coolant Strainer Only Comes With ULS 110 HP (82 kW) 130HP (97kW))



OC1250

Change DEF Tank Filter
(if equipped for ULS 110 HP (82 kW)
130 HP (97 kW))



OC1030

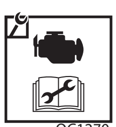
Check Cab Filter

2.4.12 Every 4000 Hours

OC1260

Change DEF Pump Filter
(if equipped for ULS 110 HP (82 kW)
130 HP (97 kW))

2.4.13 Every 5000 Hours



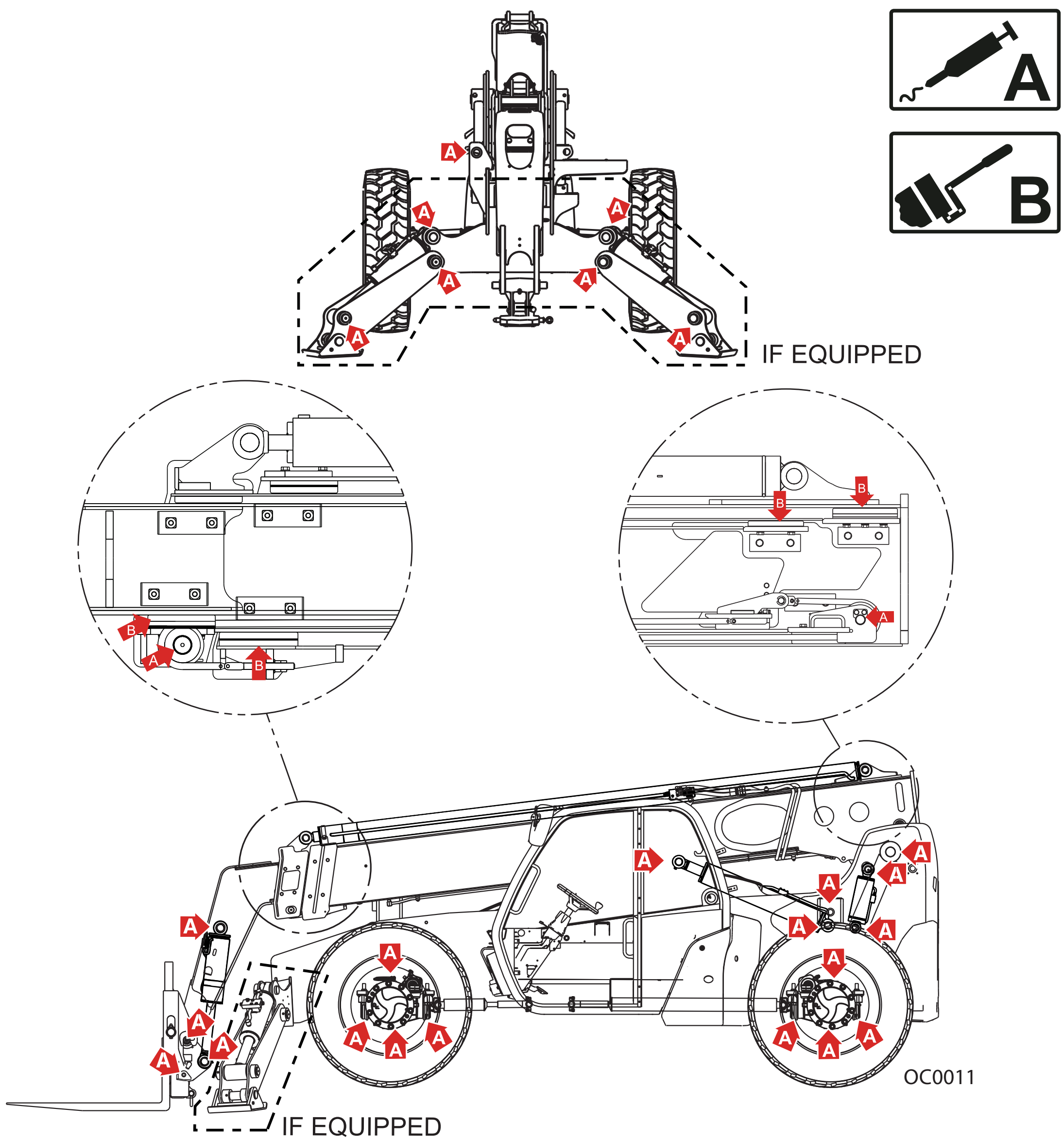
OC1270

Engine Valve Lash Adjustment

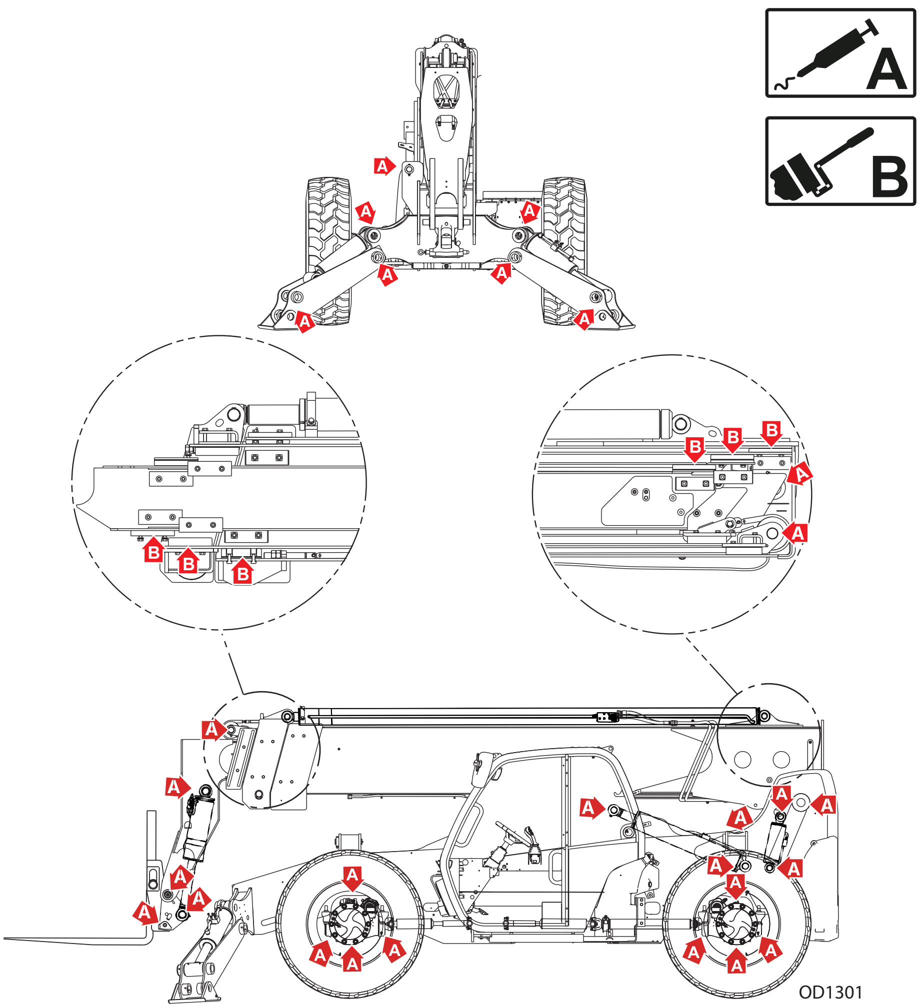
2.5 LUBRICATION SCHEDULE

2.5.1 50 Hour

a. 742, 943 & 1043

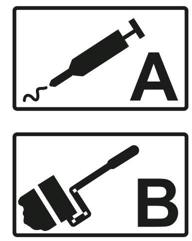


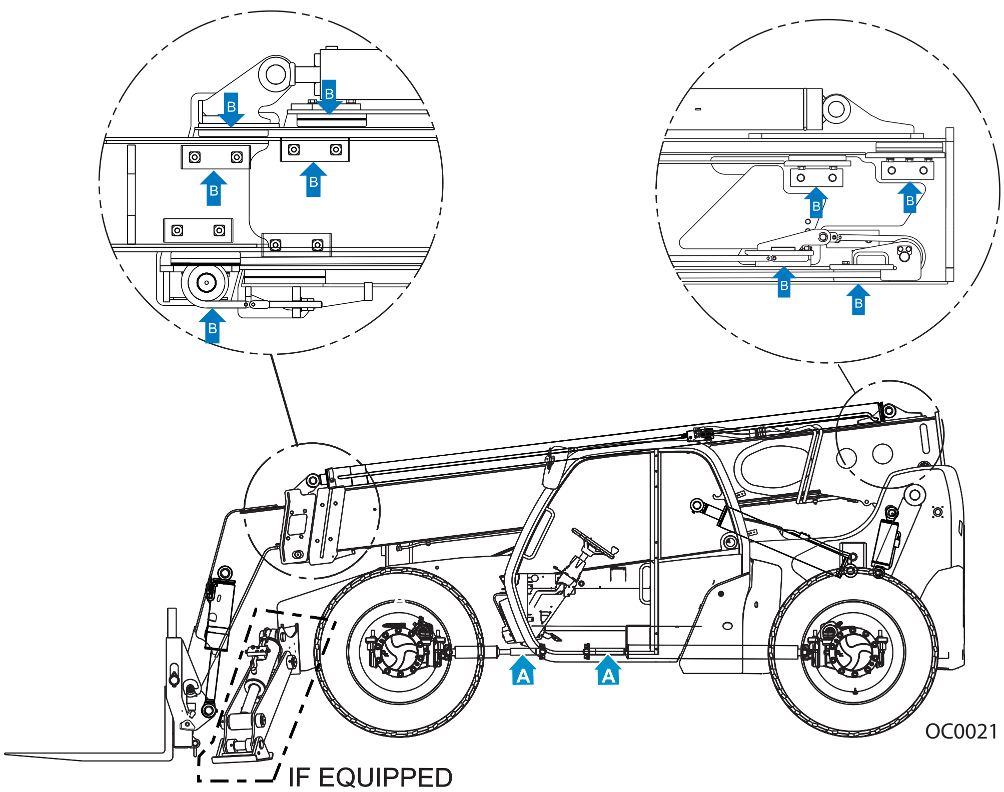
b. 1055, 1255



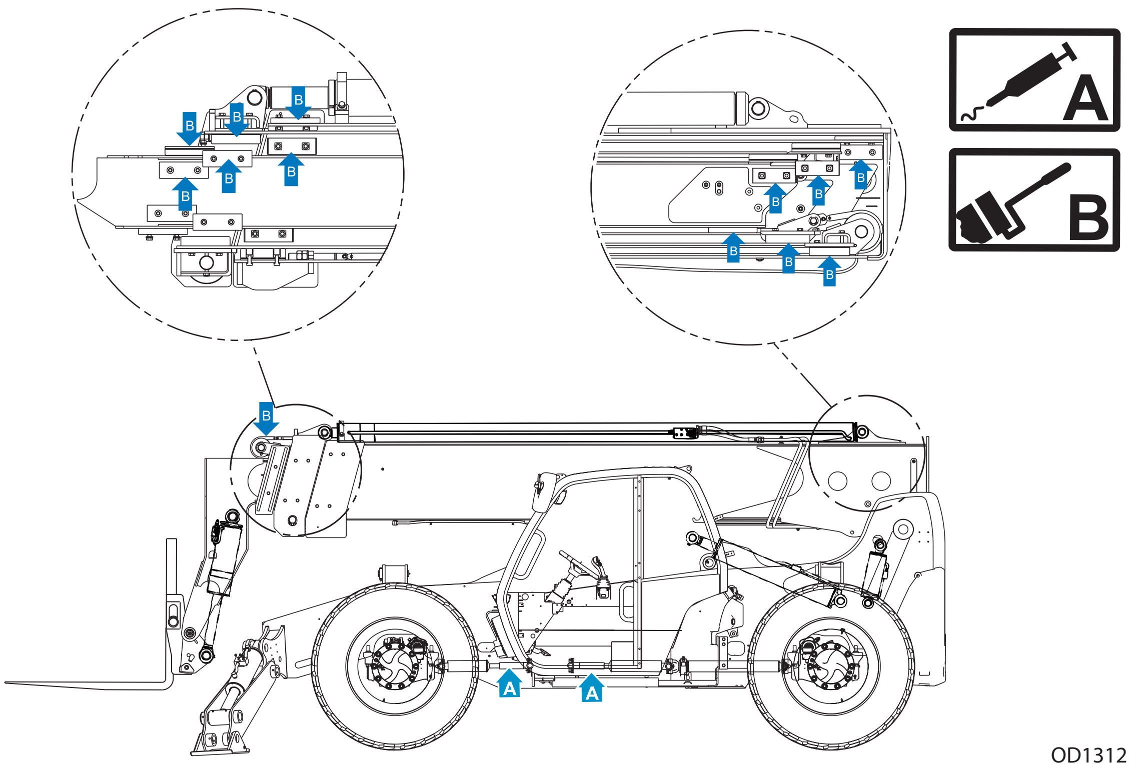
2.5.2 250 Hour

a. 742, 943 & 1043



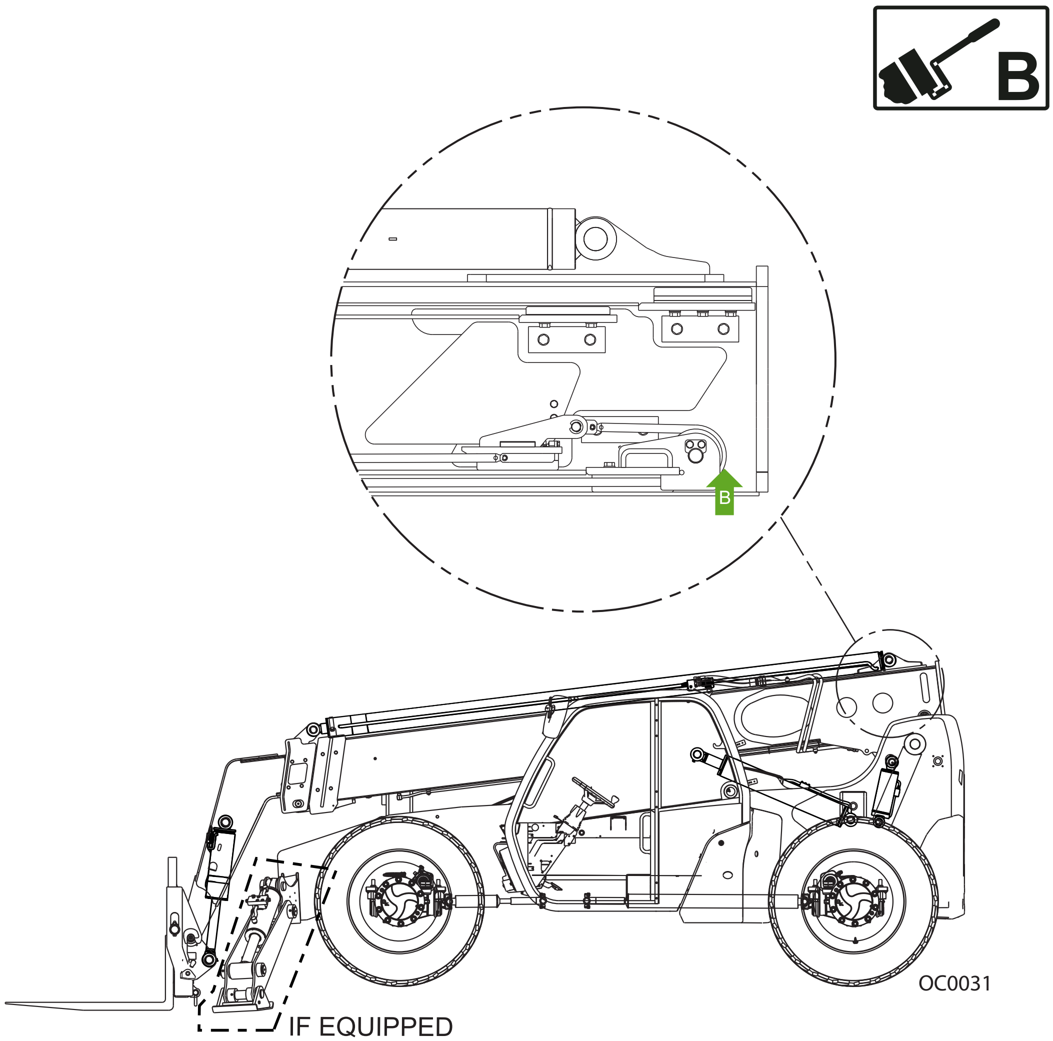


b. 1055, 1255

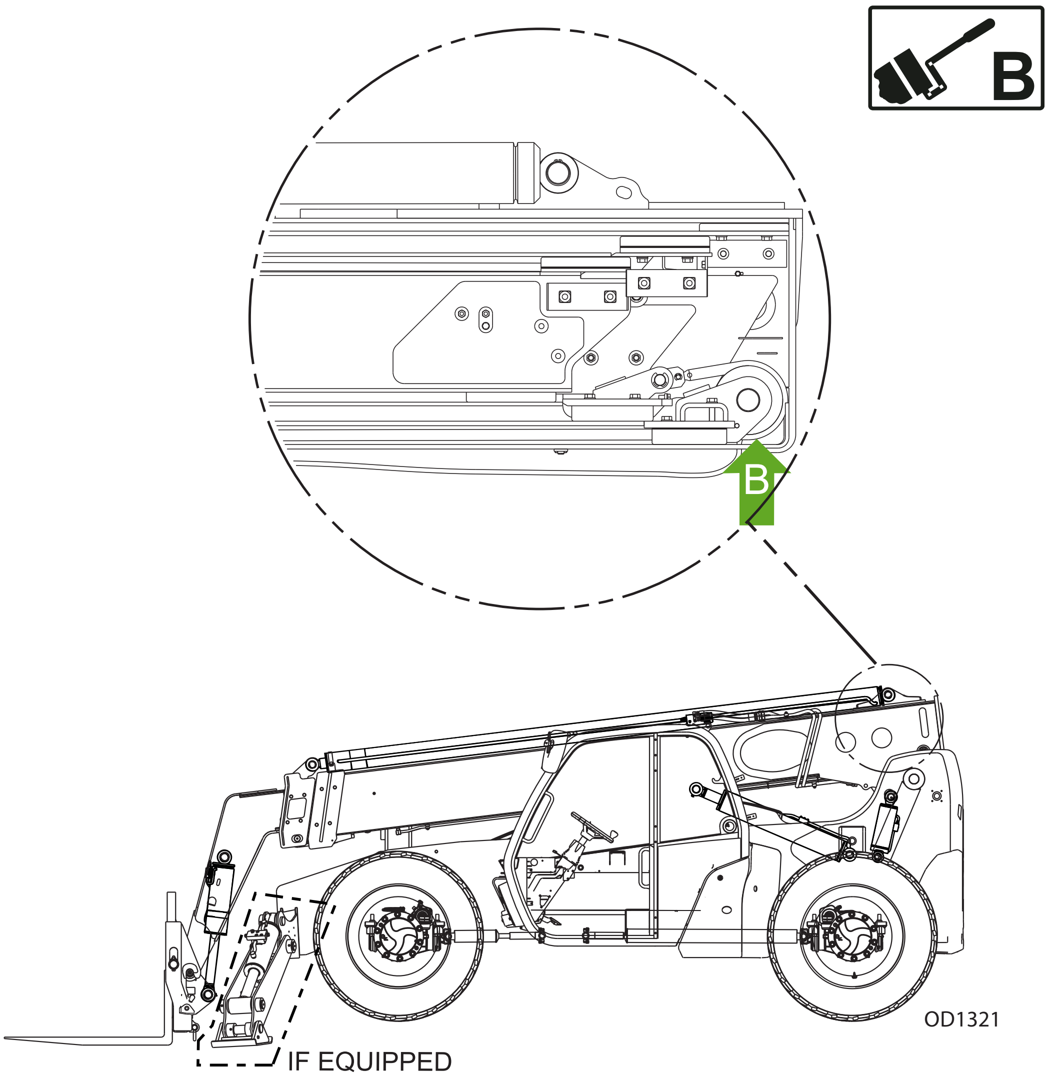


2.5.3 1000 Hour

a. 742, 943 & 1043



b. 1055, 1255



2.6 THREADLOCKING 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

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

3. * ASSEMBLY USES HARDENED WASHER

5000059K

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

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

3. * ASSEMBLY USES HARDENED WASHER

5000059K

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

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

3. * ASSEMBLY USES HARDENED WASHER

5000059K

2.7.1 SAE Fastener Torque Chart (Continued)

Values for Magni Coating Fasteners (Ref 4150701)										
SOCKET HEAD CAPSCREWS										
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
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

2.7.1 SAE Fastener Torque Chart (Continued)

Values for Zinc Yellow Chromate Fasteners (Ref 4150707)*										
SOCKET HEAD CAPSCREWS										
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
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 Zinc Yellow Chromate Fasteners (Ref 4150707)*						
CLASS 10.9 METRIC (HEX HEAD) BOLTS, CLASS 10 METRIC NUTS CLASS 12.9 SOCKET HEAD CAPSCREWS 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 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 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 CAPSCREWS 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 5000059K

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

3. * ASSEMBLY USES HARDENED WASHER

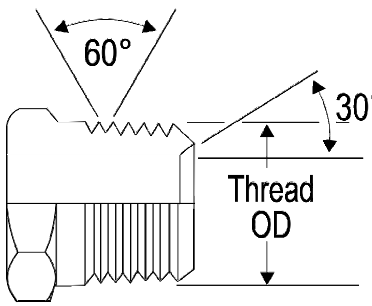
4. CLAMP LOAD LISTED FOR SHCS IS SAME AS GRADE 8 OR CLASS 10.9 AND DOES NOT REPRESENT FULL STRENGTH CAPABILITY OF SHCS. IF HIGHER LOAD IS REQUIRED, ADDITIONAL TESTING IS REQUIRED.

2.8 HYDRAULIC CONNECTION ASSEMBLY AND TORQUE SPECIFICATION

2.8.1 Definitions

a. Tapered Thread Types

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



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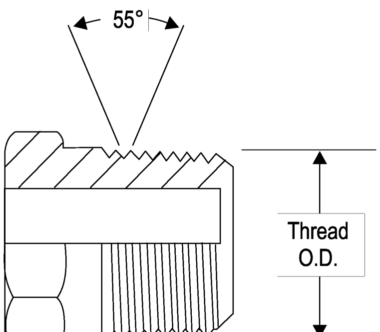
BSPT *- British standard pipe tapered per ISO7-1*



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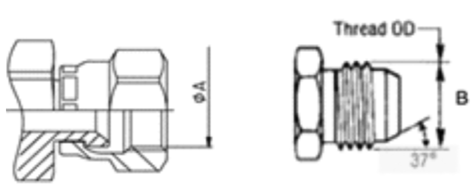
b. Straight Thread Types, Tube and Hose Connections

JIC *- 37° flare per SAE J514*



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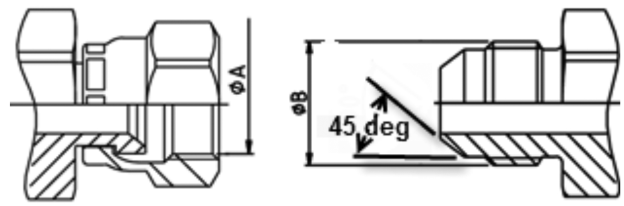
SAE *- 45° flare per SAE J512*



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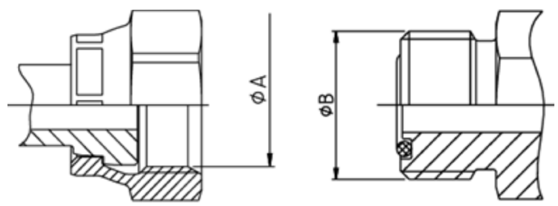
ORFS *- O-ring face seal per SAE J1453*



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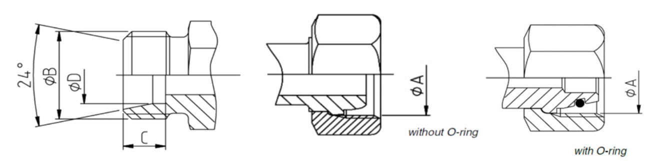
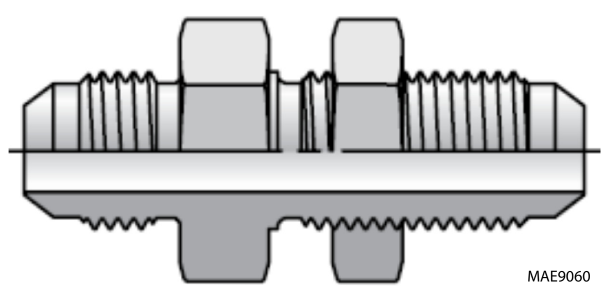
MBTL *- Metric flareless bite type fitting, pressure rating L (medium) per ISO 8434, DIN 2353*

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



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



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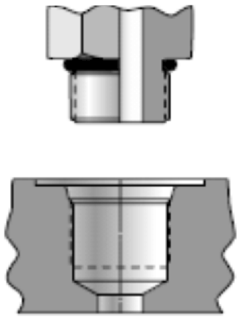
c. Straight Thread Types, Port Connections

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

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



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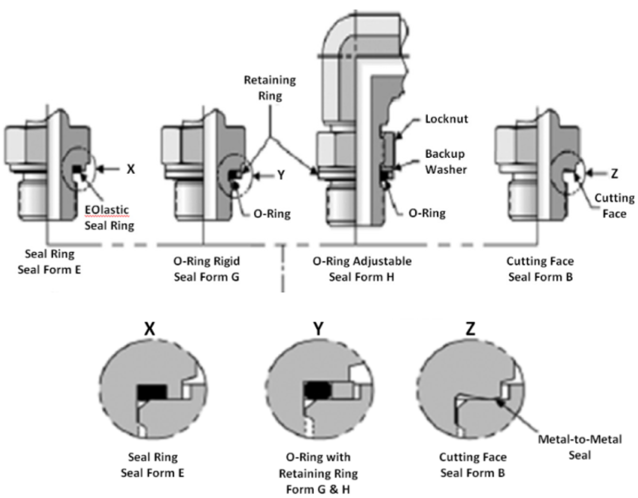
MFF *- Metric flat face port per ISO 9974-1*

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



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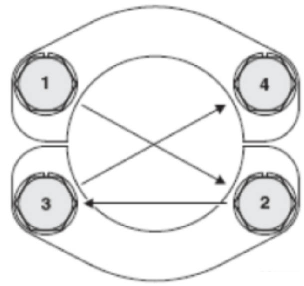
d. Flange Connection Types

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

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



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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.

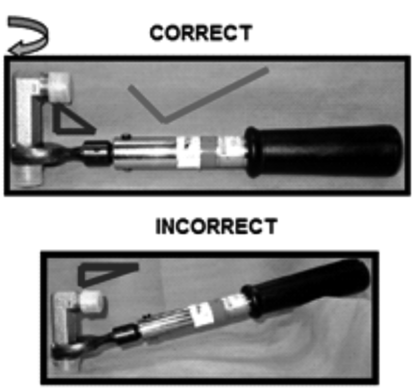
f. Assembly and Torque Specifications

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 2.8.17, “O-ring Installation (Replacement)”, 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.



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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 a suitable thread sealant, such as High Temperature high 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

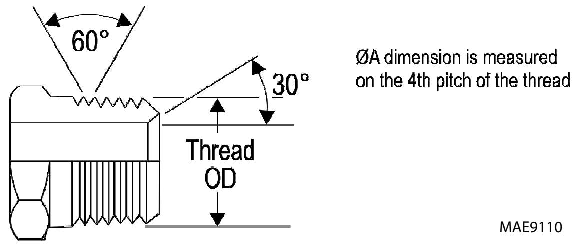
Never back off (loosen) pipe threaded connectors to achieve alignment. Meet the minimum required turns and use the last turn for alignment.

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



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 a suitable thread sealant, such as High Temperature high 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

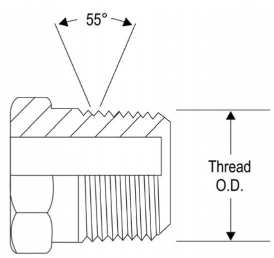
Never back off (loosen) pipe threaded connectors to achieve alignment. Meet the minimum required turns and use the last turn for alignment.

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



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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 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 and start threads by hand.

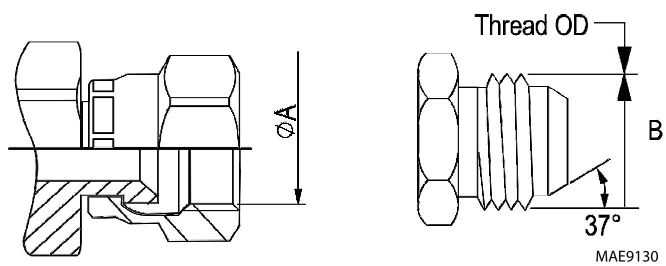
NOTICE

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.

3. 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.*

a. 37° Flare (JIC) Thread - Steel

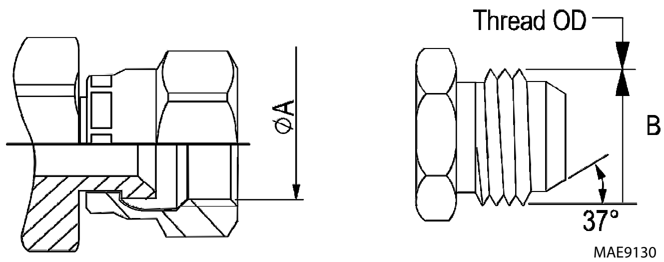


TYPE/FITTING IDENTIFICATION													Flats From Wrench Resistance (F.F.W.R)**
Material	Dash Size	Thread Size (UNF)	ØA* (in)	ØA* (mm)	ØB* (in)	ØB* (mm)	[Ft-Lb] Min	[Ft-Lb] Nom	[Ft-Lb] Max	[Nm] Min	[Nm] Nom	[Nm] Max	
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.28	7.00	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.

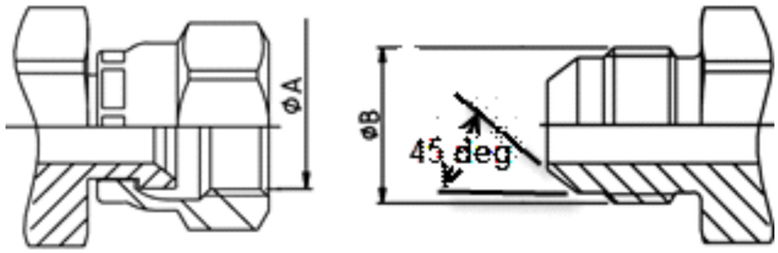
Torque fitting to value listed in below table while using the Double Wrench Method outlined in this section.

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 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. 45° Flare (SAE)



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STEEL

TYPE/FITTING IDENTIFICATION							TORQUE						Turns From Finger Tight (TFFT)**
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	1/4 to 1/2
	6	5/8-18	0.56	14.30	0.63	15.90	22	23	24	30	31	33	1/4 to 1/2
	8	3/4-16	0.69	17.50	0.75	19.10	42	44	46	57	60	62	1/4 to 1/2
	10	7/8-14	0.81	20.60	0.87	22.20	60	63	66	81	85	89	1/4 to 1/2
	12	1 1/16-14	0.98	25.00	1.06	27.00	84	88	92	114	119	125	1/4 to 1/2

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

ALUMINUM BRASS

TYPE/FITTING IDENTIFICATION							TORQUE						Turns From Finger Tight (TFFT)**
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	1/4 to 1/2
	6	5/8-18	0.56	14.30	0.63	15.90	14	15	15	19	20	20	1/4 to 1/2
	8	3/4-16	0.69	17.50	0.75	19.10	27	29	30	37	39	41	1/4 to 1/2
	10	7/8-14	0.81	20.60	0.87	22.20	39	41	43	53	56	58	1/4 to 1/2
	12	1 1/16-14	0.98	25.00	1.06	27.00	55	58	61	75	79	83	1/4 to 1/2

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 2.8.17, “O-ring Installation (Replacement),”, 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.

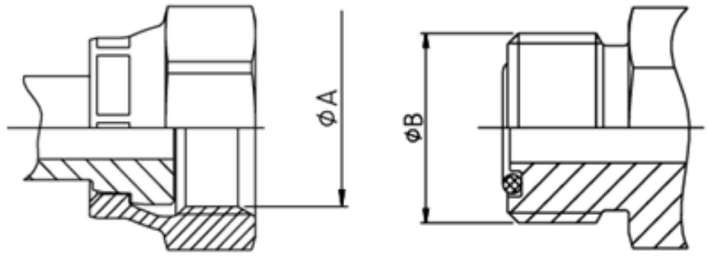
3. Pre-lubricate the O-ring with hydraulic oil.
4. Place the tube assembly against the fitting body so that the flat face comes in contact with the O-ring. Hand thread the nut onto the fitting body.
5. Torque nut to value listed in below mentioned table while using the Double Wrench Method. Refer to 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 COMPONENT; 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.

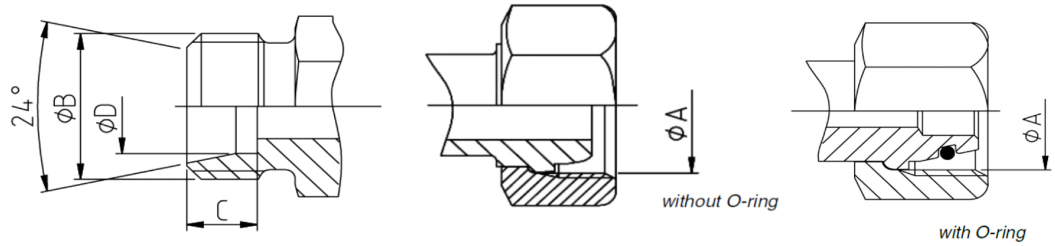
2.8.7 Assembly Instructions for DIN 24° Flare Bite Type Fittings (MBTL and MBTS)

NOTICE

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

6. 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.
7. Lubricate thread and cone of fitting body or hardened pre-assembly tool, as well as the progressive ring and nut threads.
8. Slip nut and progressive ring over tube, assuring that they are in the proper orientation.
9. Push the tube end into the coupling body.
10. 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)



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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						Flats From Wrench Resistance (F.F.W.R)**
								[Ft-Lb]			[Nm]			
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)	Min	Nom	Max	Min	Nom	Max	
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. Consult Engineering on the generation of torque values for the particular application.						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						Flats From Wrench Resistance (F.F.W.R)**
								[Ft-Lb]			[Nm]			
		(mm)	(Metric)	(mm)	(mm)	(mm)	(mm)	Min	Nom	Max	Min	Nom	Max	
	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. Consult Engineering on the generation of torque values for the particular application.						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

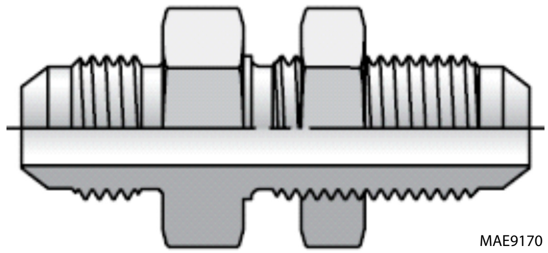
NOTE: * ØA, ØB,C, & ØD thread dimensions for reference only.

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

2.8.8 Assembly Instructions for Bulkhead (BH) Fittings

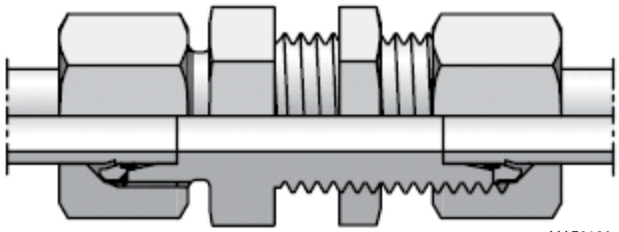
1. Ensure that threads and surface are free of rust, weld and brazing splatter, splits, burrs or other foreign material. If necessary, replace fitting or adapter.
2. Remove the locknut from the bulkhead assembly.
3. Insert the bulkhead side of the fitting into the panel or bulkhead bracket opening.
4. 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 (JLIC) 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



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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

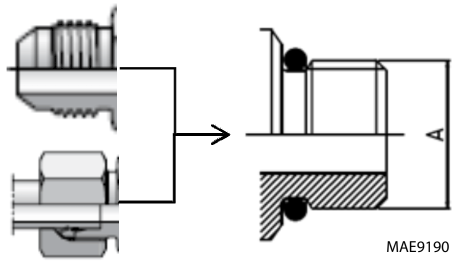
1. Inspect components to ensure that male and female port threads are free of rust, splits, dirt, foreign matter, or burrs.
2. Ensure proper O-ring is installed. If O-ring is missing install per O-ring Installation (replacement). Refer to Section 2.8.17, “O-ring Installation (Replacement),”, for procedure.

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



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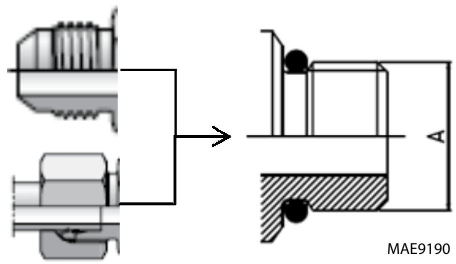
TYPE/FITTING IDENTIFICATION					HEX TYPE PLUGS & STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	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

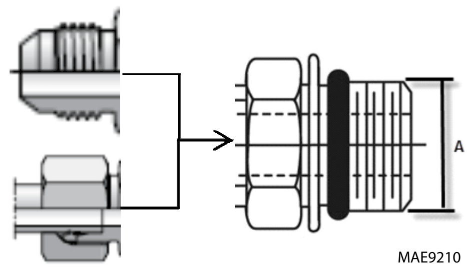


TYPE/FITTING IDENTIFICATION					STUD ENDS WITH (ORFS) OR S ERIES DIN (MBTS) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	7.93	(85)	(90)	(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



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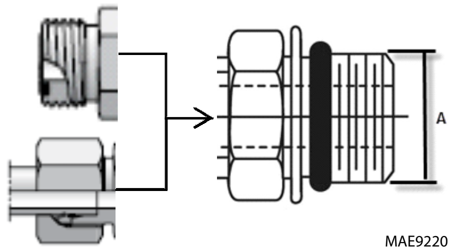
TYPE/FITTING IDENTIFICATION					ADJUSTABLE STUD END WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	Dash Size	Thread Size	ØA*		Torque					
					[Ft-Lb]			[Nm]		
		(UNF)	(in)	(mm)	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	2	5/16-24	0.31	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

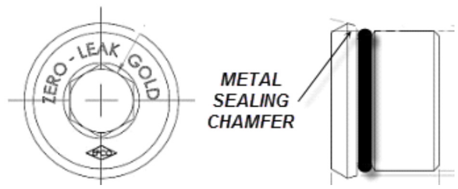
MAE9230

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



MAE9240

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 not typically specified on JLG applications. 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 not typically specified on JLG applications. 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

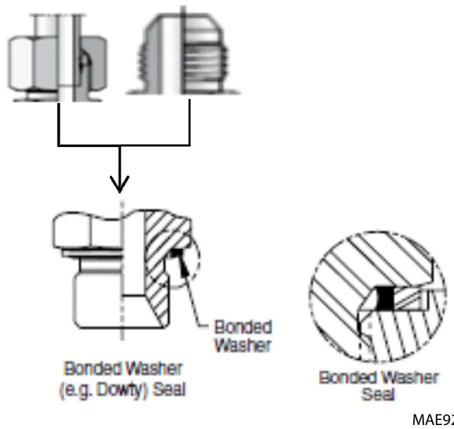
1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not pre-installed, install proper size, taking care not to damage it. Refer to Section 2.8.17, “O-ring Installation (Replacement)”, for procedure.

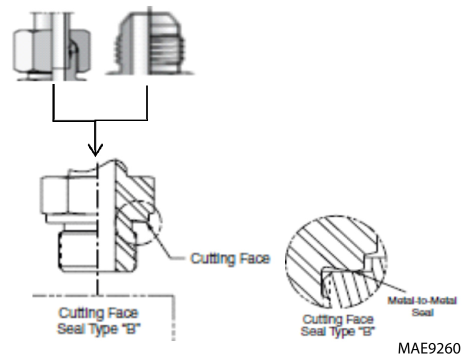
NOTICE

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.

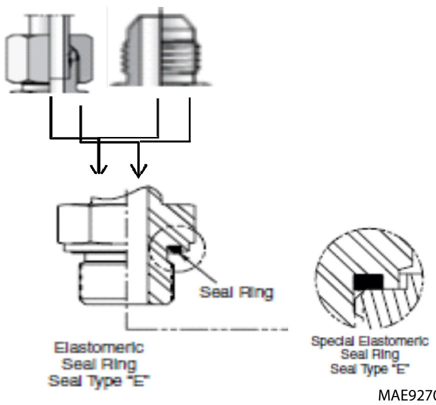
a. Metric Flat Face Port (MFF) L Series - Table 1 of 3



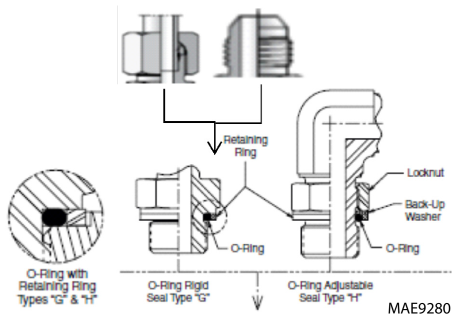


TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS WITH 37° (JIC) or L SERIES DIN (MBTL) OPPOSITE END						FORM B (CUTTING FACE) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	**Thread M Size**	**Connecting Tube O.D**	**Torque**						**Torque**					
			[Ft-Lb]			**[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



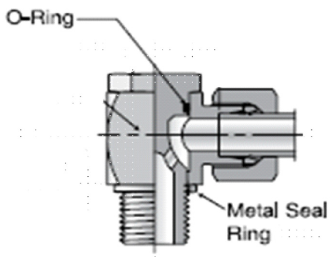
MAE9270



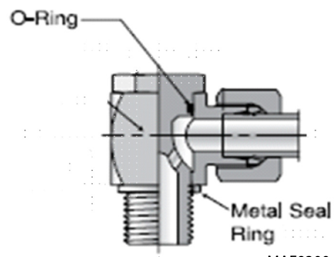
MAE9280

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	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

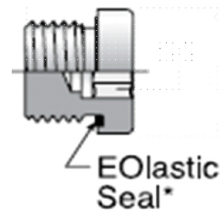
c. Metric Flat Face Port (MFF) L Series - Table 3 of 3



MAE9290



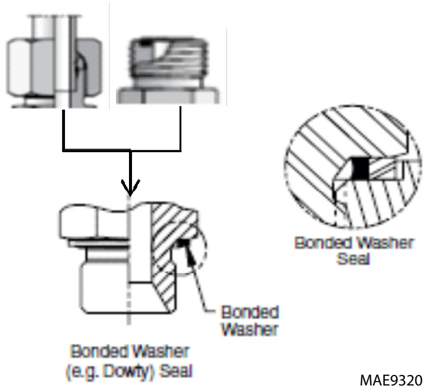
MAE9300

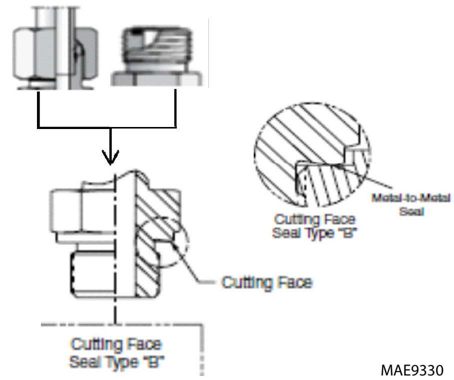


MAE9310

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

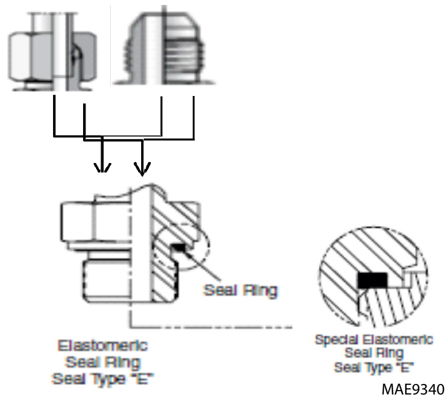
d. Metric Flat Face Port (MFF) S Series - Table 1 of 3

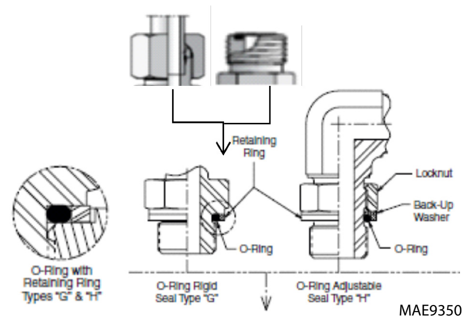




TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END						FORM B (CUTTING FACE) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(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

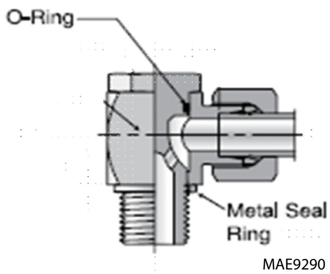
e. Metric Flat Face Port (MFF) S Series - Table 2 of 3

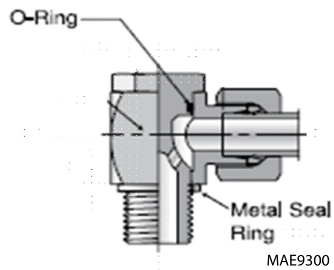


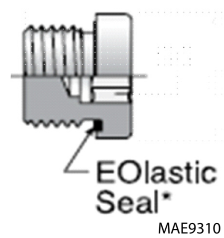


TYPE/FITTING IDENTIFICATION			FORM A (SEALING WASHER) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END						FORM B (CUTTING FACE) STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	Thread M Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[Ft-Lb]			[Nm]		
	(metric)	(mm)	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
STEEL FITTINGS WITH STEEL MATING COMPONENTS; UN-LUBRICATED THREADS	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







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

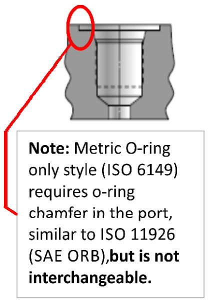
1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not pre installed, install proper size, taking care not to damage it. Refer to Section 2.8.17, “O-ring Installation (Replacement)”.

NOTICE

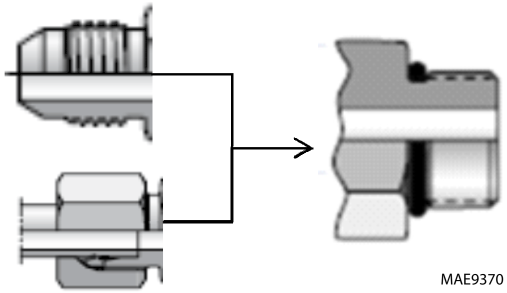
Care to be taken when lubricating O-ring. Avoid adding oil to the threaded connection of the fitting. The lubrication would cause increased clamping force and cause fitting damage.

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.

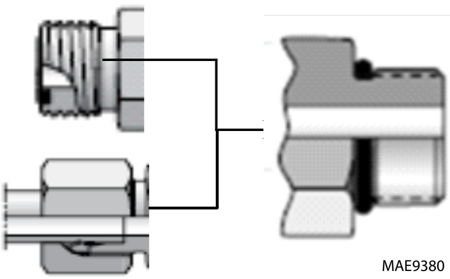
a. Metric Pipe Parallel O-Ring Boss (MPP)



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	M8 x 1	4	6	7	7	8	9	9	8	9	9	10	12	12
	M10 x 1	6	11	12	12	15	16	16	15	16	17	20	22	23
	M12 x 1.5	8	18	19	20	25	26	27	26	28	29	35	38	39
	M14 x 1.5	10	26	28	29	35	38	39	33	35	36	45	47	49
	M16 x 1.5	12	30	32	33	40	43	45	41	43	45	55	58	61
	M18 x 1.5	15	33	35	36	45	47	49	52	55	57	70	75	77
	M20 x 1.5	--	--	--	--	--	--	--	59	62	65	80	84	88
	M22 x 1.5	18	44	46	48	60	62	65	74	78	81	100	106	110
	M27 x 2	22	74	78	81	100	106	110	125	132	138	170	179	187
	M30 x 2	--	95	100	105	130	136	142	175	184	193	237	249	262
	M33 x 2	25	120	126	132	160	171	179	230	242	253	310	328	343
	M38 x 2	--	135	142	149	183	193	202	235	247	259	319	335	351
	M42 x 2	30	155	163	171	210	221	232	245	258	270	330	350	366
	M48 x 2	38	190	200	209	260	271	283	310	326	341	420	442	462
	M60 x 2	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	M8 x 1	4	4	5	5	5	7	7	5	6	6	7	8	8
	M10 x 1	6	7	8	8	9	11	11	10	11	11	14	15	15
	M12 x 1.5	8	12	13	13	16	18	18	17	18	19	23	24	26
	M14 x 1.5	10	17	18	19	23	24	26	21	22	23	28	30	31
	M16 x 1.5	12	20	21	21	27	28	28	27	28	29	37	38	39
	M18 x 1.5	15	21	22	23	28	30	31	34	36	37	46	49	50
	M20 x 1.5	--	--	--	--	--	--	--	30	40	42	41	54	57
	M22 x 1.5	18	29	30	31	39	41	42	48	51	53	65	69	72
	M27 x 2	22	48	51	53	65	69	72	81	86	90	110	117	122
	M30 x 2	--	62	65	68	84	88	92	114	120	125	155	163	169
	M33 x 2	25	78	82	86	106	111	117	150	157	164	203	213	222
	M38 x 2	--	88	93	97	119	126	132	153	161	168	207	218	228
	M42 x 2	30	101	106	111	137	144	150	159	168	176	216	228	239
	M48 x 2	38	124	130	136	168	176	184	202	212	222	274	287	301
	M60 x 2	50	150	157	164	203	213	222	241	253	265	327	343	359

2.8.12 Assembly Instructions for Adjustable Port End (BSPP) Fittings

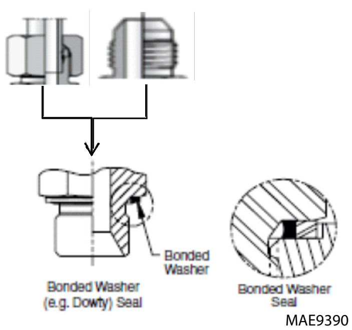
1. Inspect components to ensure that male and female threads and surfaces are free of rust, splits, dirt, foreign matter, or burrs.
2. If O-ring is not pre installed, install proper size, taking care not to damage it. Refer to Section 2.8.17, “O-ring Installation (Replacement)”, for instructions.

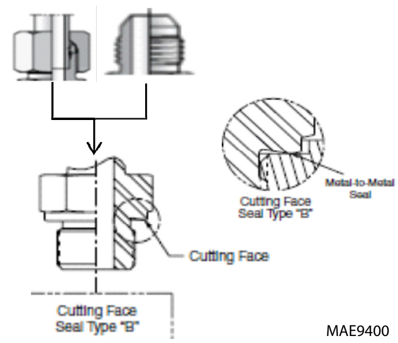
NOTICE

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

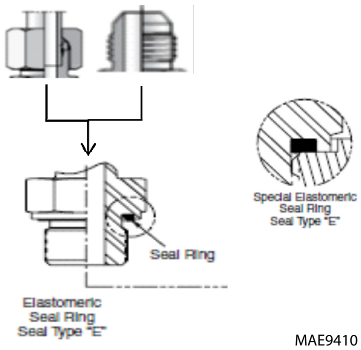


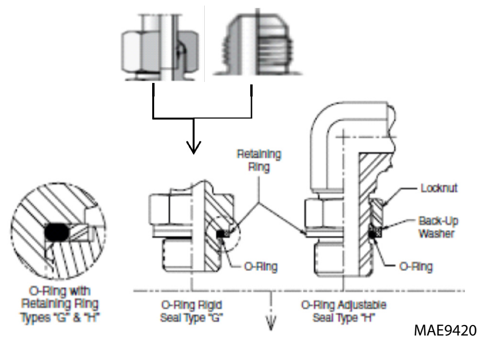


TYPE/FITTING IDENTIFICATION			FORM A**(SEALING WASHER) STUD ENDS WITH 37° (JIC) or L SERIES DIN (MBTL) OPPOSITE END						FORM B** (CUTTING FACE) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	BSPP Thread G Size	Connecting Tube O.D.	Torque						Torque					
			[Ft-Lb]			[Nm]			[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 1-1/4A	35	115	121	127	156	164	172	259	272	285	351	369	386

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

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

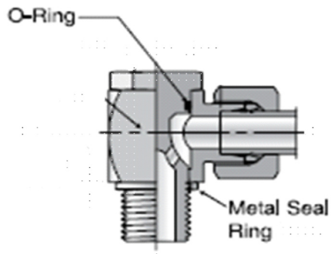




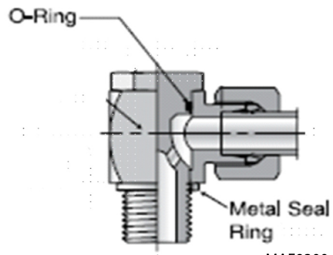
TYPE/FITTING IDENTIFICATION			FORM A**(SEALING WASHER) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END						FORM B** (CUTTING FACE) STUD ENDS WITH 37° (JIC) OR L SERIES DIN (MBTL) OPPOSITE END					
Material	**BSPP Thread G Size**	**Connecting Tube O.D.**	**Torque**						**Torque**					
			[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	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 1-1/4A	35	216	227	237	293	308	321	216	227	237	293	308	321

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

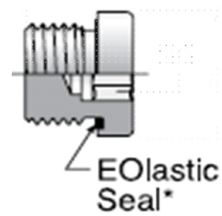
c. British Standard Parallel Pipe Port (BSPP) L Series - Table 3 of 3



MAE9290



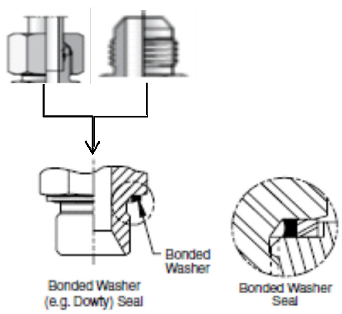
MAE9300



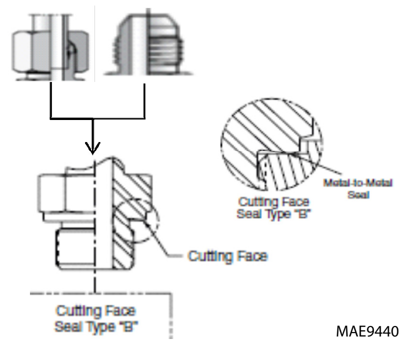
MAE9310

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	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

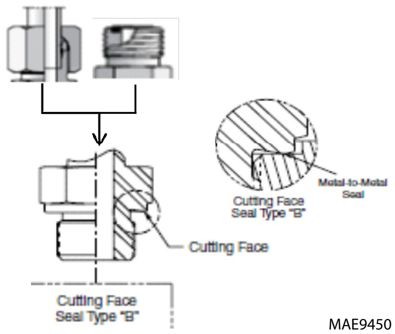


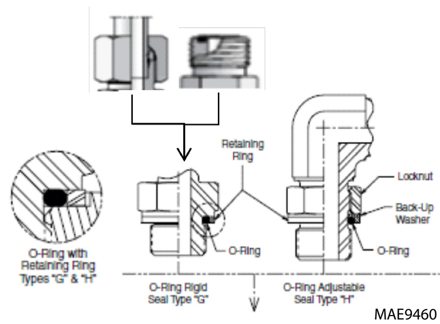
MAE9440

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

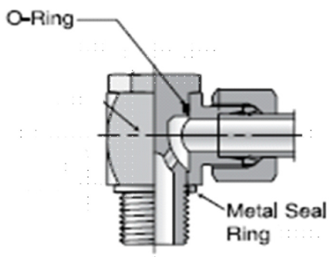




TYPE/FITTING IDENTIFICATION			FORM E* (EOLASTIC SEALING RING) STUD ENDS AND HEX TYPE PLUGS WITH (ORFS) or S SERIES DIN (MBTS) OPPOSITE END						FORM G/H*** (O-RING W/ RETAINING RING) STUD ENDS & ADJUSTABLE STUD ENDS WITH (ORFS) OR S SERIES DIN (MBTS) OPPOSITE END					
Material	BSPP Thread G Size	Connecting 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



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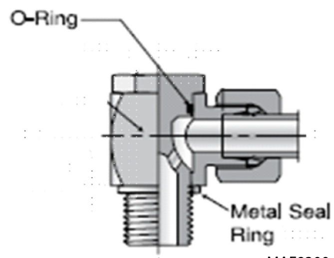
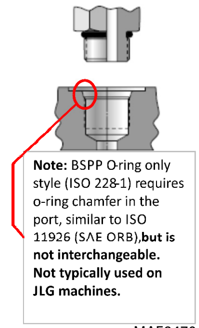


MAE9300



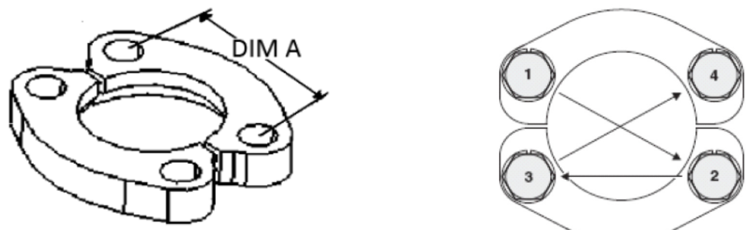
MAE9470

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

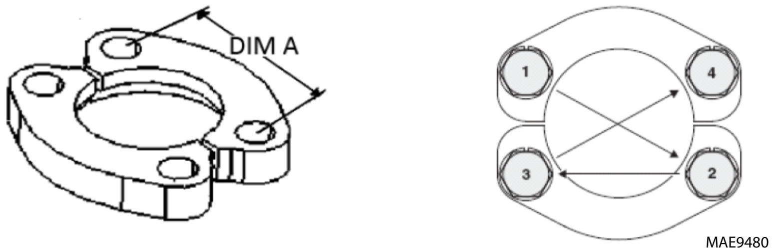
**TYPE/FITTING IDENTIFICATION
STEEL 4-BOLT FLANGE SAE J518
(INCH FASTENERS)**

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

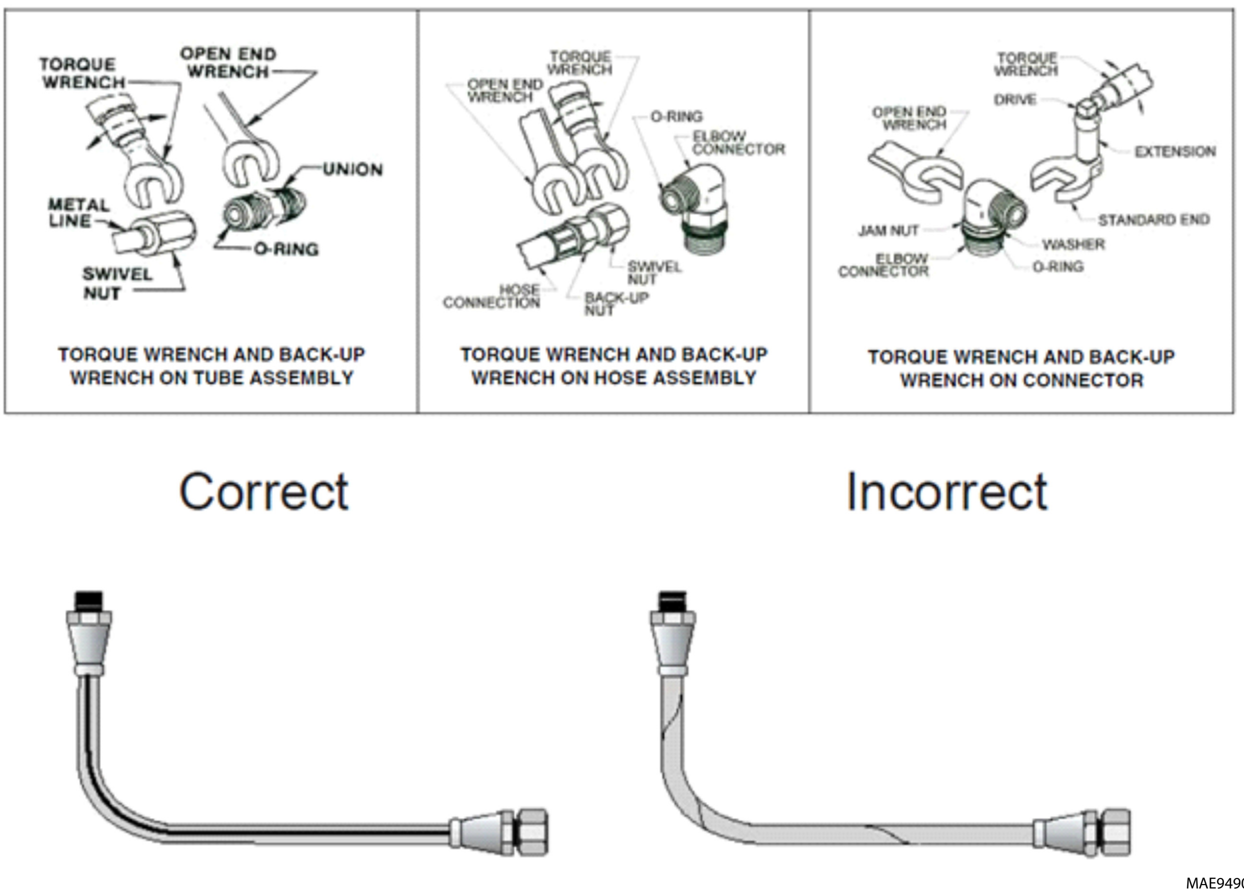
TYPE/FITTING IDENTIFICATION							STEEL 4-BOLT FLANGE SAE J518 (METRIC FASTENERS)											
Type	Inch Flange SAE Dash Size	Flange Size		A*		Bolt Thread Size	Fastener Torque for Flanges Equipped with CLASS 8.8 Screws						Fastener Torque for Flanges Equipped with CLASS 10.9 Screws					
							[Ft-Lb]			[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 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 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.

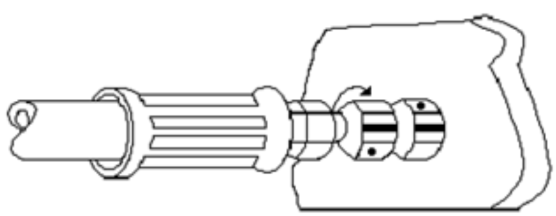
Double Wrench Method to Prevent Hose Twist



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



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.

2.8.17 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

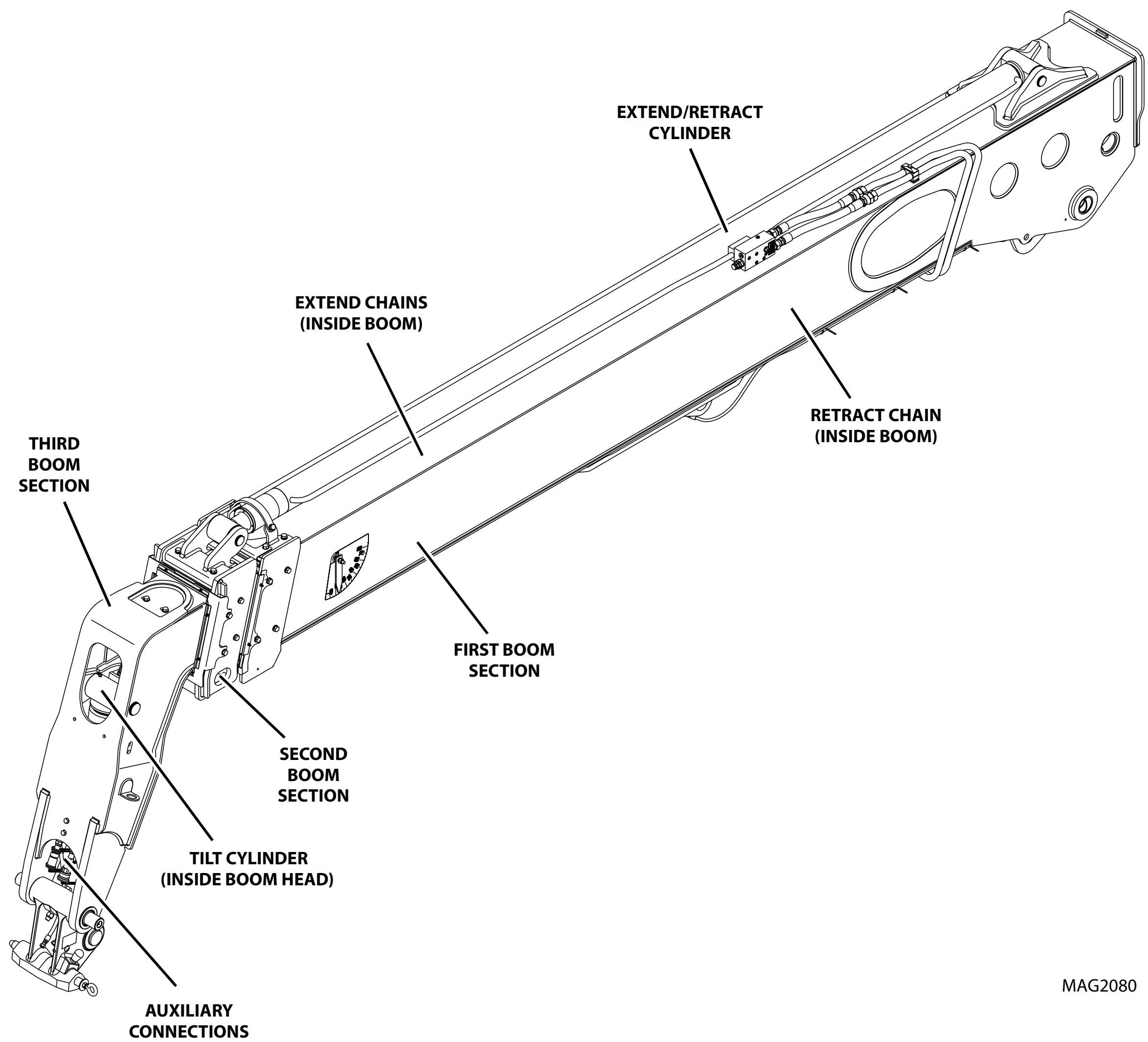
Contents

3.1 BOOM SYSTEM COMPONENT TERMINOLOGY

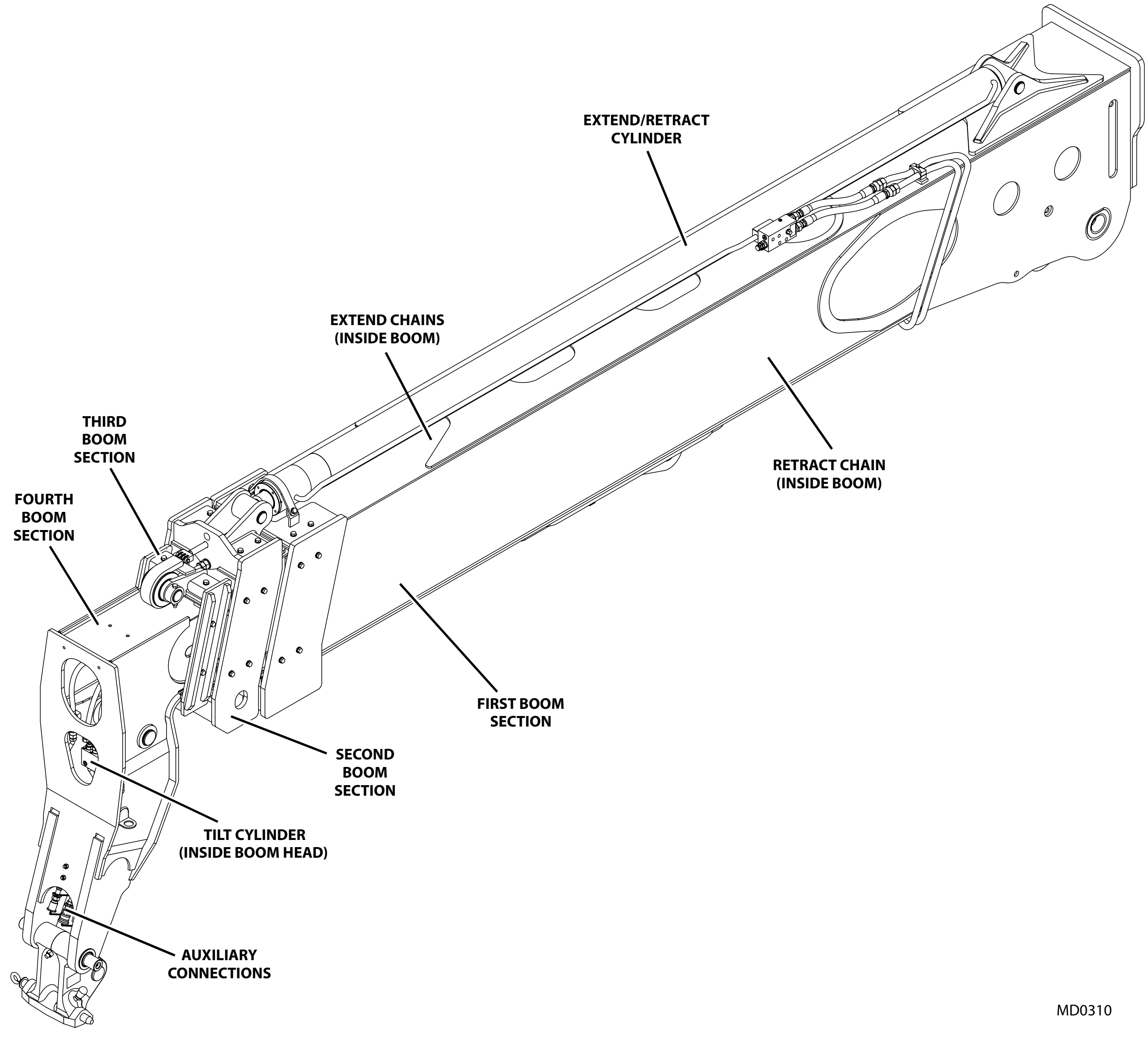
To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the name and location of the major assemblies of the boom system. The following illustration identifies the components that are referred to throughout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

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

3.1.1 742, 943, 1043



3.1.2 1055, 1255



3.2 BOOM SYSTEM

3.2.1 Boom System Operation - 742, 943, 1043

The three section boom consists of the first, second and third assemblies with extend chain(s) and a retract chain.

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.

The first, second and third boom sections are connected by extend and retract chains. These chains are routed around sheaves on the front and the rear of second boom section. As the extend/retract cylinder is forced out hydraulically, the third boom section is pulled out by the extend chain(s).

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

This mechanical linkage formed by the chains and supporting hardware, extends and retracts the third boom section into the second boom section at the same rate.

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 - 1055, 1255

The four section boom consists of the first, second, third and fourth assemblies with double third section extend chains, a single fourth section extend chain, a single third and fourth section retract chains.

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.

The first, second, third and fourth boom sections are connected by extend and retract chains. These chains are routed around sheaves on the second and third boom sections. As the second and third boom sections are forced out, the extend chains pull the third and fourth boom sections out of the second boom section.

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

This mechanical linkage formed by the chains and supporting hardware, extends and retracts the third and fourth boom sections at the same rate.

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

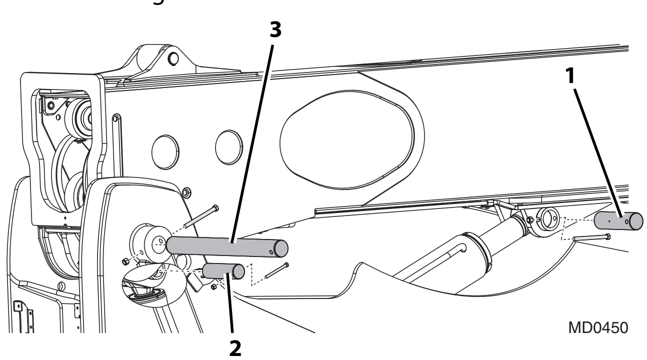
3.3 BOOM REMOVAL/INSTALLATION

3.3.1 Complete Boom Removal

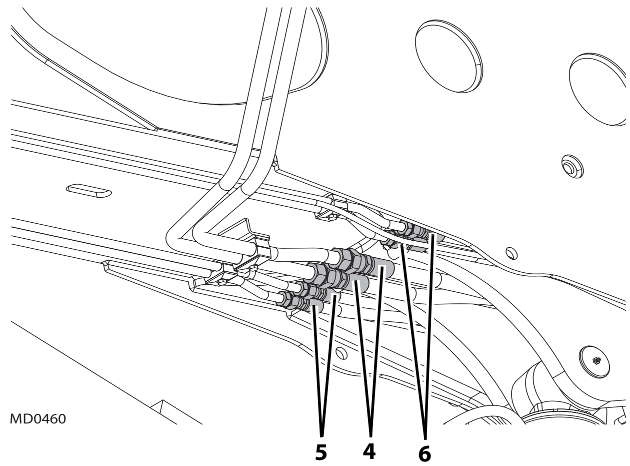
While the boom sections can be separated from each other on the machine, it is more efficient to remove the complete boom assembly from the machine and place it on suitable supports for separation.

Note: *When removing a complete boom assembly use a hoist or crane with a minimum lift capacity of 10,000 lb (4,536 kg).*

1. Remove any attachment from the quick coupler assembly. Refer to Operation & Safety Manual.
2. Remove the quick coupler assembly. Refer to Section 3.13.1, “Manual Coupler”.
3. 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.
4. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
5. Open the engine cover. Allow the system fluids to cool.
6. Properly disconnect the battery. Refer to Section 9.8, “Battery”, for procedure.
7. Close engine cover to access lift/lower cylinder pin and the compensation cylinder pin.
8. Properly support the boom assembly using a hoist or crane.
9. Remove boom angle sensor arm. Refer to Section 9.11.6, “Boom Angle Sensor”.



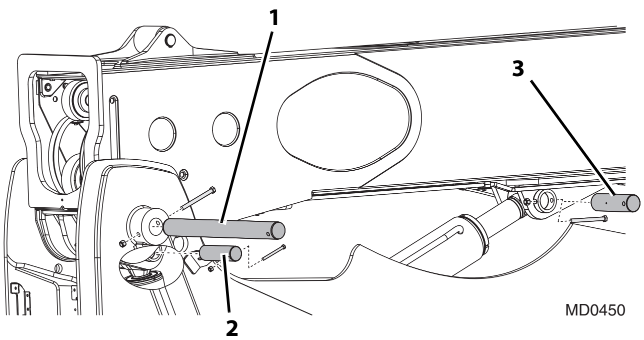
10. Remove the pin (**1**) from the rod end of the lift/lower cylinder being careful not to drop the cylinder. Lower the cylinder to a secure position.
11. Remove the pin (**2**) from the rod end of the compensation cylinder being careful not to drop the cylinder. Lower the cylinder to a secure position.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



14. 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.
15. 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.
16. Label and disconnect all electrical connections to the boom assembly.
17. Remove the boom assembly pivot pin (**3**).
18. Confirm that the boom assembly is balanced with the sling and remove the boom assembly pivot pins.
19. Lift the boom assembly from the machine and lower onto suitable supports.

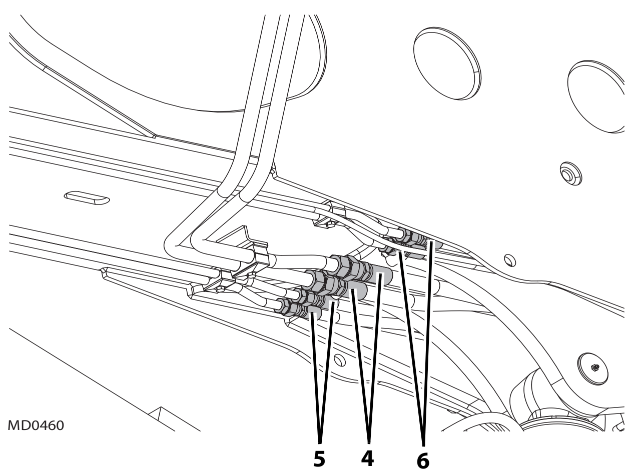
3.3.2 Complete Boom Installation

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.



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 and lock bolt (**1**).
4. With the sling still in place, install the compensating cylinder, pin and lock bolts (**2**).
5. With the sling still in place, install the rod end of the lift/lower cylinder, pin and lock bolt (**3**).

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.*



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 9.11.6, “Boom Angle Sensor”.
10. Remove slings and/or supports from the boom assembly.
11. 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.
12. Lower the boom assembly and shut engine OFF.
13. Clean up all debris, hydraulic fluid, etc., in, on, near and around the machine.

3.4 BOOM ASSEMBLY MAINTENANCE - 742, 943, 1043

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 to 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 3.12.1, “Wear Pad Inspection”).
2. Check chain rollers.
3. Apply grease at all lubrication points (grease fittings).
   (Refer to Section 2.5, “Lubrication Schedule”).
4. Check for proper operation by operating all boom functions through their full ranges of motion several times.

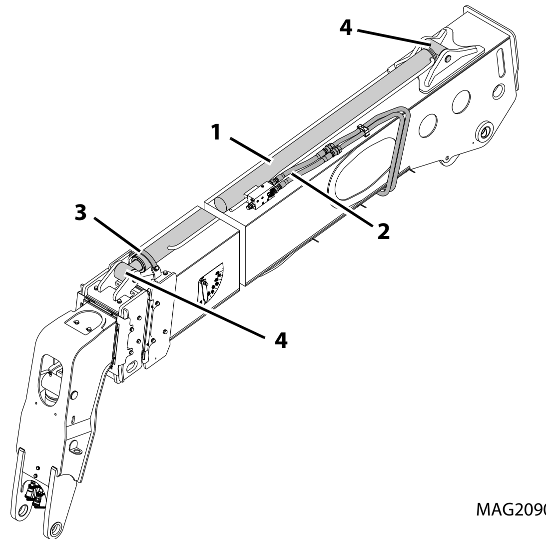
Depending on your particular circumstance, the following procedures explain the removal/installation of individual boom sections or removal/installation of the complete boom.

⚠ WARNING

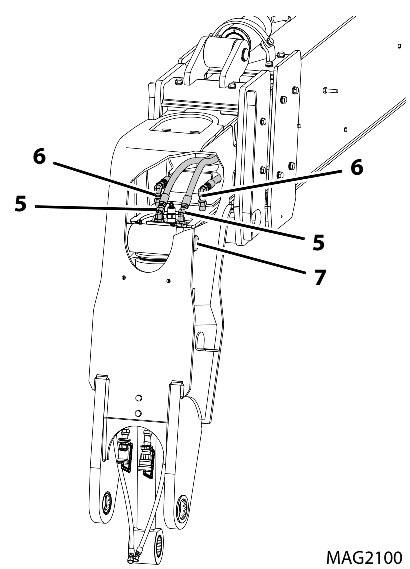
NEVER modify the boom by welding or drilling unless approved in writing by *JLG*. The structural integrity of the boom will be impaired if subjected to any repair involving welding or drilling.

3.4.1 Second and Third Boom Section Removal

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

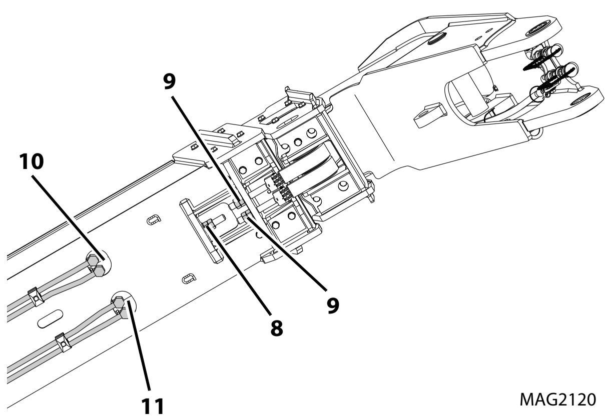


2. Properly support the extend/retract cylinder (**1**) using a hoist or crane.
3. Label, disconnect and cap the extend/retract cylinder hoses (**2**) from the extend/retract cylinder. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
4. Loosen and remove the extend/retract cylinder strap (**3**).
5. Remove one retaining ring from the mounting pin (**4**) at each end of the extend/retract cylinder.
6. Remove each mounting pin and remove the extend/retract cylinder and place in a secure location.



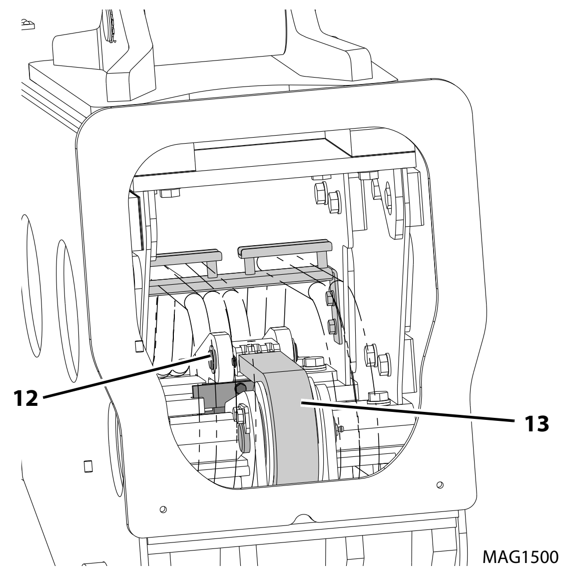
7. Label, disconnect and cap the tilt circuit hoses (**5**) from the tilt cylinder at the front of the third boom section. If equipped, label, disconnect and cap the auxiliary circuit hoses (**6**) from the fittings at the top front of the third boom section. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
8. 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 (**7**) at the barrel end of the tilt cylinder. Lower the tilt cylinder and place in a secure location.

943, 1043

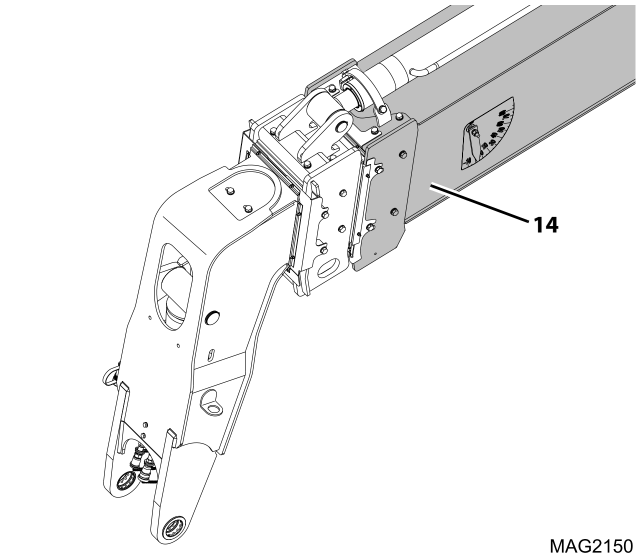


Note: *Before removing the extend chains, measure and note the distance between the face of the jam nut to the end of the chain clevis. This measurement will be used when reassembling the boom.*

9. Loosen and remove the lock nut and jam nut (**8**) on the retract chain at the front of the first boom section.
10. Loosen and remove the lock nuts and jam nuts (**9**) on the extend chains at the front of the first boom section.
11. Label, disconnect and cap both tilt hoses (**10**) and both auxiliary hoses (**11**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
12. Pull both tilt hoses (**10**) and both auxiliary hoses (**11**) through the rear of the first boom section.



13. Remove the clip and pin (**12**) from the retract chain clevis that is attached to the rear of the third section boom. Lay the retract chain (**13**) over the rear of the first boom section.



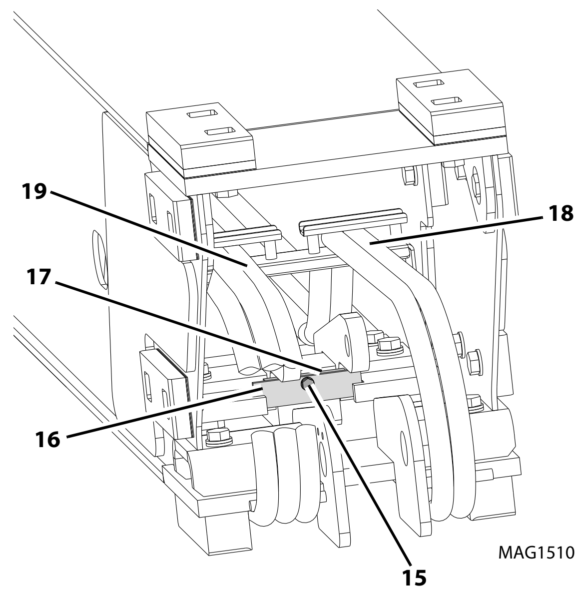
14. Pull the second and third section booms out 6 - 8 in (152 - 203 mm) and remove all the wear pads, shims and backing plates from the front inside of the first section boom (**14**). Label all parts for installation.
15. Using a sling around the front of the second boom section, lift and slide the two boom sections 75% 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. Remove the retract chain from the inside of the first boom section. Clean and inspect chain. Replace if damaged.
17. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
18. Inspect hoses, hardware, wear pads, mounting points, chains and other components visible with the first boom section. Replace any item if damaged. (Refer to Section 3.11.1, “Boom Chain Inspection” and Section 3.12.1, “Wear Pad Inspection”).

Note: *It is recommended that if any chain or hose is damaged then ALL chains or hoses are replaced.*

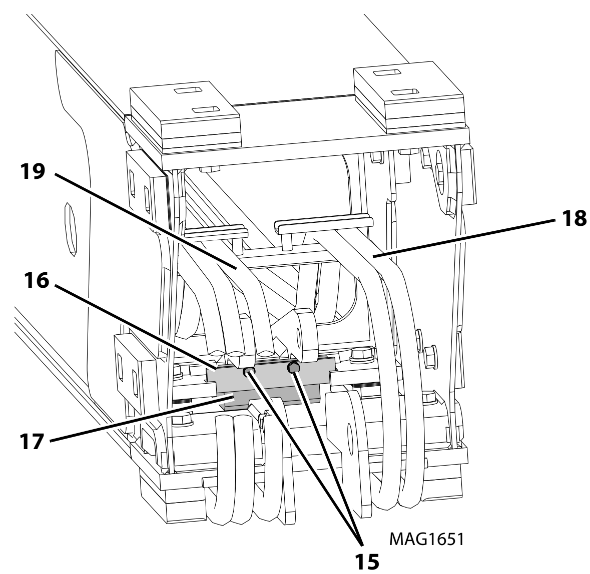
3.4.2 Third Boom Section Removal

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

742



943, 1043



Note: *Removal of the retract chain roller from the rear of the second boom section may be required to access the extend chain clevis assemblies.*

2. At the rear of the boom, mark the location of tilt hoses (**18**) and the auxiliary hoses (**19**). Loosen and remove the hose bracket assembly attached to the third boom section securing tilt hoses (**18**) and the auxiliary hoses (**19**).

3. Loosen and remove the mounting bolt(s) (**15**) and bracket (**16**) securing each extend chain clevis(es) (**17**).
4. Fasten a rope/wire to each extend chain clevis(es).
5. Pull the third boom section out 6 - 8 in (152 - 203 mm). Remove the top wear pads, shims and backing plate from the second boom section. Label and tag each set of wear pads being removed.
6. Remove the side wear pads, shims and backing plates from either side of the rear of the second boom section. Label and tag each set of wear pads being removed.
7. Place a sling around the front of the third boom section. Lift and slide the two boom sections 75% 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 from the remainder of the way out of the second boom section and set the third boom sections down on suitable supports.
8. Remove the extend chains from bottom of second boom section. Clean and inspect chain. Replace if damaged.
9. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
10. Inspect hardware, wear pads, mounting points, chains and other components visible with the second boom section. Replace any item if damaged.
(Refer to Section 3.11.1, “Boom Chain Inspection” and Section 3.12.1, “Wear Pad Inspection”).

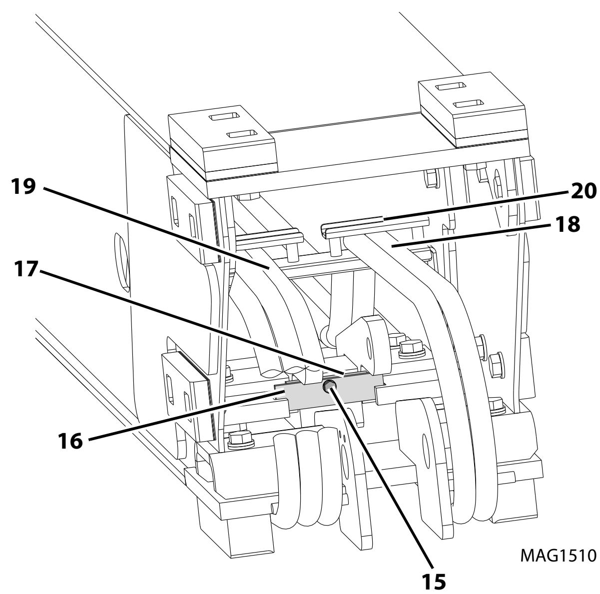
Note: *It is recommended that if any chain or hose is damaged then ALL chains or hoses are replaced.*

3.4.3 Third Boom Section Installation

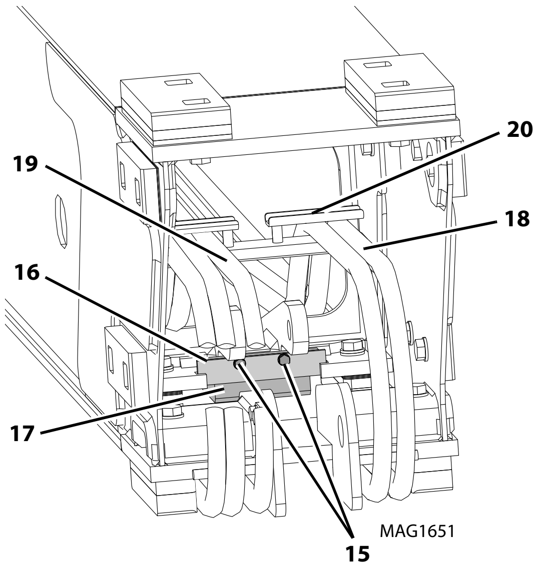
Note: *Shimming of the wear pads may be required after the boom assembly is installed on the machine and hydraulic power is available. Refer to Section 3.12, “Boom Wear Pads”.*

1. Install the extend chains on the bottom inside of second boom section. Lay the extend chain along the length of second boom section.
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 (914 - 1219 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. Carefully slide the third boom section into 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 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. Do not shim or tighten bolts at this time.

742



943, 1043



5. Secure each extend chain clevis(es) (**16**) with the previously removed bracket (**17**) and mounting bolt(s) (**15**). Torque as required.

Note: *Installation of the retract chain roller from the rear of the second boom section may be required if removed to access the extend chain clevis assemblies.*

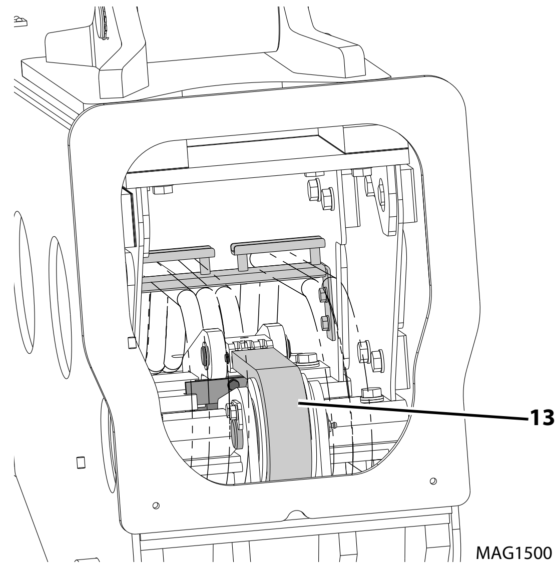
Note: *Grease wear pads, bores and pins during assembly.*

Note: *Shim wear pads as needed to maintain an even gap between the wear pads and the next boom section. The number of shims can vary at each shim point.*

6. Shim all wear pads on the rear of the third boom section and front of the second boom section.
7. Retract the third boom section the remainder of the way into the second boom section.
8. At the rear of the boom, install the hose bracket (**20**) to the third boom section.

3.4.4 Second and Third Boom Section Installation

Note: *Shimming of the wear pads may be required after the boom assembly is installed on the machine and hydraulic power is available. Refer to Section 3.12, "Boom Wear Pads".*



1. Install the retract chain (**13**) to bottom front inside of the first boom section. Install the lock nut and jam nut. Lay the retract chain over the rear of the first boom section.

Note: *Keep the retract chain, tilt and auxiliary hoses centered in the first boom section while installing the second boom section into the first boom section.*

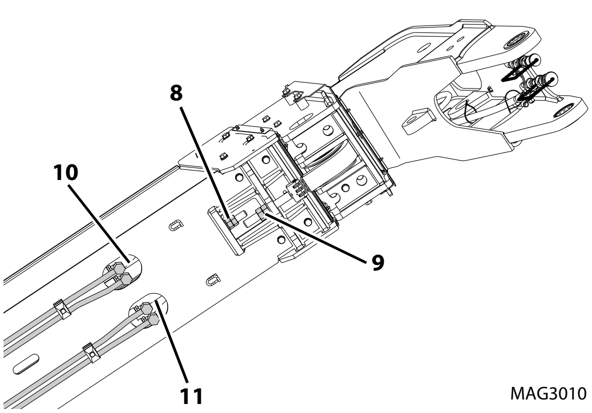
2. Grease the inside first boom section on areas where the second boom section wear pads will slide.

3. Using a suitable sling, balance the second 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.
4. 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.
5. Retract the second and third boom sections the remainder of the way into the first boom section.

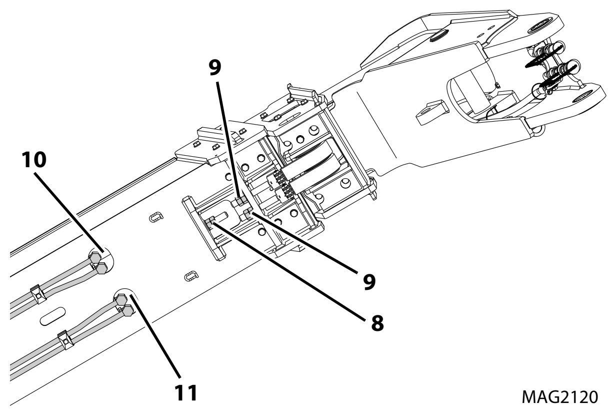
Note: *Shim wear pads as needed to maintain an even gap between the wear pads and the next boom section. The number of shims can vary at each shim point.*

6. Shim all wear pads on the rear of the second boom section and front of the first boom section. Torque as required.

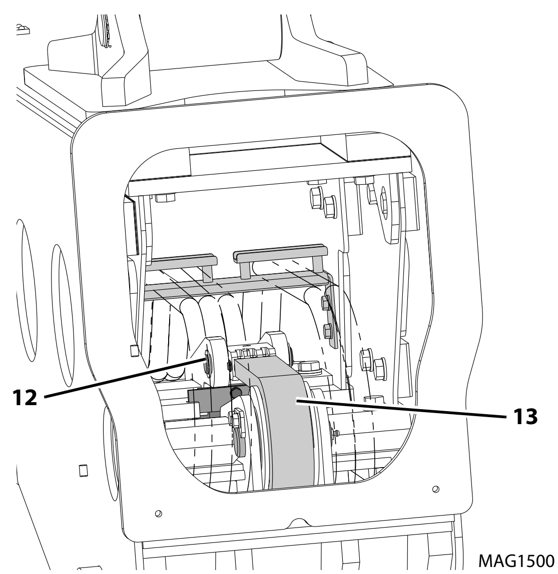
742



943, 1043

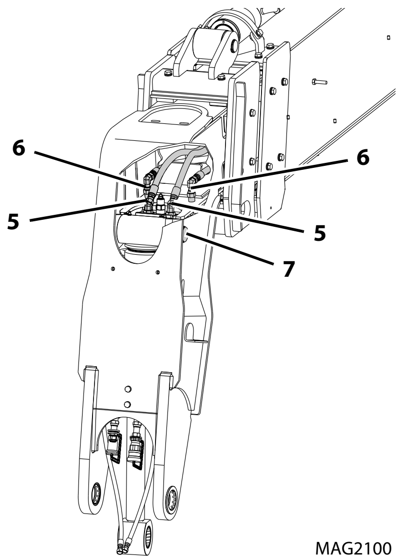


7. Attach the retract chain (**8**) at the bottom front of the first boom section. Install the lock nut and jam nut.
8. Attach the extend chains (**9**) at the bottom front of the first boom section. Install the lock nut and jam nut.
9. Feed the tilt hoses (**10**) and auxiliary hoses (**11**) between 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 and parallel with the retract chain.
10. Connect the tilt hoses (**10**) and auxiliary hoses (**11**) to the tubes mounted at the bottom front of the first boom section.



11. Attach the retract chain (**13**), pins and clips to the clevises (**12**) at the rear of the second boom section.

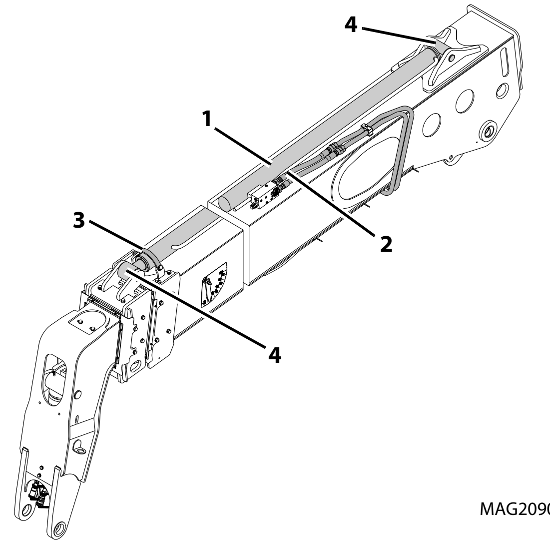
__Note:__ Adjust all extend chains using the measurement taken in the beginning of the tear down procedure. Depending on the extent of the parts being replaced, the above measurement is to be used as a starting point ONLY.



12. 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 and retaining clips (**7**).

__Note:__ Grease tilt cylinder barrel end bore and pin before installing.

13. 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 (**5**). Torque as required.
14. Remove the plugs from the auxiliary fittings and the caps from the auxiliary hoses of the hose carrier. Install both auxiliary hoses (**6**). Torque as required.



15. Attach a sling around a balance point on the extend/retract cylinder (**1**) and carefully set on top of the first boom section.

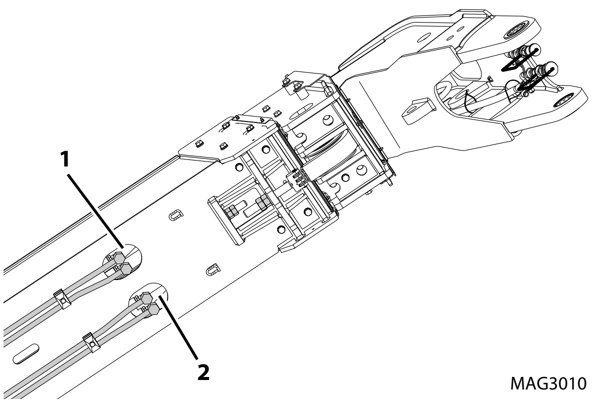
__Note:__ Grease extend/retract cylinder barrel end bore and rod end bore and pins before installing.

16. Align the extend/retract cylinder barrel end with bore at rear of the first boom section. Install the pin and retaining clip (**4**).
17. Align the extend/retract cylinder rod end with bore at front of the second boom section. Install the pin and retaining clip (**4**).
18. Install extend/retract cylinder strap (**3**). Torque as required.
19. Uncap and connect the previously labeled extend/retract cylinder hoses (**2**) to the extend/retract cylinder.

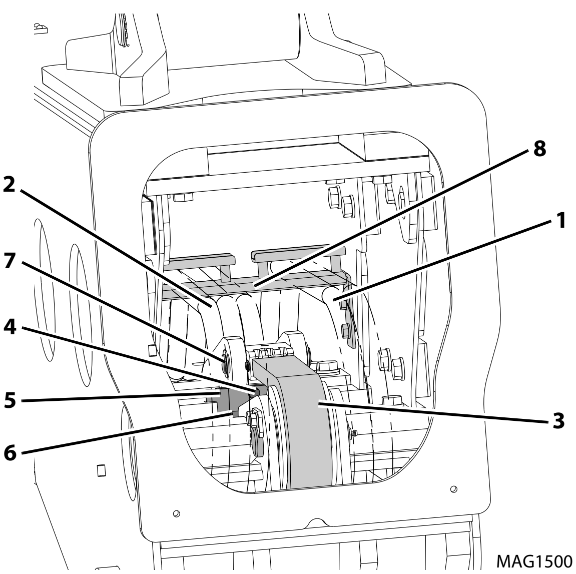
__Note:__ Torque extend and retract chains lock and jam nuts to 85 - 92 lb-ft (115 - 125 Nm).

3.5 THIRD BOOM SECTION REMOVAL/ INSTALLATION ONLY - 742, 943, 1043

3.5.1 Removal



1. Extend and retract the boom for 3 - 6 ft (914 - 1829 mm) to loosen the chain.
2. Label, disconnect and cap both tilt hoses (**1**) and both auxiliary hoses (**2**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
3. Secure a rope/wire to both tilt hoses (**1**) and both auxiliary hoses (**2**).



4. At the rear of the boom, remove hose bracket assembly (**8**) from the third boom section.
5. Pull both tilt hoses and both auxiliary hoses through the rear of the first boom section.
6. Disconnect the retract chain clevis (**7**) from the rear of the third boom section.

Note: *Removal of the retract chain roller from the rear of the second boom section may be required to access the extend chain clevis assemblies.*

7. Loosen and remove the mounting bolt(s) (**4**) and bracket (**5**) securing each extend chain clevis(es) (**6**).
8. Fasten a rope/wire to each extend chain clevis(es).
9. Remove all wear pads, shims and backing plates from the front of the second boom section. Label and tag each set of wear pads being removed.
10. Place a sling around the front of the third boom section. Lift and slide the two boom sections 75% 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.

3.5.2 Installation

Note: *Shimming of the wear pads may be required after the boom assembly is installed on the machine and hydraulic power is available. Refer to Section 3.12, "Boom Wear Pads".*

1. Using a suitable sling, balance the third boom section and carefully slide 3 - 4 ft (914 - 1219 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 - 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 hose bracket assembly (**8**) to the third boom section.
4. At the rear of the boom, secure a rope/wire to both tilt hoses (**1**) and both auxiliary hoses (**2**). Pull the hoses between the first and second boom sections.
5. At the bottom front of the boom, remove the caps from both tilt hoses (**1**) and both auxiliary hoses (**2**). Connect each hose to the previously labeled tubes attached to the third boom section.

6. Connect the extend chain clevis (**6**) to the rear of the third boom section.
7. Connect the retract chain clevis (**7**) from the rear of the third boom section.

3.6 BOOM ASSEMBLY MAINTENANCE - 1055, 1255

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.

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

Note: *Before removing the 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 3.12.1, “Wear Pad Inspection”).
2. Check chain rollers.
3. Apply grease at all lubrication points (grease fittings). (Refer to Section 2.5, “Lubrication Schedule”).
4. Check for proper operation by operating all boom functions through their full ranges of motion several times.

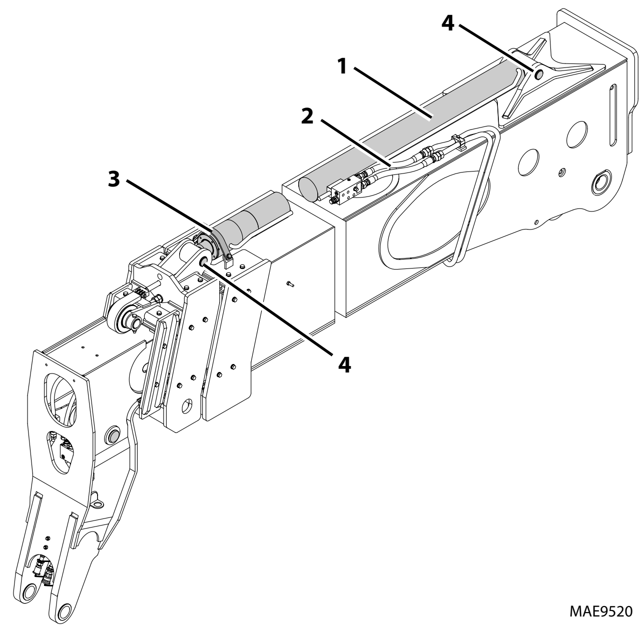
Depending on your particular circumstance, the following procedures explain the removal/installation of individual boom sections or removal/installation of the complete boom.

WARNING

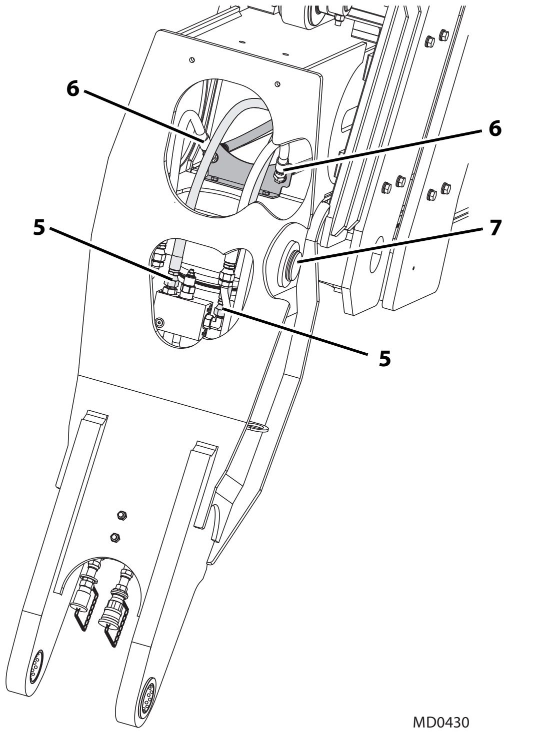
NEVER modify the boom by welding or drilling unless approved in writing by JLG. The structural integrity of the boom will be impaired if subjected to any repair involving welding or drilling.

3.6.1 Second, Third and Fourth Boom Section Removal

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

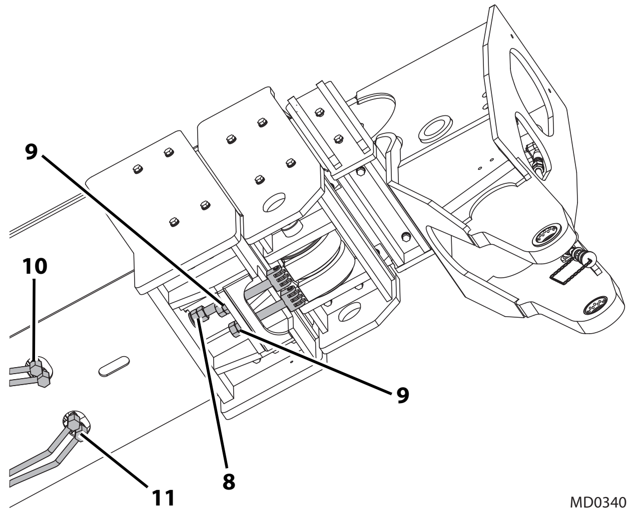


2. Properly support the extend/retract cylinder (**1**) using a hoist or crane.
3. Label, disconnect and cap the extend/retract cylinder hoses (**2**) from the extend/retract cylinder. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
4. Loosen and remove the extend/retract cylinder straps (**3**).
5. Remove one retaining ring from the mounting pin (**4**) at each end of the extend/retract cylinder.
6. Remove each mounting pin and remove the extend/retract cylinder and place in a secure location.

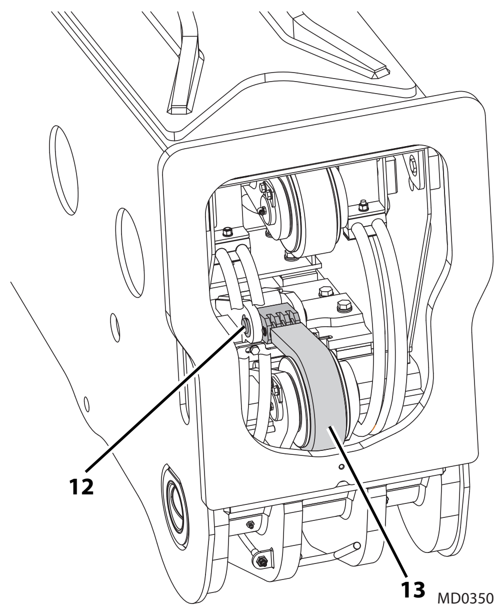


7. Label, disconnect and cap the tilt circuit hoses (**5**) from the tilt cylinder at the front of the fourth boom section. If equipped, label, disconnect and cap the auxiliary circuit hoses (**6**) from the fittings at the top front of the fourth boom section. Cap all fittings and openings to prevent dirt and debris from entering the hydraulic system.
8. 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 (**7**) at the barrel end of the tilt cylinder. Lower the tilt cylinder and place in a secure location.
9. Loosen and remove the rear cover assembly from the rear of the first boom section.

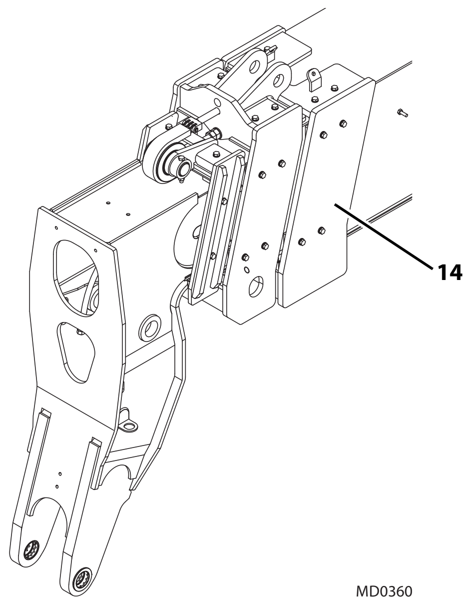
Note: *Before removing the extend chains, measure the distance between the face of the jam nut to the end of the chain clevis. This measurement will be used when reassembling the boom.*



10. Loosen and remove the lock nut and jam nut (**8**) on the retract chain at the front of the first boom section.
11. Loosen and remove the lock nuts and jam nuts (**9**) on the extend chains at the front of the first boom section.
12. Label, disconnect and cap both tilt hoses (**10**) and both auxiliary hoses (**11**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
13. Pull both tilt hoses (**10**) and both auxiliary hoses (**11**) through the rear of the first boom section.



14. Remove the clip and pin (**12**) from the retract chain clevis that is attached to the rear of the third section boom. Lay the retract chain (**13**) over the rear of the first boom section.

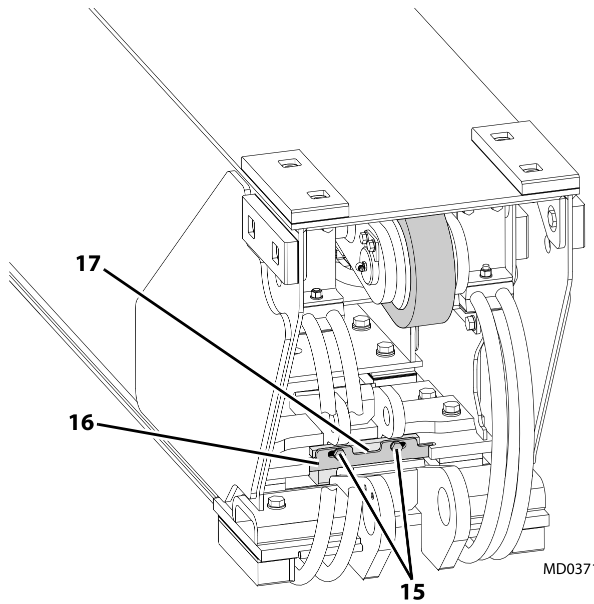


15. Pull the second, third and fourth section booms out 6 - 8 in (152 - 203 mm) and remove all the wear pads, shims and backing plates from the front inside of the first section boom (**14**). Label all parts for installation.
16. Using a sling around the front of the second boom section, lift and slide the three boom sections 75% 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 three boom sections being removed. Carefully pull the three boom sections from the remainder of the way out of the first boom section and set the three boom sections down on suitable supports.
17. Remove the retract chain from the inside of the first boom section. Clean and inspect chain. Replace if damaged.
18. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
19. Inspect hoses, hardware, wear pads, mounting points, chains and other components visible with the first boom section. Replace any item if damaged. (Refer to Section 3.11.1, “Boom Chain Inspection” and Section 3.12.1, “Wear Pad Inspection”).

Note: *It is recommended that if any chain or hose is damaged, ALL chains or hoses are replaced.*

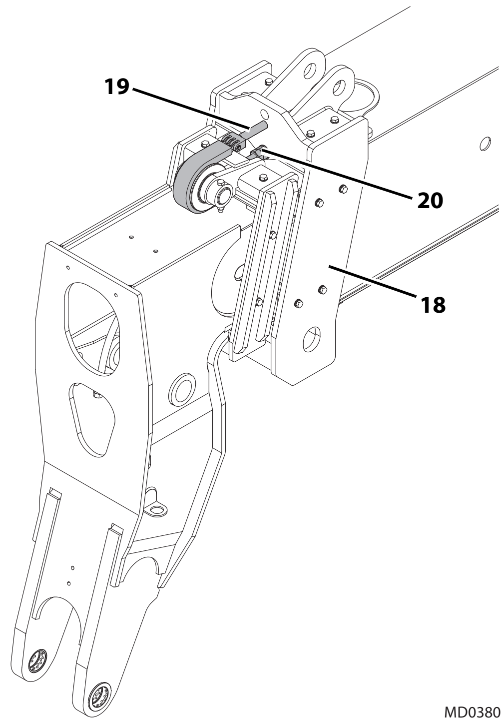
3.6.2 Third and Fourth Boom Section Removal

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



Note: *Removal of the retract chain roller from the rear of the second boom section may be required to access the extend chain clevis assemblies.*

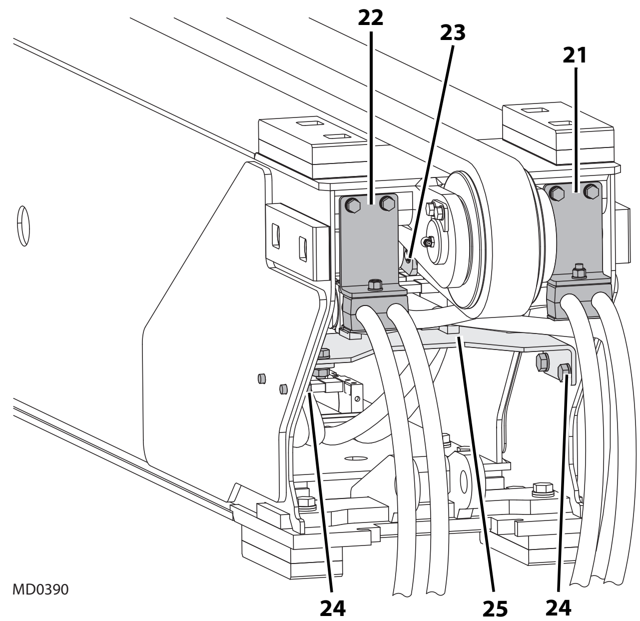
2. Loosen and remove the mounting bolts (**15**) and bracket (**16**). Secure each extend chain clevises (**17**).
3. Fasten a rope/wire to each extend chain clevis.



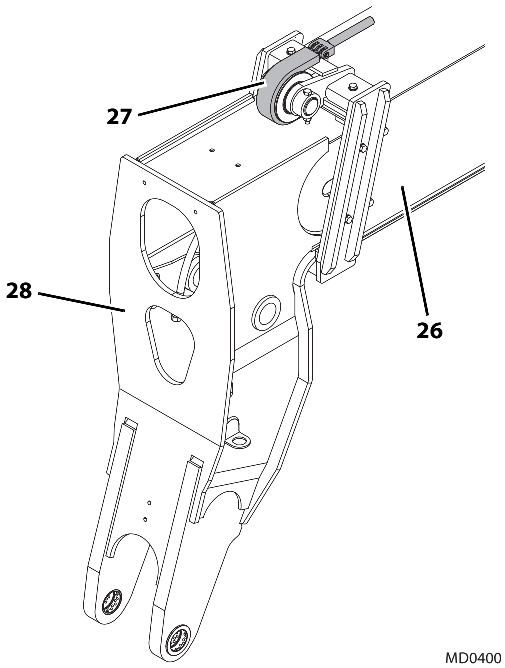
4. At the top front of the second boom section (**18**), remove the jam nuts, nuts and washers from the extend chain clevis (**19**).
5. At the top front of the second boom section (**18**), remove the jam nuts, nuts and washers from the retract chain clevis (**20**).
6. Pull the third boom section out 6 - 8 in (152 - 203 mm). Remove the top wear pads, shims and backing plate from the second boom section. Label and tag each set of wear pads being removed.
7. Remove the side wear pads, shims and backing plates from either rear side of the second boom section. Label and tag each set of wear pads being removed.
8. Place a sling around the front of the third boom section. Lift and slide the two boom sections 75% 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 two boom sections being removed. Carefully pull the two boom sections from the remainder of the way out of the second boom section and set the two boom sections down on suitable supports.
9. Remove the extend chains from bottom of second boom section. Clean and inspect chain. Replace if damaged.
10. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
11. Inspect hardware, wear pads, mounting points, chains and other components visible with the second boom section. Replace any item if damaged. (Refer to Section 3.11.1, “Boom Chain Inspection” and Section 3.12.1, “Wear Pad Inspection”).
12. It is recommended that if any chain or hose is damaged that ALL chains or hoses are replaced.

3.6.3 Fourth Boom Section Removal

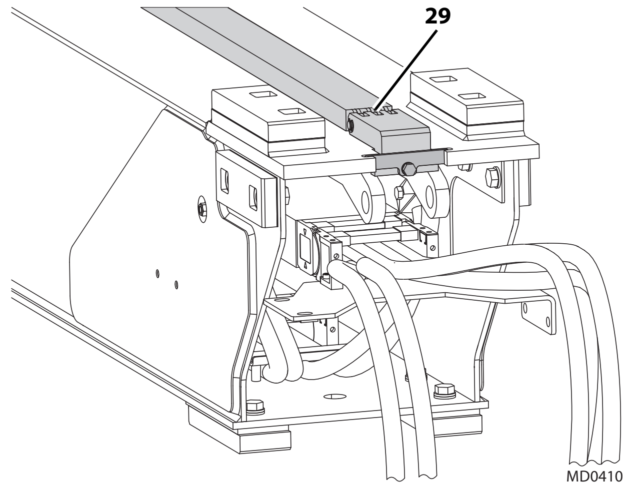
1. Verify the boom assembly is setting on stable, secure and suitable supports.



2. At the rear of the boom, loosen and remove the hose brackets attached to the third boom section securing tilt hoses (**21**) and the auxiliary hoses (**22**).
3. Remove the clip and pin from the retract chain clevis (**23**) that is attached to the rear of the fourth section boom. Lay the retract chain over the rear of the third boom section.
4. Remove the retract chain from top of third boom section. Clean and inspect chain. Replace if damaged.
5. Loosen and remove the bolts (**24**) securing the hose bracket (**25**) to the third boom section.



6. At the top front of the third boom section (**26**), lay the extend chain and clevis (**27**) over the front of the fourth boom section (**28**).
7. Remove the top wear pads, shims and backing plate from the third boom section. Label and tag each set of wear pads being removed.
8. Remove all wear pads, shims and backing plates from the front of the third boom section. Label and tag each set of wear pads being removed.
9. Place a sling around the front of the fourth boom section. Lift and slide the two boom sections 75% of the way out of the third 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 fourth boom section from the remainder of the way out of the third boom section and set the fourth boom section down on suitable supports.



10. Remove the extend chain (**29**) from top of fourth boom section. Clean and inspect chain. Replace if damaged.
11. Inspect the boom and welds. Consult your local authorized service distributor if structural damage is detected.
12. Inspect hardware, wear pads, mounting points, chains and other components visible with the fourth boom section. Replace any item if damaged. (Refer to Section 3.11.1, “Boom Chain Inspection” and Section 3.12.1, “Wear Pad Inspection”).

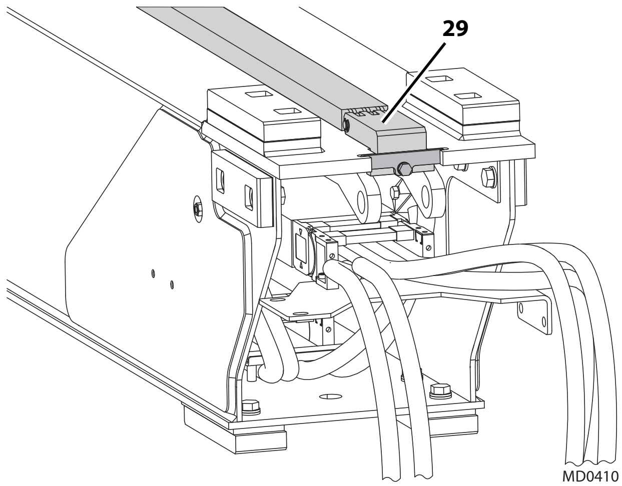
Note: *It is recommended that if any chain or hose is damaged, ALL chains or hoses are replaced.*

3.6.4 Hose Carrier Removal - Installation

Refer to Section 3.8, “Hose Carrier Assembly - 1055, 1255”, for detailed hose carrier removal and installation.

3.6.5 Fourth Boom Section Installation

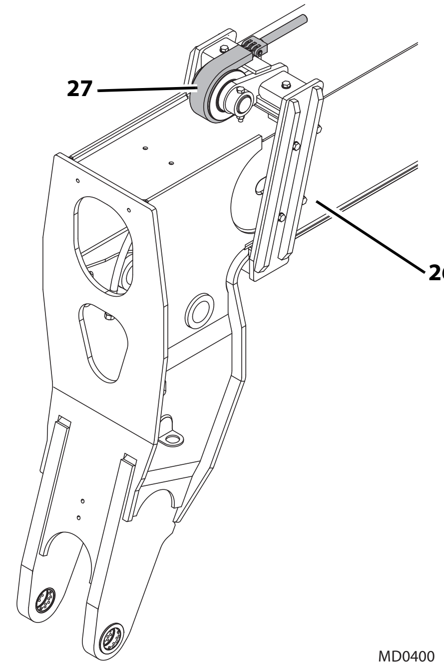
Note: *Shimming of the wear pads may be required after the boom assembly is installed on the machine and hydraulic power is available. Refer to Section 3.12, "Boom Wear Pads".*



1. Install the extend chain (**29**) on the top rear of fourth boom section. Lay the extend chain the length of fourth boom section.
2. Grease the inside third boom section on area's where the fourth boom section wear pads will slide.
3. Using a suitable sling, balance the fourth boom section and carefully slide 3 - 4 ft (914 - 1219 mm) into the front of the third boom section. Set the fourth boom section head onto suitable support and reset sling under the boom head of the fourth boom section. Carefully slide the fourth boom section into the third boom section. Leave 6 - 8 ft (1829 - 2438 mm) of the fourth boom section out to be able to install wear pads in front of the third boom section.
4. With the sling still under boom head install the bottom front wear pads and backing plates on the third boom section. Lower the fourth boom section and install the top front and side wear pads and backing plates on the third boom section. Do not shim or tighten bolts at this time.

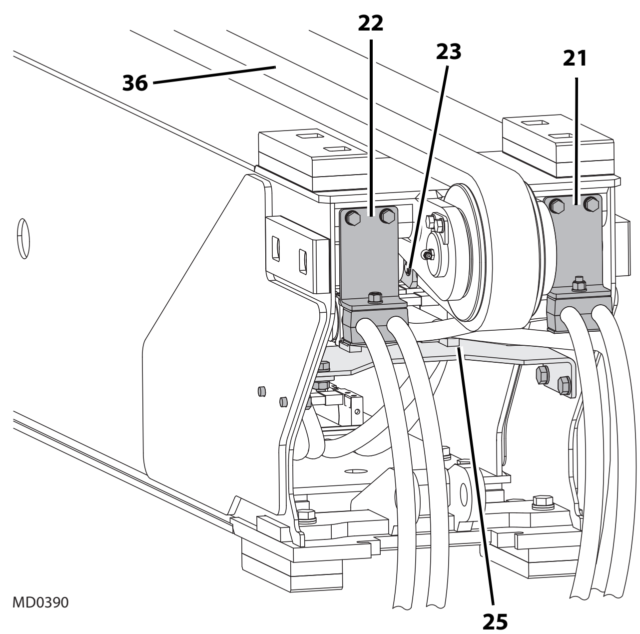
Note: *Grease wear pads, bores and pins during assembly.*

5. Retract the fourth boom section from the remainder of the way into the third boom section.



Note: *Shim wear pads as needed to maintain an even gap between the wear pads and the next boom section. The number of shims can vary at each shim point.*

6. Shim all wear pads on the front of the third boom section.
7. Lay the extend chain and clevis (**27**) over the top of the third boom section (**26**).



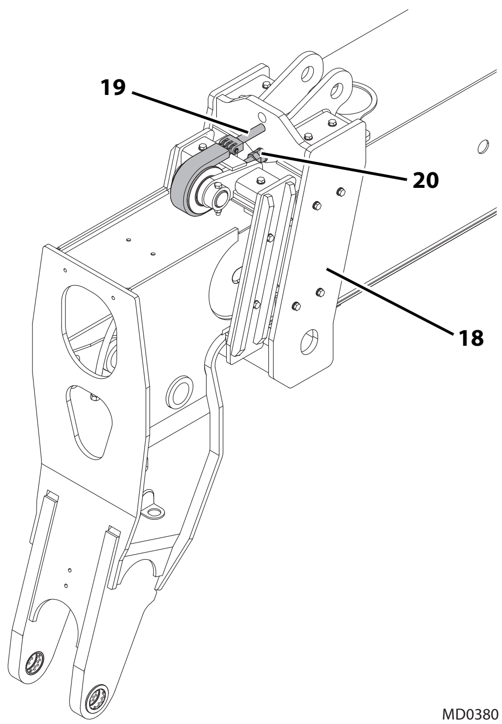
8. Lay the retract chain (**36**) the length of third boom section.

9. Install the pin and clip to the retract chain clevis (**23**) to the top rear of the fourth section boom.
10. At the rear of the boom, install the tilt hoses bracket (**21**) and the auxiliary hoses bracket (**22**) tray support (**25**) to the third boom section.

3.6.6 Third and Fourth Boom Section Installation

Note: *Shimming of the wear pads may be required after the boom assembly is installed on the machine and hydraulic power is available. Refer to Section 3.12, "Boom Wear Pads".*

1. Install the extend chains on the bottom inside of second boom section. Lay the extend chain the length of second boom section.

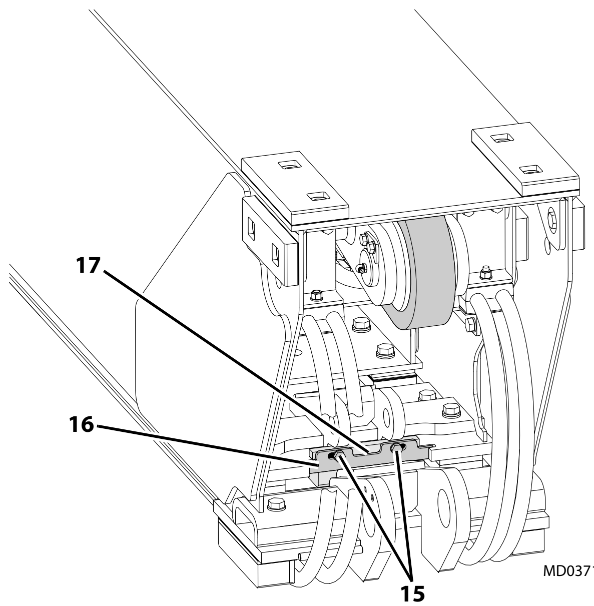


2. Grease the inside second boom section on areas where the third boom section wear pads will slide.
3. Using a suitable sling, balance the third and fourth boom sections and carefully slide 3 - 4 ft (914 - 1219 mm) into the front of the second boom section. Set the third and fourth boom sections onto a suitable support and reset the sling under the boom head of the fourth boom section. Carefully slide the third and fourth boom sections into the second boom section. Leave 6 - 8 in (152 - 203 mm) of the third boom section out to be able to install the wear pads in the front of the second boom section.
4. With the sling still under 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.

Note: *Installation of the retract chain roller from the rear of the second boom section may be required if removed to access the extend chain clevis assemblies.*

5. Secure the retract chain clevis (**20**) to the top front of the second boom section (**18)** with the previously removed jam and lock nuts.
6. Secure the extend chain clevis to the top front of the second boom section (**19)** with the previously removed jam and lock nuts.

Note: *Grease wear pads, bores and pins during assembly.*



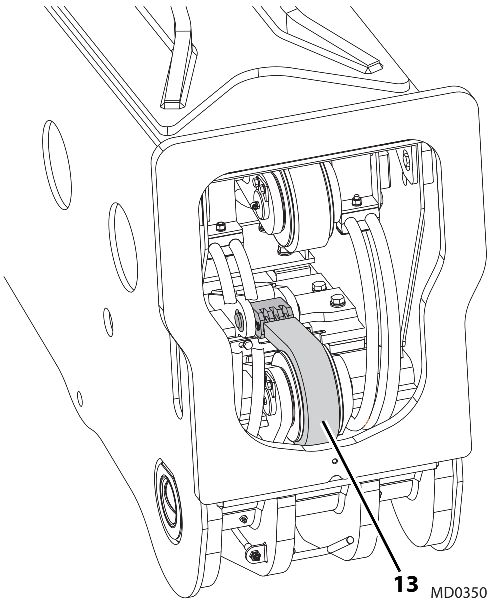
7. Secure each extend chain clevises (**17**) with the previously removed bracket (**16**) and mounting bolts (**15**). Torque as required.

Note: *Shim wear pads as needed to maintain an even gap between the wear pads and the next boom section. The number of shims can vary at each shim point.*

8. Shim all wear pads on the rear of the third boom section and front of the second boom section.

3.6.7 Second, Third and Fourth Boom Section Installation

Note: *Shimming of the wear pads may be required after the boom assembly is installed on the machine and hydraulic power is available. Refer to Section 3.12, "Boom Wear Pads".*



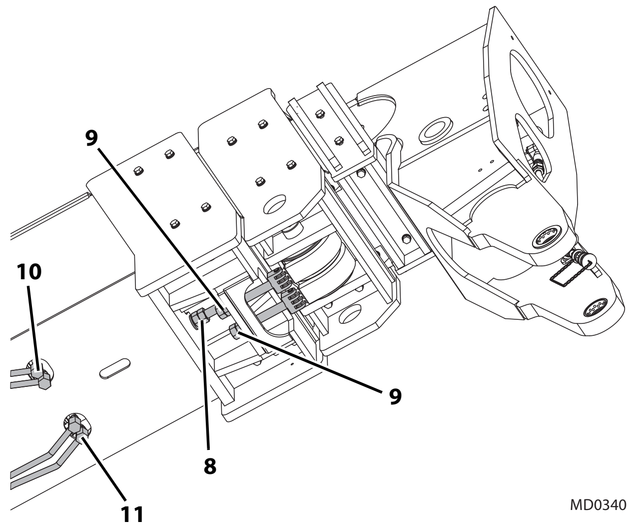
1. Install the retract chain (**13**) to bottom front inside of the first boom section. Install the lock nut and jam nut. Lay the retract chain over the rear of the first boom section.

Note: *Keep the retract chain, tilt and auxiliary hoses centered in the first boom section while installing the second boom section into the first boom section.*

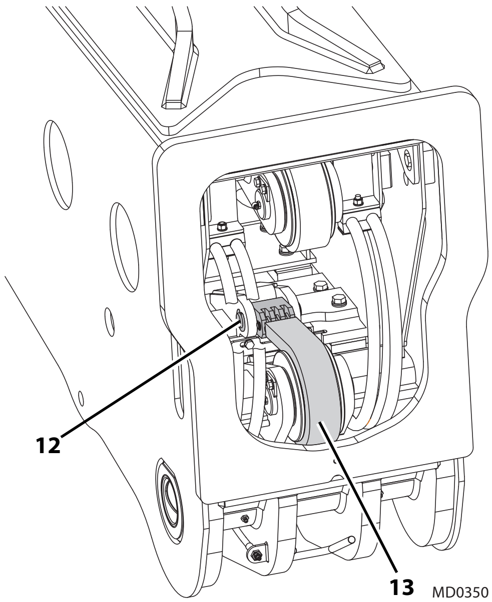
2. Grease the inside first boom section on area's where the second boom section wear pads will slide.
3. Using a suitable sling, balance the second, third and fourth boom sections and carefully slide 3 - 4 ft (914 - 1219 mm) into the front of the first boom section. Set the second, third and fourth boom sections onto a suitable support and reset sling under the boom head of the fourth boom section. Carefully slide the second, third and fourth 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.
4. 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.
5. Retract the second, third and fourth boom sections the remainder of the way into the first boom section.

Note: *Shim wear pads as needed to maintain an even gap between the wear pads and the next boom section. The number of shims can vary at each shim point.*

6. Shim all wear pads on the rear of the second boom section and front of the first boom section. Torque as required.

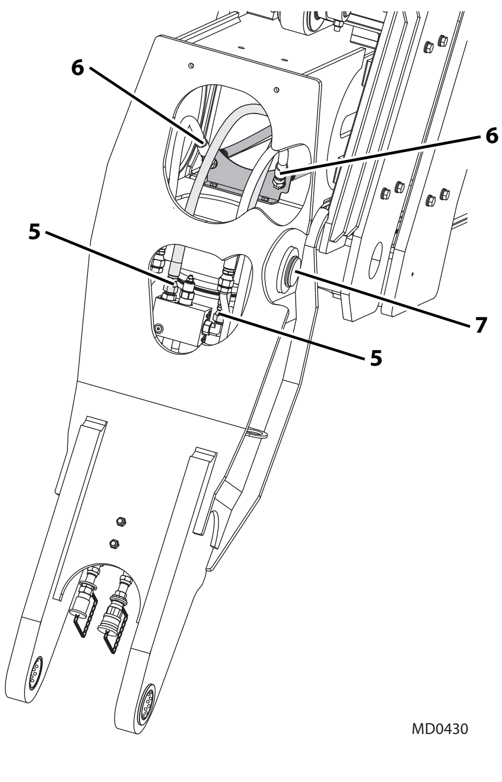


7. Attach the retract chain (**8**) at the bottom front of the first boom section. Install the lock nut and jam nut.
8. Attach the extend chains (**9**) at the bottom front of the first boom section. Install the lock nut and jam nut.
9. Feed the tilt hoses (**10**) and auxiliary hoses (**11**) between 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 and parallel with the retract chain.
10. Connect the tilt hoses (**10**) and auxiliary hoses (**11**) to the tubes mounted at the bottom front of the first boom section.



11. Attach the retract chain (**13**), pins and clips to the clevises (**12**) at the rear of the second boom section.

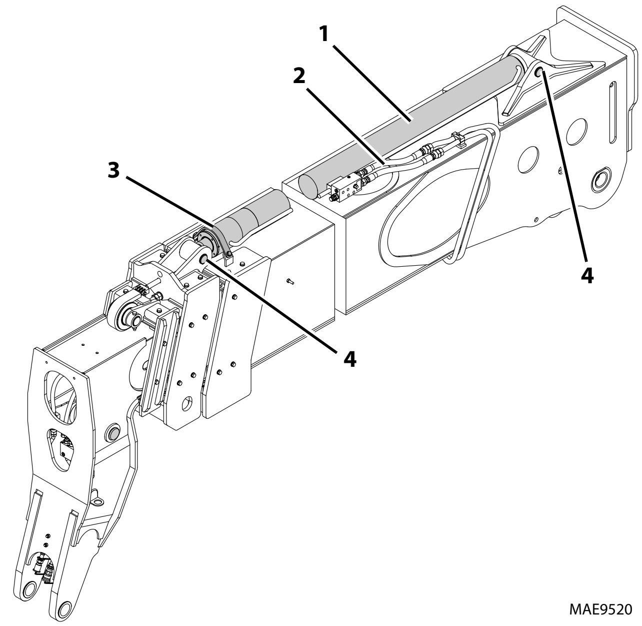
Note: *Adjust all extend chains using the measurement taken in the beginning of the tear down procedure. Depending on the extent of the parts being replaced, the above measurement is to be used as a starting point ONLY.*



12. 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 and retaining clips (**7**).

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

13. Remove the plugs from the fittings on the tilt cylinder and the caps from the tilt hoses from the hose carrier. Install both tilt hoses (**5**). Torque as required.
14. Remove the plugs from the auxiliary fittings and the caps from the auxiliary hoses from the hose carrier. Install both auxiliary hoses (**6**). Torque as required.



15. Attach a sling around a balance point on the extend/retract cylinder (**1**) 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.*

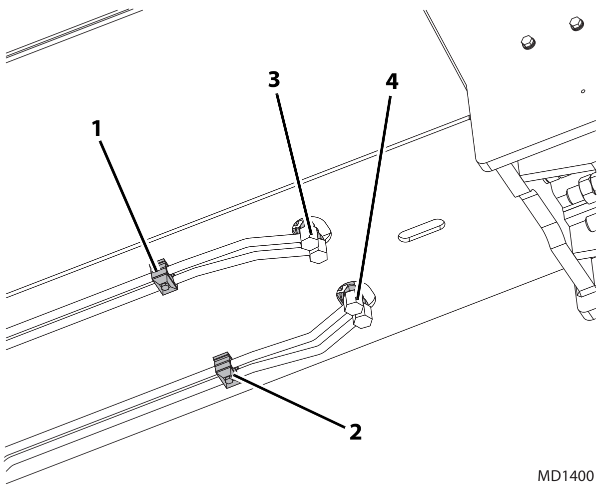
16. Align the extend/retract cylinder barrel end with bore at rear of the first boom section. Install the pin and retaining clip (**4**).
17. Align the extend/retract cylinder rod end with bore at front of the second boom section. Install the pin and retaining clip (**4**).
18. Install extend/retract cylinder support (**3**). Torque as required.
19. Uncap and connect the previously labeled extend/retract cylinder hoses (**2**) to the extend/retract cylinder.

Note: *Torque extend and retract chains lock and jam nuts to 85 - 92 lb-ft (115 - 125 Nm).*

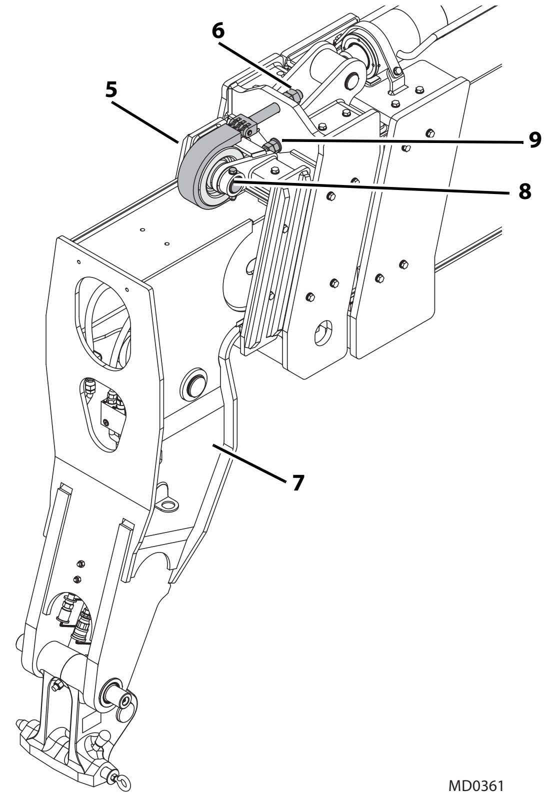
3.7 FOURTH BOOM SECTION REMOVAL/ INSTALLATION ONLY - 1055, 1255

3.7.1 Removal

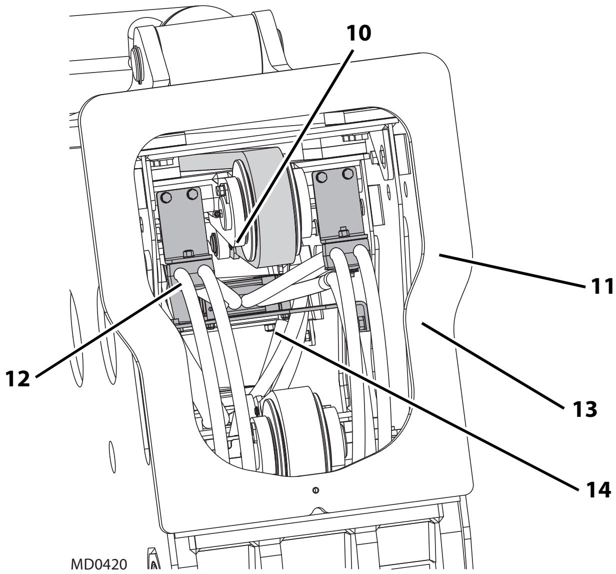
1. Start machine, level and extend boom until the side and bottom front wear pad bolts on the third boom section are accessible. Shut machine OFF.



2. Remove the tilt tubes clamp (**1**) and the auxiliary tubes clamp (**2**).
3. Label, disconnect and cap both tilt hoses (**3**) and both auxiliary hoses (**4**) from the tubes attached to the first boom section. Cap all fittings to prevent dirt and debris from entering the hydraulic system.
4. If equipped, disconnect the electrical connection at the bottom rear of the first boom section.Secure a rope/wire to both tilt hoses (**3**), both auxiliary hoses (**4**) and if equipped, the electrical cable.



5. At the top front of the second boom section, remove the lock nut and adjusting nut (**5**) from the extend chain clevis and lay the extend chain and clevis (**6**) on top of the fourth boom section (**7**).
6. Remove the locking bolt, pin and sheave (**8**) from the top front of the third boom section.
7. At the top front of the second boom section, loosen the lock nut and adjusting nut from the retract chain clevis (**9**).
8. Remove the top wear pads, shims and backing plates from the front of the third boom section. Label and tag each set of wear pads being removed.
9. Place a sling around the front of the fourth boom section and raise the fourth boom section to allow the removal of the bottom front wear pads, shims and backing plates.
10. Remove all side and bottom wear pads, shims and backing plates from the front of the third boom section. Label and tag each set of wear pads being removed.



11. Disconnect the retract chain clevis (**10**) from the rear of the fourth boom section.
12. At the rear of the boom, remove the tilt hose clamp (**11**) and auxiliary hose clamp (**12**) from the third boom section.
13. Remove the two right side bolts and two top left bolts securing the hose carrier bracket (**13**) to the rear side of the third boom section.
14. Pull the hose carrier back and remove the four bolts securing the hose carrier bracket to the hose carrier (**14**). Remove bracket.
15. Pull both tilt hoses, both auxiliary hoses and if equipped, the electrical cable from between the first and second boom sections through the rear of the first boom section.
16. Lift and slide the fourth boom section 75% of the way out of the third boom section. Set the boom head down on a suitable support, then center the sling to balance the fourth boom section. Carefully pull the fourth boom section the remainder of the way out of the third boom section and set down on suitable supports.

3.7.2 Installation

1. Using a suitable sling, balance the fourth boom section and feed the tilt hoses, auxiliary hoses and if equipped, the electrical cable through the front of the third boom section. Carefully slide 3 - 4 ft (914 - 1219 mm) into the front of the third boom section. Set the fourth Boom section head onto suitable support and reset sling under the boom head of the fourth boom section. Carefully slide the fourth boom section into the third boom section. Leave approximately 1ft (305 mm) of the fourth boom section out to be able to install wear pads in front of the third boom section.
2. With the sling still under boom head install the bottom front wear pads and backing plates on the third boom section. Lower the fourth boom section and install the top front and side wear pads and backing plates on the third boom section. Tighten as required.
3. Remove caps and connect the auxiliary circuit hoses to the backside of the bulkhead at the front of the fourth boom section.
4. At the rear of the boom, secure a rope/wire to both tilt hoses (**3**), both auxiliary hoses (**4**) and if equipped, the electrical cable. Pull the hoses between the first and second boom sections. Remove the rope/wire from both tilt hoses, both auxiliary hoses.
5. At the bottom front of the boom, remove the caps from both tilt hoses (**3**) and both auxiliary hoses (**4**). Connect each hose to the previously labeled tubes attached to the bottom of the first boom section.
6. Install the tilt tubes clamp (**1**) and the auxiliary tubes clamp (**2**).
7. If equipped, secure the electrical cable to the tilt cylinder tube tubes attached to the first boom section.
8. Connect the extend chain clevis (**10**) to the rear of the fourth boom section.
9. Install the hose carrier bracket (**13**) by pulling the hose carrier back and install the four bolts securing the hose carrier bracket to the hose carrier (**14**).
10. Install the two right side bolts and two top left bolts securing the hose carrier bracket (**13**) to the rear side of the third boom section.
11. Install the tilt hose clamp (**11**) and auxiliary hose clamp (**12**) from the third boom section.
12. Install the sheave, pin and locking bolt (**8**) from the top front of the third boom section.
13. At the top front of the second boom section, install the extend chain and clevis (**1**). Install the adjusting nut and lock nut the lock nut to the extend chain clevis (**5**).

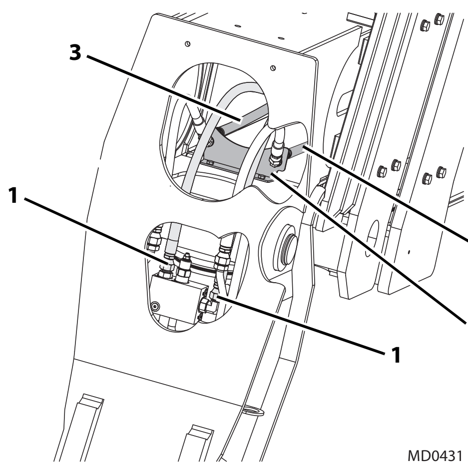
14. Refer to Section 3.10, “Boom Sections Adjustment - 1055, 1255”, for detailed chain and boom section adjustment.

3.8 HOSE CARRIER ASSEMBLY - 1055, 1255

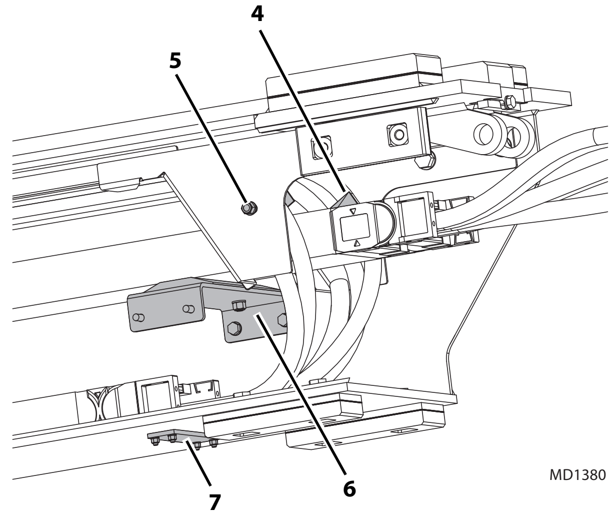
Note: *Removal and installation of the hose carrier can also be performed after the fourth boom section has been removed.*

3.8.1 Hose Carrier Removal

1. Refer to Section 3.6.3, “Fourth Boom Section Removal”, for detailed removal instructions.



2. Label, disconnect and plug the tilt circuit hoses (**1**) from the tilt cylinder at the front of the fourth boom section.
3. Remove the two bolts securing the auxiliary hose bulkhead (**2**) to the fourth boom section. Pull the bulkhead forward to aid in removal of the auxiliary hoses.
4. Label, disconnect and plug the auxiliary circuit hoses (**3**) from the back side of the bulkhead at the front of the fourth boom section.



Note: *Side plate removed for clarity.*

5. Remove the tilt hose clamp (**4**) and auxiliary hose clamp (**5**) from the rear sides of the fourth boom section.
6. Remove the hose carrier bracket tray support (**6**) from the rear sides of the fourth boom section.
7. Remove the four bolts securing the hose carrier bracket (**7**) from the bottom of the fourth boom section.
8. Carefully pull the hose carrier the out of the rear fourth boom section and set down on suitable supports.
9. Secure the tilt hoses, the auxiliary hoses and if equipped the electrical cable with nylon ties. Remove tilt and/or auxiliary hoses if required.

3.8.2 Hose Carrier Installation

Note: *If replacing the tilt hoses and/or auxiliary hoses, label the new hoses according to the hoses being replaced.*

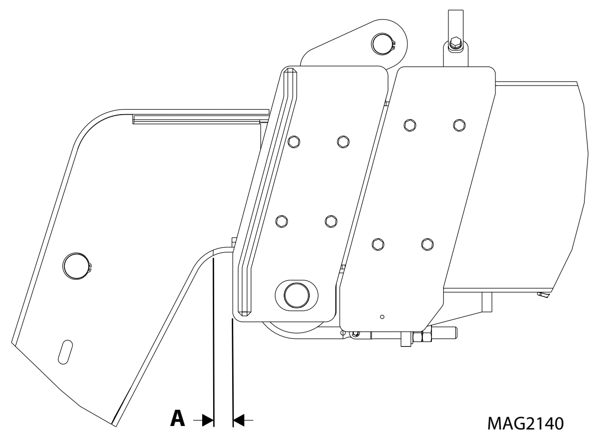
1. Verify the auxiliary hose length from the end of the hose fitting to the face of the hose carrier is 193 in (4902 mm). Verify the tilt hose length from the end of the hose fitting to the face of the hose carrier is 200 in (5080 mm).
2. Carefully slide the hose carrier into the rear of the fourth boom section.
3. Install the four bolts securing the hose carrier bracket (**7**) to the bottom of the fourth boom section.
4. Install the hose carrier bracket tray support (**6**) to the rear sides of the fourth boom section.
5. Carefully feed the tilt hoses, auxiliary hoses and if equipped the electrical cable through the appropriate hose channels at the top rear of the fourth boom section.
6. Remove the plugs from the auxiliary circuit hoses (**3**) and connect to the fittings on the back side of the bulkhead (**2**) at the front of the fourth boom section.
7. Secure the auxiliary hose bulkhead (**2**) to the fourth boom section with the previously removed hardware.
8. Remove the plugs from the tilt circuit hoses (**1**) and connect to the fittings on the tilt cylinder at the front of the fourth boom section.
9. Install the tilt hoses clamp (**5**) and auxiliary hoses clamp (**4**) to the rear sides of the fourth boom section.
10. Refer to Section 3.7, "Fourth Boom Section Removal/ Installation Only - 1055, 1255".

3.9 BOOM SECTIONS ADJUSTMENT - 742, 943, 1043

3.9.1 Chain Adjustments

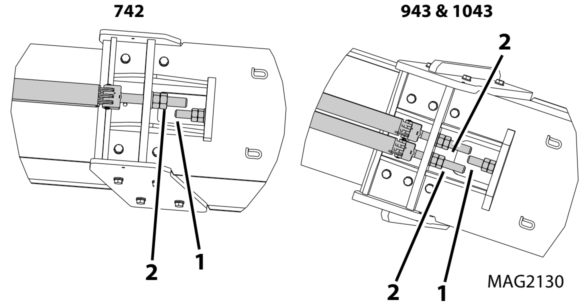
The chains are adjusted by tightening and/or backing off the adjusting nuts at the threaded end of the chains. The opposite chain adjusting nut usually must be loosened whenever this procedure is performed.

1. Park the machine on a firm, level surface, fully retract and raise the boom to a horizontal (level) position, place the transmission in (N) NEUTRAL, engage the park brake switch.

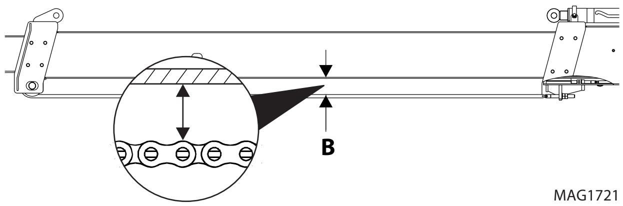


2. The boom is properly adjusted whenever the following parameters are met.
   742
   A. 1.45 - 1.85 in (37 - 47 mm)

   943 & 1043,
   A. 0.62 - 1.02 in (16 - 26 mm)
3. If adjustments are needed:
   Start the machine and fully extend the boom, then retract the boom 2.0 in (50 mm).



4. Loosen the locknuts on the extend and retract chains.



5. Set the “SAG” in the chains to the following dimensions:
   For **742**
   B. 4.84 - 5.03 in (123 - 128 mm)

   For **943 & 1043,**
   B. 3.46 - 3.66 in (88 - 93 mm)
6. Tighten adjusting nut (**1**) to move the 3rd boom section in.
   Tighten adjusting nuts (**2**) to move the 3rd boom section out.
7. Tighten the extend and retract chain locknuts to 86 lb-ft (120 Nm) against the adjusting nut.

Note: *Ensure that there is a minimum of one full thread of the clevis showing beyond the lock nut.*

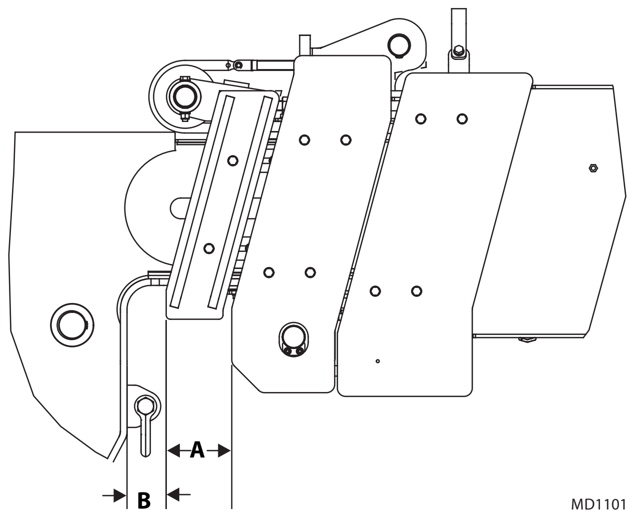
8. Start the machine and retract boom fully. Check dimensions (**A**).
9. Start the machine and cycle the extend-retract cylinder a minimum of three times to verify dimensions (**A**).

3.10 BOOM SECTIONS ADJUSTMENT - 1055, 1255

3.10.1 Chain Adjustments

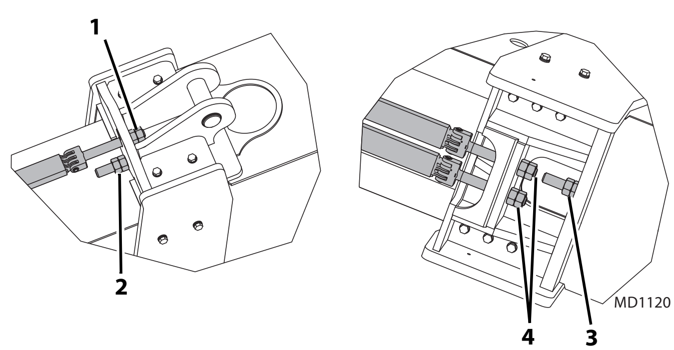
The chains are adjusted by tightening and/or backing off the adjusting nuts at the threaded end of the chains. The opposite chain adjusting nut usually must be loosened whenever this procedure is performed.

1. Park the machine on a firm, level surface, fully retract and raise the boom to a horizontal (level) position, place the transmission in (N) NEUTRAL, engage the park brake switch.

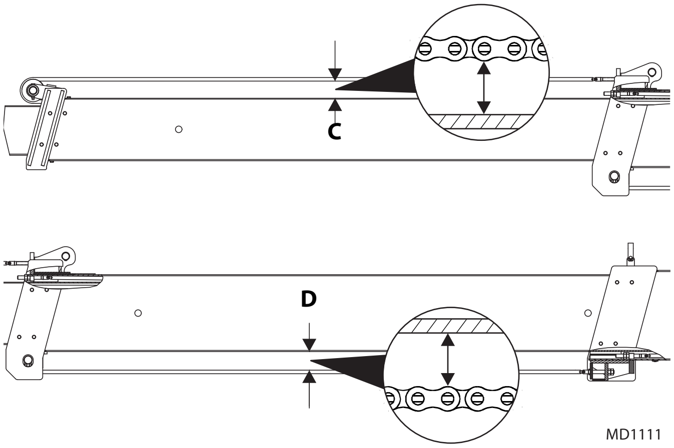


2. The boom is properly adjusted whenever the following parameters are met.

   A. 6.2 - 6.6 in (158 - 168 mm)
   B. 3.7 - 4.1 in (95 - 105 mm)
3. If adjustments are needed:
   Start the machine and fully extend the boom, then retract the boom 2.0 in (50 mm).

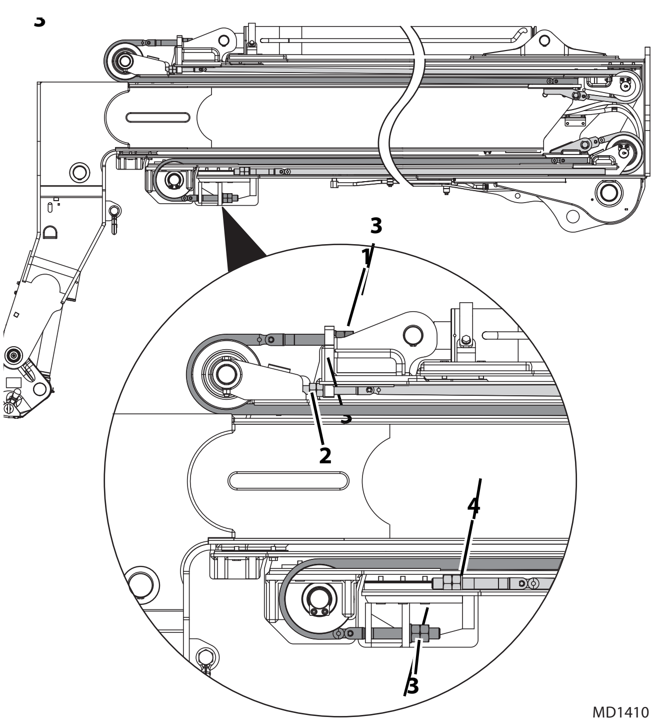


4. Loosen the locknuts on the extend and retract chains.



5. Set the “SAG” in the chains to the following dimensions:
   For **1055,**
   C. 3.94 - 4.13 in (100 - 105 mm)
   D. 5.20 - 5.39 in (132 - 137 mm)

   For **1255,**
   C. 5.16 - 5.35 in (131 -136 mm)
   D. 6.42 - 6.61 in (163 -168 mm)



6. Tighten adjusting nut (**1**) to move the 4th boom section out.
   Tighten adjusting nut (**2**) to move the 4th boom section in.
   Tighten adjusting nut (**3**) to move the 3rd boom section in.
   Tighten adjusting nuts (**4**) to move the 3rd boom section out.
7. Tighten the extend and retract chain lock nuts to 86 lb-ft (120 Nm) against the adjusting nut.

Note: *Ensure that there is a minimum of one full thread of the clevis showing beyond the lock nut.*

8. Start the machine and retract boom fully. Check dimensions (**A** and **B**).
9. Start the machine and cycle the extend-retract cylinder a minimum of three times to verify dimensions (**A** and **B**).

3.11 BOOM EXTEND AND RETRACT CHAINS

3.11.1 Boom Chain Inspection

⚠ WARNING

Worn pins, stretched or cracked links or corrosive environments can cause chain failure. A chain failure could result in uncontrolled boom movement, loss of load or machine instability.

Under normal operating conditions the boom chains will need to be inspected every 250 hours of operation. The retract chains need to be exposed and inspected every 1000 hours of operation. Refer to the Service Manual for the proper procedure. Environmental conditions and dynamic impulse/shock loads can drastically affect normal operating conditions and require more frequent inspection intervals.

Environments in which material handling machines operate can vary widely from outdoor moisture to temperature to mildly corrosive or highly corrosive industrial atmospheres, in addition to abrasive exposures such as sand and grit. Some effects can be as follows:

- Moisture - Corrosive rusting reduces chain strength by pitting and cracking.
- Temperature - Low temperature reduces chain strength by embrittlement. Going in and out of cold storage results in moisture from condensation.
- Chemical Solutions or Vapors - Corrosive attack on the chain components and/or the mechanical connections between the chain components. Cracking can be (and often is) microscopic. Going from microscopic cracking to complete failure can be either abrupt or may require an extended period of time.
- Abrasives - Accelerated wearing and scoring of the articulating members of the chain (pins and plates), with a corresponding reduction in chain strength. Due to the inaccessibility of the bearing surfaces (pin surfaces and plate apertures), wear and scoring are not readily noticeable to the naked eye.

Following are some examples of dynamic shock loading which can impose abnormal loads above the endurance limit of a leaf chain.

- High velocity movement of load, followed by sudden, abrupt stops.
- Carrying loads in suspension over irregular surfaces such as railroad tracks, potholes, and rough terrain.
- Attempting to “inch” loads which are beyond the rated capacity of the machine.

The above load cycles and environmental conditions make it impossible to predict chain life. It is therefore necessary to conduct frequent inspections until replacement life can be predicted.

The boom chain’s normal life expectancy can be expressed as a maximum percent of elongation. This is generally 3%. As the chain flexes back and forth over the sheave, the bearing joints (pins and inside link plates) gradually incur wear due to articulation.

3.11.2 Inspection Guidelines

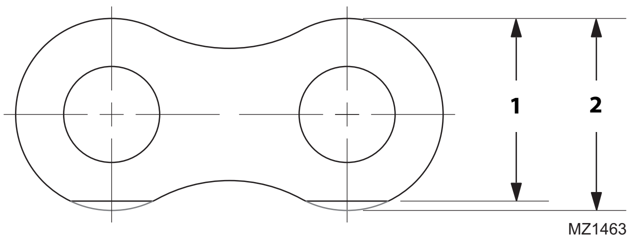
a. Extend Chain

1. Park the machine on a firm, level surface, raise the boom to a horizontal (level) position, place the transmission in (N) NEUTRAL, engage the park brake switch.
2. Fully extend the boom until the extend chain is taut. Shut the engine off.
3. The extend chain will be visible for inspection with the machine in this state.
4. While doing the chain inspection, check all chain clevis ends, pins for distortion or cracking and sheaves for bearing wear or grooving from the chain.

b. Retract Chains

1. Park the machine on a firm, level surface, raise the boom to a horizontal (level) position, place the transmission in (N) NEUTRAL, engage the park brake switch.
2. Fully retract the boom. Shut the engine off.
3. Both retract chain clevises and pins will be visible in this state.
4. Limited visual inspection of the retract chains is possible. For complete retract chain inspection, the retract chains must be removed from the boom. Refer to Section 3.4, “Boom Assembly Maintenance - 742, 943, 1043” and Section 3.6, “Boom Assembly Maintenance - 1055, 1255”.
5. Inspect the chains for the following conditions:

Edge Wear

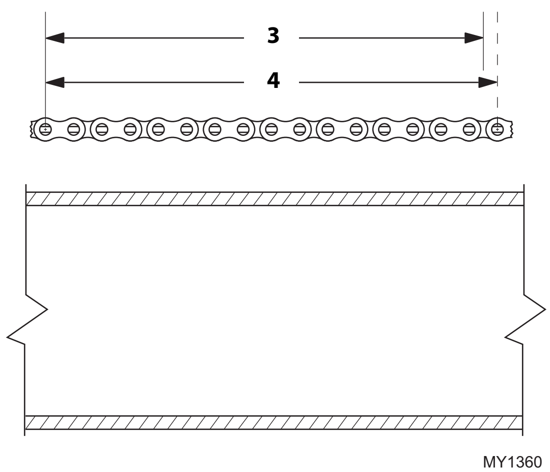


Check the chain for wear on the link plate edges caused by running back and forth over the sheave. The maximum reduction of material should not exceed 5%. Measure and compare to a normal link plate height by measuring a portion of chain that does not run over the sheave. If the measured plate height (**1**) is 5% less than the normal plate height (**2**), discard and replace the chain.

Elongation

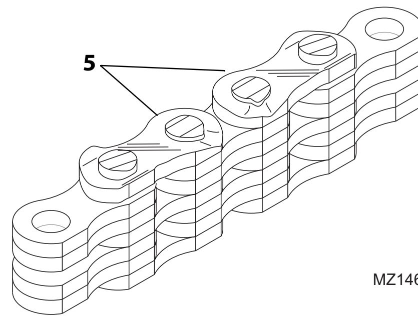
It is important to measure the chain in the section that moves over the sheaves because it receives the most frequent articulation. Measuring the chain near its clevis terminals could give an inaccurate reading. The ends of the chains, near the clevis terminal, will not have flexed as frequently, if at all, as the middle of the chains.

It is best to measure in 12 pin increments from pin center to pin center. For example, if the links are 25 mm (1 in) from pin center to pin center, the distance should be 305 mm (12 in). If the links are 19 mm (0.75 in) apart, the distance after 12 pins should be 229 mm (9 in).



If the distance measured (**3**) is 3% greater than the normal length (**4**), discard and replace the chain.

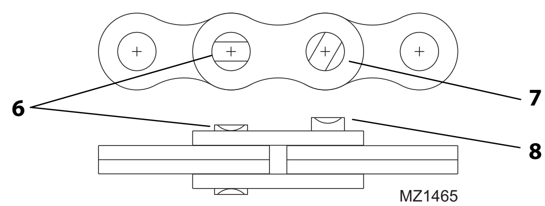
Distorted or Battered Link Plates



Distorted or battered link plates (**5**) on a leaf chain can cause tight joints and prevent flexing.

Turning or Protruding Pins

Highly loaded chain, operating with inadequate lubrication can generate abnormal frictional forces between pin and link plates. When chain is allowed to operate in this condition, a pin or series of pins, can begin to twist out of a chain, resulting in failure.



Examine the pin head rivets to determine if the "VEE" flats are still in correct alignment (**6**). Chain with rotated/displaced heads (**7**) or abnormal pin protrusion (**8**) should be replaced immediately.

DO NOT attempt to repair the chain by welding or driving the pin(s) back into the chain. Once the press fit integrity between outside plates and pins has been altered, it cannot be restored.

Any wear pattern on the pin heads or the sides of the link plates indicates misalignment in the system. This condition damages the chain as well as increases frictional loading and should be corrected.

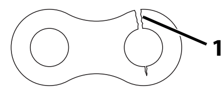
Cracked Plates

Inspect the chains very carefully, front and back as well as side to side, for any evidence of cracked plates. If any one crack is discovered, the chain should be replaced in its entirety.

It is important, however to determine the cause of the crack before installing a new chain so the condition does not repeat itself.

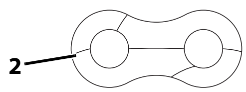
The types of cracks are:

- **Fatigue Cracking** - Fatigue cracks (**1**) are a result of repeated cyclic loading beyond the chain's endurance limit.



MZ1467

- **Stress Corrosion Cracking** - The outside link plates are particularly susceptible to stress corrosion cracking (**2**).

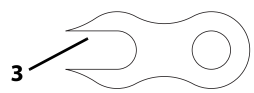


MZ1468

- **Corrosion Fatigue Cracking** - Corrosion fatigue cracks are very similar to fatigue cracks in appearance. Corrosion fatigue is the combined action of an aggressive environment and cyclic stress.

Other Modes of Failure

- **Ultimate Strength Failure** - These types of failures are caused by overloads far in excess of the design load. Either fractured plates (**3**) or enlarged holes (**4**) can occur. If either of these failures occurs, the chain should be replaced immediately.



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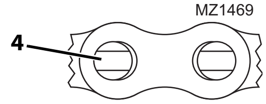
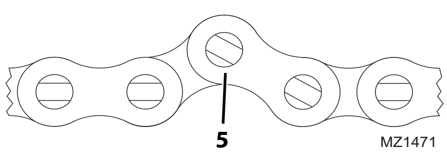


MZ1470

- **Tight Joints** - All joints in the chain should flex freely. Tight joints (**5**) resist flexing.
  If the problem is caused by dirt or foreign substance packed in the joints, clean and lubricate thoroughly before re-installing the chain.
  If the problem is caused by corrosion and rust or bent pins, replace the chain.



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3.11.3 Expose Chains for Inspection

a. Extend Chain

1. Park the machine on a firm, level surface. Place the transmission in (N) NEUTRAL, engage the park brake switch and raise the boom to a horizontal (level) position.
2. Fully extend the boom until the extend chain is taut. Shut the engine OFF.

The extend chain will be visible for inspection with the machine in this state.

While doing the chain inspection, check all chain clevis ends for distortion or cracking and sheaves for bearing wear or grooving from the chain.

If during the inspection, if any chain is found to be damaged or stretched, the chain must be replaced. It is recommended that when any chain is replaced, that all the chains and clevises be replaced at the same time.

b. Retract Chains

The retract chains are only partially visible through the rear of the boom with all the sections retracted. It is possible to see a section of the retract chain as the boom is slowly extended. If during the inspection, if any chain is found to be damaged or stretched, the chain must be replaced. It is recommended that when any chain is replaced, that all the chains and clevises be replaced at the same time.

Refer to Section 3.11.1, “Boom Chain Inspection”.

***Note: DO NOT** attempt to repair a chain. Replace a stretched or damaged chain with a new part. Always replace both the chain and the clevis. It is recommended that when any chain is replaced, that all chains and clevis' be replaced at the same time.*

3.11.4 Chain Lubrication

After inspection and before being returned to service, chains must be lubricated with gear oil. Refer to Section 2.3, “Fluid and Lubricant Capacities”, for detailed Information.

The lubricant must penetrate the chain joint to prevent wear. Applying lubricant to the external surfaces will prevent rust, but the chains should be articulated to make sure the lubricant penetrates to the working surfaces between the pins and links.

To prepare the chain for lubrication, the chain plates should be brushed with a stiff brush or wire brush to clear the space between the plates so that lubricant can penetrate to the working surfaces.

Lubricant may be applied with a narrow paint brush or directly poured on, but the chain should be well flooded with lubricant and the boom should be extended and retracted to be sure that the lubricant penetrates to the working surfaces. All surplus lubricant should be wiped away from the external surfaces. **DO NOT** use a solvent for this wiping operation.

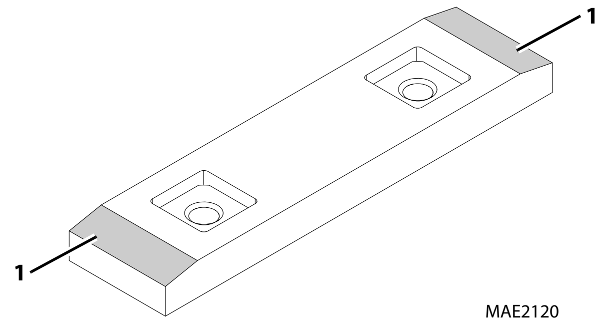
Regular application of lubricant is necessary to make sure that all working surfaces are adequately lubricated. In extremely dusty conditions, it may be necessary to lubricate the chains more often. Refer to Section 2.4, “Service and Maintenance Schedules” and Section 2.5, “Lubrication Schedule”, for detailed information.

Lubrication of chains on machines working consistently in extreme hot or cold conditions requires special consideration. Contact the *JLG* dealer for guidance.

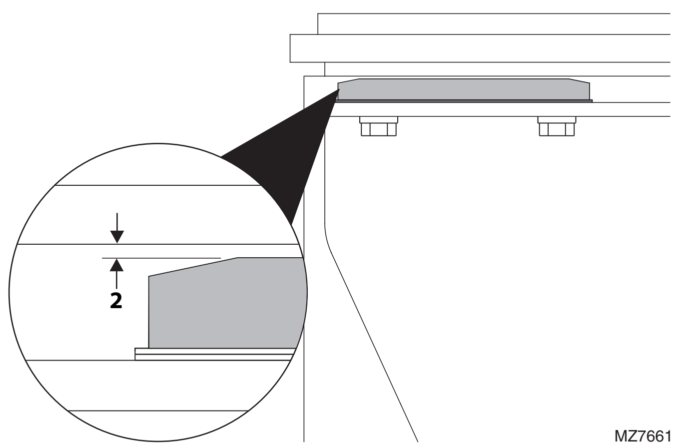
3.12 BOOM WEAR PADS

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

3.12.1 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 total gap between the side/top wear pad(s) 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.

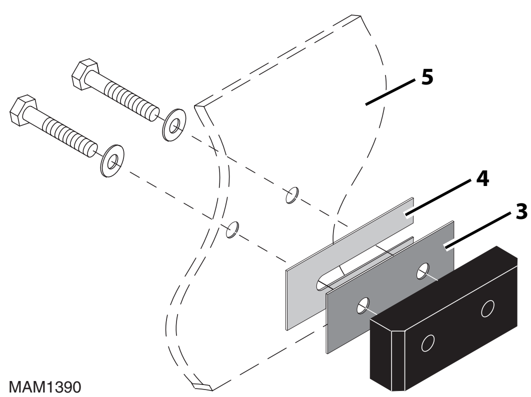
3.12.2 Boom Wear Pad Installation, Lubrication

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.

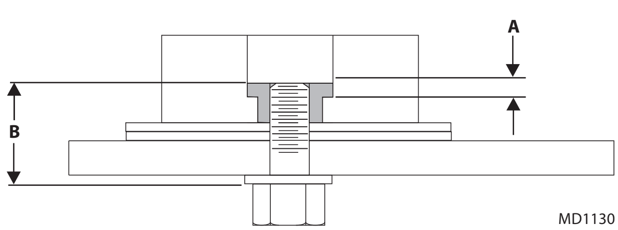
Lubrication of the boom wear surfaces is also recommended when the machine is stored, to help prevent rusting.

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

- Maintain a total boom section clearance between the side/top wear pad(s) and the next boom section (**2**) is 0.019 - 0.059 in (0,5 - 1,5 mm).
- The wear pad inserts and mounting bolts MUST be clean before mounting bolts are installed.
- Refer to Section 2.8.1, “Definitions”.



- A spacer (**3**) with holes must be used before any shim (**4**) is used.
- A shim (**4**) must inserted between the spacer (**3**) and wear pad support plate, block or boom section (**5**).
- 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 shims, spacers and washers being used.
- The bolt length can be ± 0.004 in (±0,1 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.

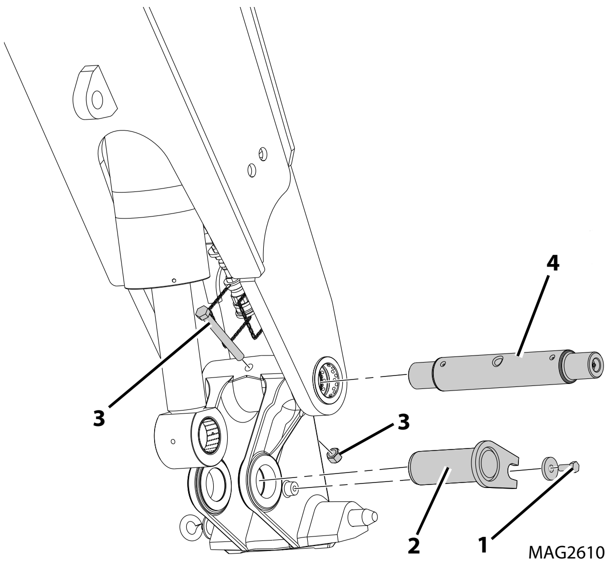
3.13 QUICK COUPLER

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

3.13.1 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

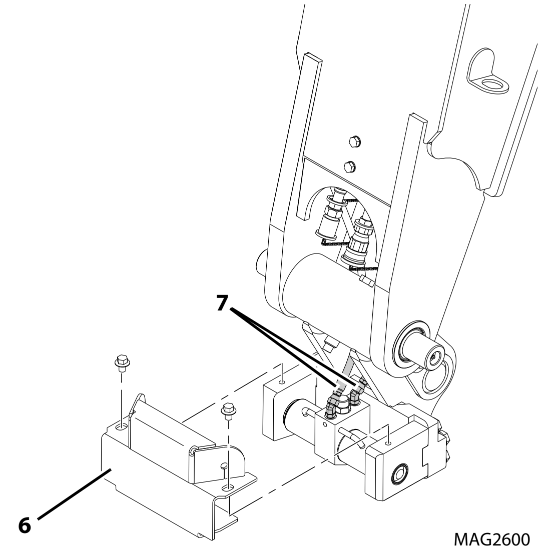
DO NOT coat the pin or any rotating parts.

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**).

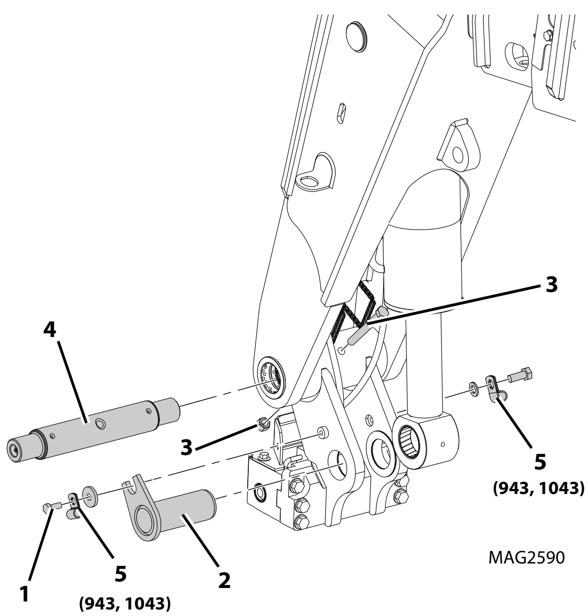
3.13.2 Hydraulic Coupler

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 (**6**). Label and disconnect the hydraulic hoses (**7**) 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. **742, 943, 1043:** Remove the bolt and washer (**1**) and p-clamps (**5**) securing the tilt cylinder rod end to the quick coupler assembly. Remove the rod end pin (**2**).
5. **1055, 1255:** Remove the bolt and washer (**1**) securing the tilt cylinder rod end to the quick coupler assembly. Remove the rod end pin (**2**).
6. 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.
7. 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.

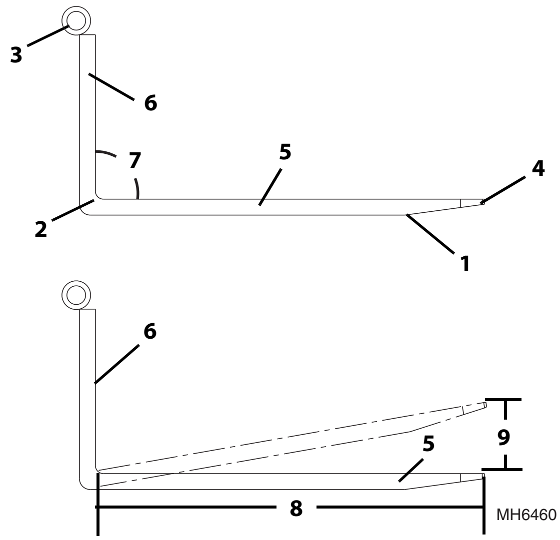
NOTICE

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 (2,0 mm).
6. **742, 943, 1043:** Align the quick coupler with the tilt cylinder rod end and insert the coupler pin (**2**). Secure with the previously removed p-clamps (**5**), bolt and washer (**2**).
7. **1055, 1255:** 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**).
8. Uncap and reconnect the hydraulic hoses (**7**) to proper fittings on the quick coupler assembly on the boom head.
9. Reinstall cylinder cover (**6**) with the hardware removed earlier.

3.14 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**).

3.15 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.

3.15.1 Equipment and Supplies Required without Precision Gravity Lower System (PGLS)

Auxiliary Hydraulic Power Supply:

- Portable hydraulic unit or another machine with an auxiliary hydraulic power supply with the 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".

Hoses:

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

Fittings:

- Two -ORFS/ORB 10-10 Caps
- Two -ORFS/ORB 10-10 Plugs

Adaptors:

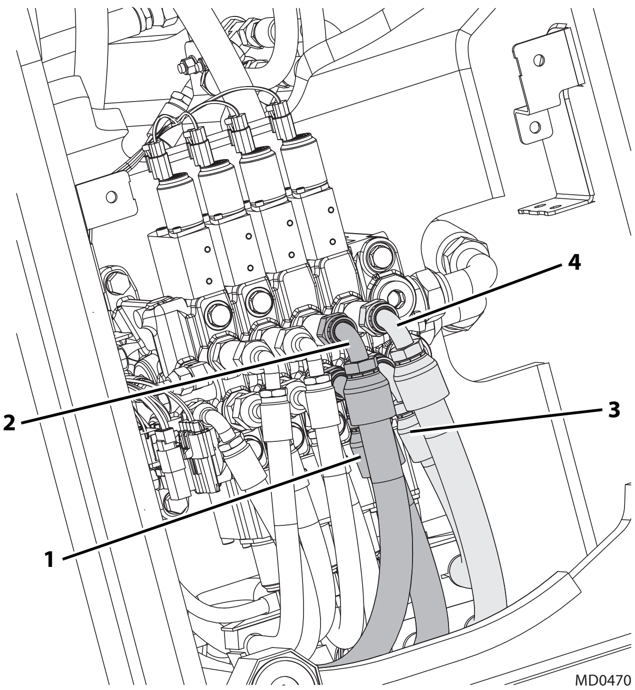
- Two -ORFS/ORB 10-10 Adaptors

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

3.15.2 Lowering Procedure without Precision Gravity Lower System (PGLS)

a. Retract the boom as follows:

1. Remove the rear cover from the machine.
2. Place a suitable receptacle under the main control valve.



VIEW FROM REAR OF FRAME

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.

3.15.3 Equipment and Supplies Required with Precision Gravity Lower System (PGLS)

Auxiliary Hydraulic Power Supply:

- **Primary** Portable hydraulic unit or another machine with an auxiliary hydraulic power supply with the capacity to hold up to 9 gal (35 L) of hydraulic oil from the machine during lowering process.
- **Secondary** Portable hydraulic unit or compressed air source capable of producing, regulating and releasing pressure between 87 psi (6 bar) - 216 psi (15 bar) of hydraulic pressure. A pressure gauge to monitor, vent and/or release applied pressure.

Note: *A secondary portable hydraulic unit is required to produce the required pilot pressure to aid in the lowering of the boom when equipped with PGLS.*

NOTICE

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

Hoses:

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

Fittings:

- Two -ORFS/ORB 10-10 Caps
- Two -ORFS/ORB 10-10 Plugs
- One -ORFS/ORB 4-6 Cap

Adaptors:

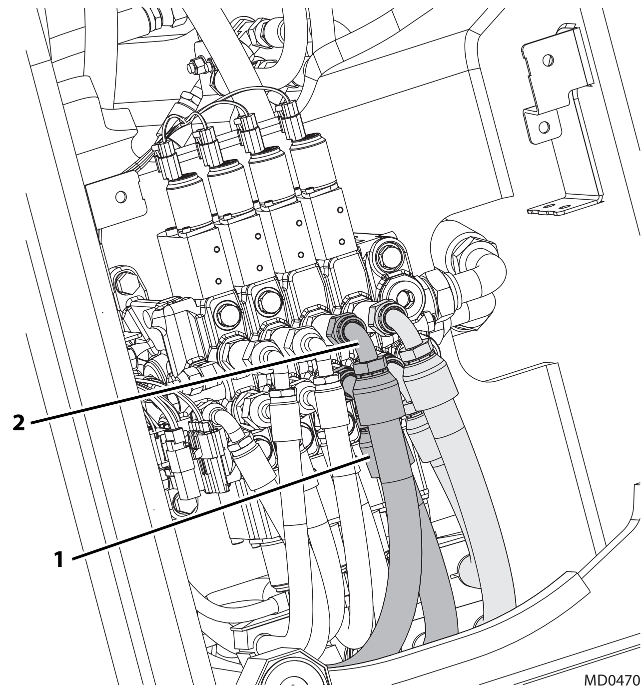
- Two -ORFS/ORB 10-10 Adaptors
- One -ORFS/ORB 4-6 Tee

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

3.15.4 Lowering Procedure with Precision Gravity Lower System (PGLS)

a. Retract the boom as follows:

1. Remove the rear cover from the machine.
2. Place a suitable receptacle under the main control valve.



VIEW FROM REAR OF FRAME

3. Label and disconnect the extend/retract cylinder hoses (**1** & **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.

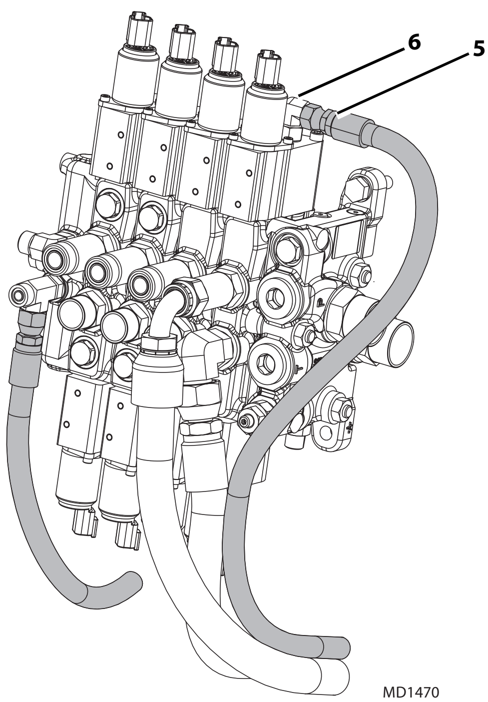
Note: *Loss of hydraulic oil is limited to the amount trapped within each hose.*

4. Using the hoses and fittings specified, connect the hoses between the primary 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 primary 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. Disconnect the PGLS pilot hose (**5**) from the main control valve. Install cap to the main control valve pilot port fitting (**6**) to prevent fluid loss and keep dirt and debris from entering the hydraulic system.

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

3. Connect the specified tee fitting to the PGLS pilot hose (**5**) removed from the main control valve lift/lower pilot port section of the affected machine.
4. Connect the secondary auxiliary power supply and a digital pressure gauge to the open ends of the previously installed tee fitting.

Note: *PGLS pilot pressure is NOT to exceed 216 psi (15 bar).*

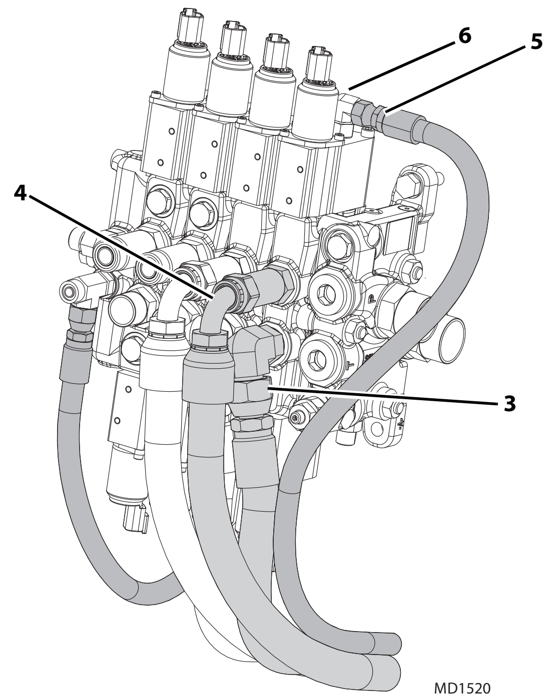
5. Use the secondary auxiliary power supply, slowly apply pressure to the PGLS pilot port hose. Do Not exceed *216 psi (15 bar)*. To slow or stop the rate of decent, use the vent or release feature of the secondary power supply to decrease the pilot pressure below 87 psi (6 bar)

Note: If the boom fails to lower to a safe level when following Step B, continue directly to Step C.

6. With the boom lowered, relieve all PGLS pilot pressure, loosen and remove the secondary auxiliary power supply, pressure gauge and tee fitting. Remove the cap from the main control valve pilot port fitting (**6**) and reconnect the PGLS pilot hose (**5**).
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.

c. Lower the boom as follows (If Required):

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



2. Relieve all PGLS pilot pressure (**5**) from the previously installed secondary auxiliary hydraulic power supply.
3. 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.*

4. Using the hoses and fittings specified, connect the hoses between the primary auxiliary hydraulic power supply and the hoses removed from the main control valve lift/lower section of the affected machine.
5. 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.

6. Use the secondary auxiliary power supply, slowly apply pressure to the PGLS pilot port on the main control valve.

Note: *PGLS pilot pressure is NOT to exceed 216 psi (15 bar).*

7. Use the primary auxiliary power supply to lower the boom.
8. With the boom lowered, relieve all PGLS pilot pressure, loosen and remove the secondary auxiliary power supply, pressure gauge, tee fitting and reconnect the PGLS pilot hose (**5**) to the main control valve pilot port fitting (**6**).
9. Loosen and remove the jumper hoses and reconnect the lift/lower cylinder hoses (**3** & **4**).
10. 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.
11. Clean up all debris, hydraulic fluid, etc., in, on, near and around the machine.
12. Install the previously removed rear cover.

3.16 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 8.13.1, "General Cylinder Removal Instructions". 4. Refer to Section 9.5, "Electrical System Schematics".
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 3.12, "Boom Wear Pads".
3. Excessive pivot pin noise and/or wear.	1. Insufficient lubrication.	1. Lubricate at regular intervals. Refer to Section 2.5, "Lubrication Schedule". Replace worn pins as needed.
	2. Worn bearing(s).	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.	1. Lubricate at regular intervals. Refer to Section 2.5, "Lubrication Schedule". Replace worn pins as needed.
	2. Worn bushing(s).	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 8.13.1, "General Cylinder Removal Instructions". 4. Replace bushing. 5. Refer to Section 9.5, "Electrical System Schematics".

Problem	Possible Causes	Remedy
6. Drooping chain, or jerky boom extend or retract functions.	1. Chain(s) tension not properly adjusted.	1. Adjust chain(s).
	2. Chain(s) stretched or binding.	2. Replace chains as needed. Refer to Section 3.3, “Boom Removal/ Installation”.
	3. Wear pads loose, contaminated, excessively worn or damaged.	3. Replace wear pad. Refer to Section 3.12, “Boom Wear Pads”.
	4. Contaminated, corroded or rusted wear pad sliding surfaces.	4. Remove contamination and/or corrosion from wear pad sliding surfaces and lubricate. If the surfaces cannot be reconditioned, replace the boom section(s).
	5. Extend/retract hydraulic system not operating properly.	5. Refer to Section 8.5, “Hydraulic Circuits”.
	6. Damaged boom section.	6. Replace the damaged boom section.
7. 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 8.13.1, “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”.
8. Rapid boom pad wear.	1. Incorrect wear pad gap.	1. Check wear pad gaps and correct as needed. Refer to Section 3.12, “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.
9. Auxiliary hydraulics will not operate.	1. Auxiliary hydraulic system not operating properly.	1. Refer to Section 8.5, “Hydraulic Circuits”.

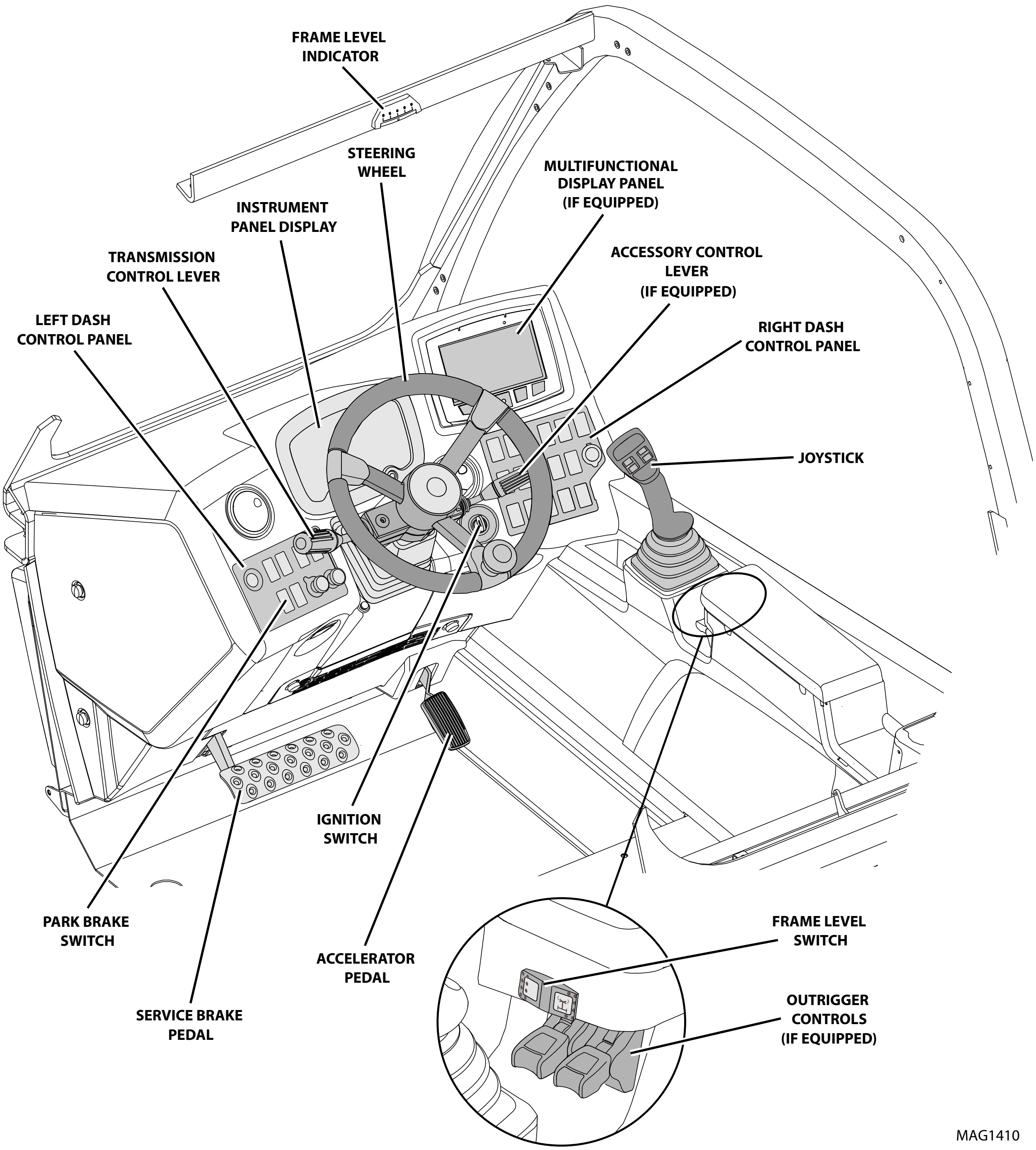
Problem	Possible Causes	Remedy
10. Excessive chain wear.	1. Improper chain adjustment.	1. Adjust to correct tension. Refer to Section 3.11.1, "Boom Chain Inspection"- Replace chains as needed.
	2. Chain sheave(s) not properly lubricated.	2. Lubricate chain sheave. Refer to Section 2.4, "Service and Maintenance Schedules".
	3. Chain sheave(s) not rotating freely.	3. Lubricate chain sheave. Refer to Section 2.4, "Service and Maintenance Schedules". Repair or replace chain sheave(s) as needed.
	4. Improper chain lubrication.	4. Lubricate at regular intervals. Refer to Section 2.4, "Service and Maintenance Schedules". Replace chains as needed.

Section 4
Cab

Contents

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

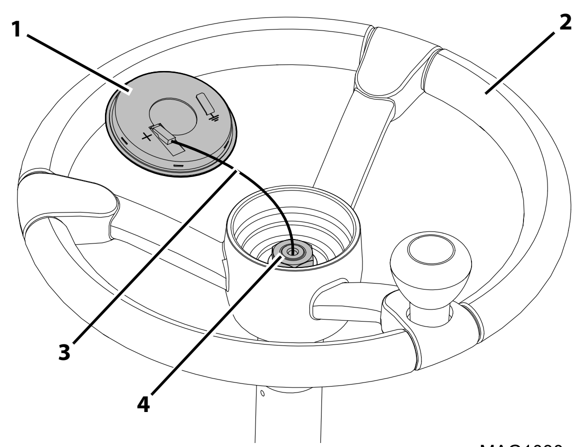
The cab serial number plate is located on the left side of the cab, below the seat. Information specified on the serial number plate includes the cab model number, the cab serial number and other data. Write this information down in a convenient location to use in cab correspondence.

4.3 CAB COMPONENTS

4.3.1 Steering Wheel

a. Steering Wheel Removal

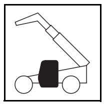
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly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

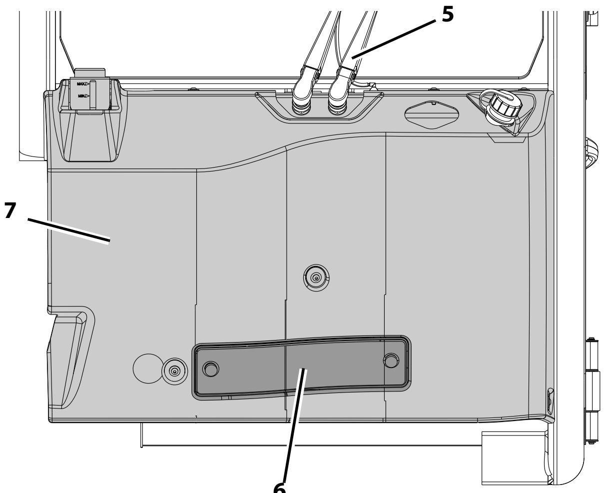
1. Install steering wheel (**2**) onto splined steering column shaft.
2. Secure steering wheel with nut (**4**). Torque as required.
3. Connect the previously remove horn connectors (**3**).
4. Press the horn button (**1**) onto steering wheel.
5. Properly connect the battery. Refer Section 9.8, “Battery”, 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.



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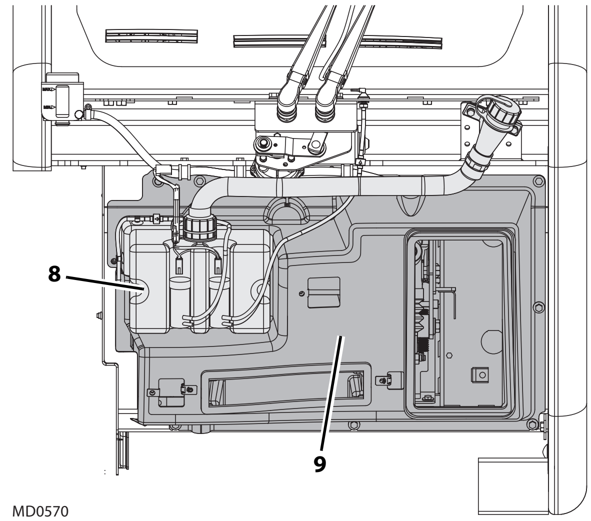
6. If equipped, remove the windshield wiper assembly (**5**).
7. Remove cab air filter cover (**6**).
8. Remove access covers (**7**) from front of cab.



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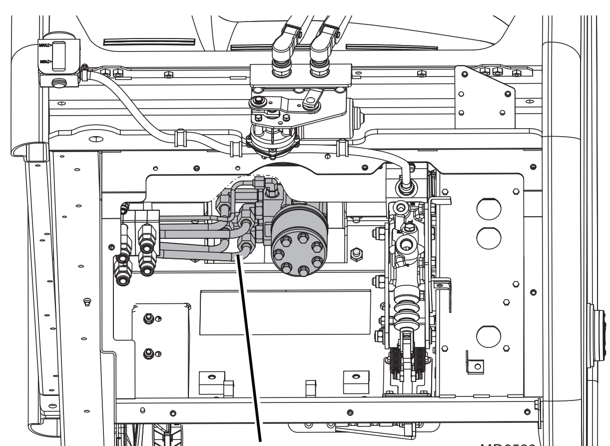
9. If equipped, remove windshield washer assembly (**8**), heater cover and heater assembly (**9**). Refer to Section 4.3.7, “Heater System (if equipped)”.
10. Slowly turn surge tank cap to first stop and allow any pressure to escape. Remove surge tank cap.
11. Place a suitable container beneath radiator 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.



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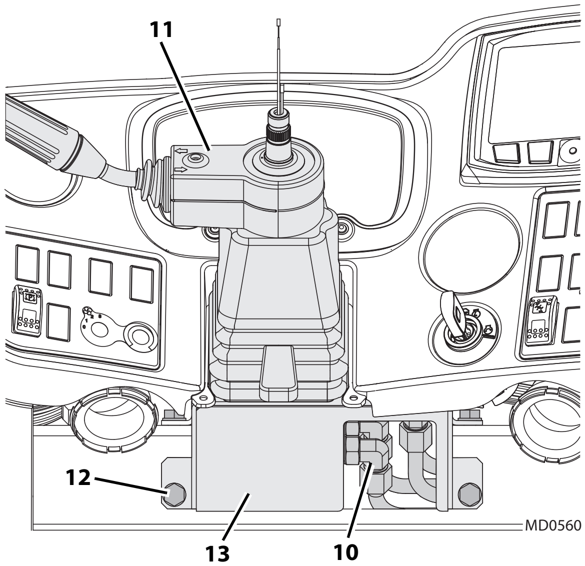
13. Label, disconnect and cap hydraulic tubes (**10**) attached to orbital valve.
14. Remove steering wheel. Refer to Section 4.3.1, “Steering Wheel”.



15. 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.

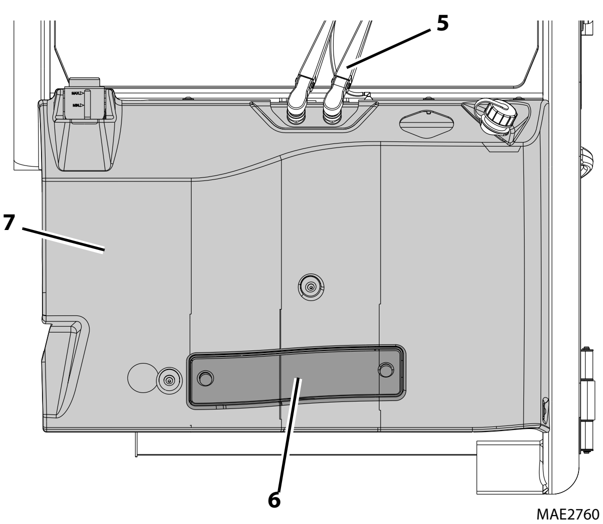
b. Brake Valve Installation

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

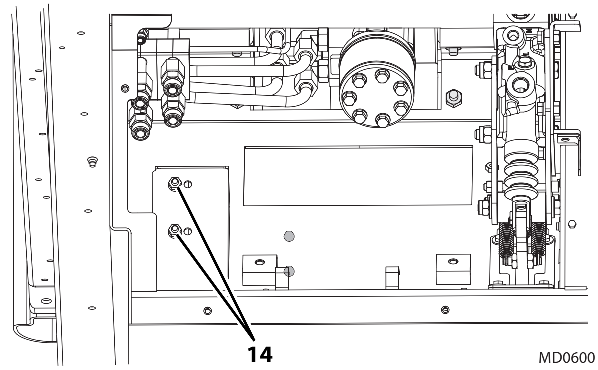
4.3.4 Electronic Throttle Pedal

a. Throttle Pedal Removal

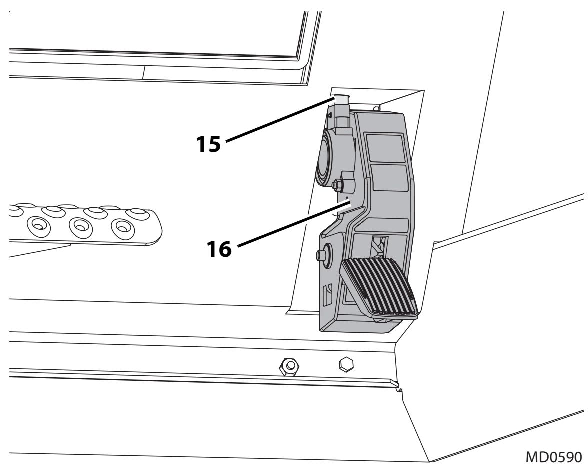
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly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

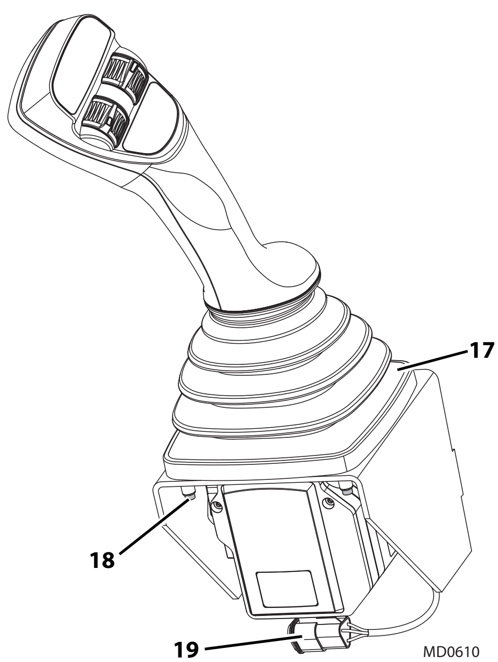
1. Position throttle pedal on its mounting location in cab.
2. Reconnect electrical connection to pedal assembly.
3. Secure throttle pedal into position with previously used hardware (**14**).
4. If equipped, install heater and windshield washer assembly.
5. Open surge tank cap and fill the radiator 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.

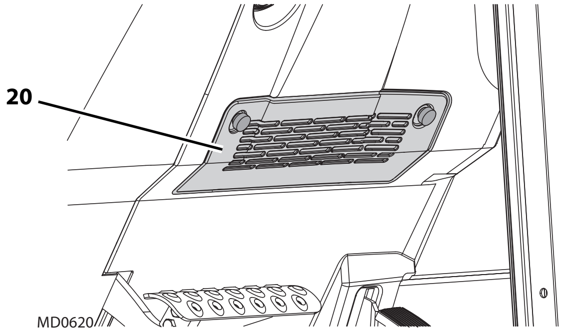
4.3.6 Window Wiper Assembly

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

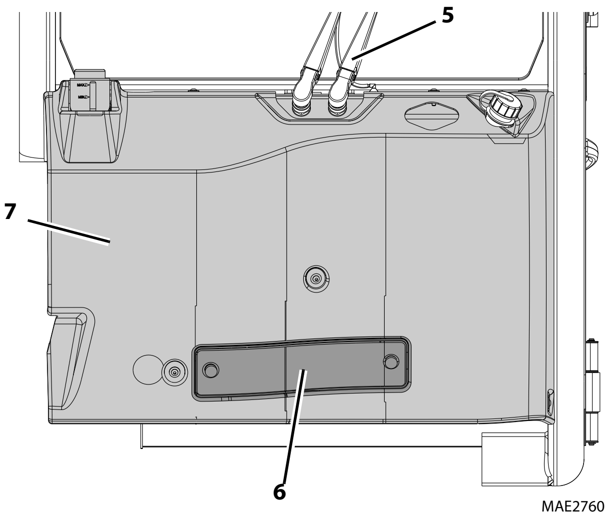
4.3.7 Heater System (if equipped)

a. Removal

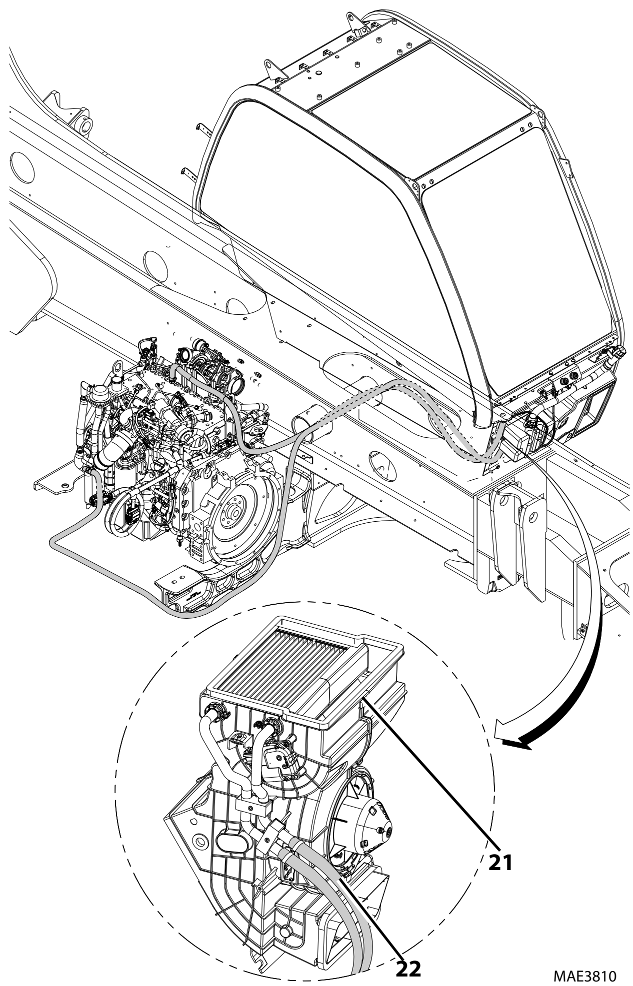
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine covers. Allow system fluids to cool.
4. Properly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



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

b. 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. If equipped, connect previously labeled air conditioning hoses to appropriate locations.
5. 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”.

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

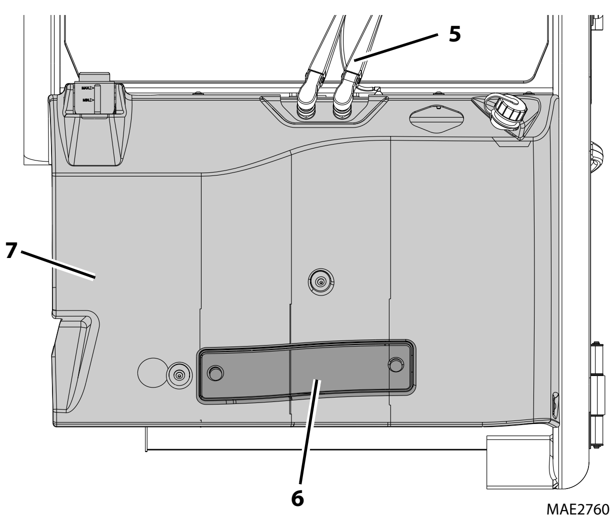
Note: *STOP engine immediately if any leakage is noted, and make any necessary repairs before continuing.*

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

4.3.8 Heater and A/C System (if equipped)

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 covers. Allow system fluids to cool.
4. Properly disconnect the battery. Refer Section 9.8, “Battery”, for procedure.



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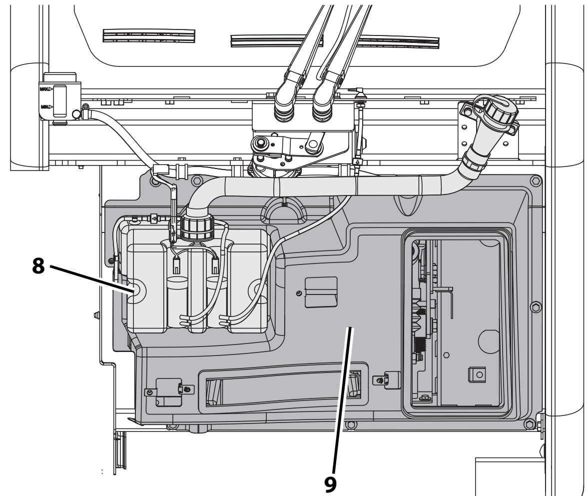
5. If equipped, remove windshield wiper assembly (**5**).
6. Remove access covers (**6** and **7**) from front of cab.
7. If equipped, remove windshield washer assembly.



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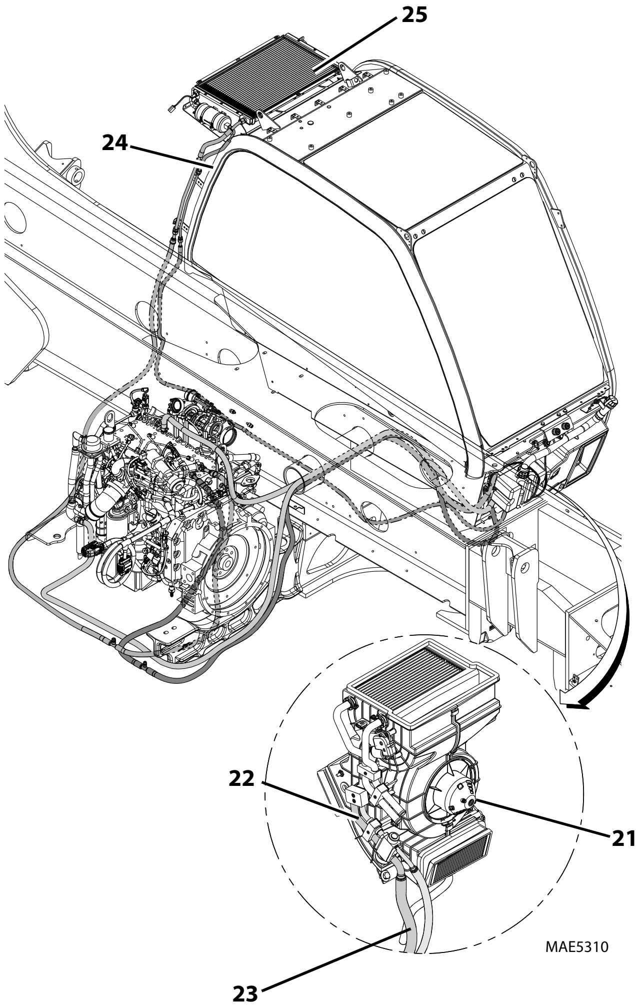
8. If equipped, remove windshield washer assembly (**8**) and heater cover (**9**).
9. Place a suitable container beneath radiator. Slowly turn surge tank cap and allow any pressure to escape. Remove surge tank cap.
10. Place a funnel at base of radiator to channel drained coolant into container. Remove 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.*



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. 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 hoses (**23**) to appropriate locations.
7. Connect previously labeled air conditioning 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: *The local* JLG *dealer or certified air conditioning service center or personnel to perform the refrigerant installation to the system.*

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. If equipped, install windshield washer assembly.
14. Install protective covers.
15. If equipped, install windshield wiper assembly (**5**).
16. Close and secure the engine cover.
17. Remove Do Not Operate Tag from ignition key switch and steering wheel.

4.4 CAB REMOVAL

⚠ WARNING

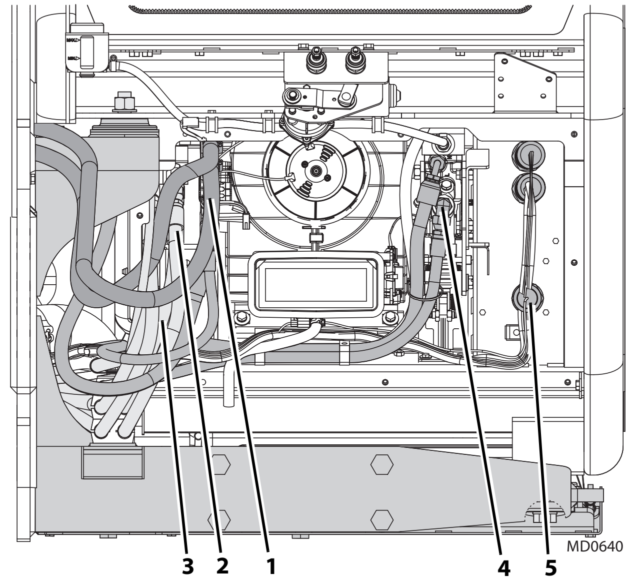
The protection offered by this ROPS/FOPS will be impaired if subjected to any modification or structural damage, at which time replacement is necessary. ROPS/FOPS must be properly installed using fasteners of correct size and grade, and torqued to their specified value.

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

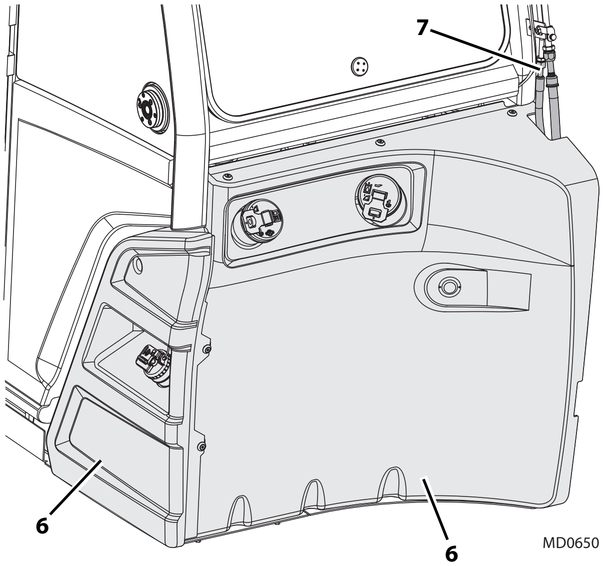
Inspect cab, its welds and mounts. If modification, damage, a cracked weld and/or fatigued metal is discovered, replace cab. Contact local *JLG* dealer with any questions about suitability or condition of a cab.

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.*

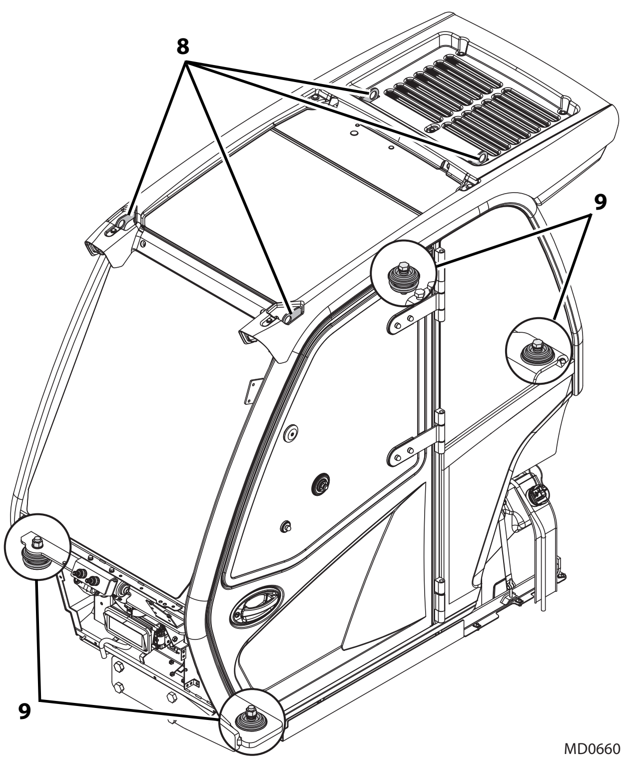
1. Park machine on a firm, level surface. Allow sufficient overhead and side clearance for cab removal. Level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL position, engage park brake and shut engine OFF.
2. Block all four wheels to help prevent machine from moving. Assure 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 4.3.8, “Heater and A/C 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.



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 AC hoses to cab AC. Refer to Section 4.3.8, “Heater and A/C System (if equipped)”.
9. Reconnect heater hoses to cab heater. Refer to Section 4.3.7, “Heater System (if equipped)”.
10. 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”.
11. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
12. Carefully examine all cab components, fasteners, etc., before engine start-up. Rectify any faulty conditions.
13. 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 in 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.*

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

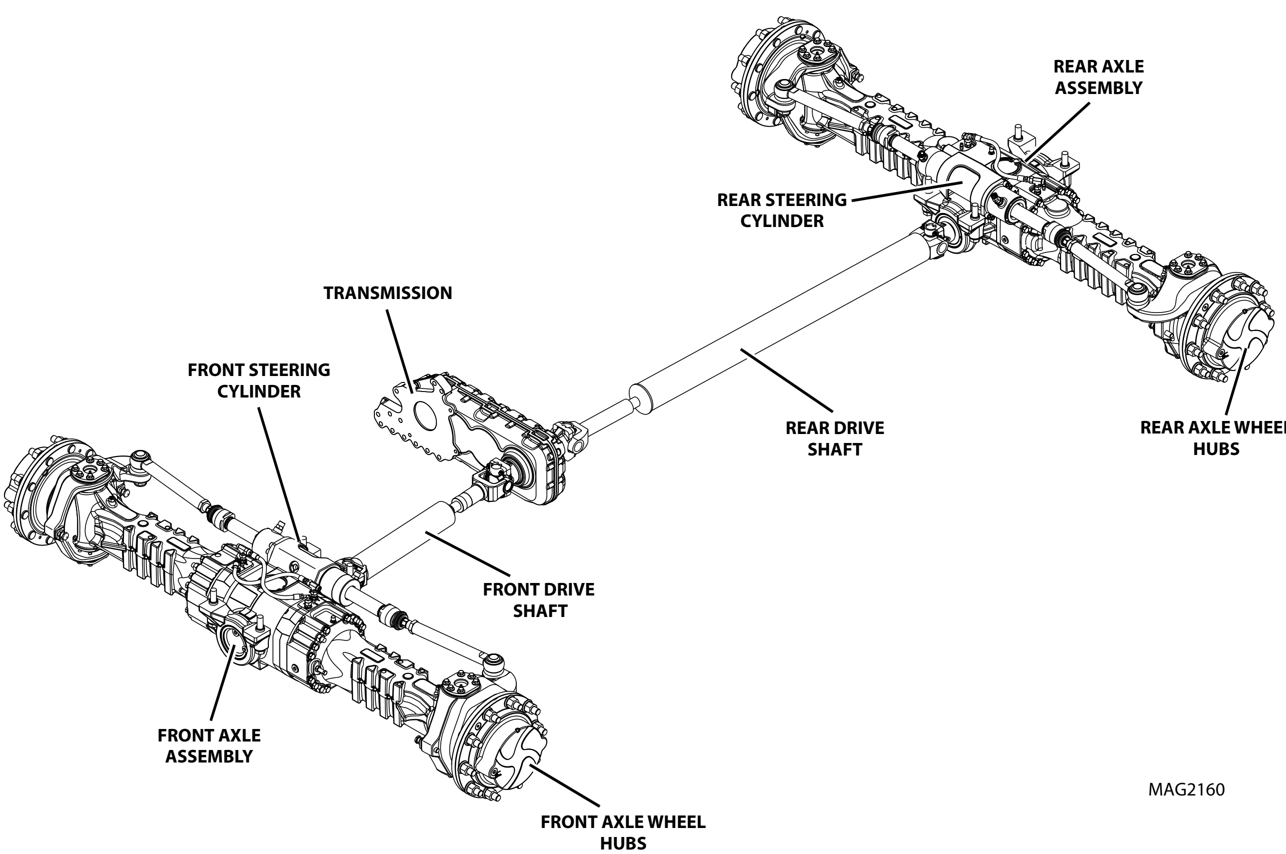
Section 5
Axles, Drive Shafts, Wheels and Tires

Contents

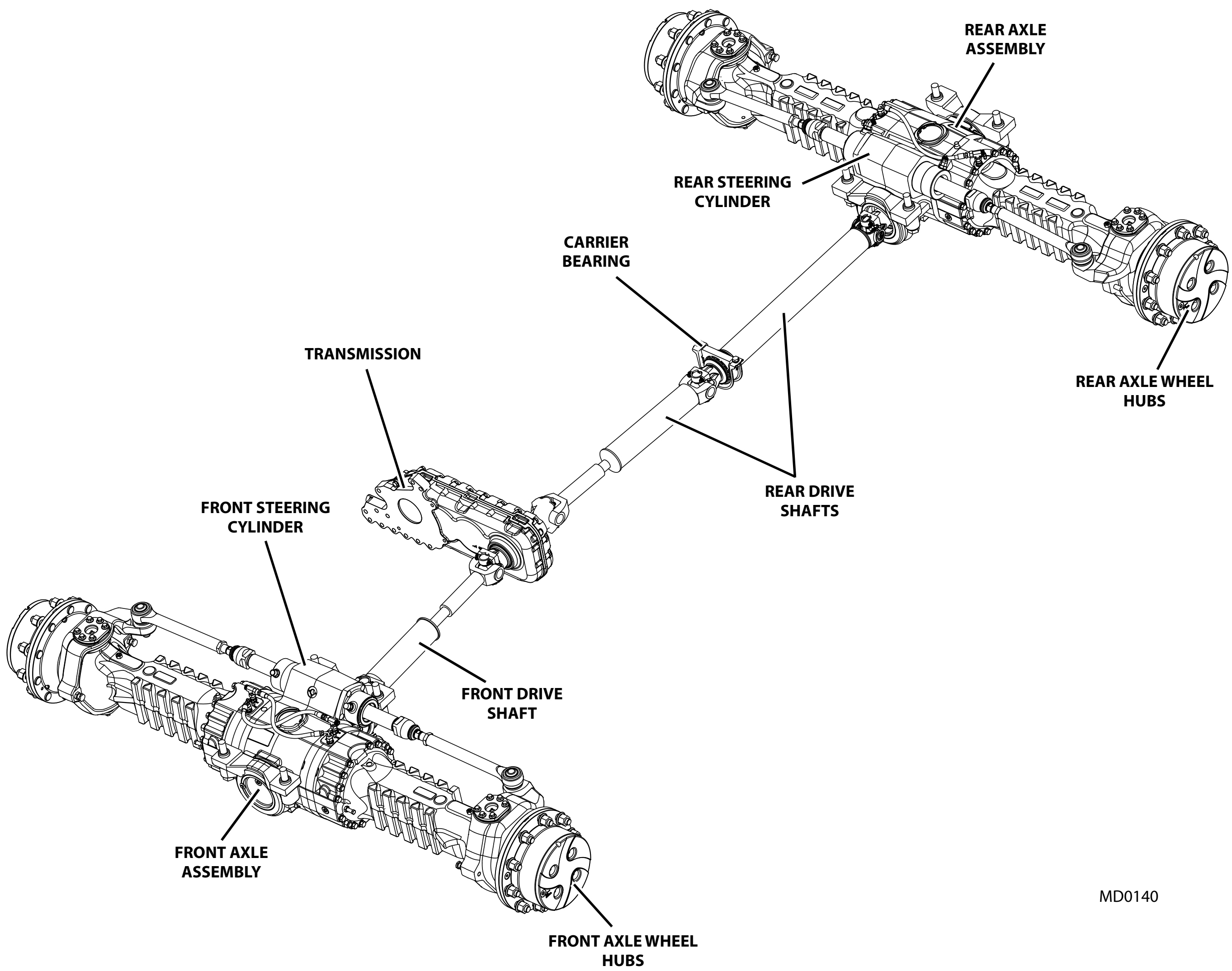
5.1 AXLE, DRIVE SHAFT AND WHEEL COMPONENT TERMINOLOGY

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

742, 943, 1043



1055, 1255


REAR AXLE
ASSEMBLY
REAR STEERING
CYLINDER
CARRIER
BEARING
TRANSMISSION
REAR AXLE WHEEL
HUBS
REAR DRIVE
SHAFTS
FRONT STEERING
CYLINDER
FRONT DRIVE
SHAFT
FRONT AXLE
ASSEMBLY
FRONT AXLE WHEEL
HUBS
MD0140

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

Supply information from the axle serial number plate when communicating about 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 #
742	Service Manual	31200162
	Parts Manual	31211370
943	Service Manual	31200239
	Parts Manual	31211371
1043	Service Manual	31200239
	Parts Manual	31211372
1055, 1255	Service Manual	31200239
	Parts Manual	31211373

5.4 AXLE REPLACEMENT

5.4.1 Axle Removal

WARNING

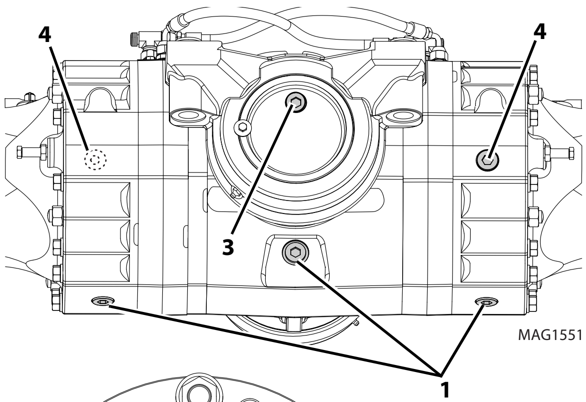
An improperly supported machine can fall. Safely raise and adequately support the machine so that it will remain stable and in place before attempting to remove an axle.

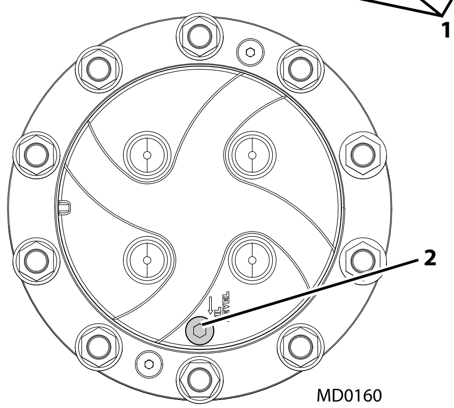
The front and rear axle assemblies differ, in that front axle assembly is equipped with a park brake mechanism and a limited slip feature; rear axle has neither. The following steps outline a typical axle removal procedure, suitable for either front or rear axle assembly.

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 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 bolts securing fender assembly to axle.





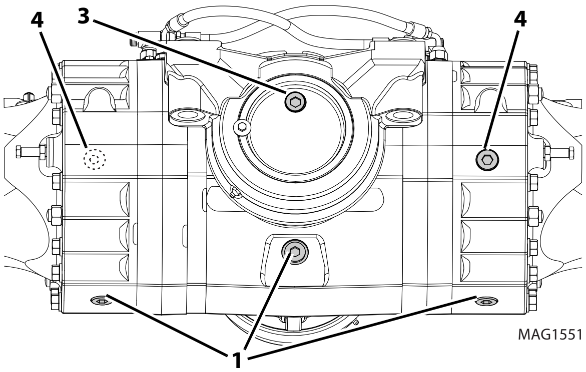
6. Loosen and remove the axle oil fill plug (**3**) and check fill plugs (**4**).
7. If axle will be disassembled after removal, place a suitable receptacle under axle (**1**) and wheel hub drain plugs (**2**). Remove drain plugs and allow oil to drain into receptacle. Transfer used oil into a suitable covered container, and label container as "Used Oil". Dispose of used oil at an approved recycling facility.
8. Label, disconnect and cap steering and brake lines at axle. Wipe up any spilled oil.
9. 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.
10. 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.
11. Support axle that is being removed with a suitable jack, hoist or overhead crane and sling. **DO NOT** raise axle or machine.
12. 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.*

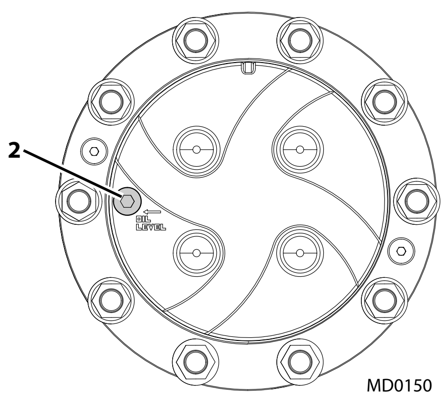
13. Remove the drive shaft assembly. Refer to Section 5.8, "Drive Shafts".
14. On front axle, remove capscrew and locknuts securing lower position cylinder-mount pin to the front cylinder. Tap the cylinder mount pin out, and move the cylinder to prevent it from interfering with axle removal.
15. Remove bolts and locknuts securing axle to frame.
16. 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. Block front and rear of both tires on axle that is already installed on machine.
4. 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.
5. Keep axle supported and balanced on the jack, hoist or overhead crane and sling throughout the installation procedure.
6. Position axle under frame, and align axle housings with holes in frame.
7. Refer to Section 2.8.1, "Definitions", for all thread locking requirements.
8. Install axle mounting bolts and nuts. Tighten and torque as required.
9. Install the drive shaft assemblies. Refer to Section 5.8, "Drive Shafts",.
10. If reinstalling an axle previously removed from machine, position drive shaft yoke on axle according to alignment marks made earlier.
11. 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.
12. Connect the steering and brake lines at axle.



13. 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.



14. 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.
15. Install and tighten the axle oil fill plug (**3**) and check fill plugs (**4**).
16. Install the wheel and tire assemblies. Refer to Section 5.9.2, "Installing Wheel and Tire Assembly onto Machine".
17. Carefully remove jack, hoist or overhead crane and sling supporting axle.
18. Carefully raise machine using a suitable jack or hoist. Remove supports from beneath frame and lower machine to ground.
19. Remove blocks from front and rear of both tires on other axle.

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

20. Install new O-rings into fittings. Lubricate O-rings with clean hydraulic oil.
21. Uncap and connect steering and brake lines at their axle fittings.
22. Check hydraulic reservoir oil level.
23. 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.
24. Install fender assembly. Torque as required.
25. Properly connect the battery. Refer Section 9.8, "Battery", for procedure.
26. Close and secure engine cover.
27. 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 2.2.3, "Steering Angle Specifications", 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.	3. Tighten capscrews to correct torque.
	2. Drive shaft universal joint(s) worn or damaged.	4. Repair or replace universal joints as needed.
	3. Drive shaft(s) damaged/ unbalanced.	5. 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 *JLG* Repair Manuals.
	5. Axle casing to brake housing and/or brake housing to differential assembly O-rings and/or seals worn or damaged.	5. Replace O-rings and seals.
	6. Axle housing mounting nuts and capscrews loose.	6. Tighten housing nuts and capscrews to 288 lb-ft (390 Nm).
	7. Differential and/or axle housing(s) damaged.	7. Replace housing(s) as needed.
5. Oil leaking from wheel end housing (planet carrier).	1. Oil level plugs loose and/or O-rings damaged or missing.	1. Replace O-rings as needed and tighten plugs to 44 lb-ft (60 Nm).
	2. O-ring between hub and housing (planet carrier) damaged or missing.	2. Replace O-ring.
	3. Shaft seal damaged or missing and/or worn or damaged shaft sealing surfaces.	3. Replace seal and/or fork joint shaft.
	4. Housing capscrews loose.	4. Tighten housing capscrews to 41 lb-ft (55 Nm).
	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.

Verify the mating surfaces between the driveshaft yoke and universal joint are clean and smooth.

Refer to Section 2.5, “Lubrication Schedule”, for information regarding the lubrication of the grease fittings on the driveshafts.

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.*

Note: *Refer to Section 2.8.1, “Definitions”, for all thread locking requirements.*

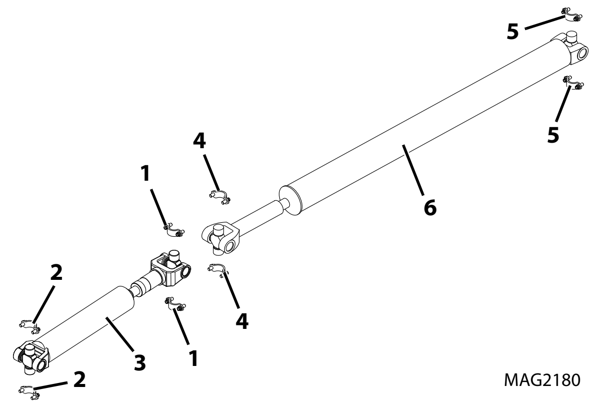
5.8.2 Drive Shaft Maintenance

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 - 742, 943, 1043

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission control lever 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.



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 transmission output shaft flange. Discard bolts.
11. Remove four bolts and two straps (**5**) securing bearing cross to rear axle. Discard bolts.
12. Remove rear drive shaft assembly (**6**).

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.*

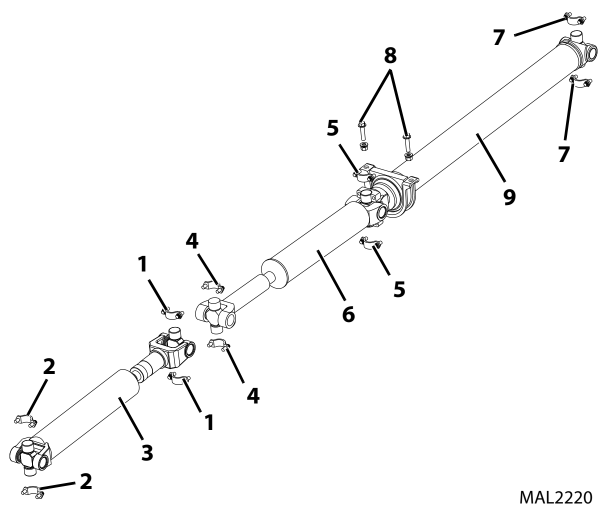
2. Refer to Section 2.8.1, “Definitions”, for all thread locking requirements.
3. Install two straps and four new bolts (**1**) securing bearing crosses to transmission. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
4. Install two straps and four new bolts (**2**) securing bearing crosses to axle. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
5. Install front drive shaft assembly (**3**).
6. Install two straps and four new bolts (**4**) securing bearing crosses to the transmission. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
7. Install two straps and four new bolts (**5**) securing bearing crosses to axle. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
8. Install rear drive shaft assembly (**6**).

9. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
10. Close and secure the engine cover.
11. Unblock the wheels.
12. Remove Do Not Operate Tags from both ignition key switch and steering wheel.

5.8.4 Drive Shaft - 1055, 1255

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission control lever 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.



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 transmission output shaft flange. Discard bolts.
11. Remove four bolts and two straps (**5**) securing bearing crosses to rear axle (**6**) at carrier bearing. Discard bolts.
12. Remove rear drive shaft assembly (**6**).
13. Remove four bolts and two straps (**7**) securing bearing cross to rear axle. Discard bolts.
14. Remove two bolts, nuts and washers (**8**) securing carrier bearing to frame.
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 2.8.1, “Definitions”, for all thread locking requirements.
3. Install two straps and four new bolts (**1**) securing bearing crosses to transmission. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
4. Install two straps and four new bolts (**2**) securing bearing crosses to axle. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
5. Install front drive shaft assembly (**3**).
6. Install two straps and four new bolts (**7**) securing bearing crosses to axle. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
7. Install previously removed bolts, nuts and washers (**8**) and secure the carrier bearing to frame. Torque to 55 lb-ft (75 Nm).
8. Install rear drive shaft assembly (**9**).
9. Install two straps and four new bolts (**4**) securing bearing crosses to the transmission. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
10. Install two straps and four new bolts (**5**) securing bearing crosses to the rear axle (**9**) at the carrier bearing. Torque bolts to 55 - 60 lb-ft (75 - 81 Nm).
11. Install rear drive shaft assembly (**6**).
12. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
13. Close and secure the engine cover.
14. Unblock the wheels.

15. Remove Do Not Operate Tags from both ignition key switch and steering wheel.

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.

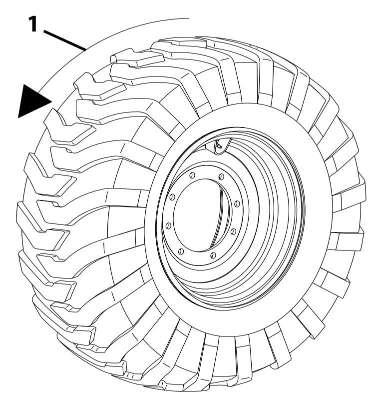
Foam filled tires have a positive effect on the weight, stability and handling characteristics of the machine, especially under load. The use of hydrofill as a tire-fill substance is not recommended because of possible environmental impact.

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 park 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.

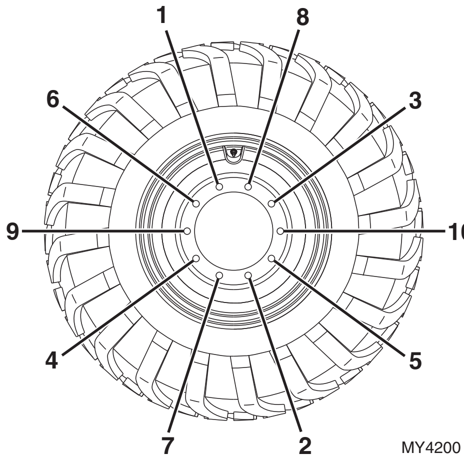
5.9.2 Installing Wheel and Tire Assembly onto Machine



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. Start all lug nuts by hand to prevent cross threading. Apply one drop of lubrication oil.



3. Tighten lug nuts in an alternating pattern as indicated in previous figure. Refer to Section 2.2.8, “Tires”, for torque values.
4. Remove machine from supports.
5. 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 3.15, “Emergency Boom Lowering Procedure”.*

WARNING

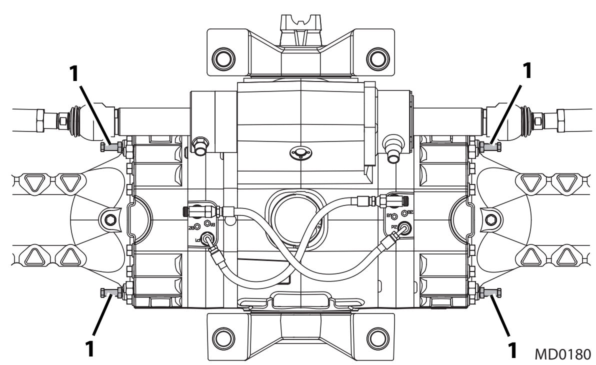
DO NOT attempt to tow a machine that is loaded or the boom/attachment is raised more than approximately 24 in (610 mm).

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”.

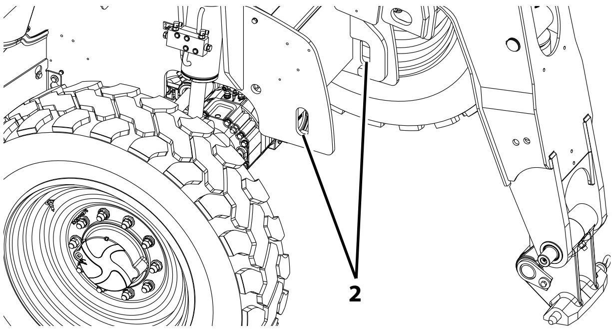


6. Loosen the nuts of the screws (**1**) for the manual release of the braking units. Draw the nuts back approximately 6 mm.
7. Tighten the screws until they are gently seated on the driving plate.
8. Carefully tighten each release screw a 1/4 turn at a time in sequence until all have been turned one full turn 360°.

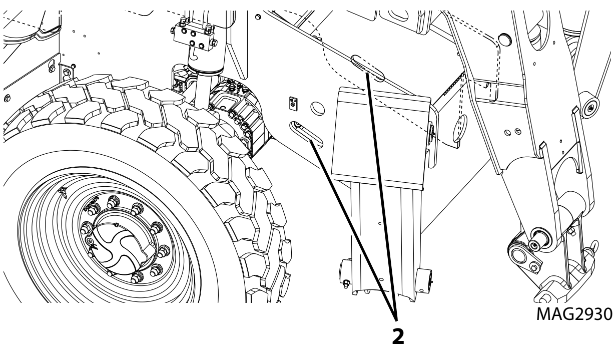
9. Repeat steps 1 thru 3 for other side of differential.

Note: *After machine has been towed to a secure location, reactivate park 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.*

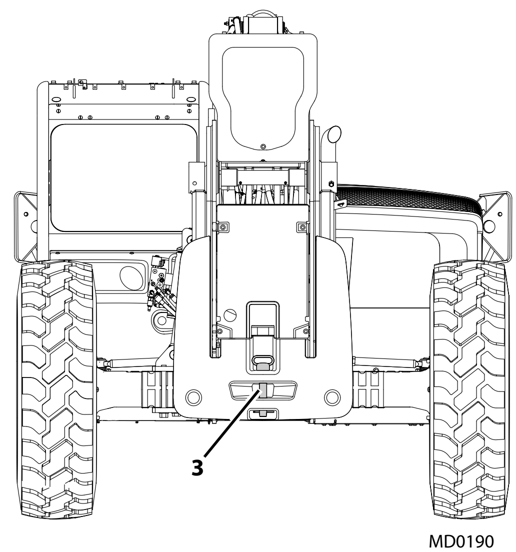
Front View - No Outrigger



Front View - With Outrigger



Rear View



10. Secure machine to a suitable towing vehicle.
    a. For towing or retrieval from front of machine, attach towing equipment to lifting points (**2**) on each side of the frame directly behind the outrigger weldments.
    b. For towing or retrieval from rear of machine, attach towing equipment to the retrieval hitch (**3**).

⚠ WARNING

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

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

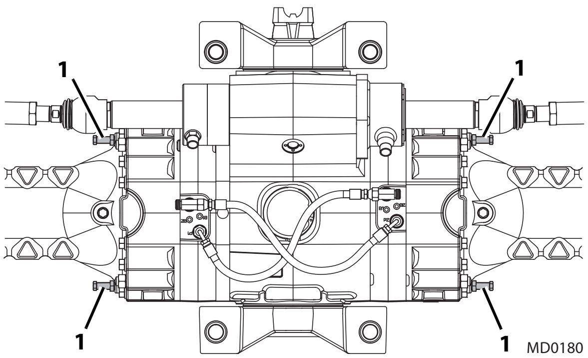
Note: *Tow machine at a very slow speed.*

16. After towing is complete, engage park brake.
17. Block all four wheels.
18. Reinstall front and rear drive shafts. Refer to Section 5.8, "Drive Shafts",.
19. 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.*



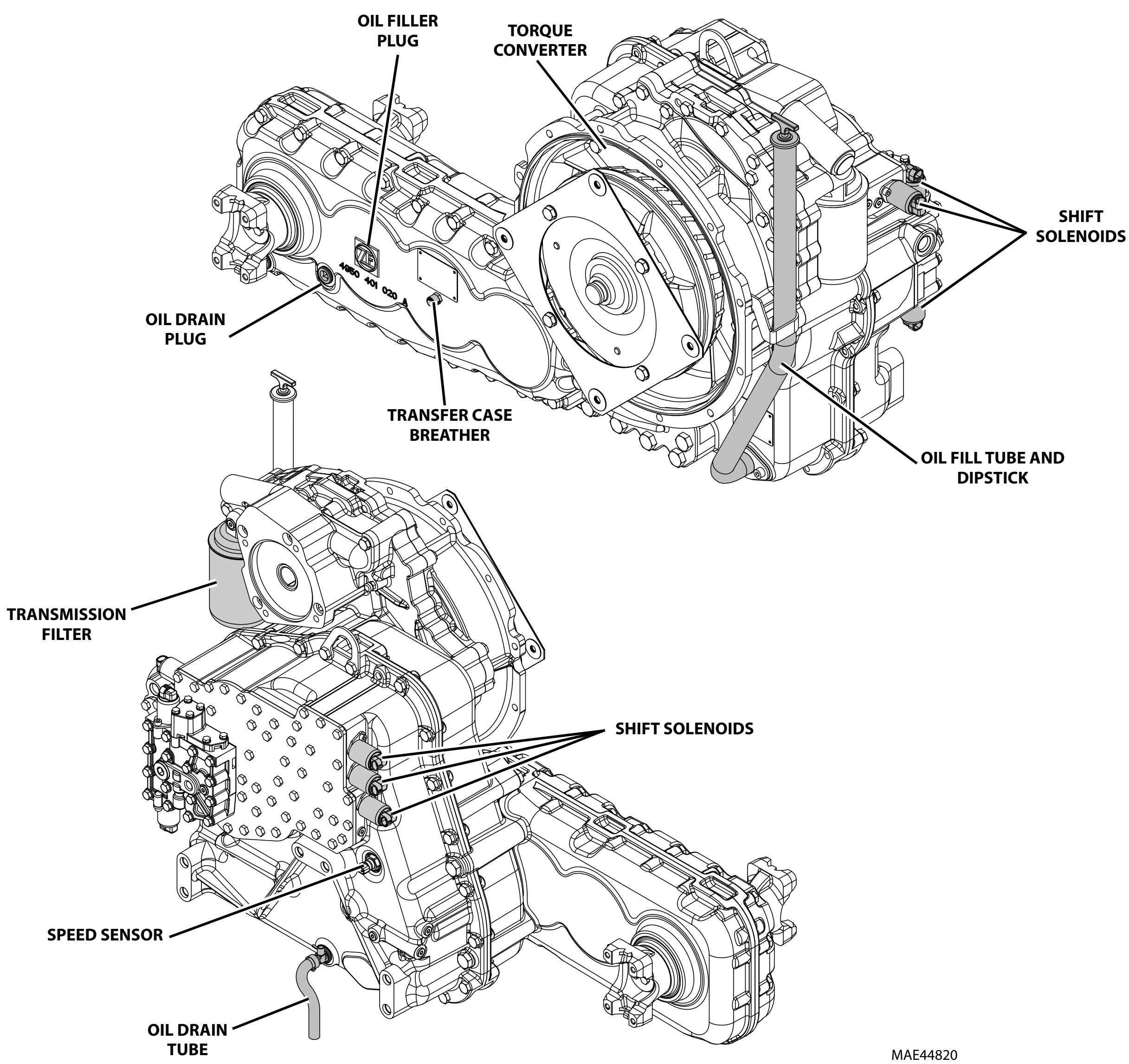
1. Loosen each release screw (**1**), only 1/4 turn at a time, in sequence, until each screw has lost contact with the guide pin.
2. Remove screws along with nuts and seals. Replace seals, lubricate screws with a silicone-based grease and re-install screws along with nuts.
3. Adjust the nut of the screw heads in relation to the arm by 1.18 in (30 mm).
4. Repeat steps 1 thru 3 for other side of differential.
5. 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 8.9.5, "Service Brake Test", and Section 8.9.7, "Steering Orbital Valve".

Section 6
Transmission

Contents

6.1 TRANSMISSION ASSEMBLY COMPONENT TERMINOLOGY

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

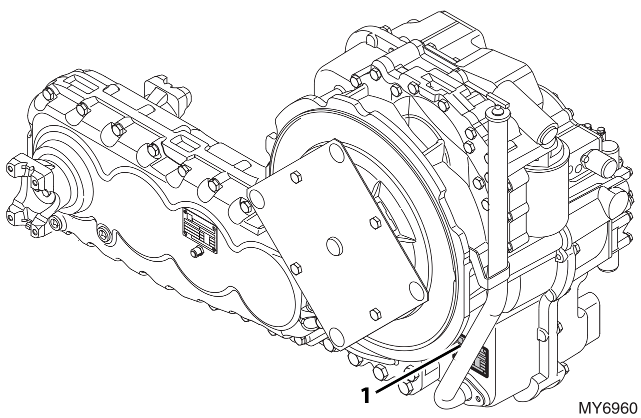


⚠ WARNING

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, installation and troubleshooting 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 #
742	Service Manual	31200241
	Parts Manual	31211370
943	Service Manual	31200241
	Parts Manual	31211371
1043	Service Manual	31200241
	Parts Manual	31211372
1055, 1255	Service Manual	31200241
	Parts Manual	31211373

6.4 TRANSMISSION REPLACEMENT

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

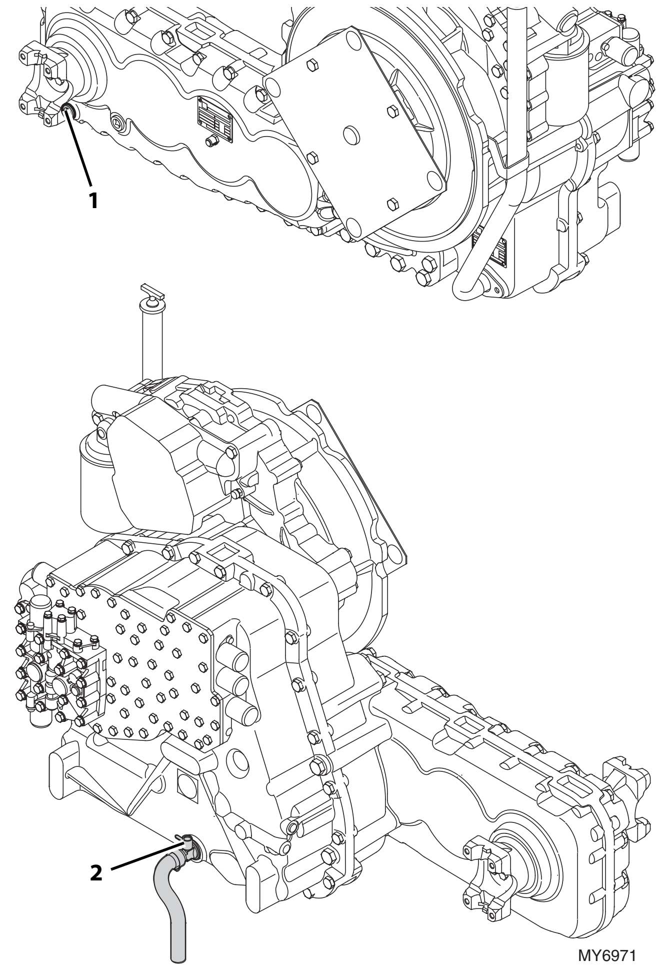
Cleanliness is of extreme importance. Before attempting to remove the transmission, thoroughly clean the exterior of the transmission to help prevent dirt from entering during the replacement process. Avoid spraying water or cleaning solution onto or near the transmission shift solenoids and other electrical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

6.4.1 Transmission Removal

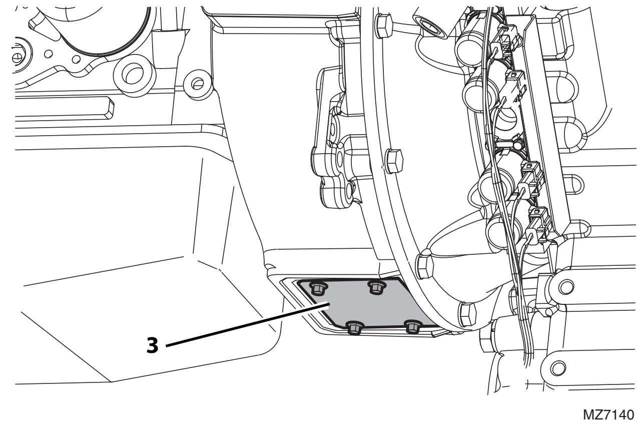
⚠ WARNING

Use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 1000 lb (454 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 (**2**). Remove the transmission drain plug, and allow the transmission oil to drain into the receptacle. Repeat the drain procedure with the transfer case (**1**).
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. Torque drain plugs to 26 lb-ft (35 Nm).



8. Remove access cover **(3**) from bottom of engine bell housing. This will allow access to remove four bolts holding the torque convertor diaphragm to the engine flywheel.
9. Turn the engine over slowly by hand and align each of the four torque convertor diaphragm bolts to be accessed. Remove them one at a time.
10. Connect a lifting strap or chain to lifting eye at top of transmission, and to a suitable hoist or overhead crane.
11. Carefully remove the transmission from the engine. Avoid causing damage to the transmission or surrounding parts.
12. 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.
13. Drain and flush entire transmission cooling system.
14. Thoroughly clean transmission filter screens and cases, and replace transmission filter elements.

6.4.2 Transmission Inspection and Internal Repair

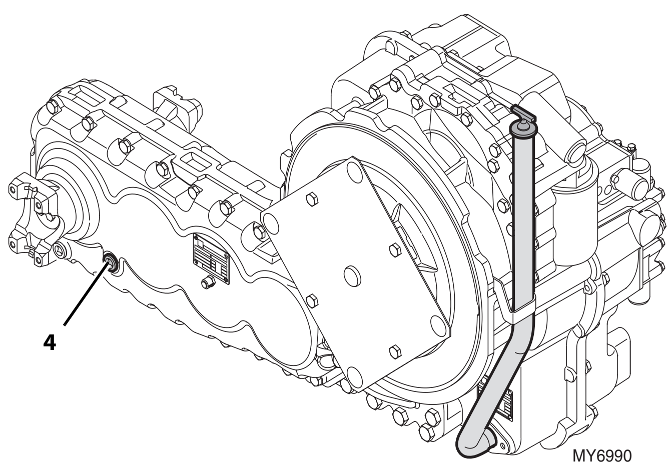
Refer to Section 6.3, "Specifications and Maintenance Information".

6.4.3 Transmission Installation

WARNING

Use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 1000 lb (454 kg).

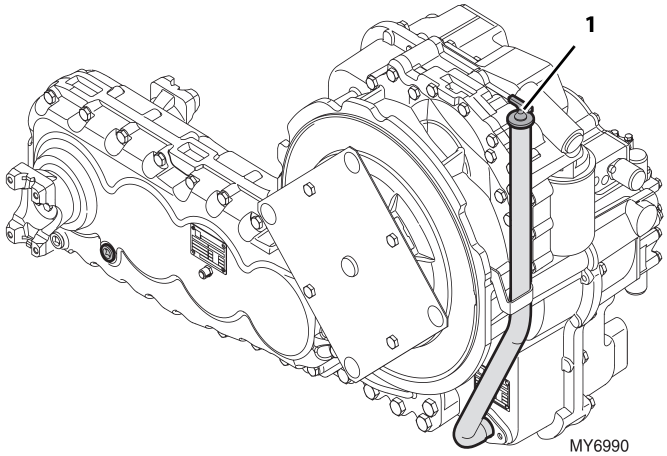
1. Install two guide studs near the top of the bell housing holes.
2. Use a hoist or overhead crane and sling attached to the lifting eye at the top of the transmission. Raise and position the transmission behind the engine.
3. Align the torque converter, align the transmission bolt holes with the two 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 four 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, “Engine Replacement”, for detailed installation instructions.
7. Initially fill the transmission with 16 quarts (15,1 liters).



8. Verify the machine is level and remove the fill plug (**4**) on the drop box. Fill the drop box until the oil is visible at the bottom of the fill plug opening. Install the fill plug and torque to 26 lb-ft (35 Nm). Refer to Section 2.3, “Fluid and Lubricant Capacities”, for detailed capacities.
9. Properly connect the battery. Refer to Section 9.8, “Battery”, for procedure.
10. Check transmission fluid level. Refer to Section 6.6, “Transmission Fluid Level Check”, for procedure.
11. Recheck all drain plugs, lines, connections, etc., for leaks, and tighten where necessary.
12. Close and secure engine cover.
13. 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.

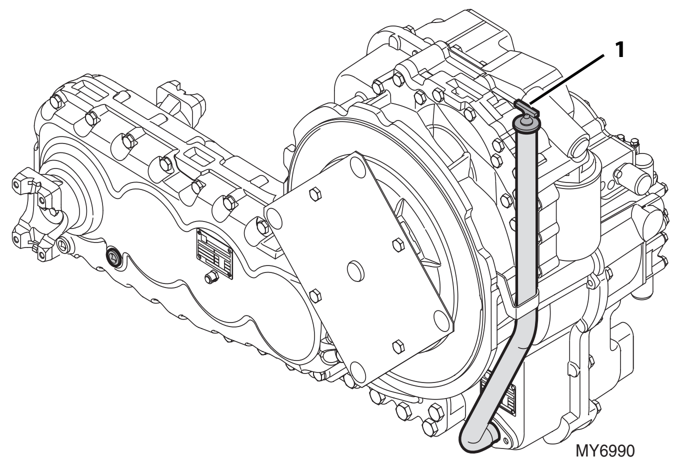


6. Remove transmission dipstick (**1**).
7. Place a suitable container beneath the transmission drain. Open drain valve and allow transmission oil to drain into a properly labeled container. Close transmission drain valve. Dispose of used transmission oil properly.
8. Reinstall belly pan.
9. Remove transmission 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 11,4 liters (12 quarts) 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.

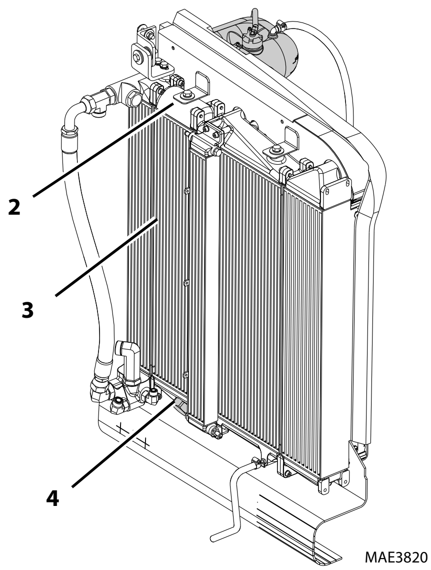


3. Remove the transmission dipstick (**1**) and check the oil level. The cold oil level after 2-3 minutes of idle must be above the HOT MIN line on the dipstick.

Note: *Depending on the amount of fluid remaining in the transmission oil cooler, the oil level may read substantially above the HOT oil top 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 4th gear.
9. Stall the transmission against 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.

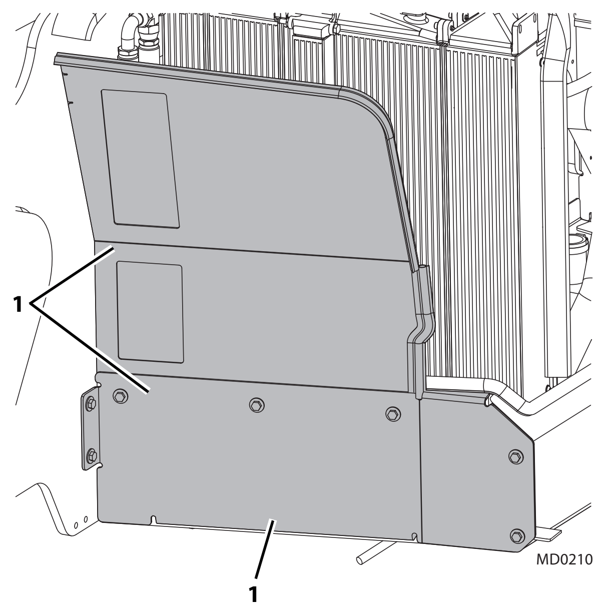


14. Verify that top (**2**) of transmission oil cooler (**3**) is warm to determine that the bypass valve (**4**) has closed and oil is circulating through the cooler. If the top of the transmission oil cooler is not warm, repeat steps 6 thru 10.
15. Remove the transmission dipstick (**1**) and check the oil level. The oil level should be in the HOT zone.
16. Add oil as required.
17. Replace the transmission dipstick.
18. Close and secure the engine cover.
19. Shut engine OFF.

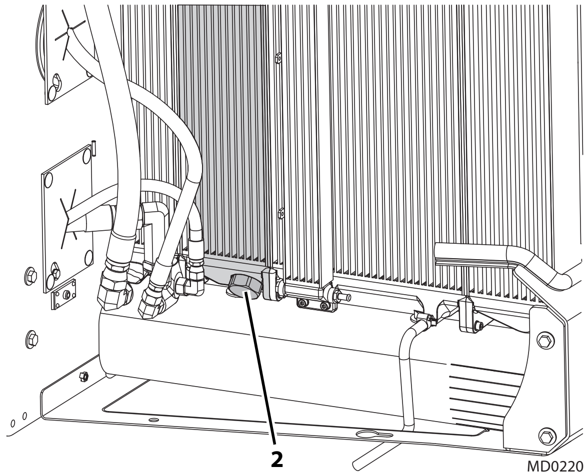
6.7 TRANSMISSION COOLER THERMAL BY-PASS VALVE

6.7.1 Thermal By-Pass Valve Cartridge 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. Loosen and remove the access covers (**1**) at the radiator assembly.



6. Thoroughly clean the radiator and surrounding area, including all the hoses and fittings, before proceeding.
7. Place a suitable container beneath the radiator cooler fittings on the hydraulic cooler. Transfer any transmission oil into a properly labeled container. Dispose of properly.
8. Loosen and remove the cartridge (**2**) from the side of the thermal by-pass valve. Plug opening to prevent dirt and debris from entering system.

6.7.2 Thermal By-Pass Valve Cartridge Installation

1. Remove the plug and install the new cartridge (**2**) in the thermal by-pass valve.
2. Reinstall access cover (**1**) to the radiator assembly.
3. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
4. Check transmission oil level. Refer to Section 6.6, “Transmission Fluid Level Check”, for procedure.
5. Remove Do Not Operate Tag from ignition key switch and the steering wheel.

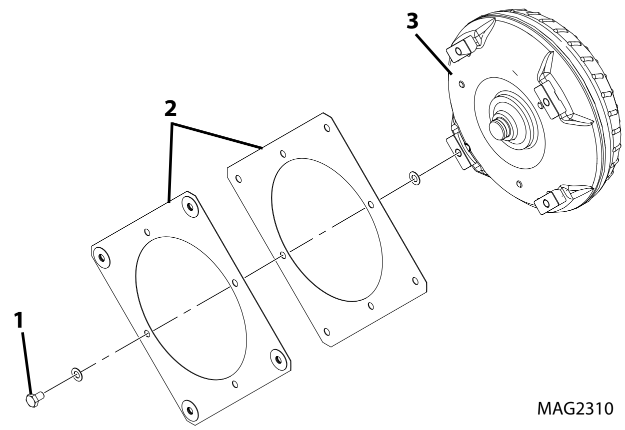
6.8 TORQUE CONVERTER DIAPHRAGM

6.8.1 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. Remove four bolts holding diaphragms to flywheel.
4. With the drive plate and torque converter removed, loosen and remove the four bolts (**1**) and eight lock washers holding the two diaphragm (**2**) to the torque converter (**3**).
5. Replace both diaphragms if damaged.

6.8.2 Torque Converter Diaphragm Installation

1. Install two new diaphragms on torque converter with previously removed bolts with 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

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

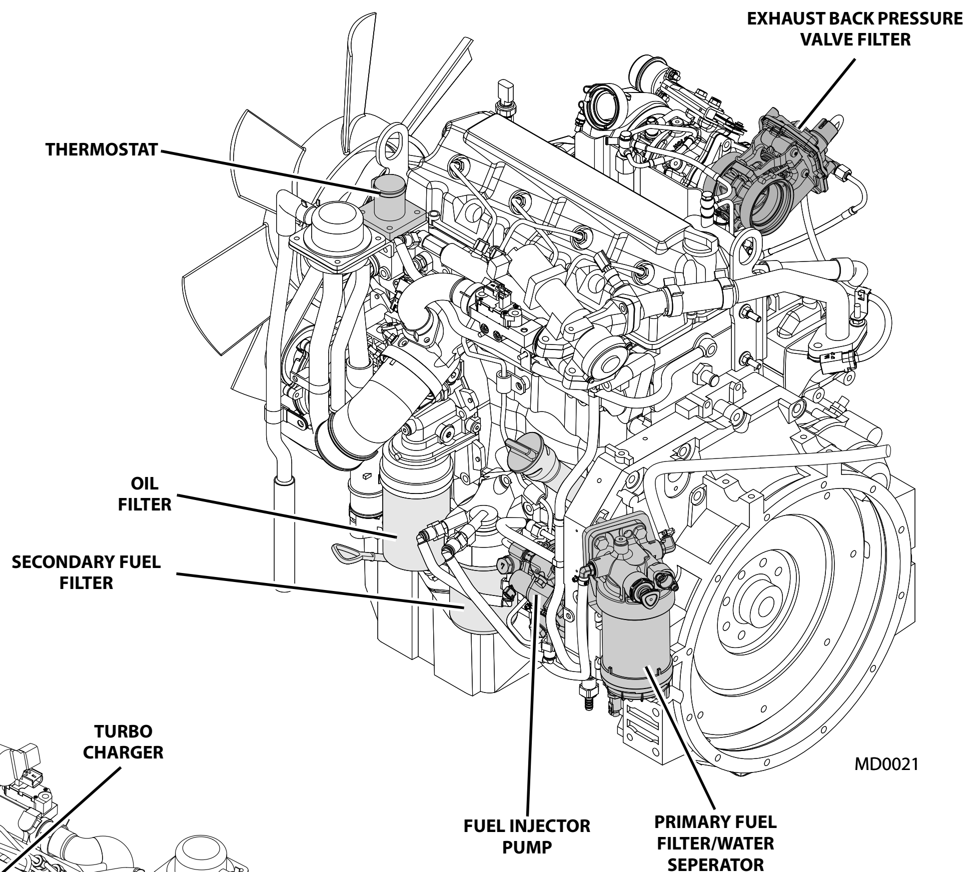
These instructions are written for worldwide use. In territories where legal requirements govern engine smoke emission, noise, safety factors, etc., apply all instructions, data and dimensions provided herein in such a way that after maintenance, service and repair of the engine, engine operation does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

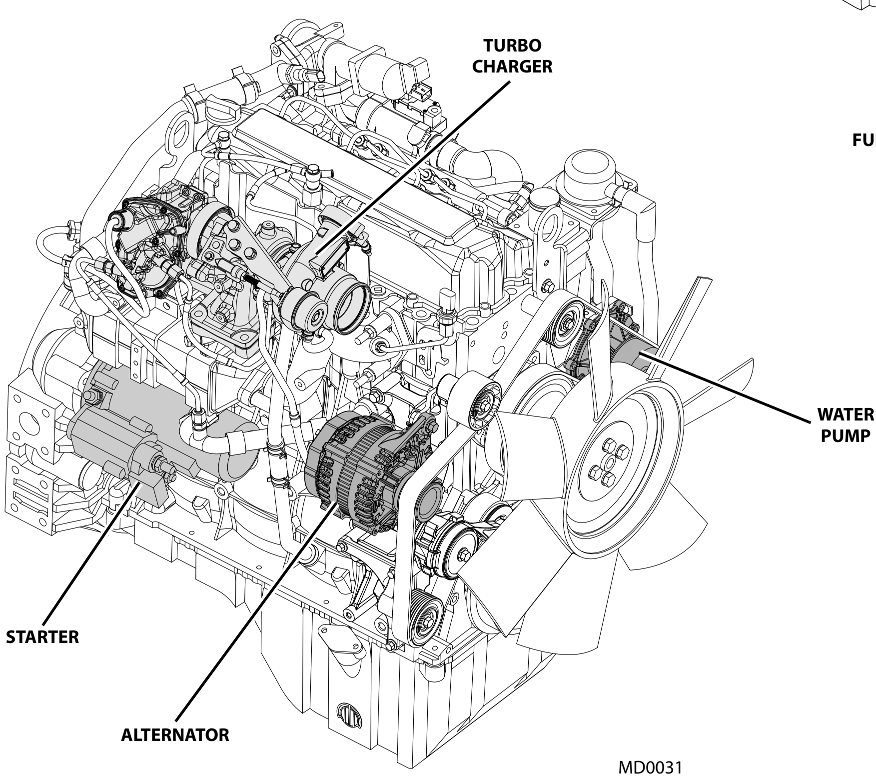
Note: *Detailed engine service instructions (covering disassembly, inspection, internal repair, assembly, adjustment and troubleshooting information) are provided in appropriate engine service manual. A gradual running-in (break-in) of a new engine is not necessary. Full load can be applied to a new 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

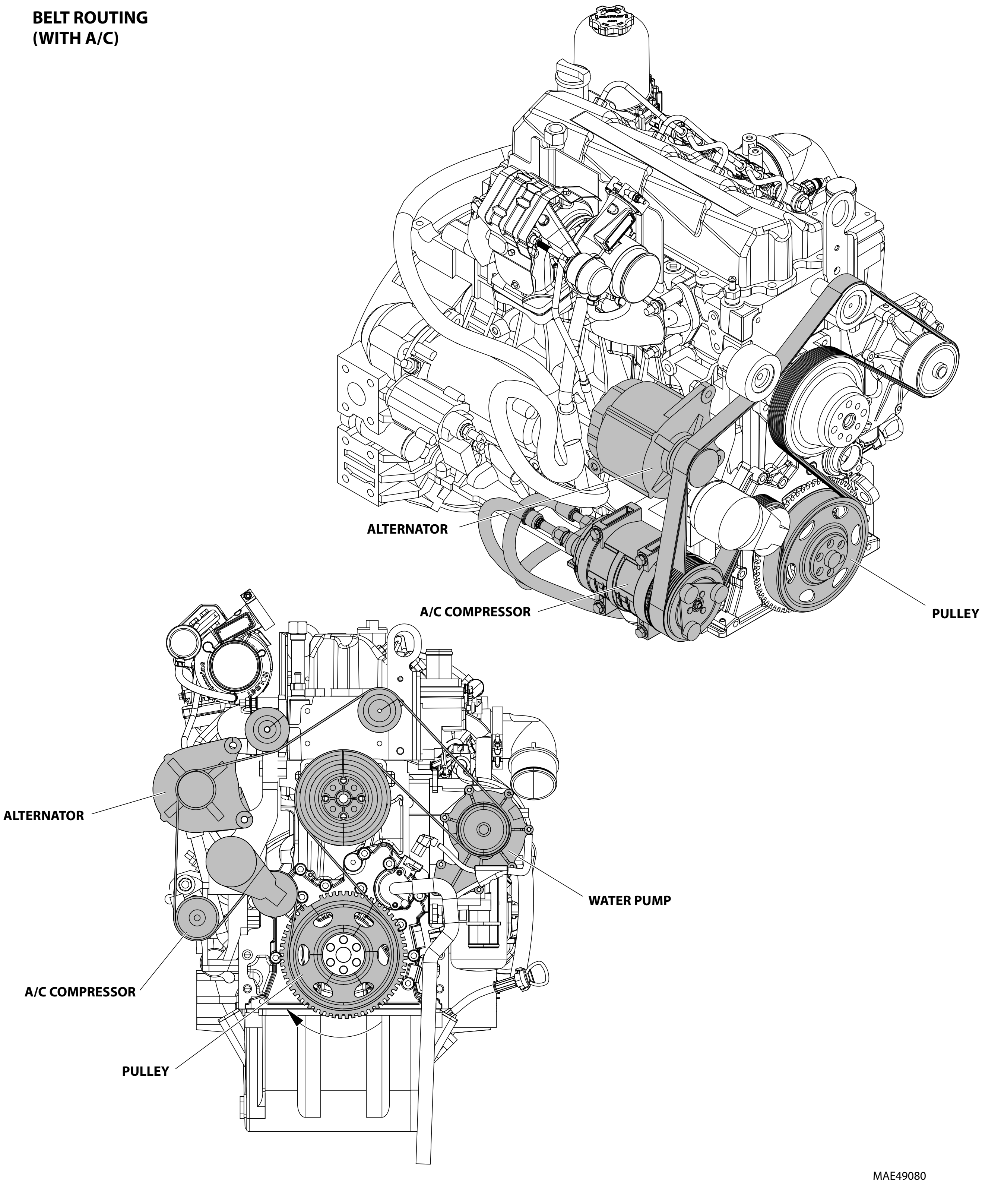
To understand the safety, operation and maintenance information presented in this section, it is necessary that the operator/mechanic be familiar with the names and locations of the engine components. The following illustration identifies the components that are referred to throughout this section.

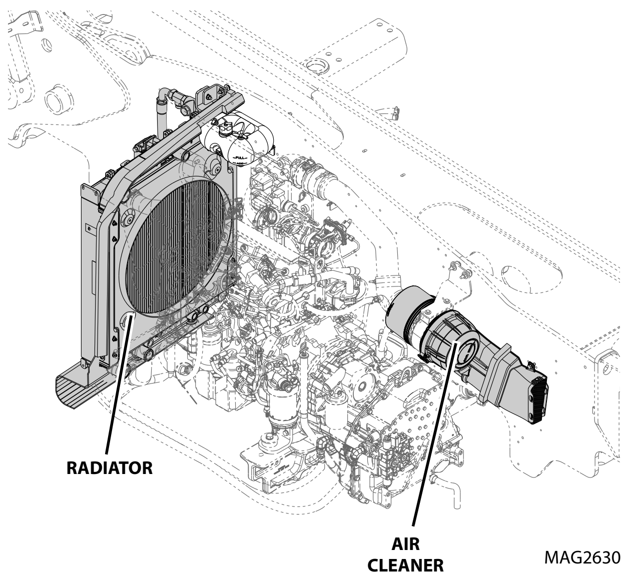
BELT ROUTING (WITHOUT A/C)



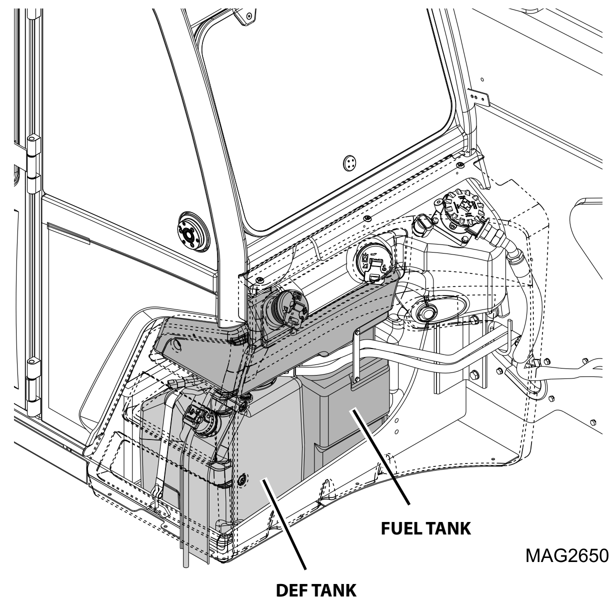


BELT ROUTING (WITH A/C)

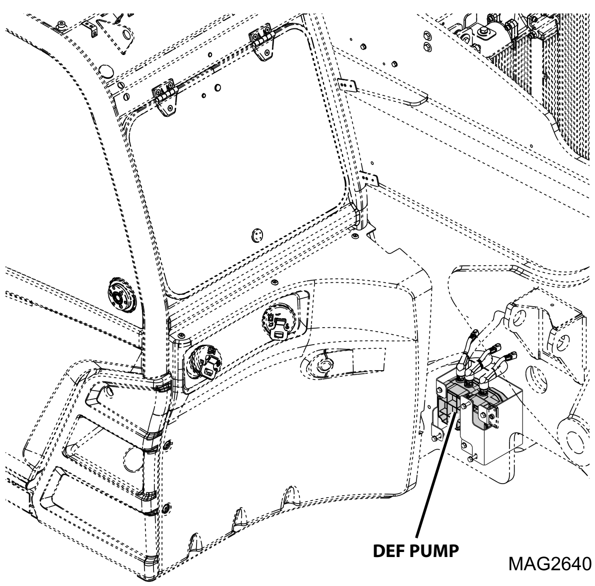




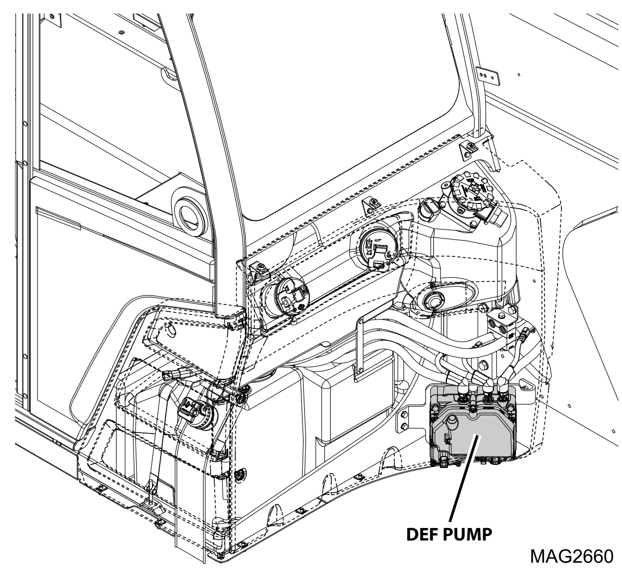
If equipped for ULS



943, 1043 (If equipped for ULS)



1055,1255 (If equipped for ULS)



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 9.20, “Engine Diagnostic”, for diagnostic codes and descriptions.

7.4 ENGINE COOLING SYSTEM

7.4.1 Surge Tank Cap

A 17.4 psi (1,2 bar) cap is used on the surge tank. An incorrect or malfunctioning cap can result in the loss of coolant and a hot running engine.

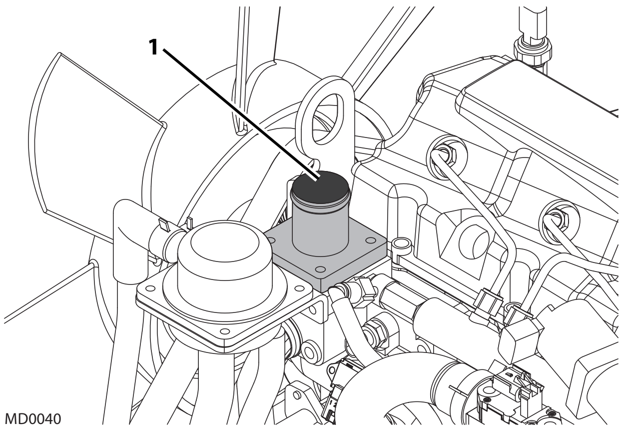
7.4.2 Thermostat Replacement

Before considering thermostat replacement, check the coolant level, fan 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 capscrews securing thermostat housing (**1**) to engine.
8. 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.
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.

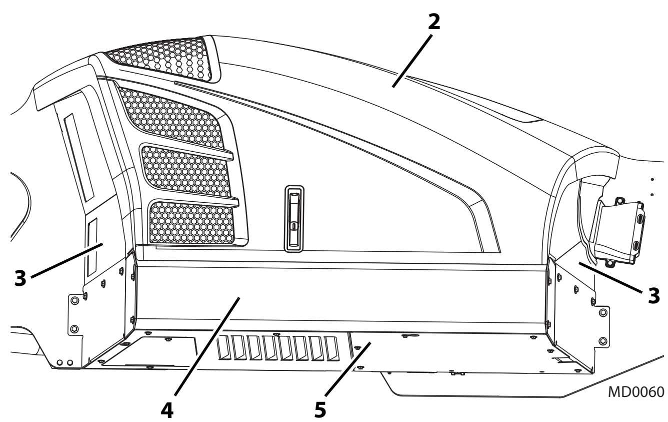
7.4.3 Radiator Assembly Replacement

Before considering radiator assembly replacement for other than obvious damage, conduct a cooling system pressure test check coolant specific gravity, coolant level, fan belt tension and dash panel 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.

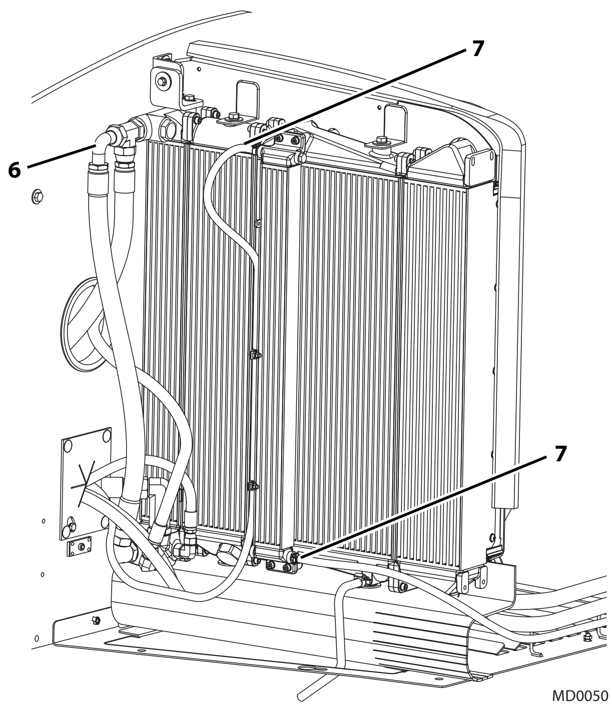
a. Radiator Assembly Removal

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.

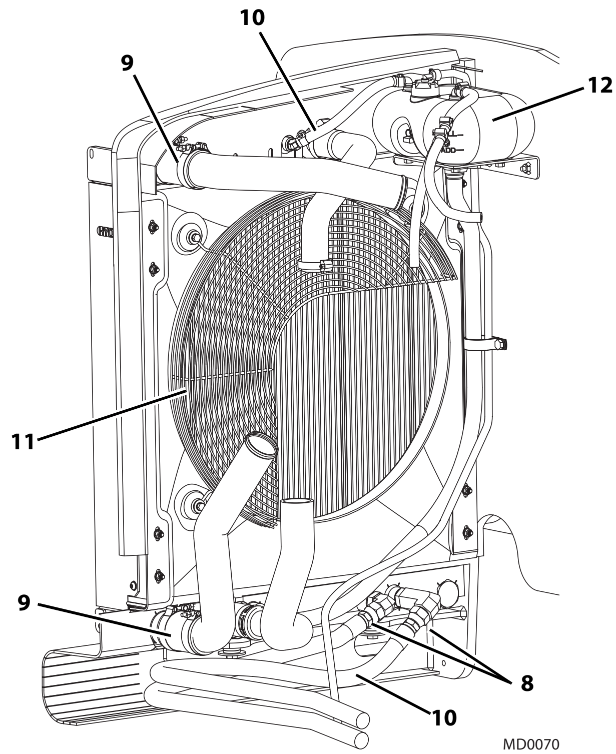


5. Remove hood (**2**), end cover (**3**), side skirt (**4**) and belly pan (**5**) from engine compartment.
6. Place a suitable receptacle under transmission drain plug. Remove transmission drain plug, and allow the transmission oil to drain into receptacle.
7. Transfer used transmission oil into a 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 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 (**6**). Cap all fittings and openings to prevent dirt and debris from entering hydraulic system.
13. Label and disconnect the fuel cooler hoses (**7**). Cap all fittings and openings to prevent dirt and debris from entering hydraulic system.



14. Label and disconnect both transmission cooler hoses (**8**). Cap all fittings and openings to prevent dirt and debris from entering hydraulic system.
15. Loosen and remove radiator assembly mounting bolts, washers and (if equipped) shims. Note the number of shims being used and there location.
16. Label, disconnect and cap hoses attached to surge tank (**12**). Remove surge tank and mounting plate.
17. Loosen and remove air intercooler tubes (**9**) from radiator assembly.
18. Loosen and remove the radiator hoses (**10**) from radiator assembly.
19. Remove bolts and washers attaching the fan guard (**11**). 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 (**11**) 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 Schematics”.

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.

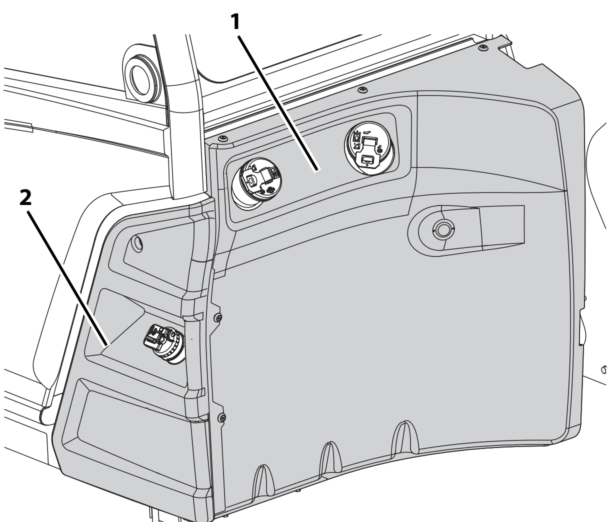
Refer to Section 2.3, “Fluid and Lubricant Capacities”, for approved fuel specification.

7.6.2 Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS)

The DEF tank is located at the rear of the cab below the fuel tank.

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.



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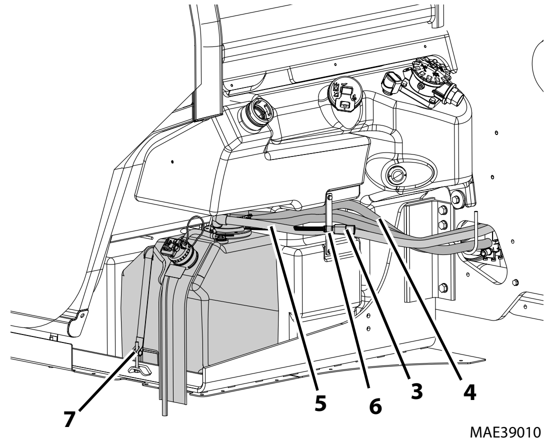
5. Remove the fuel tank/hydraulic reservoir access cover (**1**).
6. Remove DEF tank access cover (**2**).



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7. Thoroughly clean the DEF tank and surrounding area.
8. Disconnect electrical connection (**3**) on top of DEF tank.
9. Loosen clamps, label, disconnect and plug and/or cap DEF tank coolant hoses (**4**).
10. Label, disconnect and plug and/or cap DEF tank fluid hoses (**5**).
11. Remove DEF tank drain plug and transfer fluid into a suitable container. Dispose fluid at an approved recycling facility. Reinstall drain plug.
12. Remove the DEF hoses strap (**6**) from the fuel tank.
13. Remove straps (**7**) securing DEF tank to frame and remove DEF tank.

b. DEF Tank Inspection

1. If cleaning DEF tank, refer to Section 7.6.5, "Diesel Exhaust Fluid (DEF) System Cleaning (if equipped for ULS)", for procedure.
2. If replacing DEF tank, remove all components and retain for use on replacement tank. Refer to Section 7.6.3, a. "DEF Tank Header Removal".
3. Dispose of damaged DEF tank according to local regulations concerning hazardous material disposal.

c. DEF Tank Installation

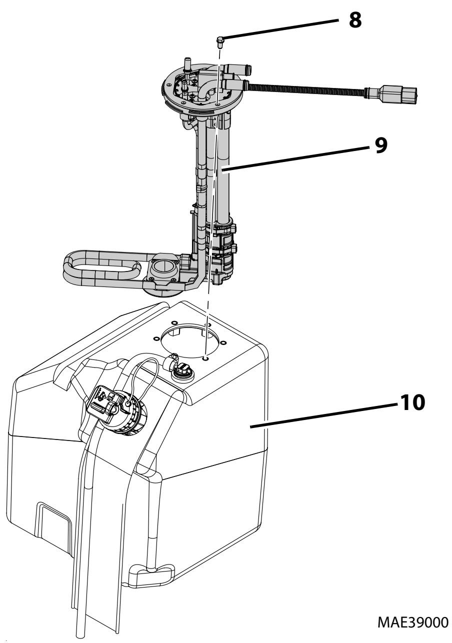
1. Install all previously removed components. Refer to Section 7.6.3, b. "DEF Tank Header Installation" for detailed header installation procedure.
2. Install DEF tank and secure to frame with the previously removed straps (**7**).
3. Remove plugs and/or caps from the previously labeled DEF tank fluid hoses (**5**) and connect to their appropriate locations.
4. Remove plugs and/or caps from the previously labeled DEF tank coolant hoses (**4**) and connect to their appropriate locations. Tighten clamps.
5. Connect electrical connection (**3**) on top of DEF tank.
6. Fill DEF tank according to specifications. Refer to Section 2.3, "Fluid and Lubricant Capacities".
7. Verify all DEF system hose connections are tight and secure from any sharp edges, moving parts and/or excessive heat.
8. Install the DEF hoses strap (**6**) to the fuel tank.
9. Install the fuel tank/hydraulic reservoir access cover (**1**).
10. Install the DEF tank access cover (**2**).
11. Properly connect battery. Refer Section 9.8, "Battery", for procedure.
12. Close and secure engine cover.
13. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.6.3 Diesel Exhaust Fluid (DEF) System Header (if equipped for ULS)

The header/filter of the DEF System is only required to be removed and the filter replaced when the system maintenance is required or is exposed to contamination. The header can be cleaned and reused when cleaning and/or replacing the DEF Tank.

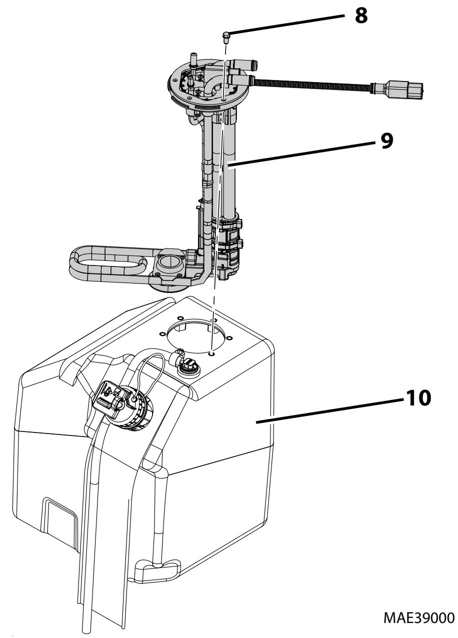
a. DEF Tank Header Removal

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



2. Loosen and remove six screws (**8**) securing header (**9**) to the DEF tank (**10**).
3. Remove the header (**9**) from the DEF tank. Note the orientation of the header for reassembly.

b. DEF Tank Header Installation



1. Install the header (**9**) into the DEF tank (**10**).

Note: *Verify the indent on the bottom of the header is located on the centering nub on the bottom of the DEF tank.*

2. Install and secure the header (**9**) with the previously removed hardware (**8**).
3. Refer to Section 7.6.2, "Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS)", for DEF tank installation.

7.6.4 Diesel Exhaust Fluid (DEF) Pump Filter (if equipped for ULS)

The pump filter of the DEF System is only required to be replaced when system maintenance is required or is exposed to contamination.

a. Pump Filter 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.

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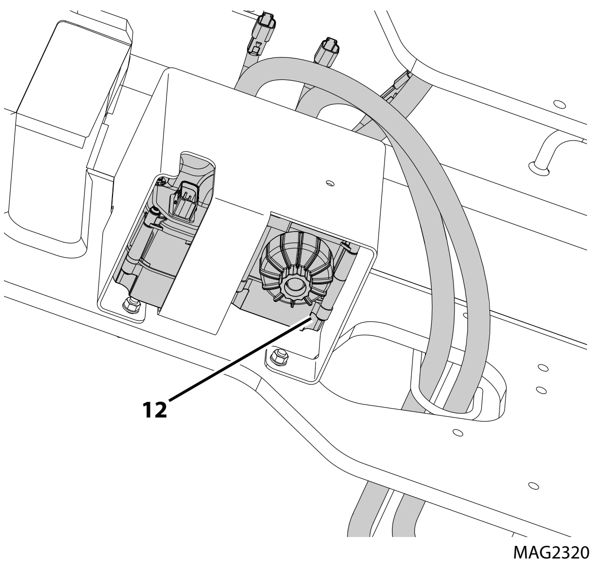

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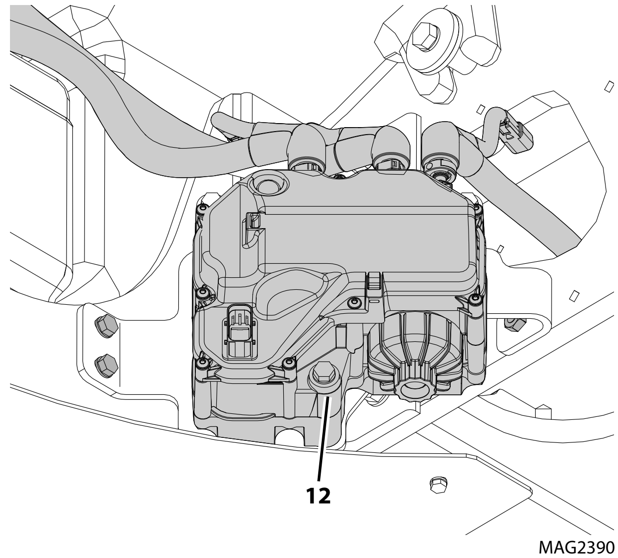

5. Thoroughly clean the DEF pump (**12**) and surrounding area.

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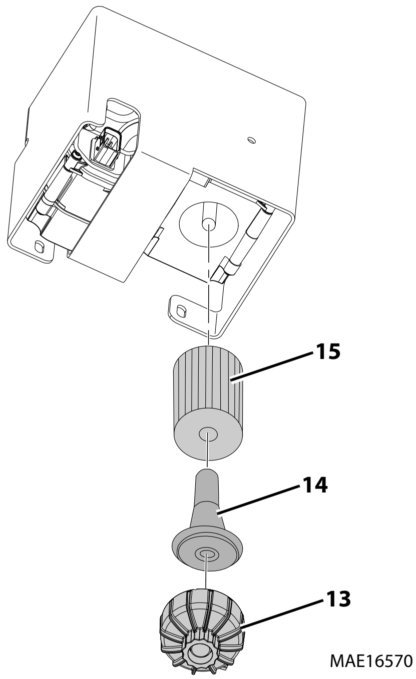

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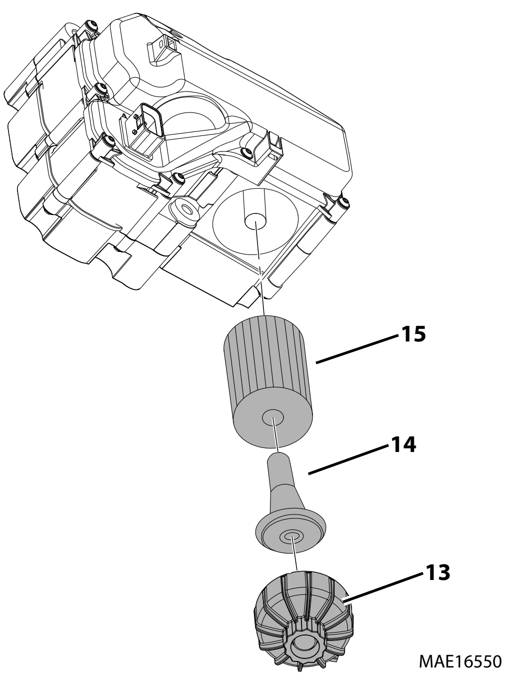
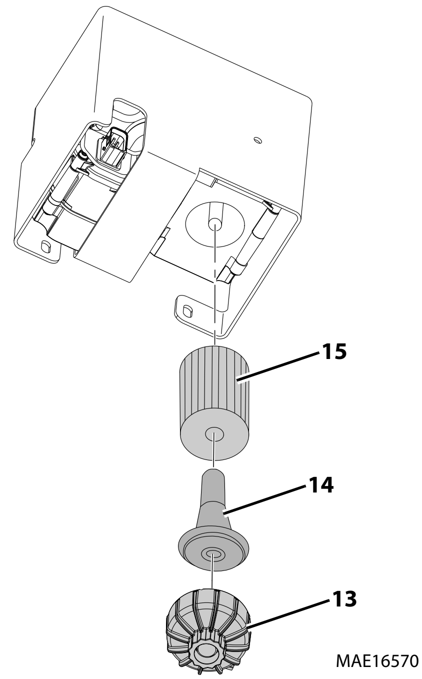


6. Remove the DEF pump filter cap (**13**), DEF seal assembly (**14**) and DEF pump filter (**15**). Discard the DEF pump filter (**15**).

b. Pump Filter Installation

943, 1043



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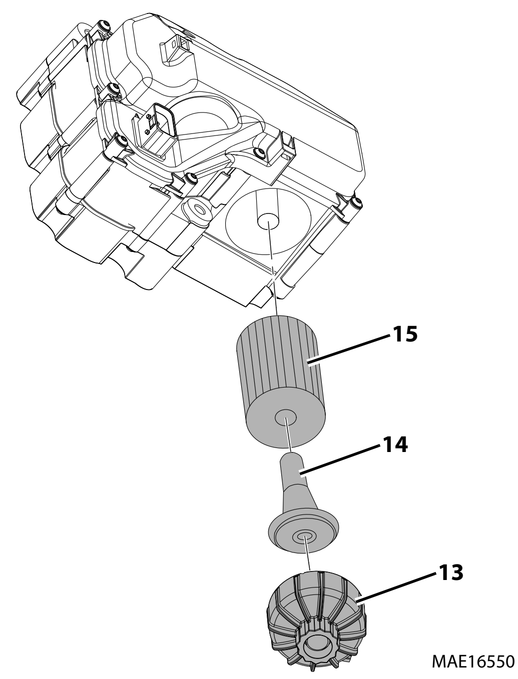


1. Wipe out the area around the filter housing.
2. Install new DEF pump filter (**15**), DEF seal assembly (**14**) and filter cap (**13**). Tighten as required.

3. Properly connect 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 steering wheel.

7.6.5 Diesel Exhaust Fluid (DEF) System Cleaning (if equipped for ULS)

Cleaning of the DEF System is only required when the system is exposed to contamination. If DEF quality is in question, obtain a sample from the DEF tank and place in a clear container. DEF should be crystal clear with a light ammonia smell. If the DEF appears cloudy, has a colored tint or has a strong ammonia smell, it is NOT likely to be within specifications.

Ensure the DEF solution is the correct specification. Cummins recommends using only DEF solutions that maintain 32.5% (+/- 1.5%) of urea content by weight. The urea content can be easily checked with a Refractometer (PN 70011925). The DEF solution must meet the requirements International Standard ISO 22241-1 for diesel engines. There is no acceptable substitute. For engines using Selective Catalytic Reduction (SCR) Systems, operating in the United States and Canada, DEF certified by the American Petroleum Institute (API) is recommended for use. DEF should be stored in sealed containers and at 23 - 77°F (-5 - 25°C). Avoid storing containers in direct sunlight to assure better shelf life.

a. DEF Tank Cleaning

1. Refer to Section 7.6.2, “Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS)”, for DEF tank removal.
2. Refer to Section 7.6.3, “Diesel Exhaust Fluid (DEF) System Header (if equipped for ULS)”, for header removal.
3. Remove the drain plug.
4. Thoroughly clean the DEF tank with de-ionized water.
5. Install and tighten drain plug.
6. Refer to Section 7.6.3, “Diesel Exhaust Fluid (DEF) System Header (if equipped for ULS)”, for filter and header installation.
7. Refer to Section 7.6.2, “Diesel Exhaust Fluid (DEF) Tank (if equipped for ULS)”, for DEF tank installation.

b. DEF Pump Cleaning

1. Refer to Section 7.6.4, “Diesel Exhaust Fluid (DEF) Pump Filter (if equipped for ULS)”, for DEF pump filter cleaning procedure.

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.*

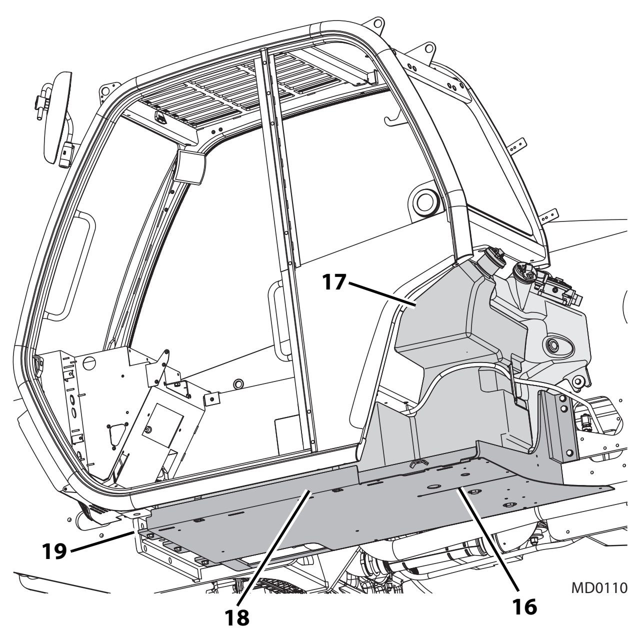
a. Fuel Tank Removal

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.*

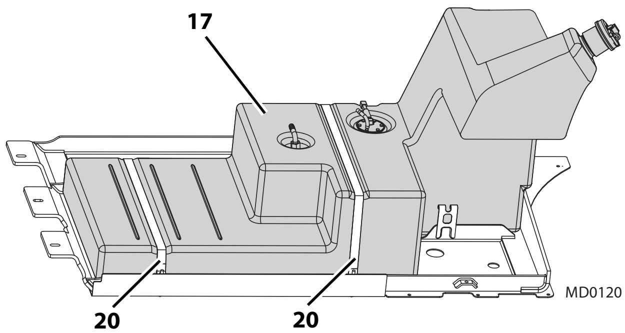
Note: *Have a dry chemical (Class B) fire extinguisher near the work area.*

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



6. Remove drain plug (**16**) from fuel tank (**17**) 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 (**18**) with a floor jack or suitable supports.

9. Remove hardware (**19**) 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 straps (**20**) securing fuel tank (**17**) 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 of 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 of fuel properly.
3. Clean fuel tank with a high pressure washer, or flush tank with hot water for five minutes and drain water. Dispose of 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

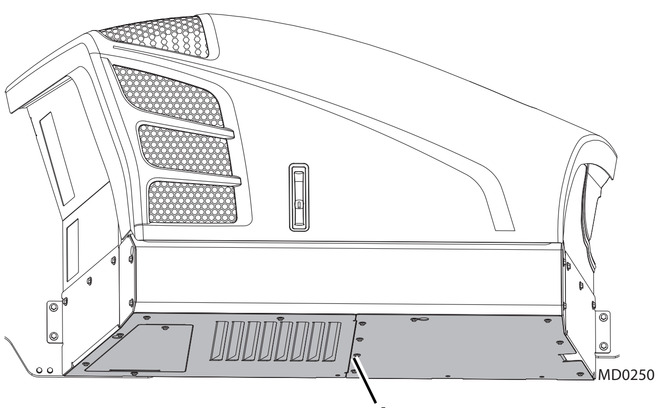
Note: *Emission Sensitive Exhaust. Assembly must be replaced exactly as removed. Contact your local JLG dealer before removing the muffler system.*

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 (110hp (82kW) or 130hp (97kW))

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**).

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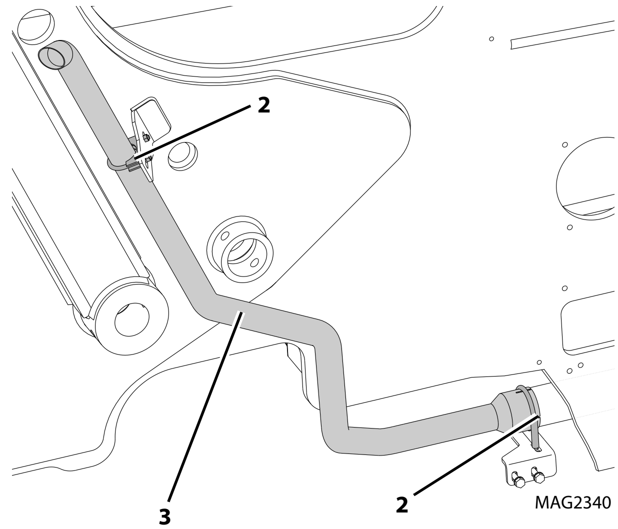

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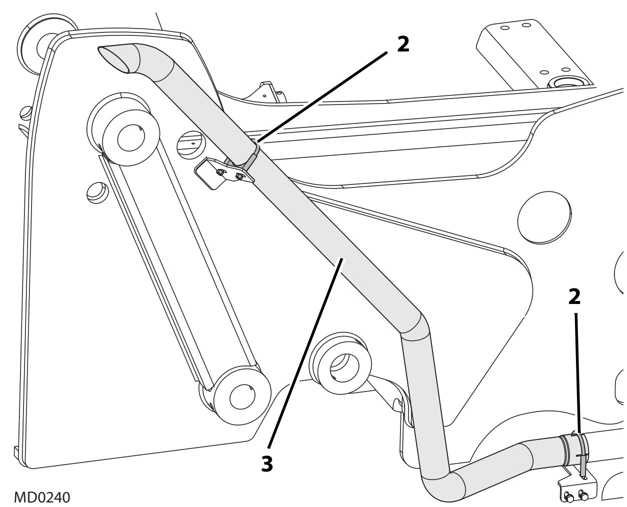
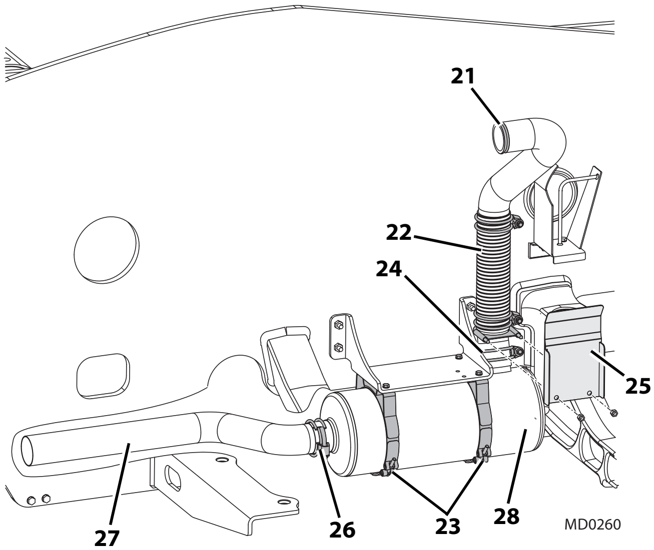
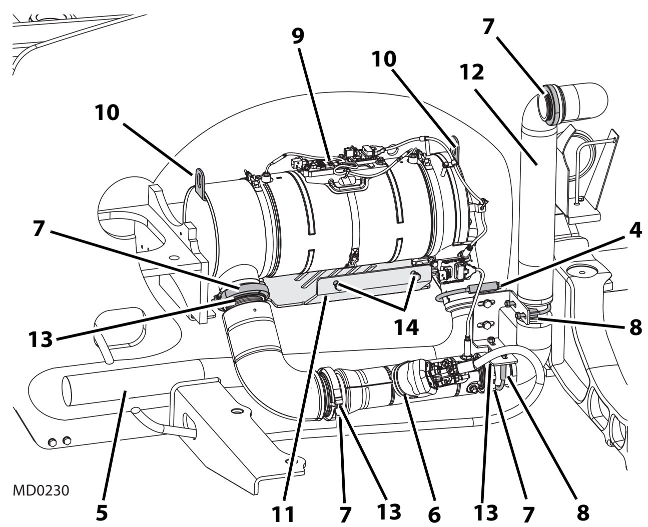


6. Loosen and remove clamps (**2**) at tail pipe (**3**).
7. Remove tail pipe (**3**).

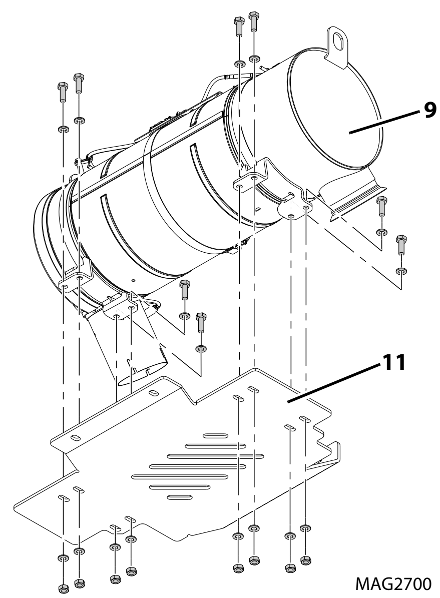




8. Loosen and remove exhaust pipe clamp (**4**) and exhaust pipe (**5**).
9. Label and disconnect all connections to the decomposition reaction tube (DRT) assembly (**6**).
10. Loosen and remove V-clamps (**7**) and gaskets (**13**) from the DRT (**6**) assembly. Remove DRT. Discard the V-clamps and gaskets.
11. Loosen and remove V-clamp (**7**) and clamps (**8**) from the flex pipe assembly (**12**). Remove flex pipe assembly.

Note: *Replace insulation on the flex pipe assembly (**12**) if damaged.*

12. Label and disconnect all connections to the selective catalytic reduction unit (SCR) assembly (**9**).
13. Disconnect the drive shaft from transmission for clearance.
14. Support the SCR assembly with proper lifting device.
15. Remove the four bolts (**14**) securing the SCR assembly to frame and carefully lower the SCR assembly from the machine.



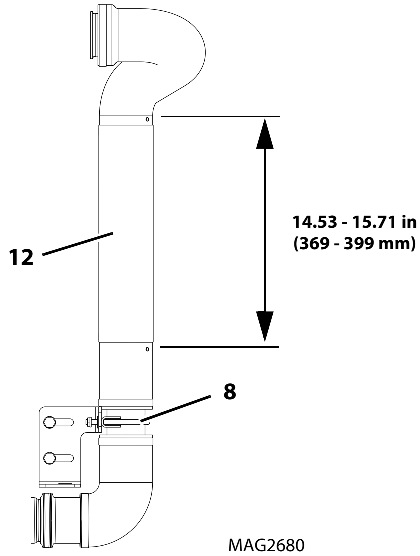
16. Remove the SCR assembly (**9**) from the mounting bracket (**11**).

b. Installation

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

Note: *V-clamps (**7**) and gasket (**13**) MUST be replaced if the SCR assembly is removed from the machine.*

1. Install mounting bracket (**11**) to SCR assembly.
2. Support the SCR assembly with proper lifting device.
3. Raise the SCR assembly into place and secure with the previously removed hardware. Remove the lifting device.
4. Connect all connections to the SCR assembly (**9**).

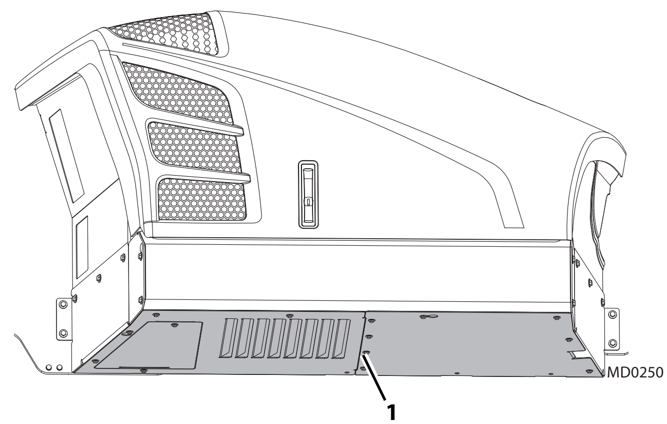


5. Install the flex pipe assembly (**12**) as follows:
    a. Loosely install the upper end of flex pipe to turbo charger with new V-clamp (**7**).
    b. Loosely install the lower end of flex pipe to bracket and secure with clamps (**8**).
    c. Measure to ensure the flex length between the center of pins is in range of 14.53 - 15.71 in (369 - 399 mm).
    d. Torque clamp (**7**) to 9 - 11 lb-ft (12 - 15 Nm).
    e. Torque clamps (**8**) to 8 - 9.5 lb-ft (11 - 13 Nm).
6. Install the decomposition reaction tube (**6**) as follows:
    a. Loosely clamp DRT (**6**) to SCR (**9**) elbow.
    b. Loosely install the DRT assembly to down pipe of flex pipe (**12**) with new V-clamps (**7**) and gaskets (**13**).
    c. Ensure the NOX sensor is oriented vertical +/-10 degree pointing up.
    d. Torque clamps (**7**) to 9 - 11 lb-ft (12 - 15 Nm).
7. Connect all connections to the DRT (**6**).
8. Install the exhaust pipe (**5**) and secure with the previously removed clamp (**4**). Do Not tighten.
9. Install the tail pipe (**3**) to the exhaust pipe (**5**) and secure to frame with previously used clamps (**2**). Do Not Tighten.
10. Torque clamps (**2** & **4**) to 8 - 9.5 lb-ft (11 - 13 Nm).
11. Connect the drive shaft to the transmission.
12. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
13. Start engine and check for exhaust leaks at all exhaust connections. Adjust or repair as needed.
14. Install belly pan.
15. Close and secure engine cover.
16. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.7.2 If equipped for ULS 74hp (55kW)

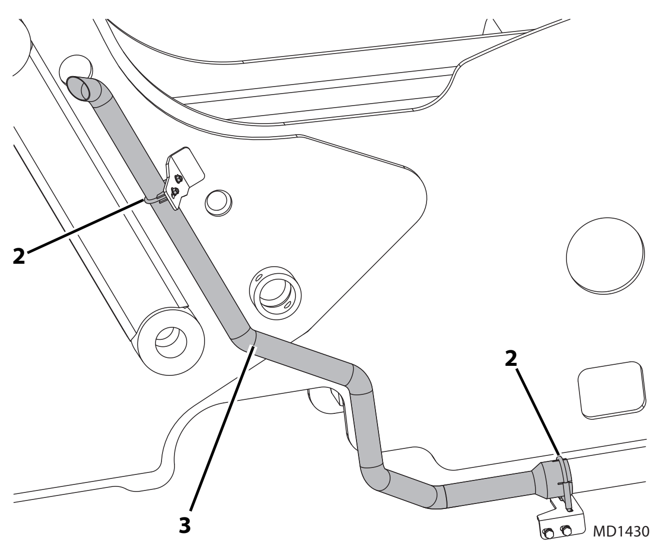
a. Removal

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.



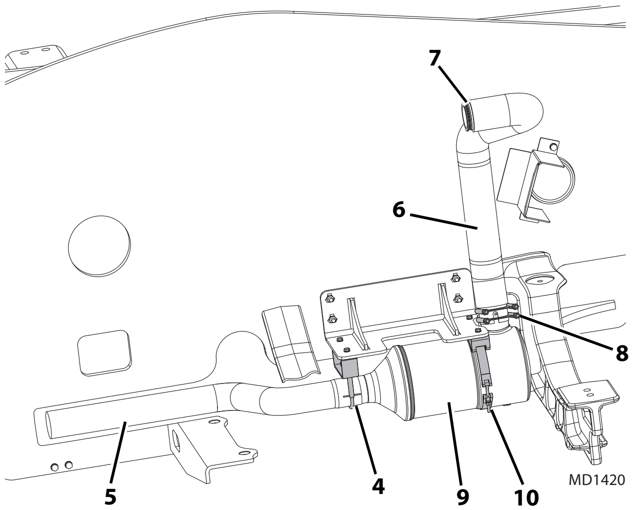
5. Remove belly pans (**1**).

742, 943



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

742, 943



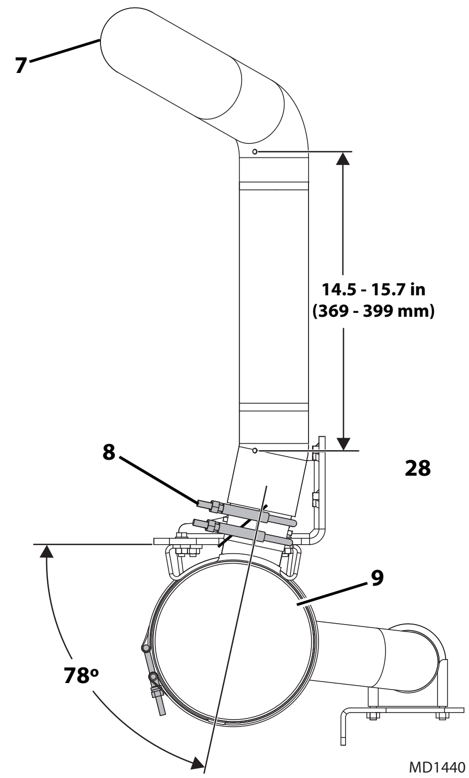
8. Loosen and remove exhaust pipe clamp (**4**).
9. Remove exhaust pipe (**5**).
10. Loosen and remove flex pipe assembly insulation (**6**).
11. Loosen and remove V-clamp (**7**) securing flex pipe assembly to the turbo charger.
12. Loosen and remove clamps (**8**) securing flex pipe assembly to muffler (**9**). Remove flex pipe assembly.
13. Remove hardware (**10**) securing muffler (**9**) to frame.
14. Carefully lower muffler (**9**) from machine.

b. Installation

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

1. Install muffler (**9**) and secure with hardware (**4** & **10**) removed earlier. Do not tighten hangar or clamp.

742, 943

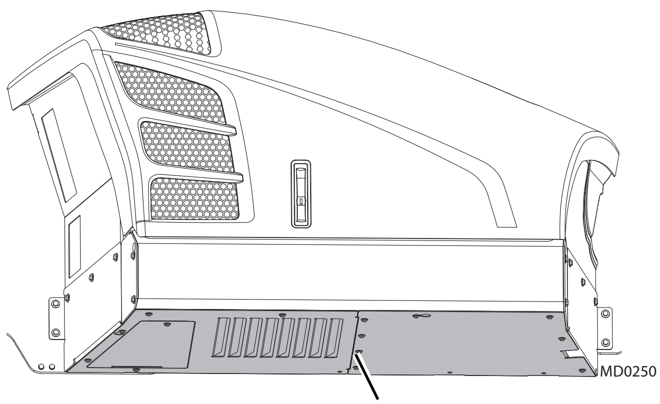


2. Orient muffler (**9**) to approximately 78º as shown above. Tighten hanger (**10**) and torque as required.
3. Install flex pipe assembly as follows:
   a. Loosely install the upper end of flex pipe assembly to turbo charger with new V-clamp (**7**).
   b. Loosely install the lower end of flex pipe to muffler (**9**) and secure with clamps (**8**). Do Not tighten.
   c. Measure to ensure the flex length between the center of pins is in range of 14.5 - 15.7 in (369 - 399 mm).
   d. Torque clamp (**7**) to 9 - 11 lb-ft (12 - 15 Nm).
   e. Torque clamps (**8**) to 8 - 9.5 lb-ft (11 - 13 Nm).
4. Install exhaust pipe (**5**) to muffler (**9**) with clamp (**4**). Do Not Tighten.
5. Install the tail pipe segment (**2**) to the exhaust pipe (**5**) with clamp (**2**) and secure to frame on existing bracket. Do Not Tighten.
6. Adjust the tail pipe, exhaust pipe and muffler for proper clearance then tighten all remaining clamps.
7. Install and secure flex pipe assembly insulation (**6**).

7.7.3 If Equipped for LS (110hp (82kW) or 130hp (97kW))

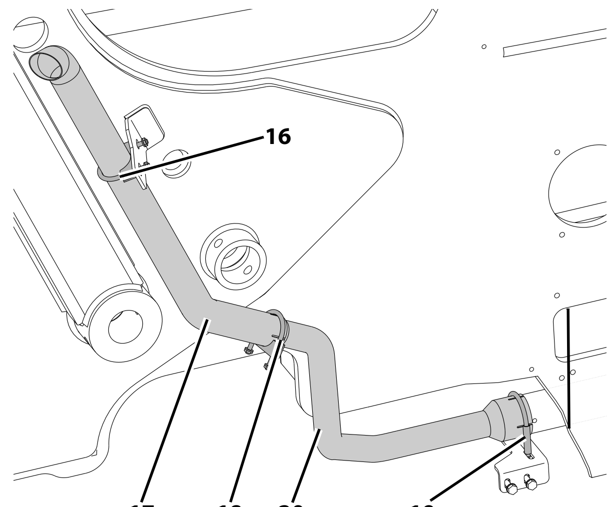
a. Removal

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.

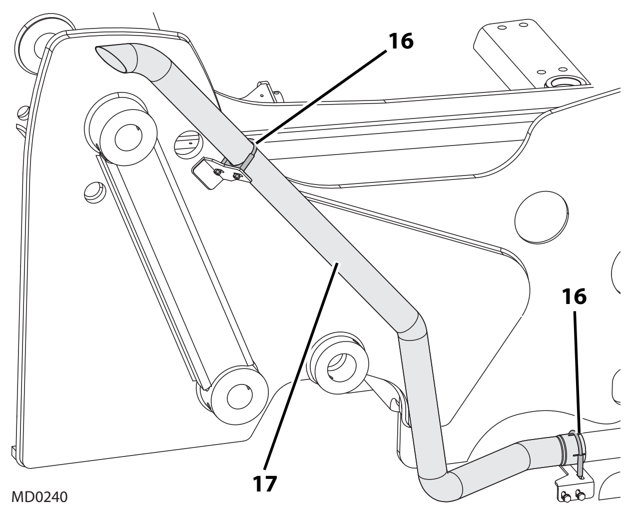


5. Remove belly pan (**15**).

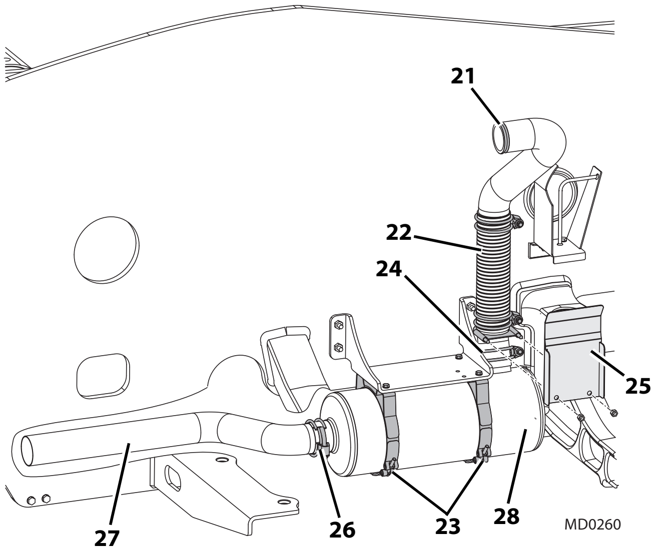
943, 1043



1055, 1255



6. **943, 1043:**
   a. Loosen and remove clamps (**16** & **18**) at tail pipe end segment (**17**).
   b. Remove tail pipe segment (**17**).
   c. Loosen and remove clamps (**19**) at tail pipe segment (**20**).
   d. Remove tail pipe segment (**20**).
7. **1055, 1255:**
   a. Loosen and remove clamps (**16**) at tail pipe (**17**).
   b. Remove tail pipe (**17**).

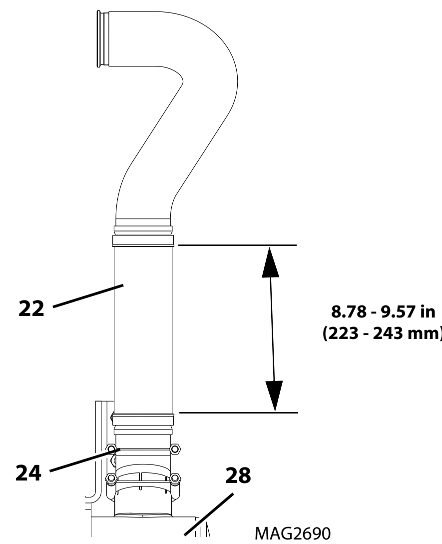


8. Loosen and remove exhaust pipe heat shield (**25**).
9. Loosen and remove exhaust pipe clamp (**26**).
10. Remove exhaust pipe (**27**).
11. Loosen and remove V-clamp (**21**) securing flex pipe assembly (**22**).
12. Remove hardware (**23**) securing muffler (**28**) to frame.
13. Carefully lower muffler (**28**) from machine.
14. Loosen and remove clamp (**24**) securing flex pipe assembly (**22**) to muffler.
15. Remove flex pipe assembly (**22**).

b. Installation

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

1. Install muffler (**28**) and secure with hardware (**23**) removed earlier. Do not tighten hangars.



2. Install flex pipe assembly (**22**) as follows:
   a. Loosely install the upper end of flex pipe assembly (**22**) to turbo charger with new V-clamp (**21**).
   b. Loosely install the lower end of flex pipe to muffler (**28**) and secure with clamp (**24**). Do Not tighten.
   c. Measure to ensure the flex length between the center of pins is in range of 8.78 - 9.57 in (223 - 243 mm).
   d. Torque clamp (**21**) to 9 - 11 lb-ft (12 - 15 Nm).
   e. Torque clamps (**24**) to 8 - 9.5 lb-ft (11 - 13 Nm).
3. Install exhaust pipe (**27**) to muffler (**28**) with clamp (**26**). Do Not Tighten.

4. **943, 1043:**
   a. Install the tail pipe segment (**20**) to the exhaust pipe (**27**) with clamp (**19**) and secure to frame on existing bracket. Do Not Tighten.
   b. Install the tail pipe segment (**17**) to the tail pipe segment (**20**) with clamp (**19**) and secure to frame with clamp (**16**). Do Not Tighten.
5. **1055, 1255:** Install the tail pipe (**17**) to the exhaust pipe (**27**) and secure to frame with clamps (**16**). Do Not Tighten.
6. Secure exhaust pipe to engine with V-band clamp (**21**). Do Not Tighten.
7. Adjust the muffler (**28**), tail and exhaust pipes for proper clearance then tighten all clamps.
8. **943, 1043:** Torque clamps (**16, 18, 19** and **26**) to 8 - 9.5 lb-ft (11 - 13 Nm).
9. **1055, 1255:** Torque clamps (**16** and **26**) to 8 - 9.5 lb-ft (11 - 13 Nm).
10. Properly connect battery. Refer Section 9.8, “Battery”, for procedure.
11. Start engine and check for exhaust leaks at all exhaust connections. Adjust or repair as needed.
12. Install belly pan.
13. Close and secure engine cover.
14. Remove Do Not Operate Tag from ignition key switch and steering wheel.

7.8 AIR CLEANER ASSEMBLY

NOTICE

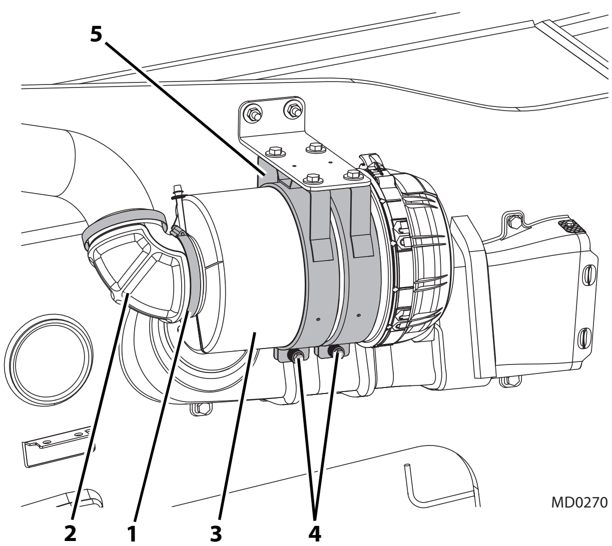
NEVER run the engine with only the inner safety element installed.

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

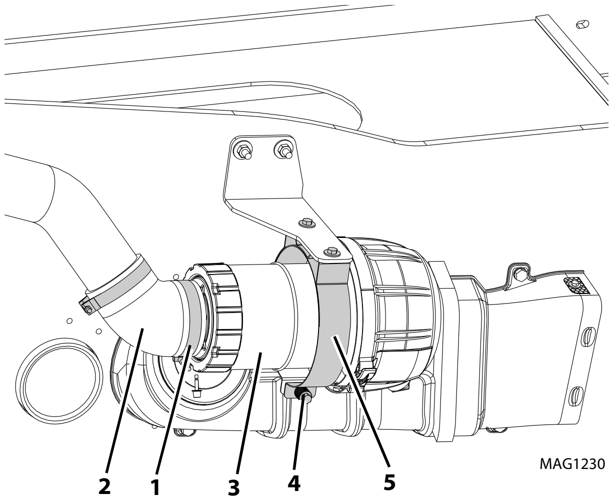
7.8.1 Air Cleaner Assembly Removal

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.

If Equipped with engine 110 HP (82 kW) and 130 HP (97 kW)



If Equipped with engine 74 HP (55 kW)



5. Disconnect all electrical connections.
6. Loosen and remove clamp (**1**) securing air intake tube (**2**) to air cleaner (**3**). Pull air intake elbow off air cleaner.
7. Remove bolts (**4**) securing air cleaner straps (**5**) to air cleaner (**3**). Remove air cleaner assembly.

7.8.2 Air Cleaner Assembly Installation

1. Install the air cleaner assembly (**3**) to the air cleaner mounting plate and secure with the previously used hardware.
2. Place the loosened clamp (**1**) over the air intake elbow (**2**) and install elbow on the air cleaner assembly. Tighten clamp.
3. Reconnect all electrical connections.
4. Properly connect 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.

7.9 ENGINE REPLACEMENT

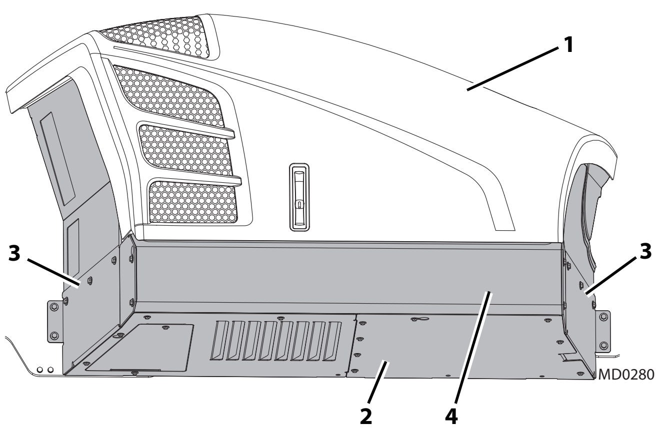
WARNING

Use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 2000 lb (907 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.*

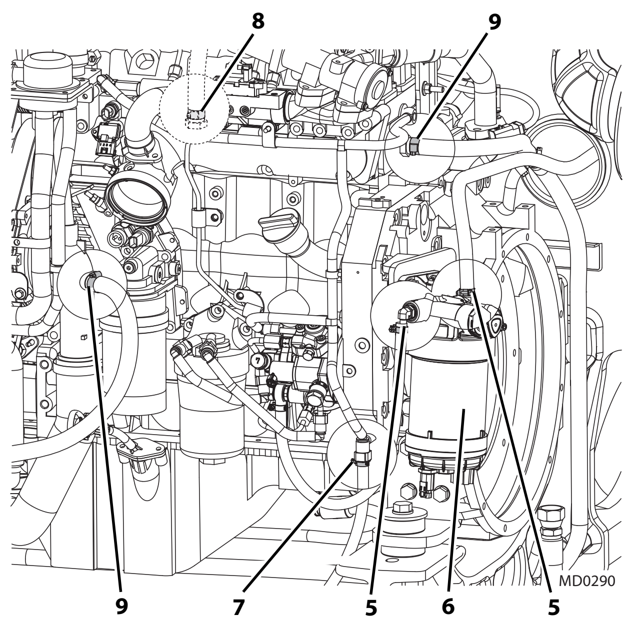
1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage park brake, and shut engine OFF.
2. Place a Do Not Operate Tag on both ignition key switch and steering wheel.
3. Open engine cover. Allow system fluids to cool.
4. Properly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



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 , "", for detailed instructions.
8. Properly drain transmission. Refer to Section 6.1, "Transmission Assembly Component Terminology", 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.*

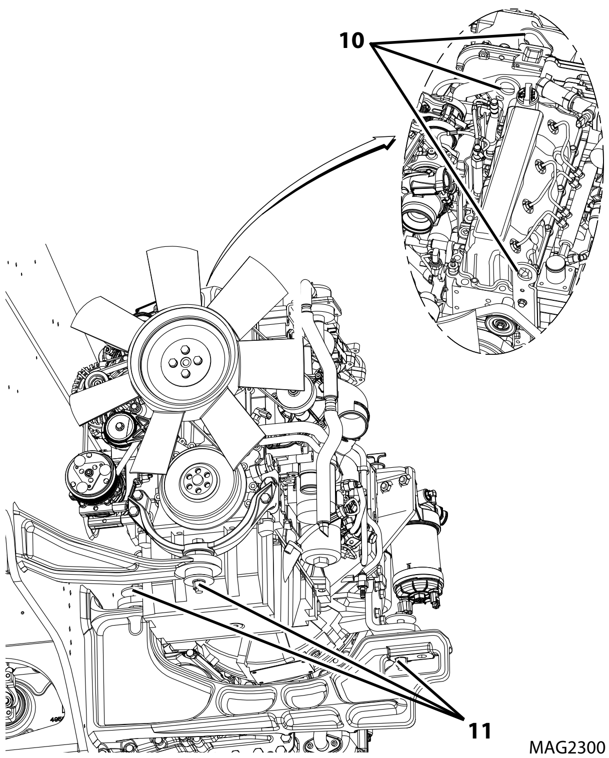
10. Label and disconnect all electrical wire connections on engine/transmission.



11. Disconnect and cap the fuel inlet lines (**5**).
12. Loosen and remove three fuel filter bracket bolts and fuel filter assembly (**6**).
13. Disconnect and cap the fuel return line (**7**) located near rear engine mount.
14. Label and remove all clamps securing any fuel line on engine.
15. **If equipped:** Remove the heater hoses (**8**) and DEF tank cooling hoses (**9**) attached to the engine.
16. 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.*

17. Remove air cleaner assembly. Refer to Section 7.8, "Air Cleaner Assembly".
18. Remove drive shaft assemblies. Refer to Section 5.8, "Drive Shafts".



19. Secure engine with a lifting strap or chain from appropriate lifting points (**10**). Use a suitable hoist or overhead crane.
20. Loosen and remove three engine/transmission mounting bolts (**11**).
21. Slightly lift and pull engine/transmission out of machine. Have an assistant ensure that engine/transmission clears all frame components during removal.
22. 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

Use a suitable hoist or overhead crane and sling with a minimum lifting capacity of 2000 lb (907 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 2.8.1, "Definitions", 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 chains.
9. Torque engine /transmission mounting bolts (**11**) 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, "Engine Exhaust System".
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

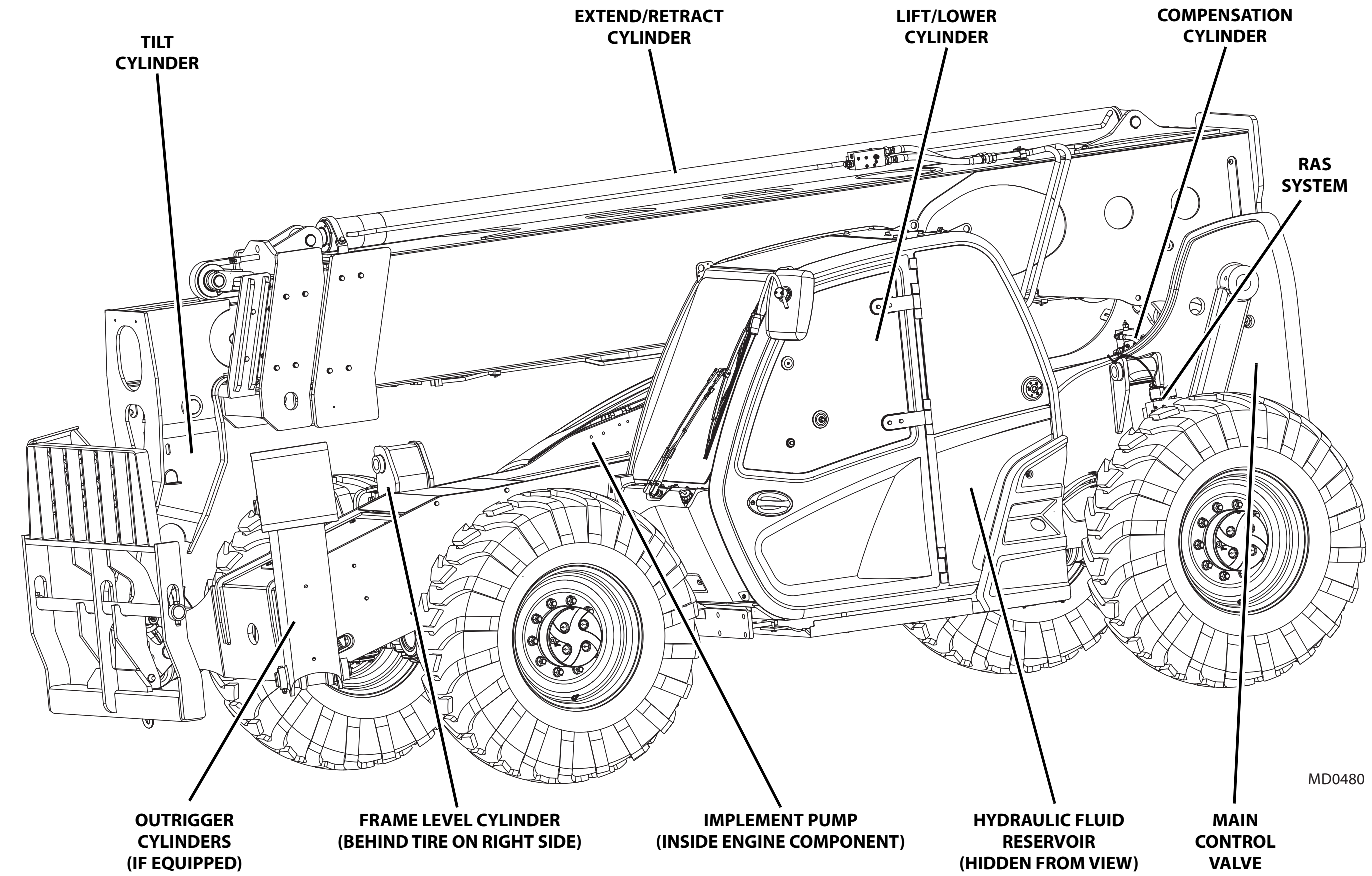
Refer to Section 7.3, “Specifications and Maintenance Information”, for detailed engine service information.

Section 8
Hydraulic System

Contents

8.1 HYDRAULIC COMPONENT TERMINOLOGY

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



8.2 SAFETY INFORMATION

⚠ WARNING

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

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.

Manufacturer’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.*

Refer to Section 2.4, “Service and Maintenance Schedules”, for the appropria312te 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 Schematics”, in this manual.

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 . 8.3, “Specifications”, for the correct pressure rating.

b. Adjusting Maximum Hydraulic Pressure

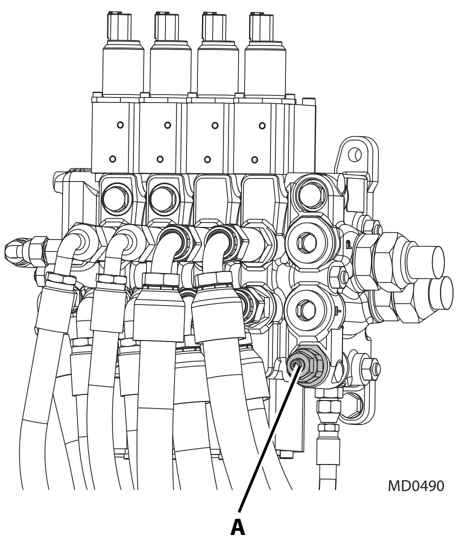
1. Shut the machine off.
2. Start the machine and loosen the jam nut on the relief. Turn the relief clockwise to increase pressure or counter-clockwise to decrease pressure. Set to the correct pressure.
3. Tighten the jam nut and recheck the pressure. If the reading is within specification, shut the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

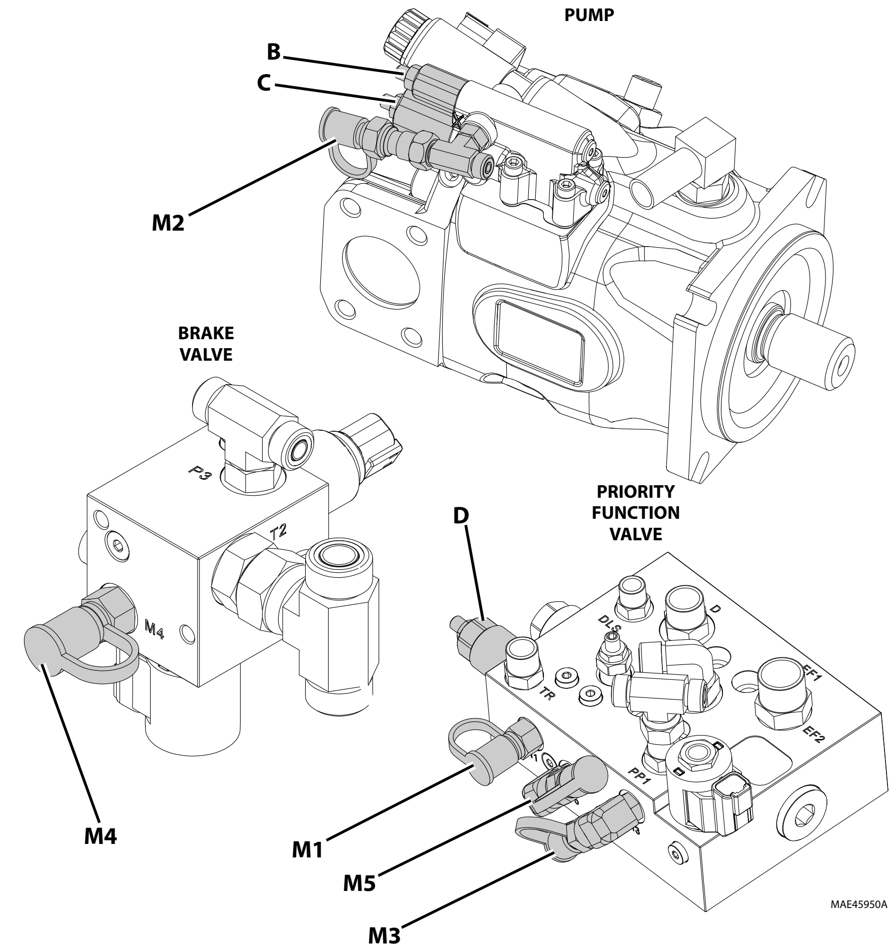
***Note: DO NOT** operate any other function while checking steering pressure.*

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

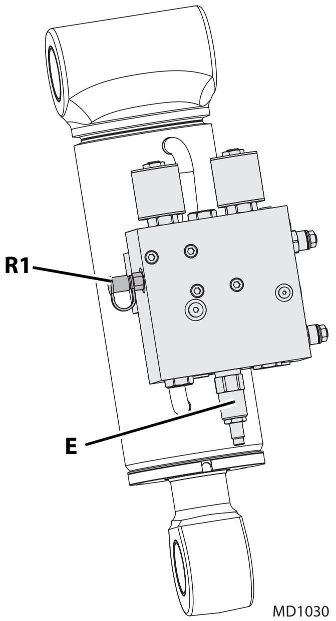
c. Pressure Specifications - 742 74 hp (55 kW)

MAIN CONTROL VALVE





RAS VALVE

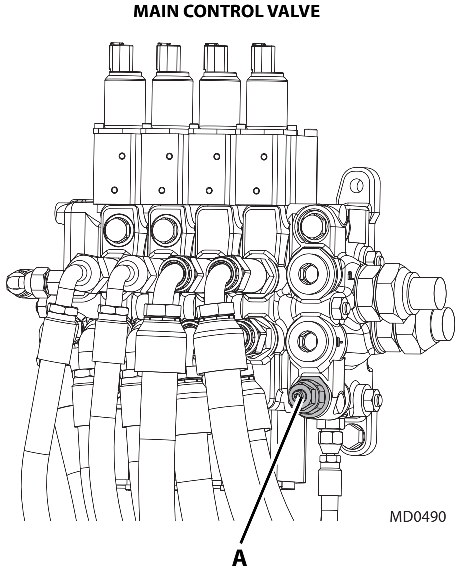


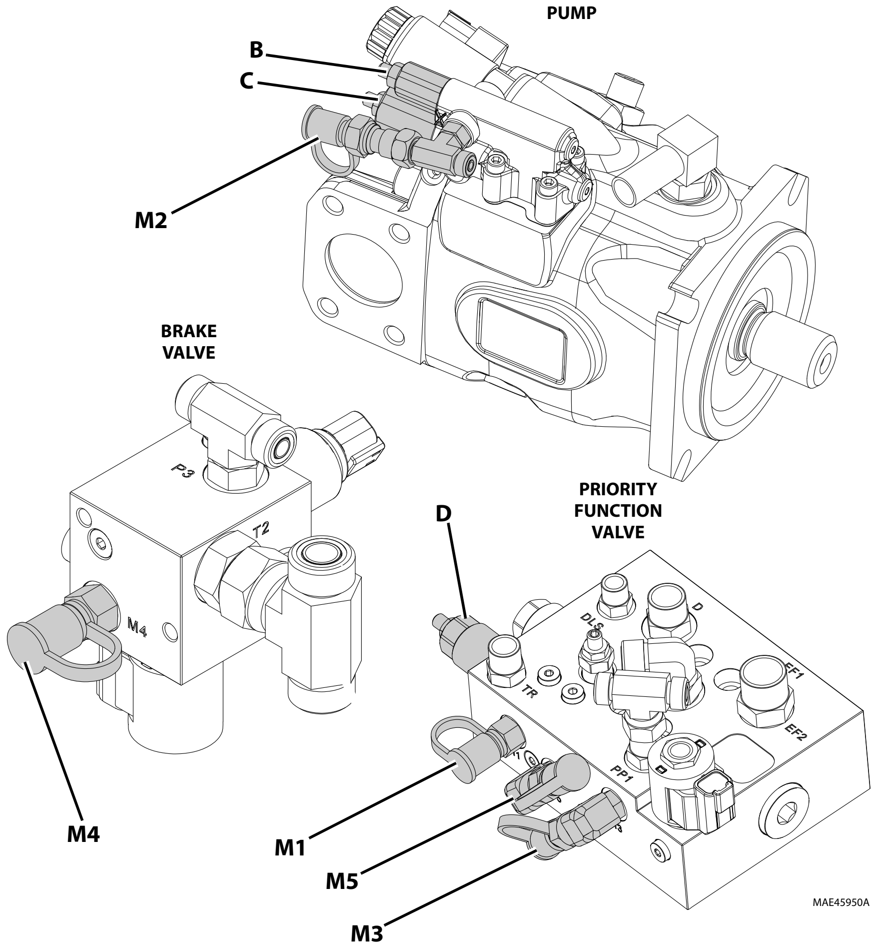
Note: *All pressures must be checked in numerical order.*

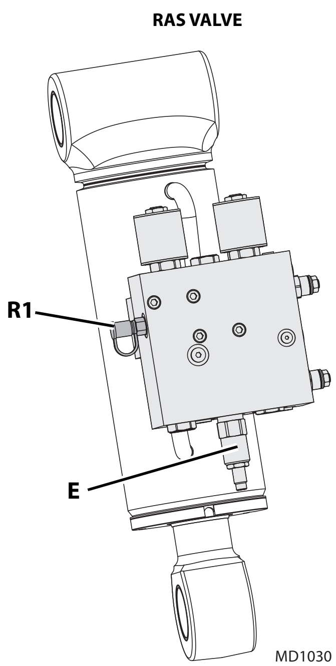
	Hydraulic Circuit	Test Port	Procedure	Adjustment Location	Range/Nominal Pressure	Notes
1	Pilot	**M3**	Connect gauge to M3 port, run engine at low idle, Turn Park Brake Off.	P(**D**)	377-435 psi (26- 30bar) **406 psi (28 bar)**	Park Brake - OFF
2	Standby (1)	**M1**	Connect gauge to M1 port, run engine at low idle, no function.	P(**B**)	493-537 psi (34-37 bar) **515 psi (35.5 bar)**	Park Brake - ON
3	Load Sense	**M2**	Connect gauge to M2 port, run engine at low idle, no function.	NA	203 - 218 psi (14-15 bar) **210 psi (14.5 bar)**	Park Brake - ON
4	Margin		(1) Standby Pressure, subtract (2) LS Pressure = Margin Pressure	Calculation **B**	290-319 psi (20-22 bar) **305 psi (21 bar)**	Park Brake - ON
5	Main High Pressure Cutoff	**M1**	Connect gauge to M1 port, run engine at low idle, stall lift down	MCV (**1**)	3726-3814 psi (257-263 bar) **3770 psi (260 bar)**	Park Brake - ON
6	Park Brake (1)	**M4**	Connect gauge to M4 port, run engine at low idle.	N/A	0-10 psi (0-0.75 bar) **0 psi (0 bar)**	Park Brake - ON
7	Park Brake (2)	**M4**	Connect gauge to M4 port, run engine at low idle. Turn Park Brake OFF.	P(**D**)	460-500 psi (32-35 bar) **480 psi (33 bar)**	Park Brake - OFF Check Only
8	Steering Priority Load Sense	**M5**	Connect gauge to M5 port, run engine at low idle, stall steering.	N/A	2566-2711 psi (177-187 bar) **2640 psi (182 bar)**	Non Adjustable - LS Relief Pre-set in the Steering Unit
9	Auxiliary	**M2**	Connect gauge to M2 port, run engine at high idle, stall auxiliary one direction, then stall in other direction. Repeat check.	N/A	3180-3430 psi (219-236.5 bar) **3305 psi (228 bar**)	Pressure/Functional Check
10	RAS	**R1**	Connect gauge to R1 port, run engine at low idle, stall lift down.	RAS (**E**)	85-125 psi (6-8.5 bar) **100 psi (7 bar)**	Pressure/Functional Check

	Hydraulic Circuit	Test Port	Procedure	Adjustment Location	Range/Nominal Pressure	Notes
11	Load Sense Relief	**M2**	Adjust Standby pressure as in steps 1, 2 & 3. Adjust Main Compensator High Pressure Cut Off to 4200 psi (290 bar). Note that adjustment may require incrementally increase Load Sense Relief Valve (MCV A) first then Main Pump Compensator (C) until a setting of 4200 psi (290 bar) can be observed on the M1 gauge. Adjust the Load Sense Relief Valve to setting shown using gauge in M2 port. Once the Load Sense Relief is adjusted to specification, the Main Pump pressure may read lower than 4200 psi (290 bar).	MCV (**A**)	3393-3538 psi (234-244 bar) **3450 psi (238 bar)**	Only needed if step 5 cannot be achieved

d. Pressure Specifications - 943, 1043, 1055, 1255







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

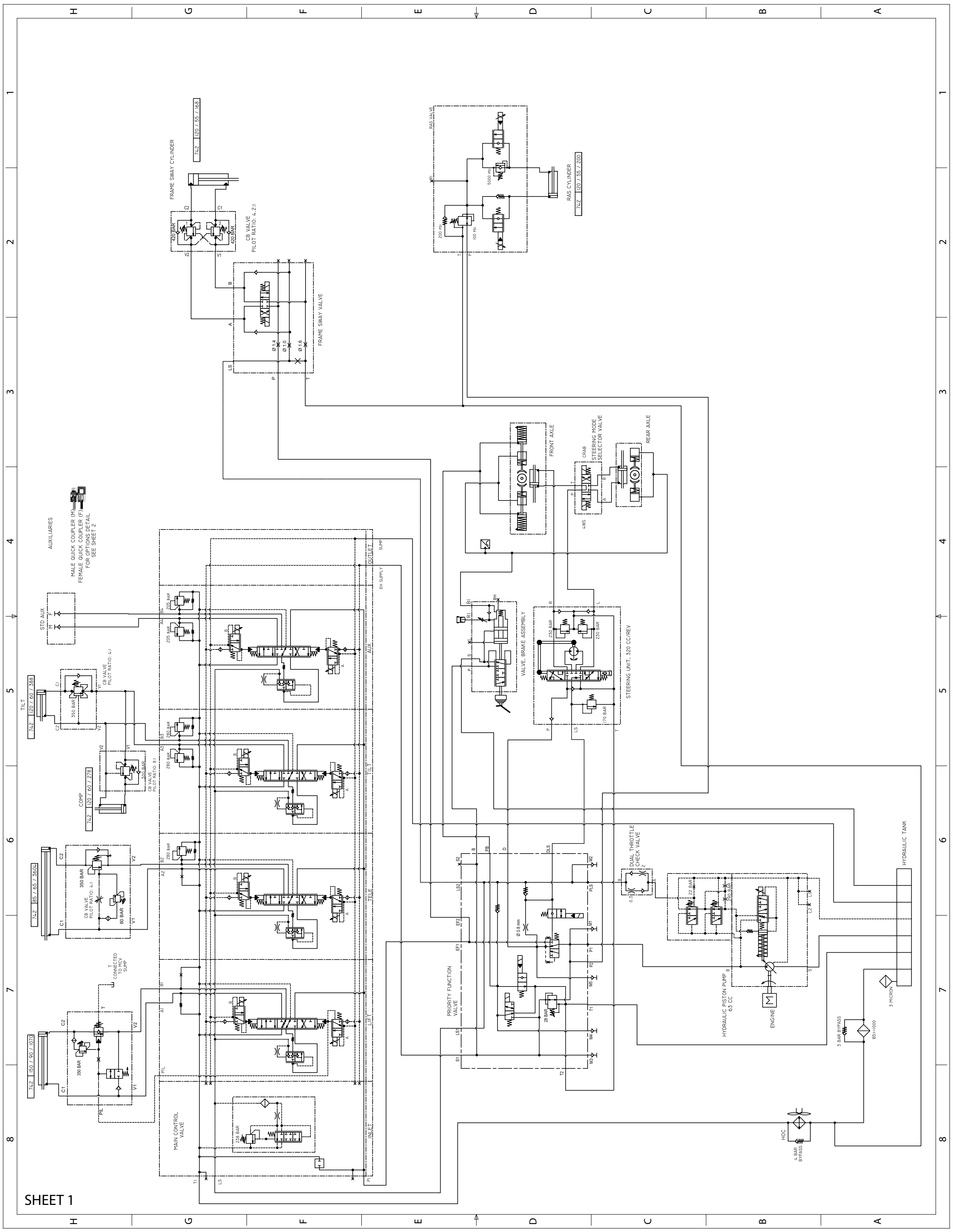
	Hydraulic Circuit	Test Port	Procedure	Adjustment Location	Range/Nominal Pressure	Notes
1	Pilot	**M3**	Connect gauge to M3 port, run engine at low idle, Turn Park Brake Off.	P(**D**)	460-500 psi (32-35 bar) **480 psi (33 bar)**	Park Brake - OFF
2	Standby (1)	**M1**	Connect gauge to M1 port, run engine at low idle, no function.	P (**B**)	493-537 psi (34-37 bar) **515 psi (35.5 bar)**	Park Brake - ON
3	Load Sense	**M2**	Connect gauge to M2 port, run engine at low idle, no function.	N/A	203-218 psi (14-15 bar) **210 psi (14.5 bar)**	Park Brake - ON
4	Margin		(1) Standby Pressure, subtract (2) LS Pressure = Margin Pressure	Calculation	290-319 psi (20-22 bar) **305 psi (21 bar)**	Park Brake - ON
5	Main High Pressure Cutoff	**M1**	Connect gauge to M1 port, run engine at low idle, stall lift down.	MCV (**A**)	3726-3814 psi (257-263 bar) **3770 psi (260 bar)**	Park Brake - ON
6	Park Brake (1)	**M4**	Connect gauge to M4 port, run engine at low idle.	N/A	0-10 psi (0-0.75 bar) **0 psi (0 bar)**	Park Brake - ON
7	Park Brake (2)	**M4**	Connect gauge to M4 port, run engine at low idle. Turn Park Brake OFF.	Priority (**D**)	460-500 psi (32-35 bar) **480 psi (33 bar)**	Park Brake - OFF Check Only
8	Steering Priority Load Sense	**M5**	Connect gauge to M5 port, run engine at low idle, stall steering.	N/A	2566-2711 psi (177-187 bar) **2640 psi (182 bar)**	Non Adjustable - LS Relief Pre-set in the Steering Unit
9	Auxiliary	**M2**	Connect gauge to M2 port, run engine at low idle, stall auxiliary one direction, then stall in other direction. Repeat check.	N/A	3180-3430 psi (219-236,5 bar) **3305 psi (228 bar**)	Pressure/Functional Check
10	RAS	**R1**	Connect gauge to R1 port, run engine at low idle, stall lift down.	RAS (**E**)	85-125 psi (6-8,5 bar) **100 psi (7 bar)**	Pressure/Functional Check

	Hydraulic Circuit	Test Port	Procedure	Adjustment Location	Range/Nominal Pressure	Notes
11	Load Sense Relief	**M2**	Adjust Standby pressure as in steps 1, 2 & 3. Adjust Main Compensator High Pressure Cut Off to 4200 psi (290 bar). Note that adjustment may require incrementally increase Load Sense Relief Valve (MCV A) first then Main Pump Compensator (C) until a setting of 4200 psi (290 bar) can be observed on the M1 gauge. Adjust the Load Sense Relief Valve to setting shown using gauge in M2 port. Once the Load Sense Relief is adjusted to specification, the Main Pump pressure may read lower than 4200 psi (290 bar).	MCV (**A**)	3393-3538 psi (234-244 bar) **3450 psi (238 bar)**	Only needed if step 5 cannot be achieved

8.6 HYDRAULIC SCHEMATIC

8.6.1 742

a. 742 for 74HP HRC engine - PVC 1911



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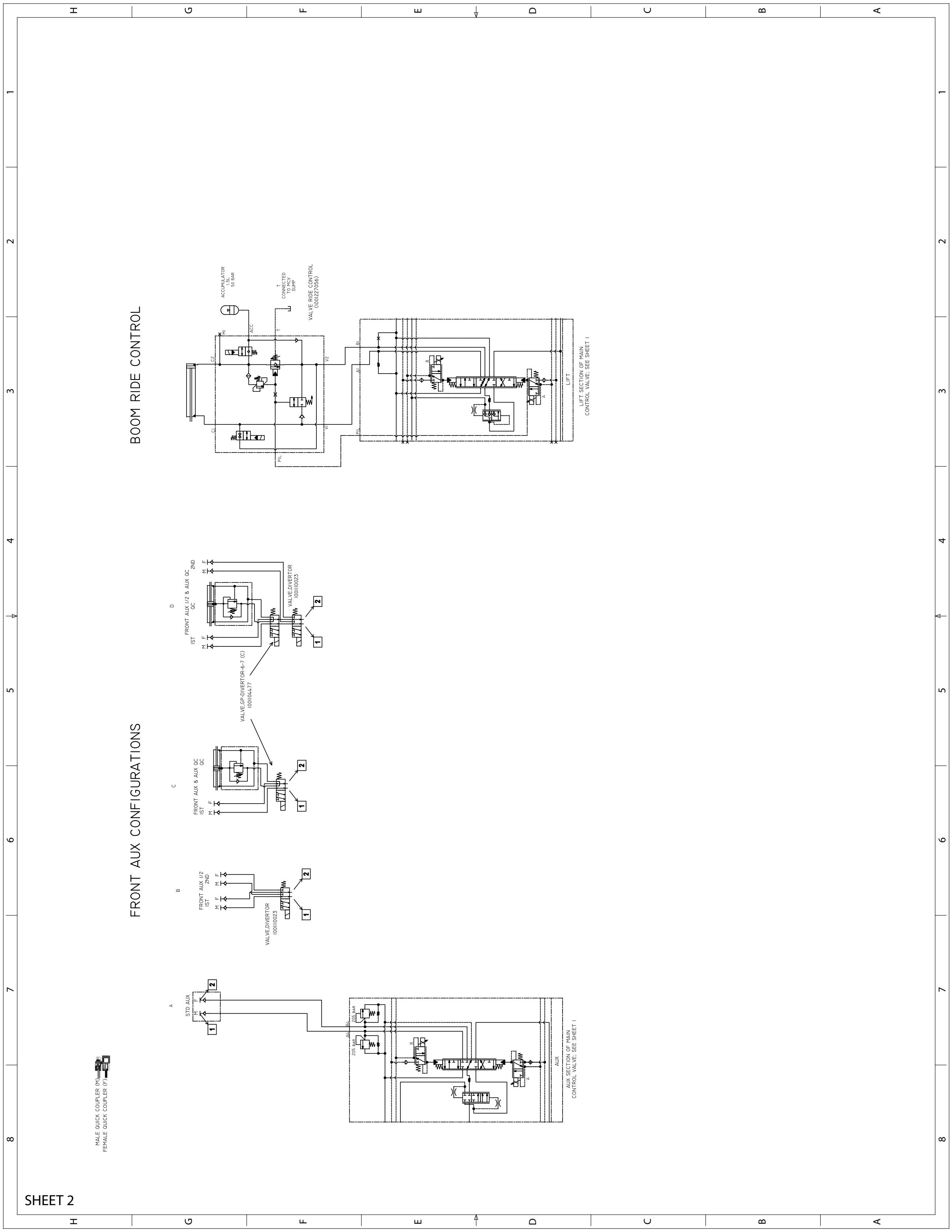
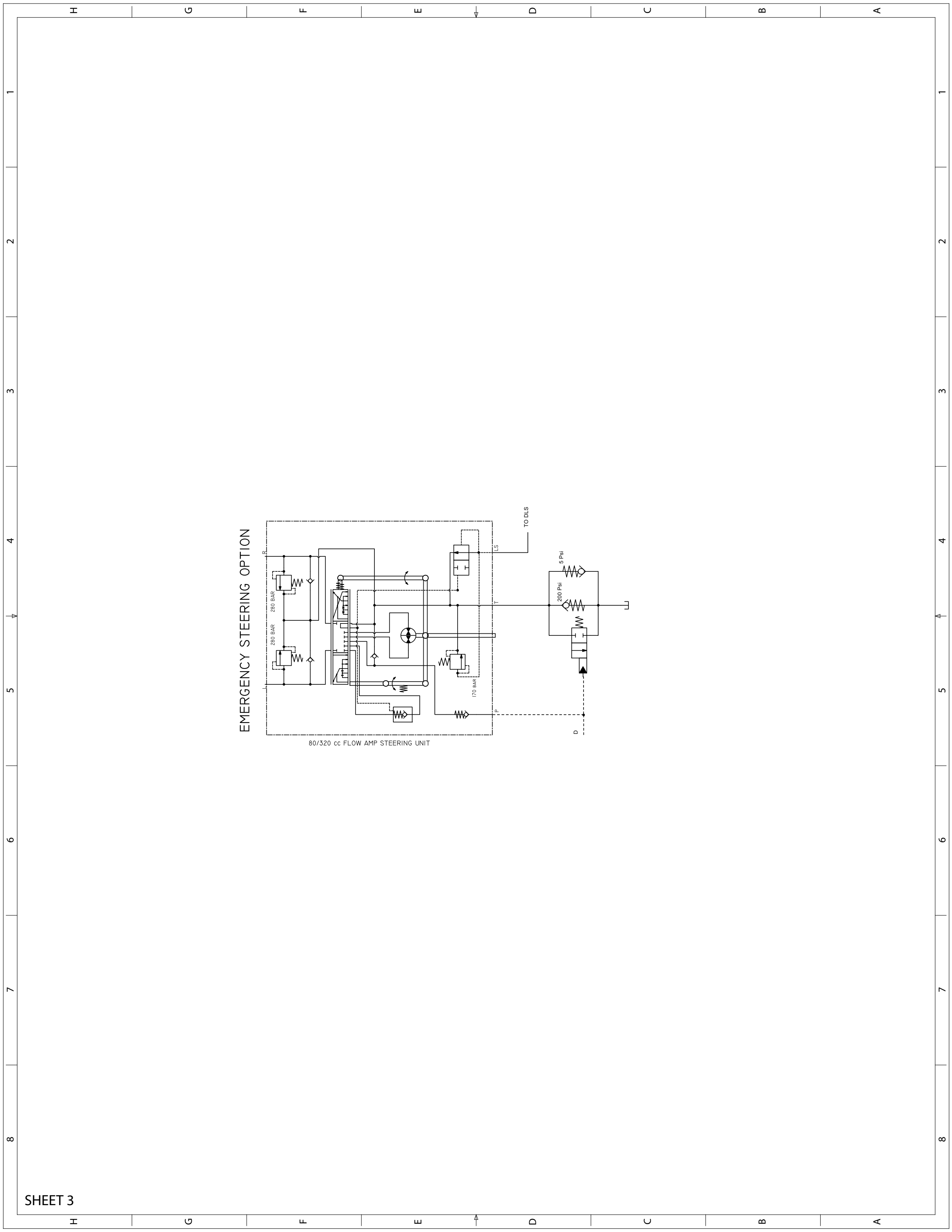
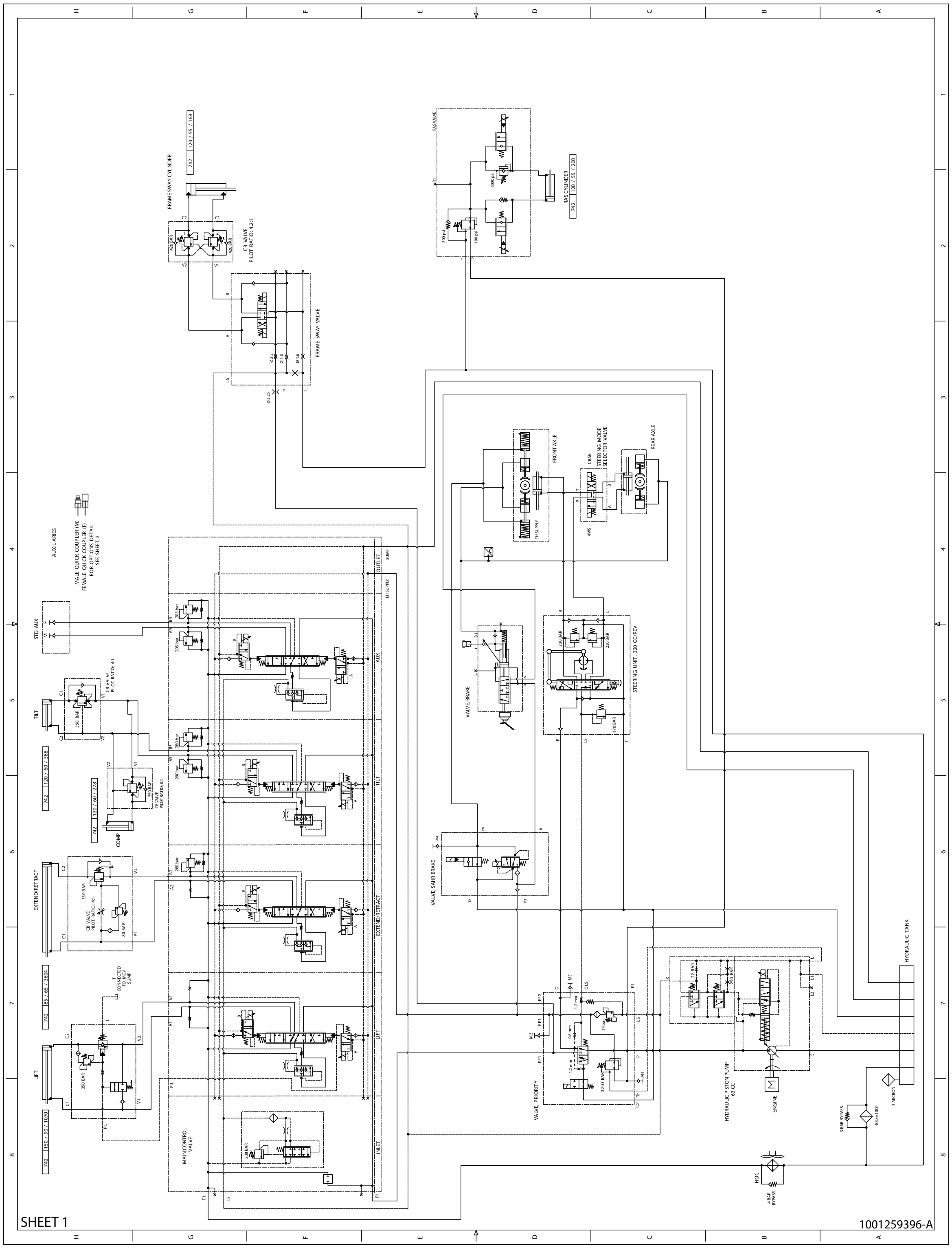

BOOM RIDE CONTROL
FRONT AUX CONFIGURATIONS
ACCUMULATOR
VALVE RIDE CONTROL
LIFT SECTION OF MAIN CONTROL VALVE; SEE SHEET 1
VALVE,DIVERTOR
STD AUX
AUX SECTION OF MAIN CONTROL VALVE; SEE SHEET 1
MALE QUICK COUPLER (M)
FEMALE QUICK COUPLER (F)
SHEET 2

TH100222A


EMERGENCY STEERING OPTION
280 BAR
280 BAR
170 BAR
80/320 cc FLOW AMP STEERING UNIT
TO DLS
5 Psi
200 Psi
SHEET 3

TH100223A

b. 742 for 74HP HRC engine - PVC 2005



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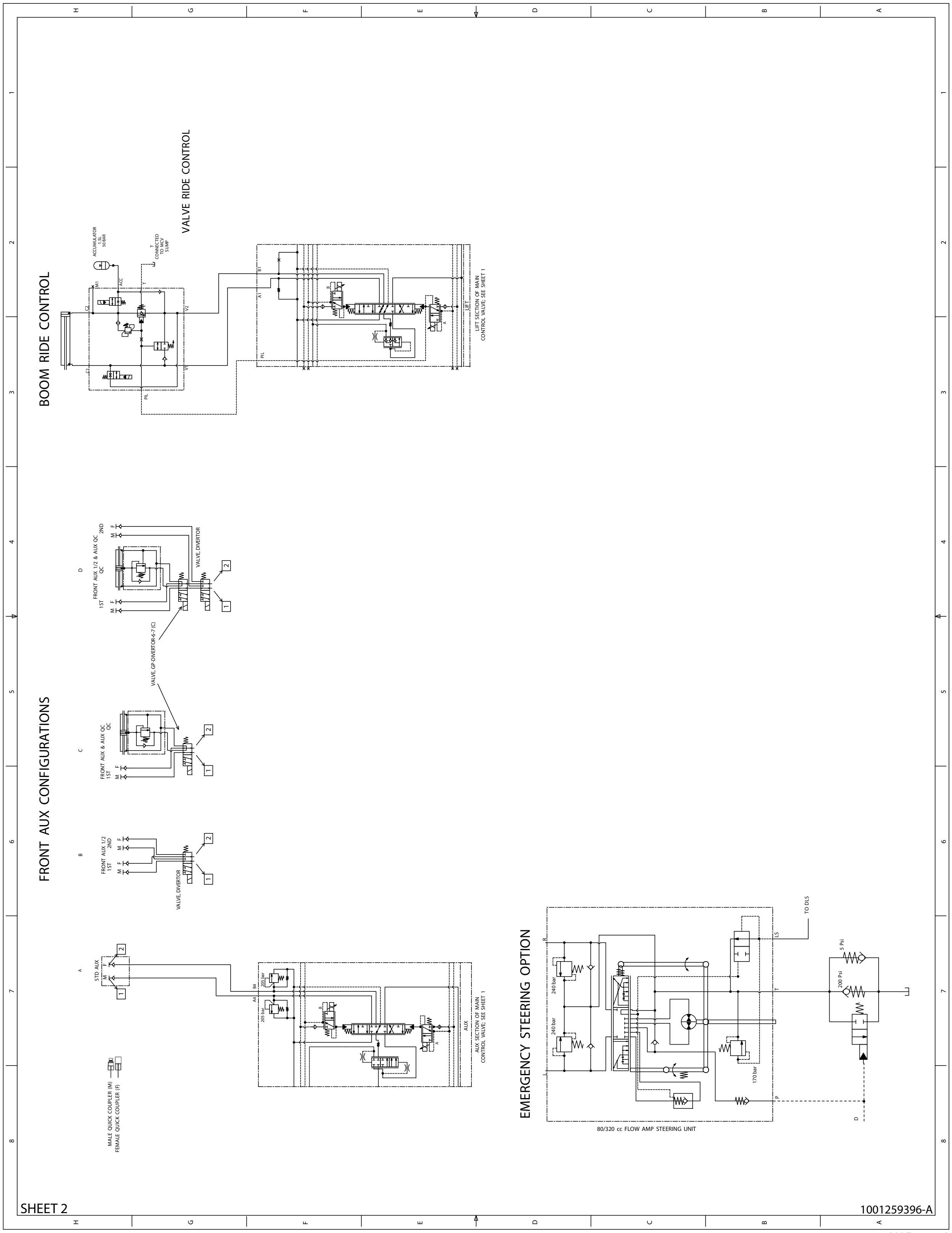
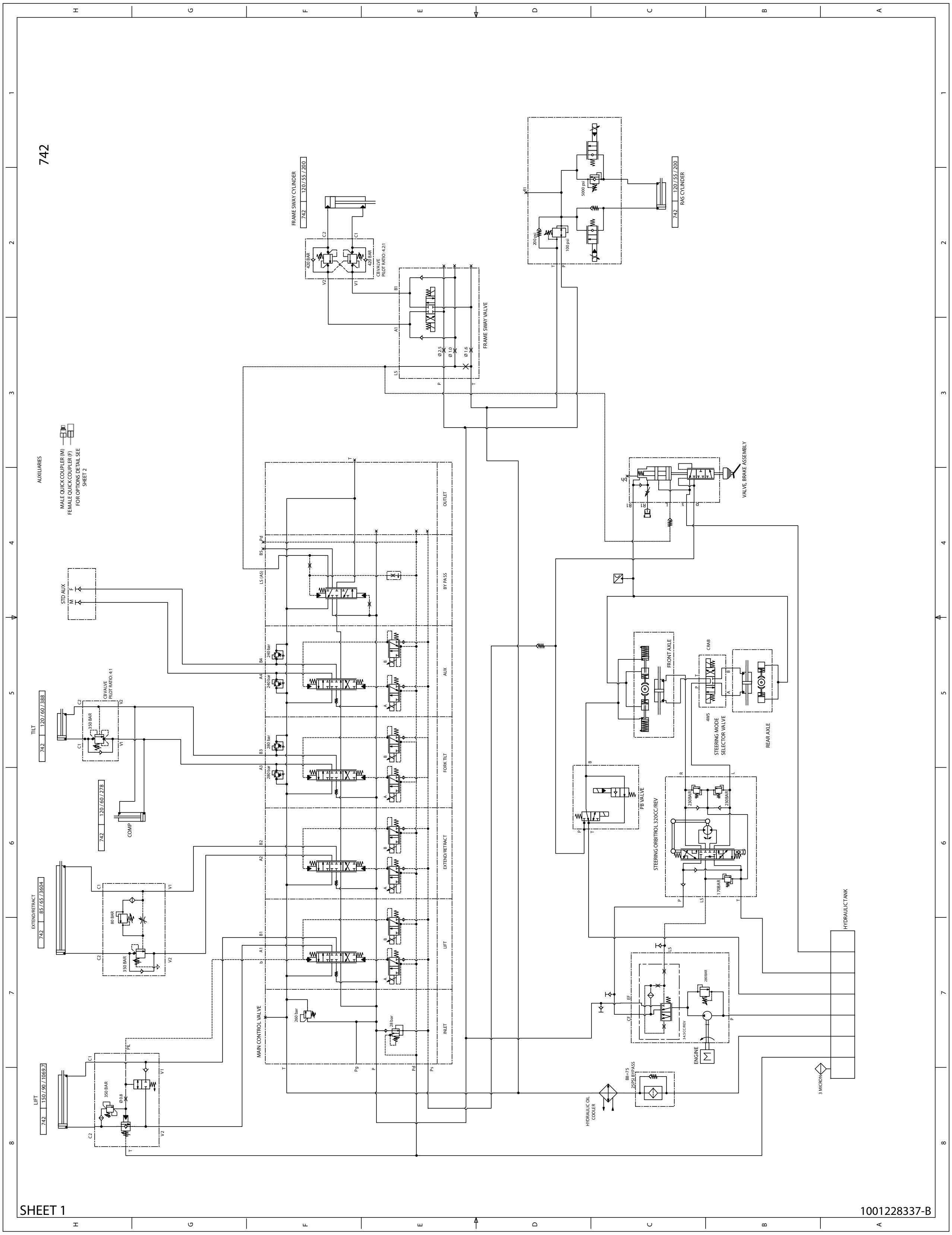

BOOM RIDE CONTROL
VALVE RIDE CONTROL
FRONT AUX CONFIGURATIONS
EMERGENCY STEERING OPTION
80/320 cc FLOW AMP STEERING UNIT
MALE QUICK COUPLER (M)
FEMALE QUICK COUPLER (F)
SHEET 2
1001259396-A

MAE44720A

c. 742 for 110HP HRC/LRC engine - PVC 1911, 2005



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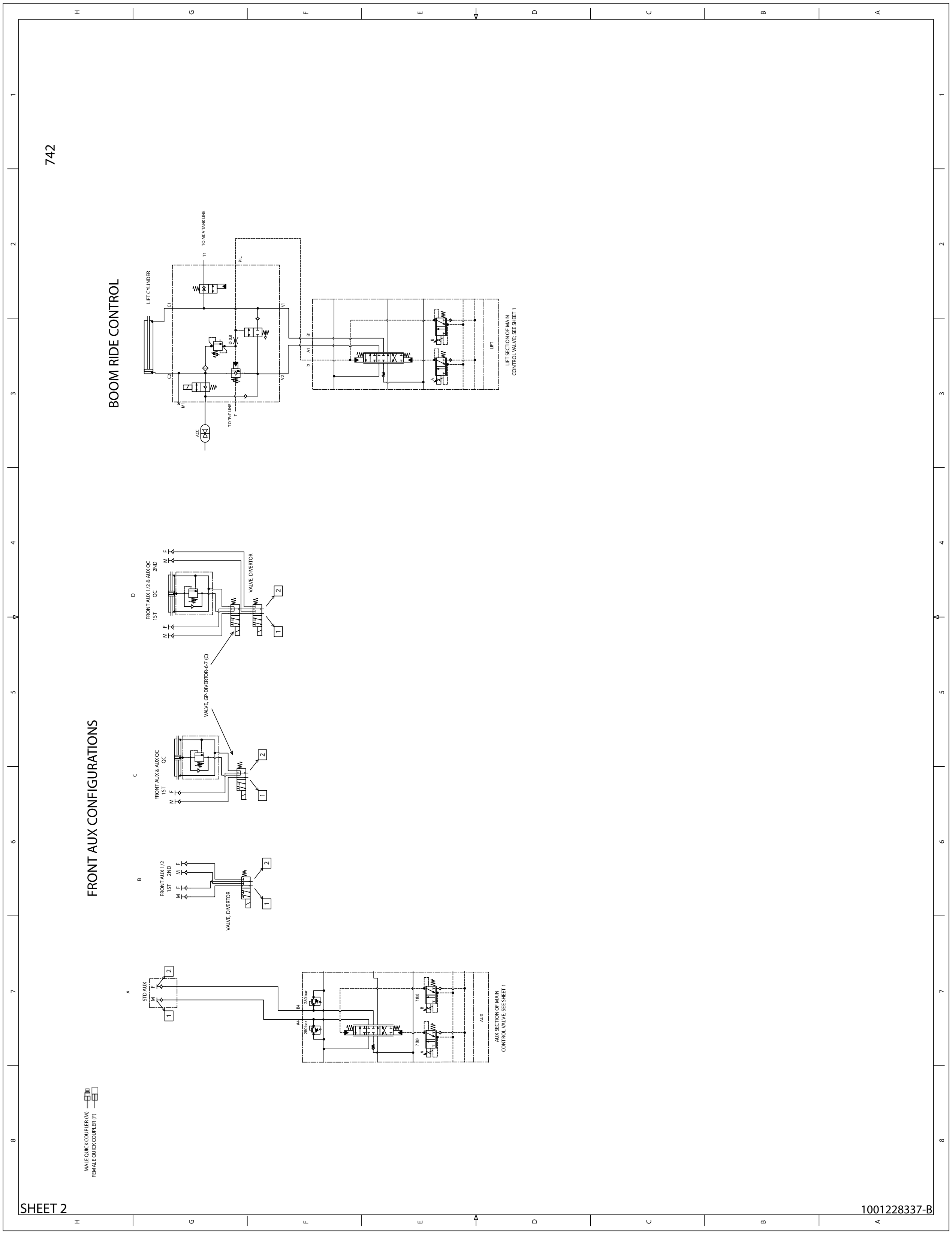
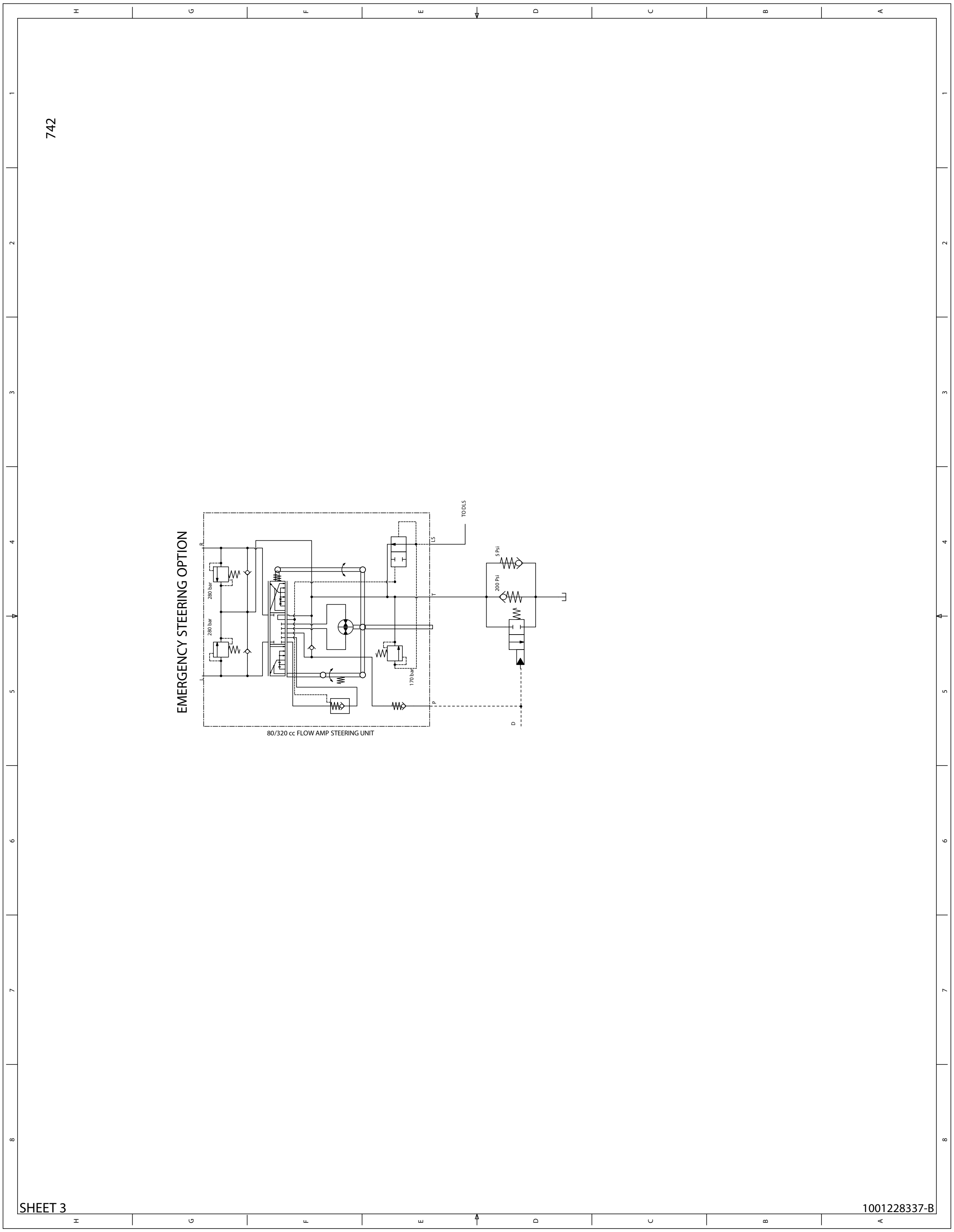

742
BOOM RIDE CONTROL
FRONT AUX CONFIGURATIONS
SHEET 2
1001228337-B

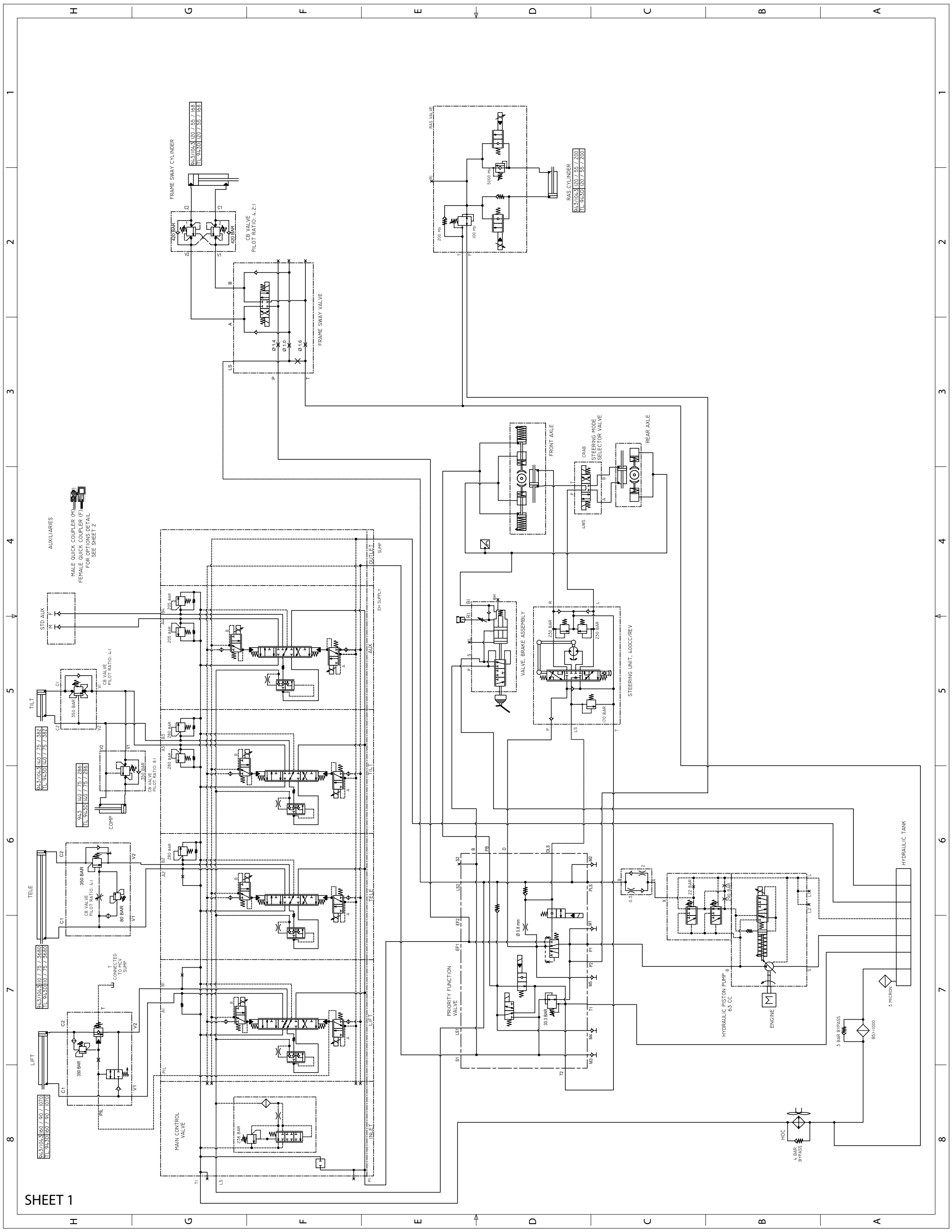
MAE44690B


742
EMERGENCY STEERING OPTION
280 bar
280 bar
170 bar
TO DLS
LS
T
P
D
5 Psi
200 Psi
80/320 cc FLOW AMP STEERING UNIT
SHEET 3
1001228337-B

MAE44700B

8.6.2 943

a. 943 - PVC 1911



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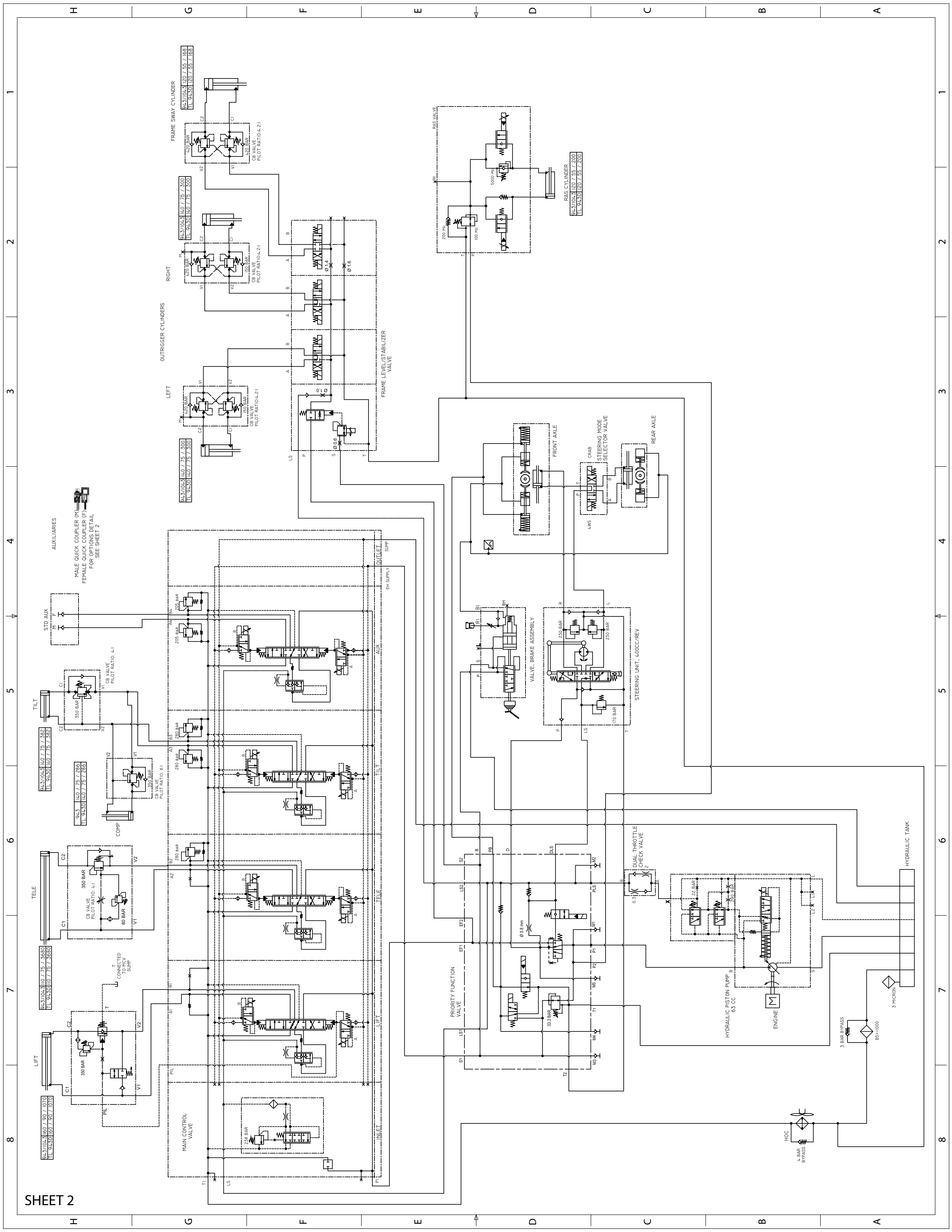
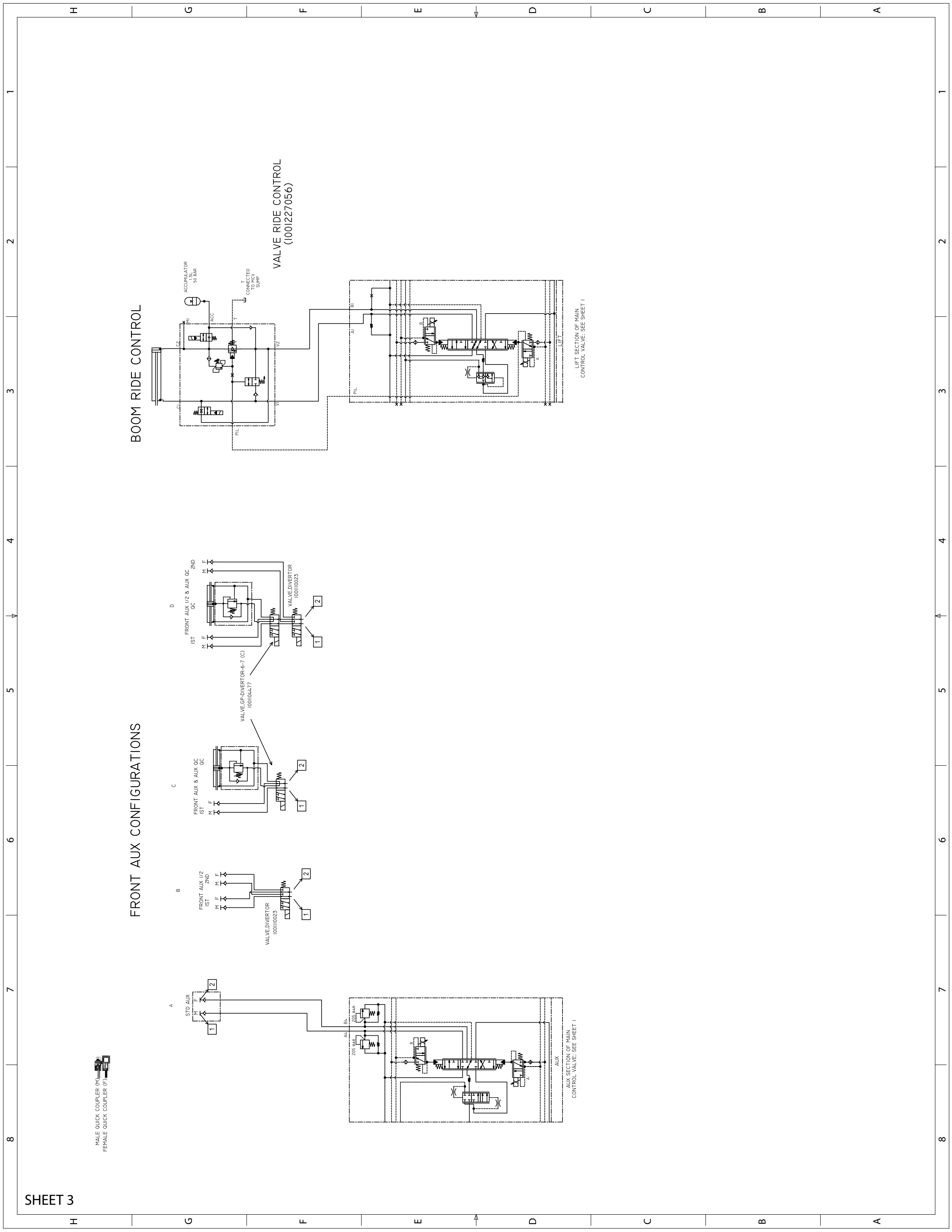
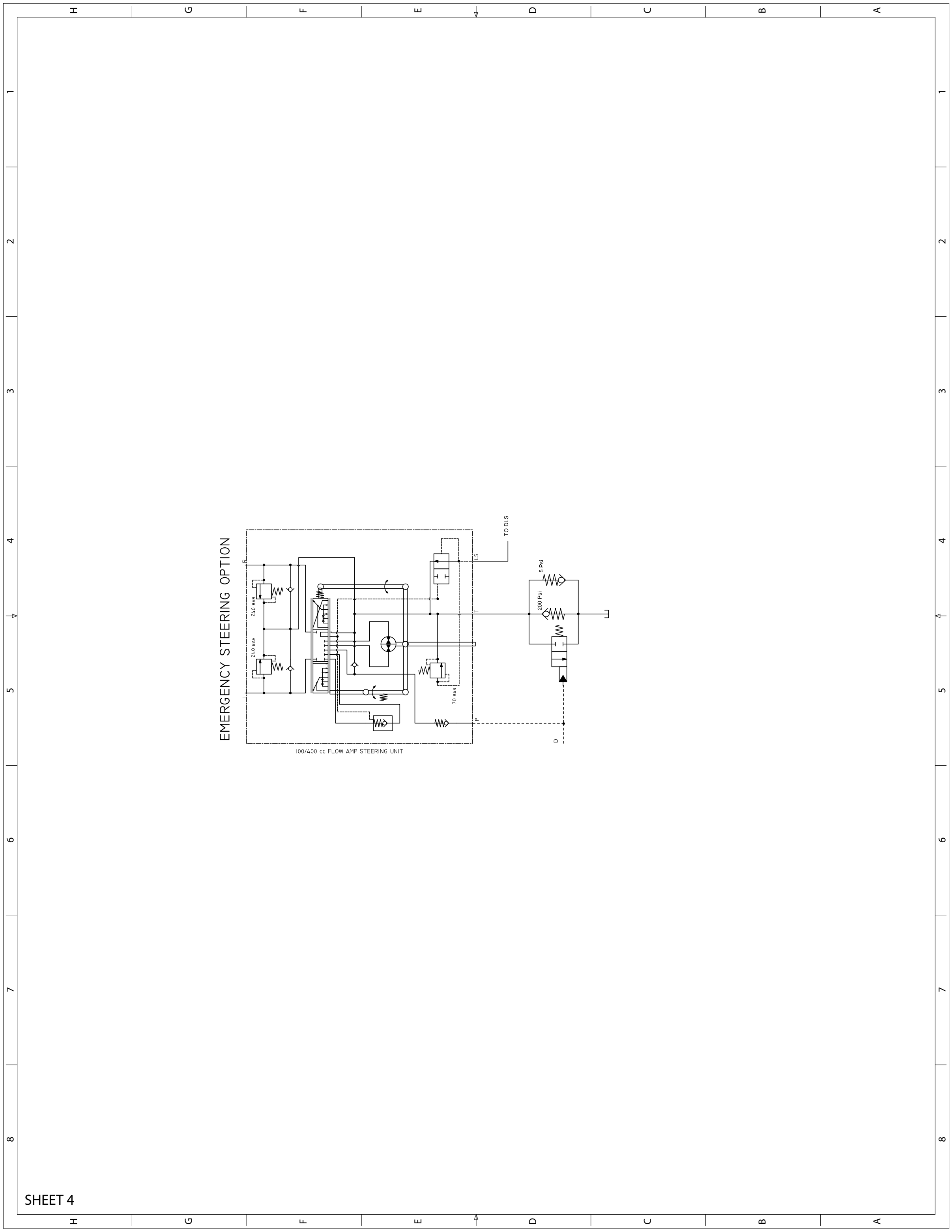

SHEET 2
FRAME SWAY CYLINDER
OUTRIGGER CYLINDERS
RIGHT
LEFT
FRAME LEVEL/STABILIZER VALVE
RAS VALVE
RAS CYLINDER
FRONT AXLE
REAR AXLE
STEERING MODE SELECTOR VALVE
AUXILIARIES
STD AUX
VALVE, BRAKE ASSEMBLY
STEERING UNIT, 400CC/REV
TILT
COMP
TELE
LIFT
PRIORITY FUNCTION VALVE
DUAL THROTTLE CHECK VALVE
HYDRAULIC TANK
HYDRAULIC PISTON PUMP 63 CC
ENGINE
MAIN CONTROL VALVE
INLET
OUTLET

TH100225A

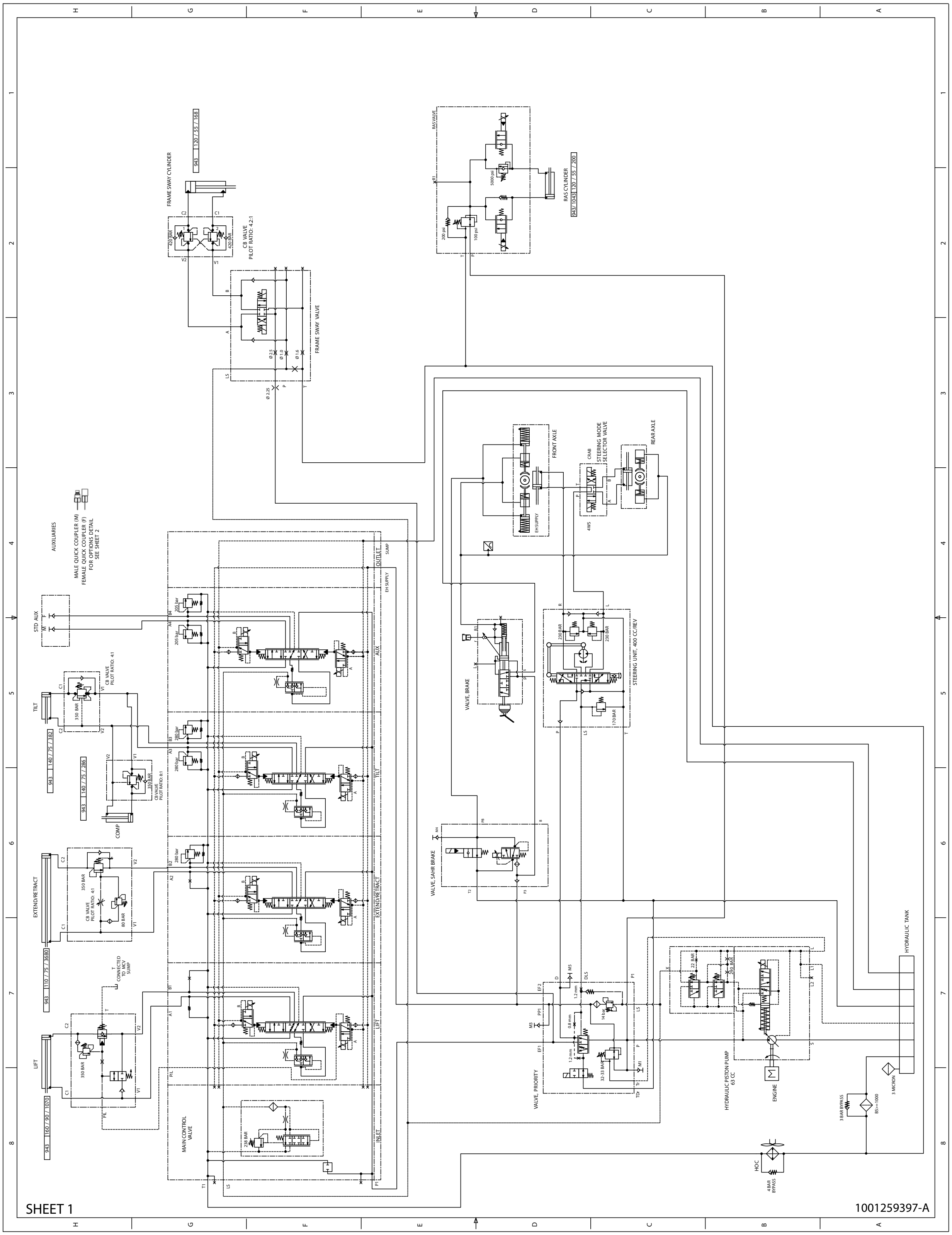

BOOM RIDE CONTROL
VALVE RIDE CONTROL
(1001227056)
FRONT AUX CONFIGURATIONS
SHEET 3

TH100226A


EMERGENCY STEERING OPTION
100/400 cc FLOW AMP STEERING UNIT
240 BAR
240 BAR
170 BAR
5 Psi
200 Psi
TO DLS
LS
T
P
D
SHEET 4

TH100227A

b. 943 - PVC 2005



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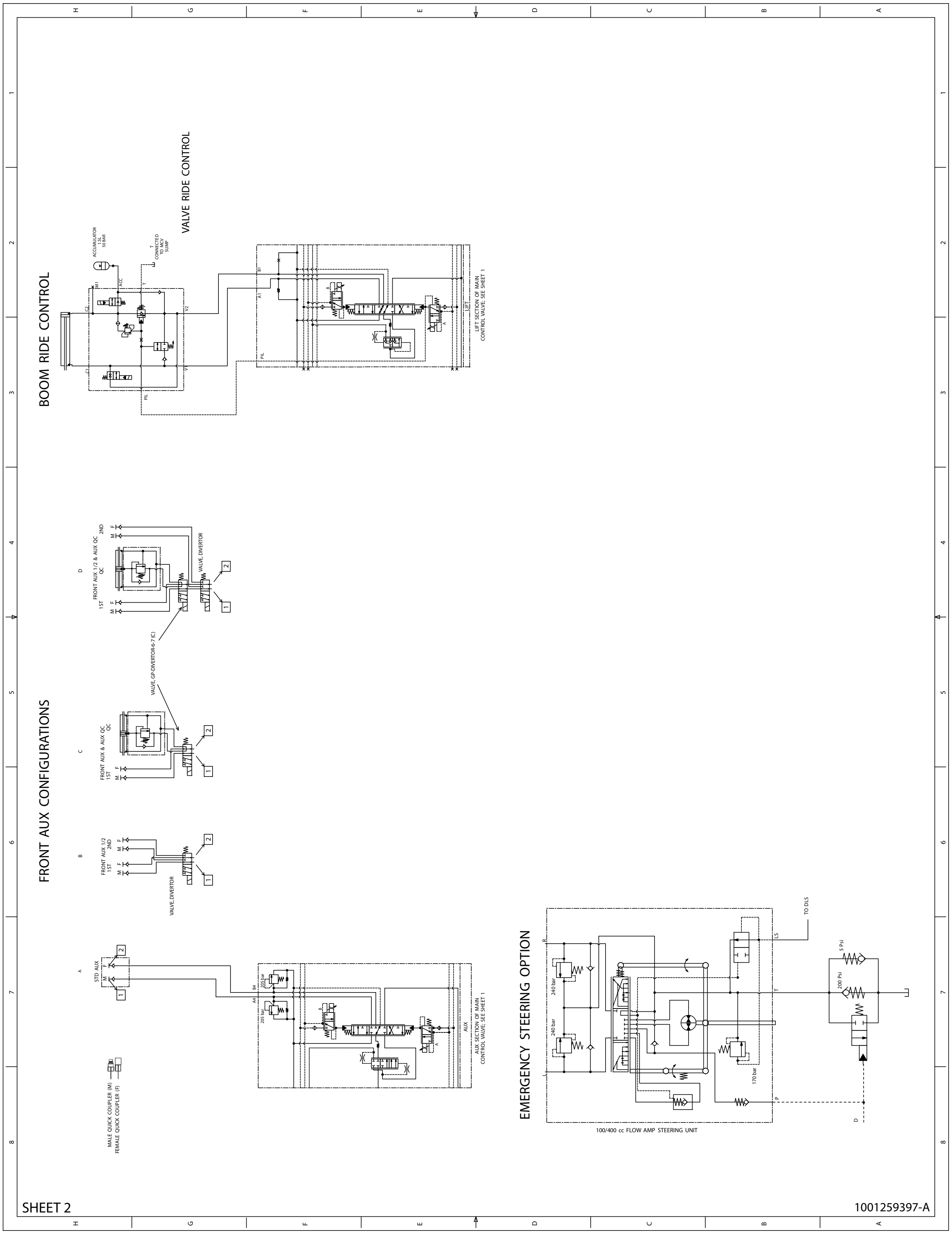
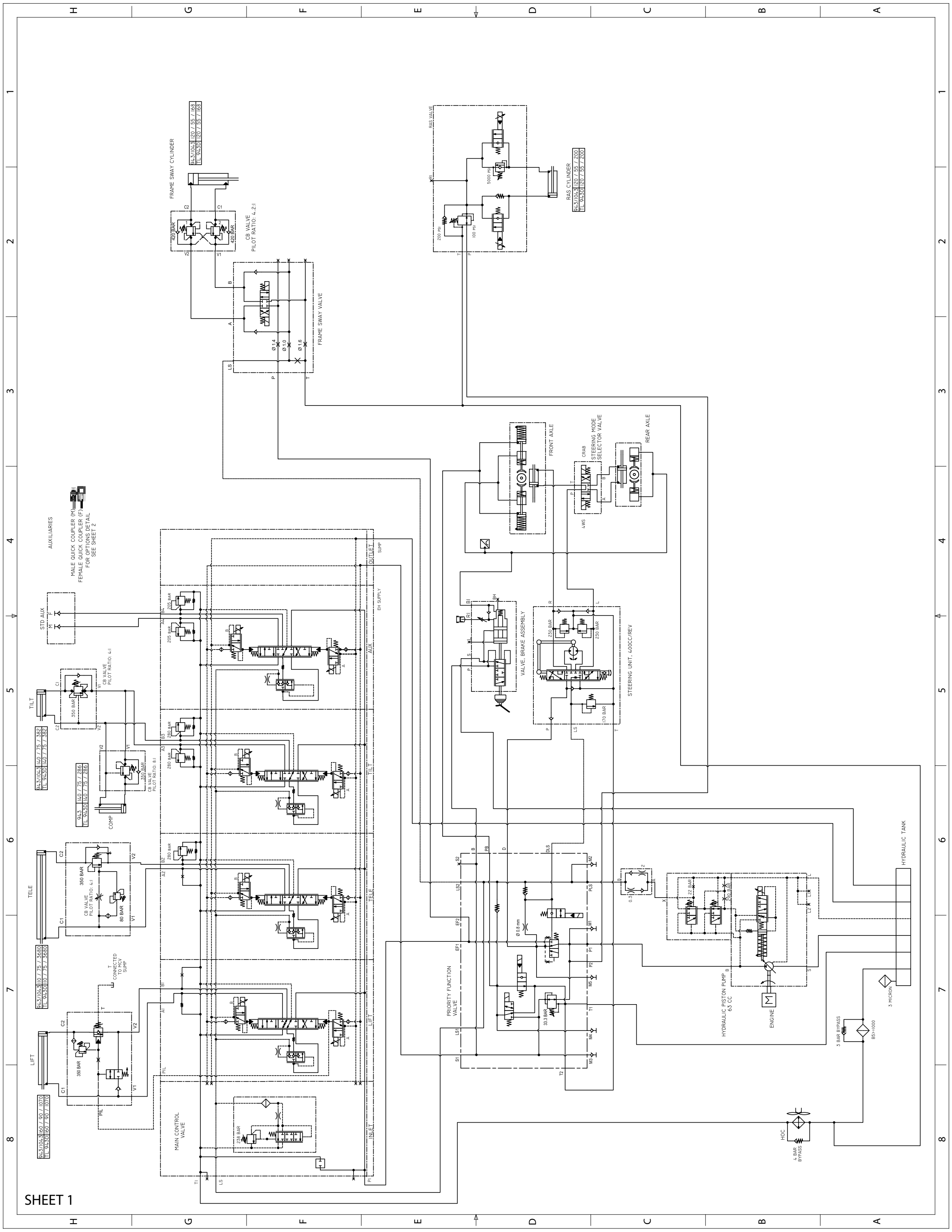

BOOM RIDE CONTROL
VALVE RIDE CONTROL
FRONT AUX CONFIGURATIONS
EMERGENCY STEERING OPTION
100/400 cc FLOW AMP STEERING UNIT
SHEET 2
1001259397-A

MAE44660A

8.6.3 1043

a. 1043 - PVC 1911



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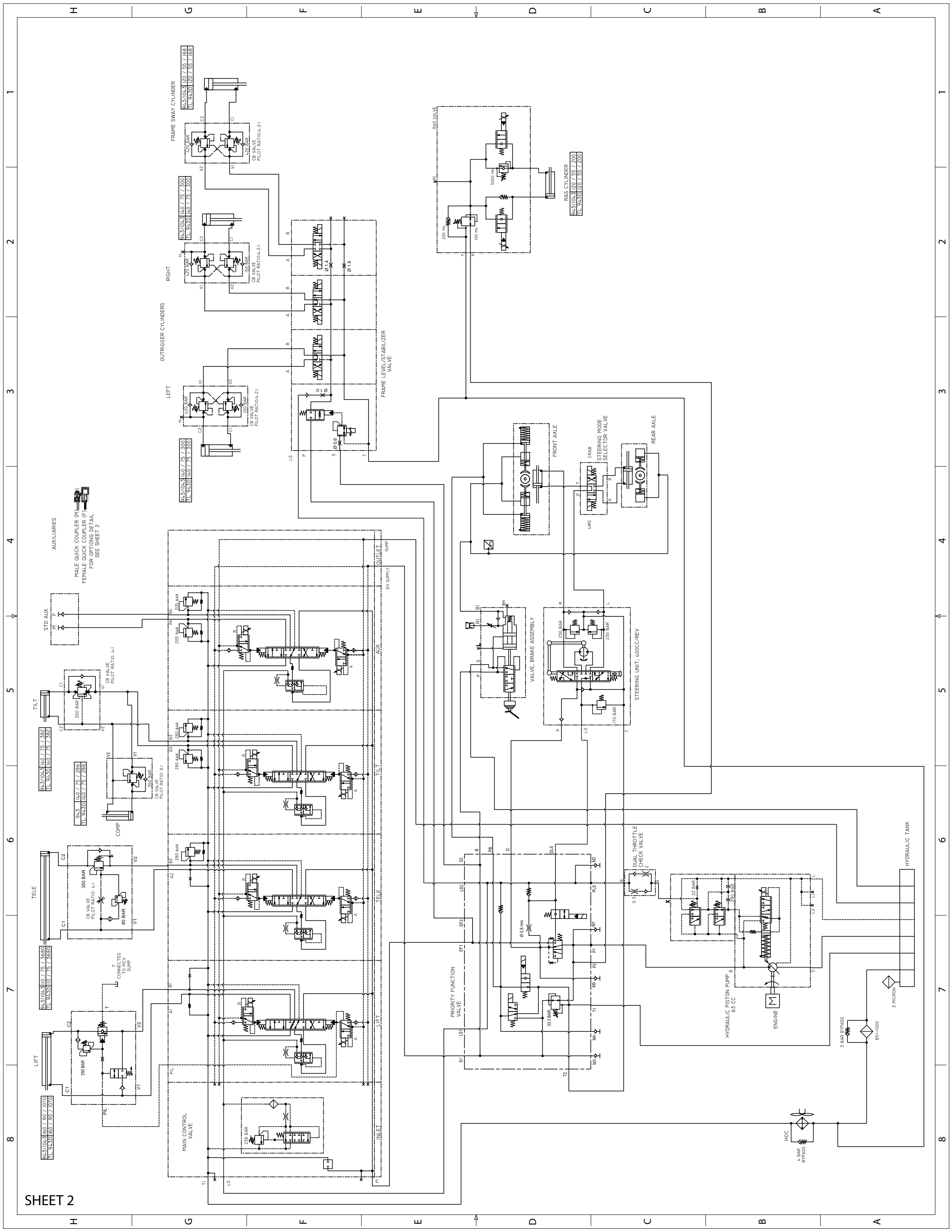

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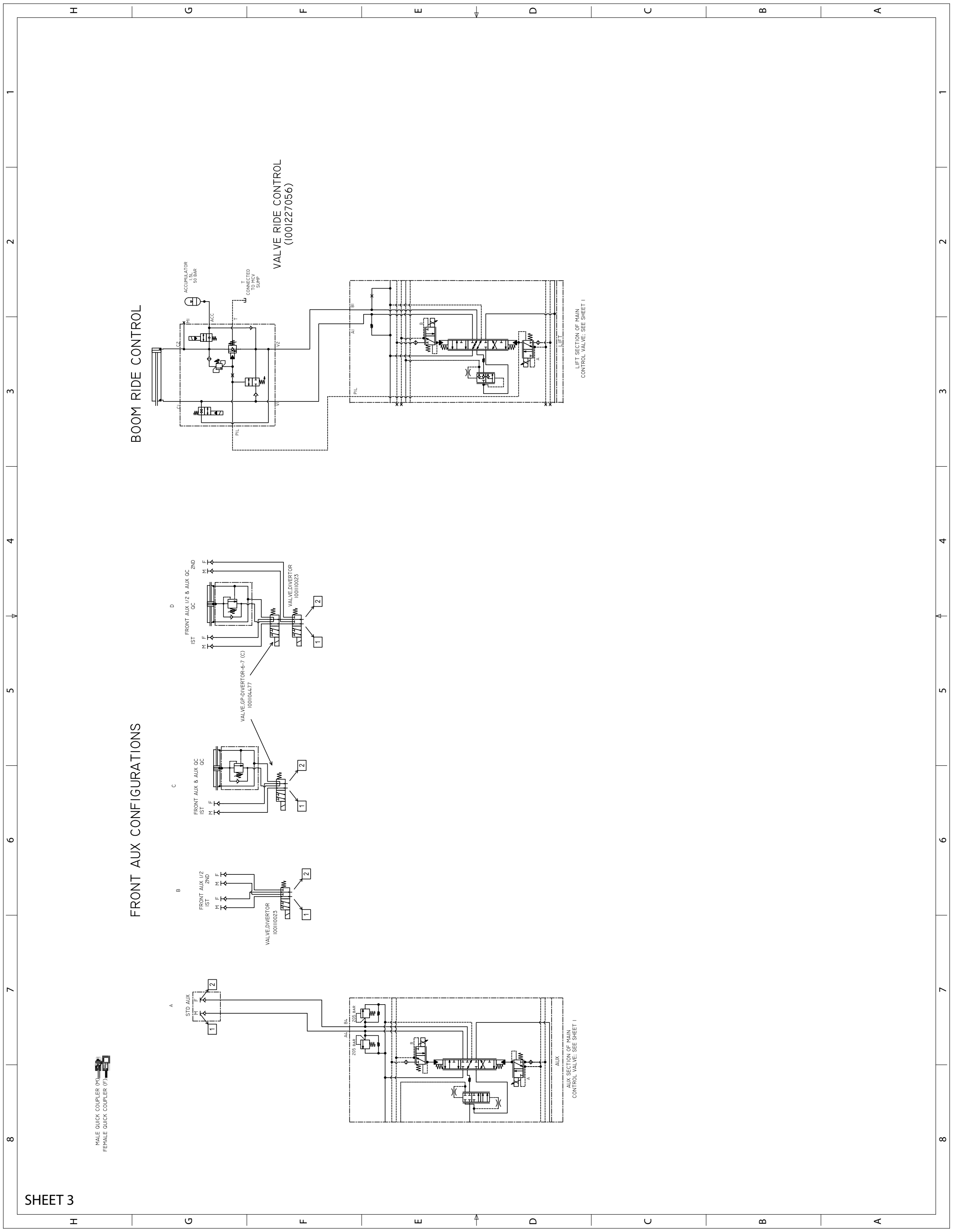
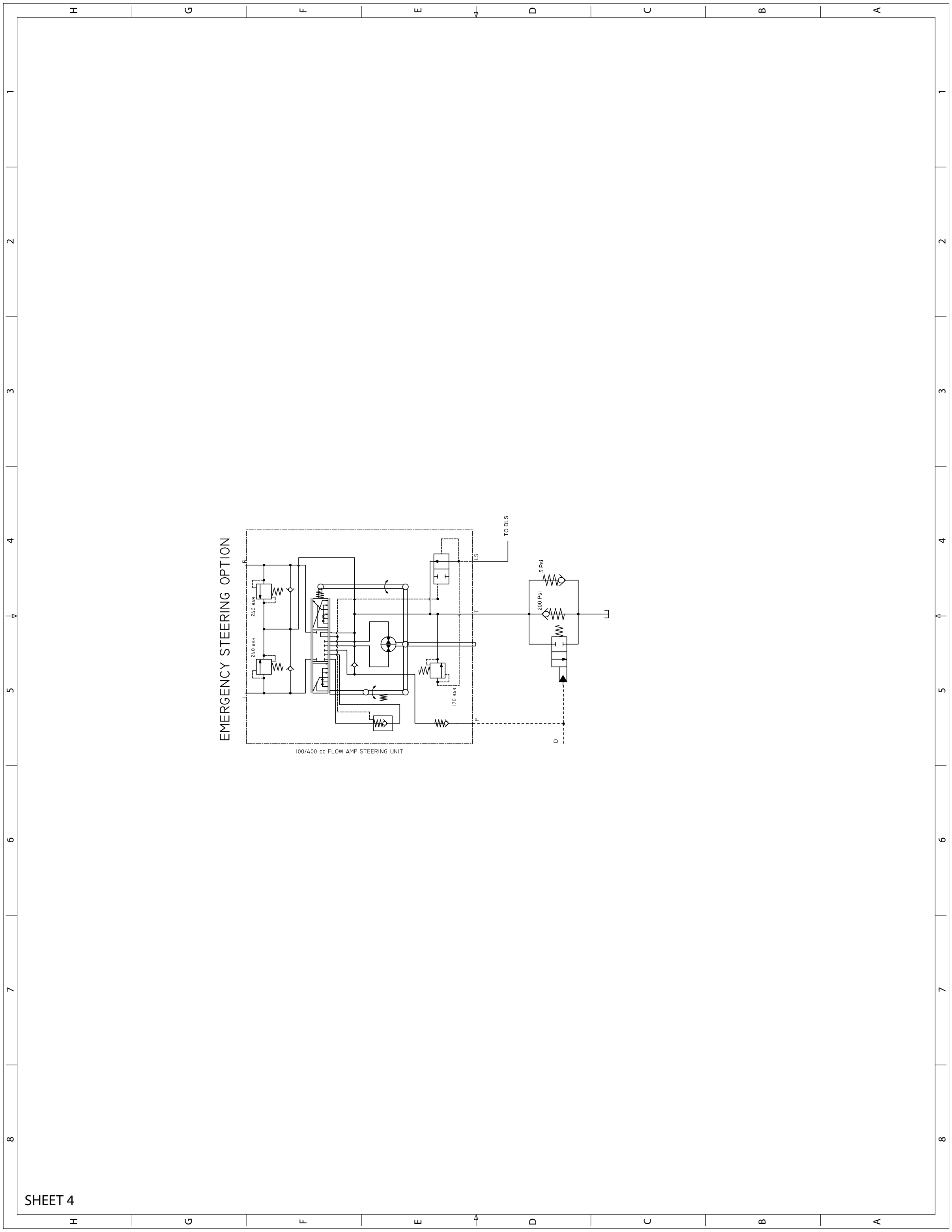
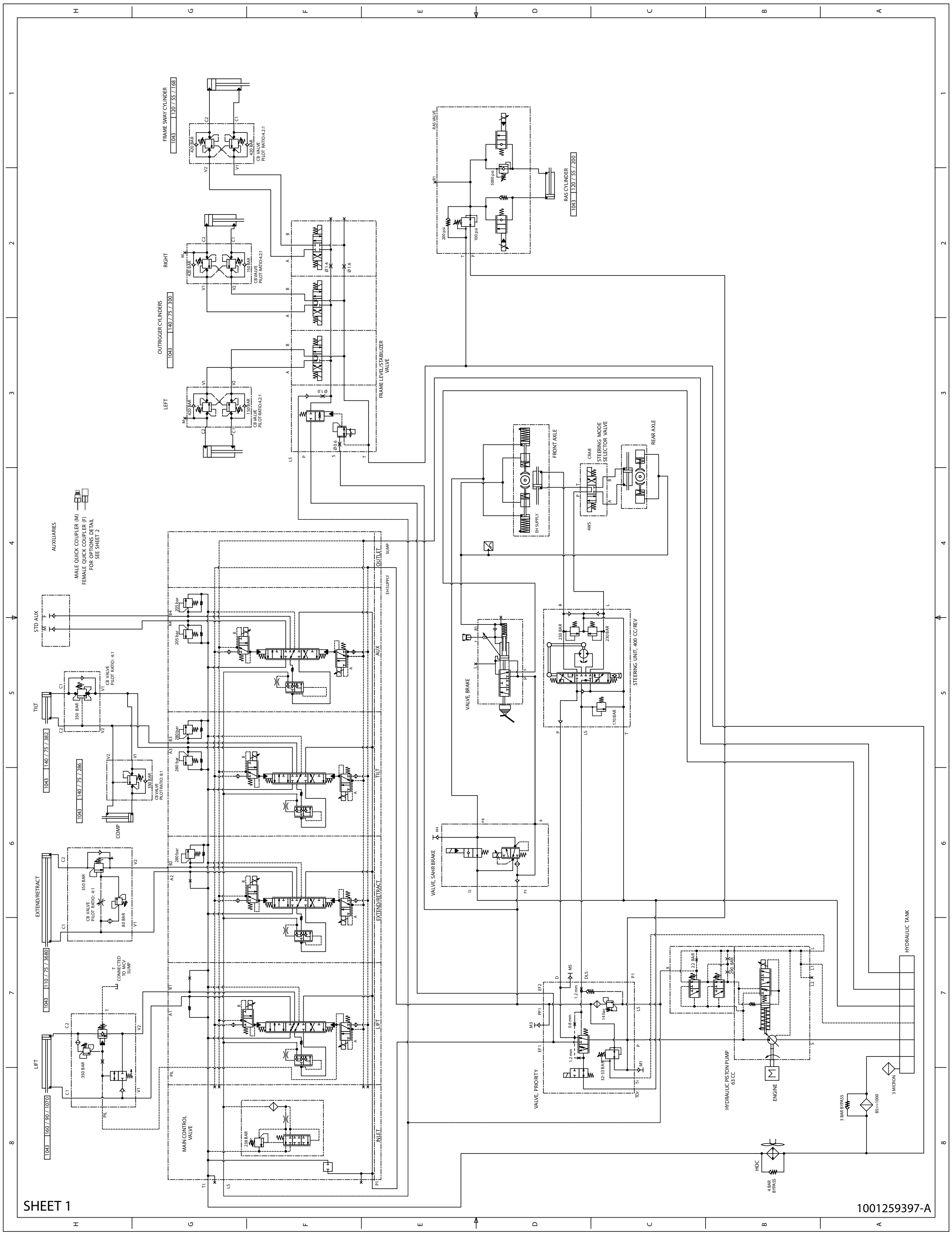

BOOM RIDE CONTROL
VALVE RIDE CONTROL
(1001227056)
FRONT AUX CONFIGURATIONS
SHEET 3

TH100226A


EMERGENCY STEERING OPTION
240 BAR
240 BAR
170 BAR
100/400 cc FLOW AMP STEERING UNIT
TO DLS
5 PSI
200 PSI
SHEET 4

TH100227A

b. 1043 - PVC 2005



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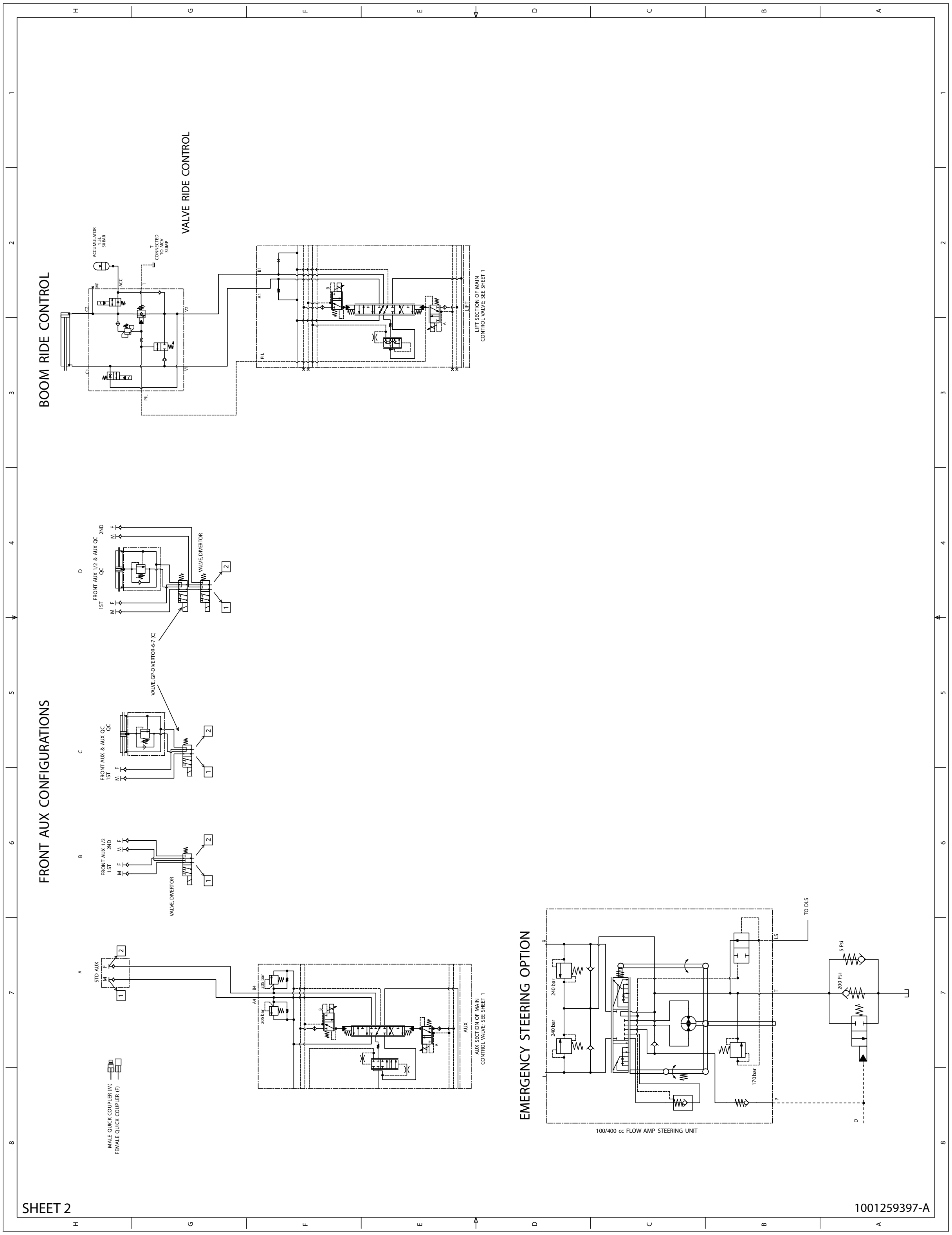
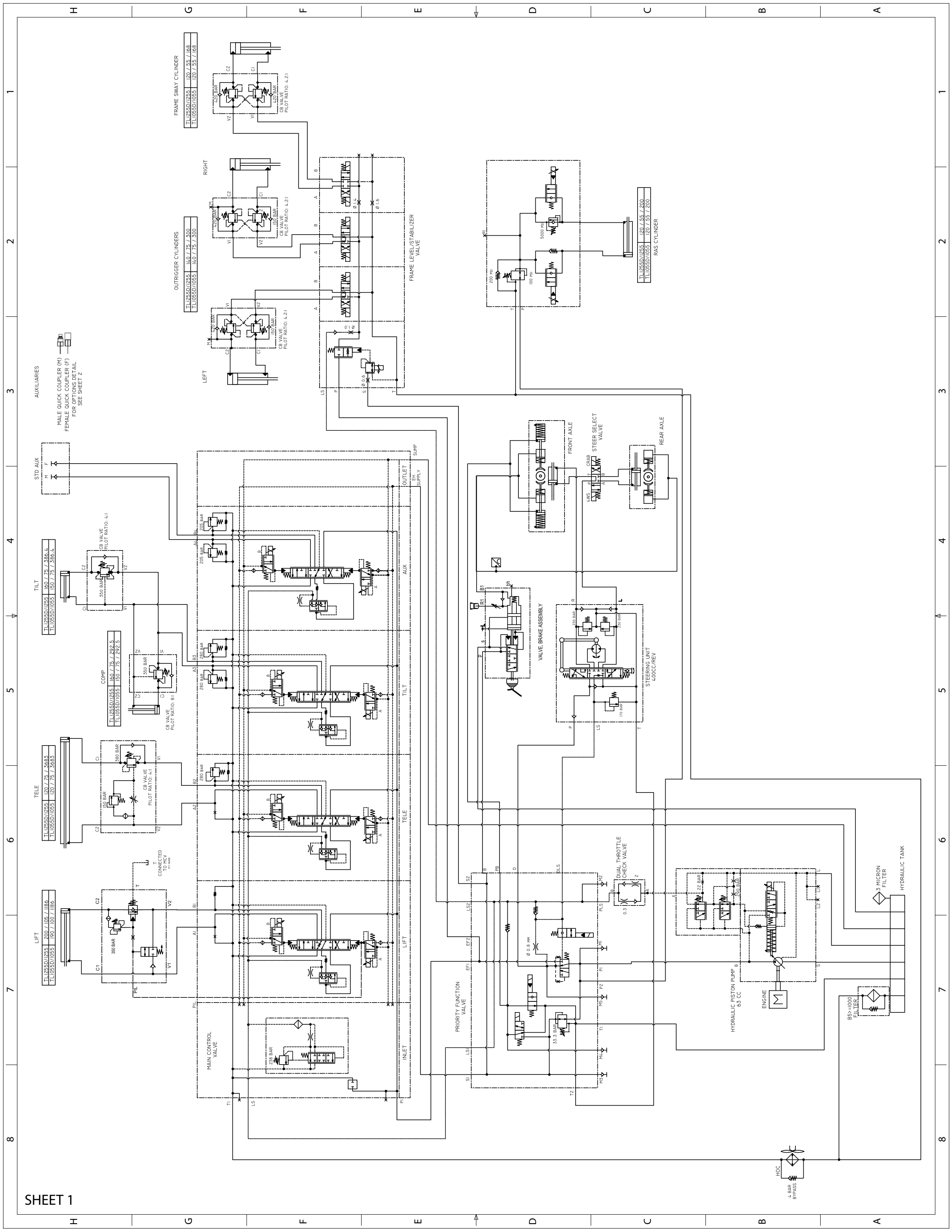

BOOM RIDE CONTROL
VALVE RIDE CONTROL
FRONT AUX CONFIGURATIONS
EMERGENCY STEERING OPTION
100/400 cc FLOW AMP STEERING UNIT
SHEET 2
1001259397-A

MAE44660A

8.6.4 1055, 1255

a. 1055, 1255 - PVC 1911



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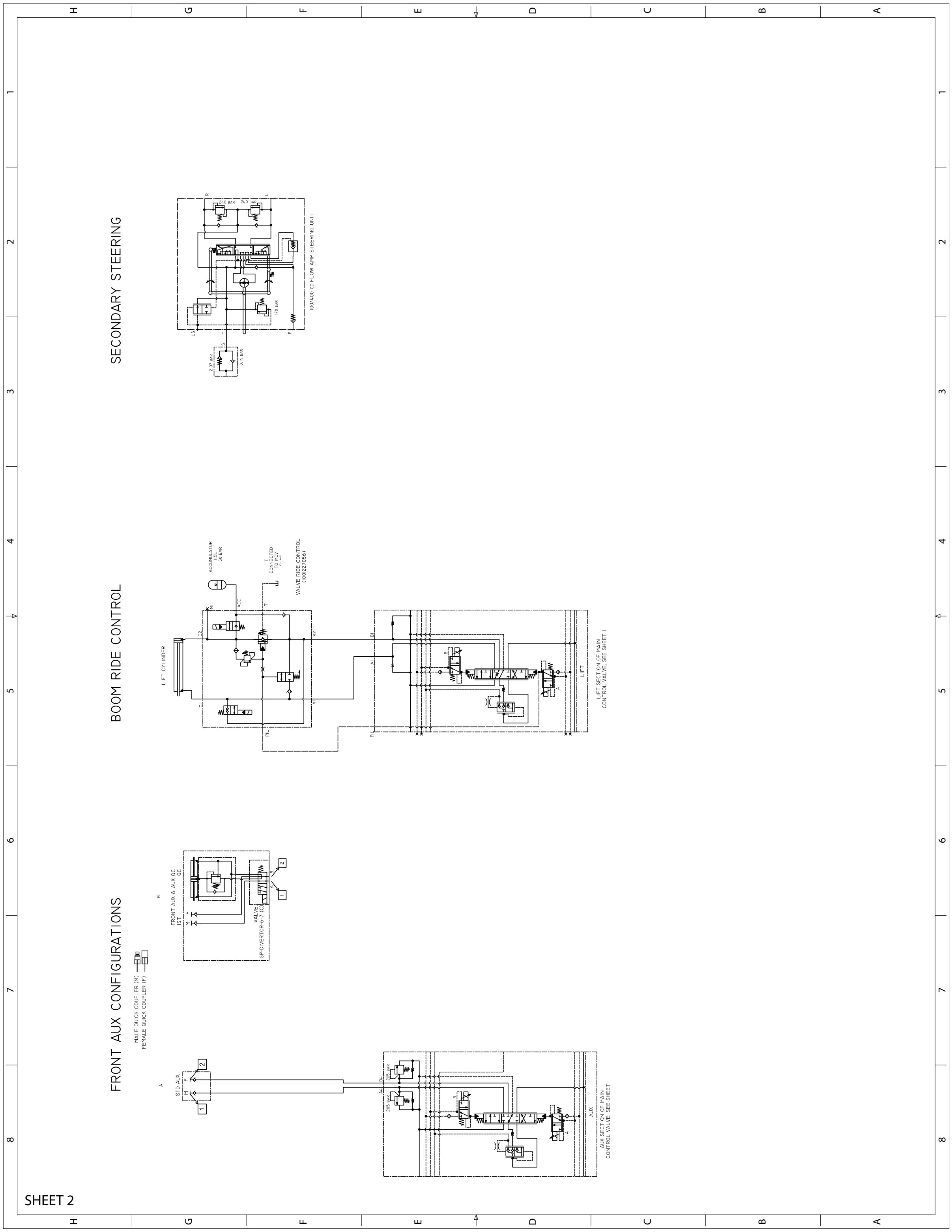
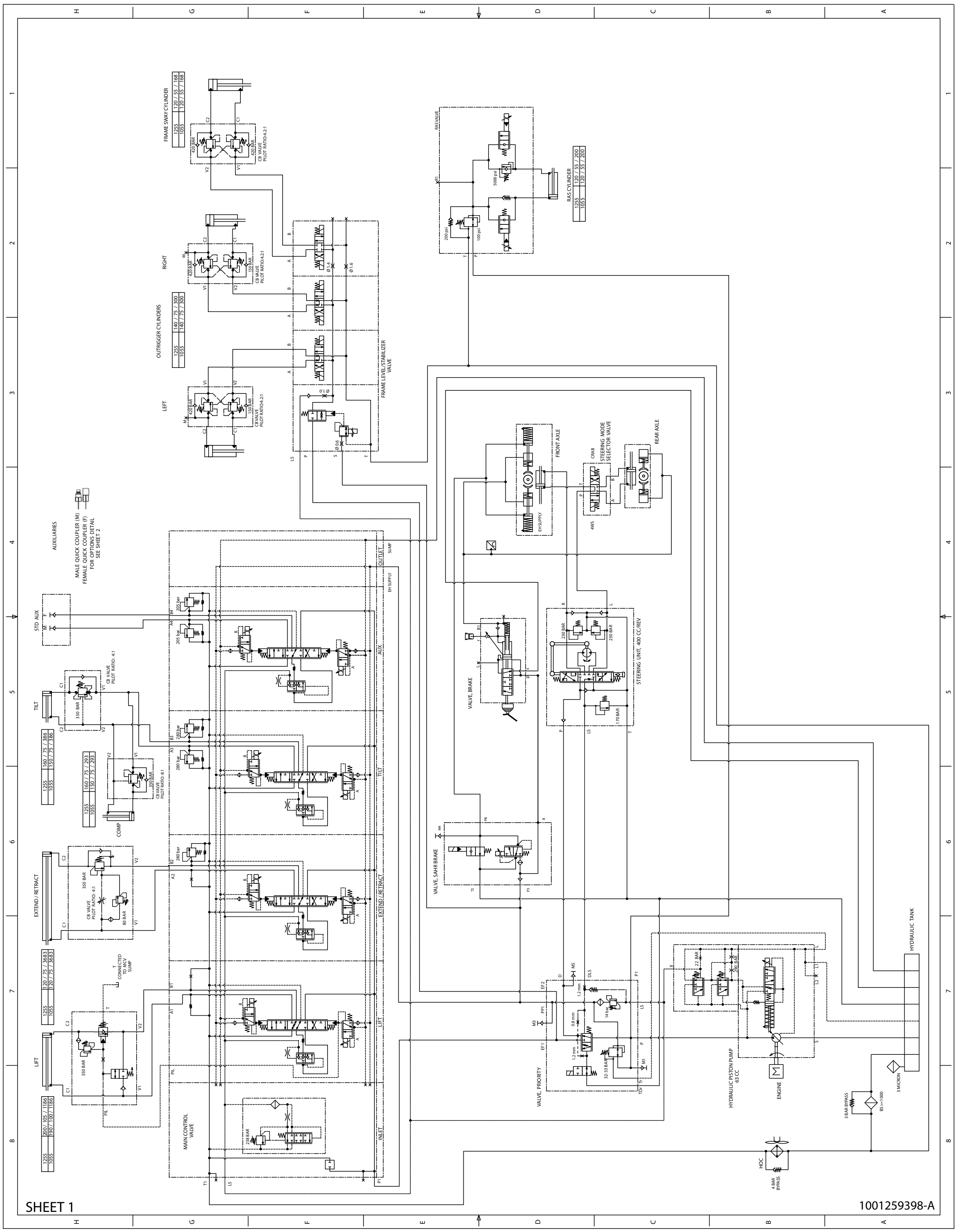

SECONDARY STEERING
BOOM RIDE CONTROL
FRONT AUX CONFIGURATIONS
LIFT CYLINDER
ACCUMULATOR
VALVE RIDE CONTROL
LIFT SECTION OF MAIN CONTROL VALVE. SEE SHEET 1
AUX SECTION OF MAIN CONTROL VALVE. SEE SHEET 1
STD AUX
MALE QUICK COUPLER (M)
FEMALE QUICK COUPLER (F)
SHEET 2

TH100229A

b. 1055, 1255 - PVC 2005



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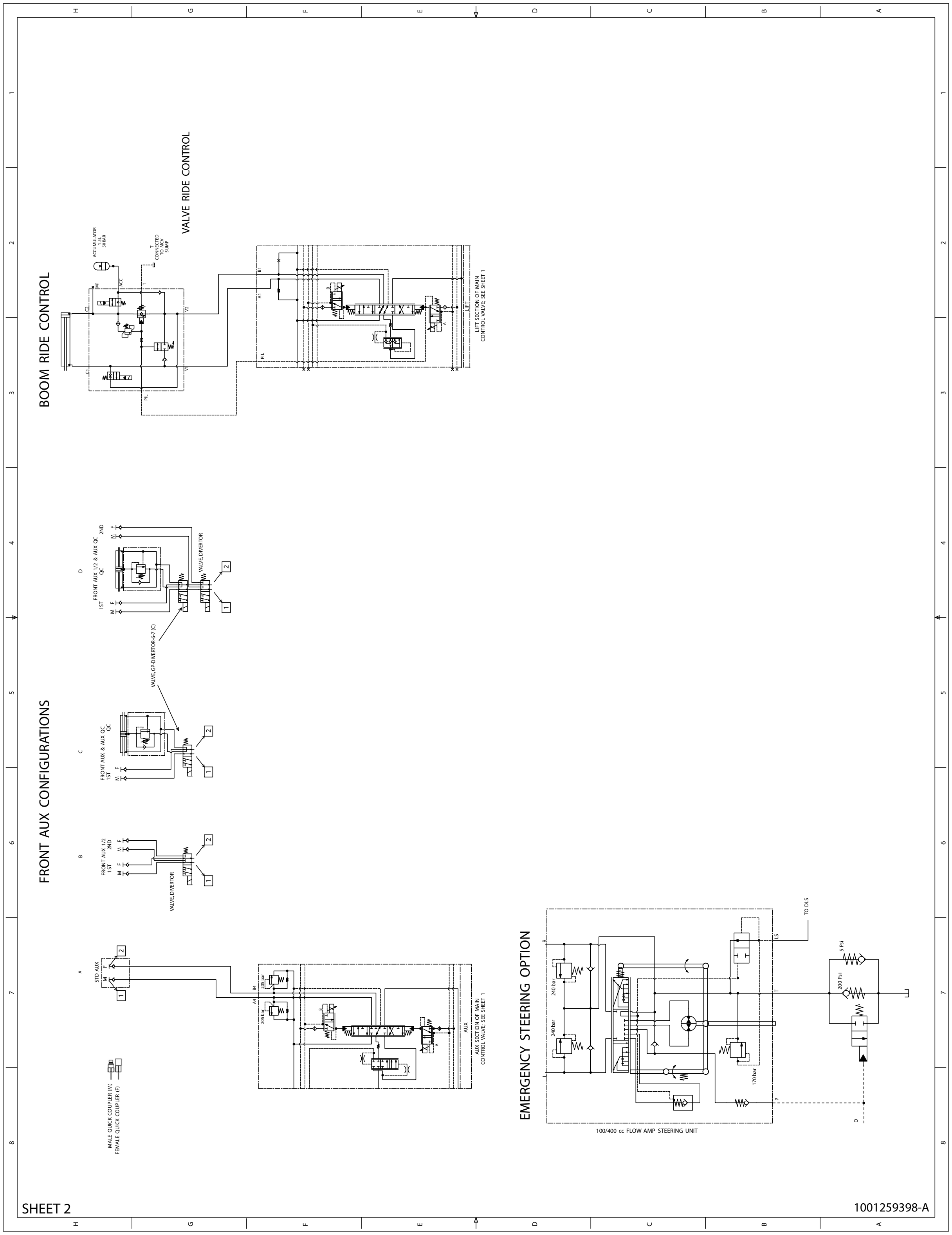

BOOM RIDE CONTROL
VALVE RIDE CONTROL
LIFT SECTION OF MAIN CONTROL VALVE; SEE SHEET 1
FRONT AUX CONFIGURATIONS
MALE QUICK COUPLER (M)
FEMALE QUICK COUPLER (F)
AUX SECTION OF MAIN CONTROL VALVE; SEE SHEET 1
EMERGENCY STEERING OPTION
100/400 cc FLOW AMP STEERING UNIT
TO DLS
SHEET 2
1001259398-A

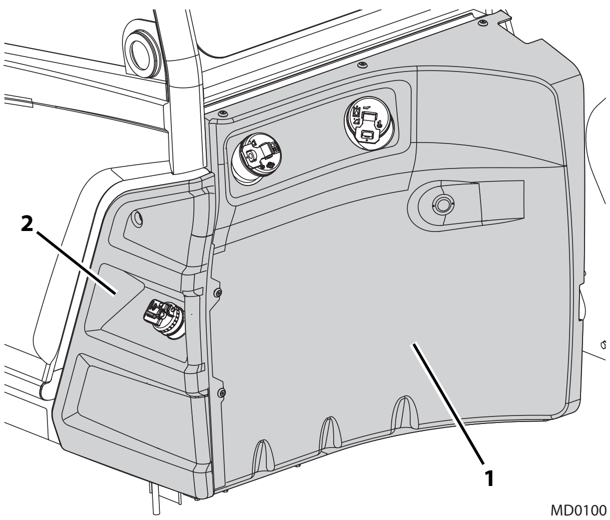
MAE44630A

8.7 HYDRAULIC RESERVOIR

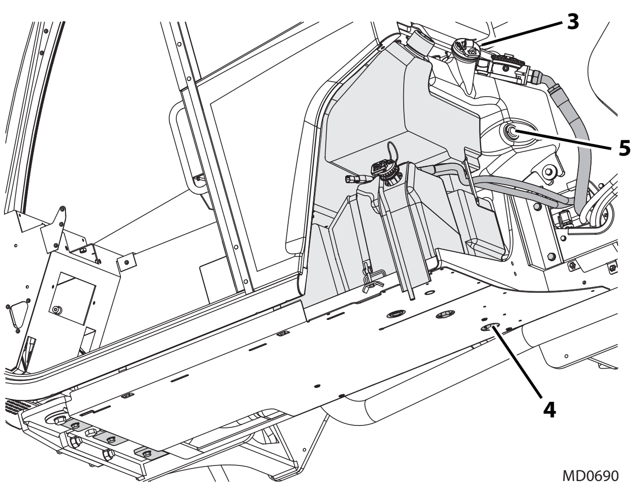
The hydraulic reservoir is located between the cab and the frame.

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**).

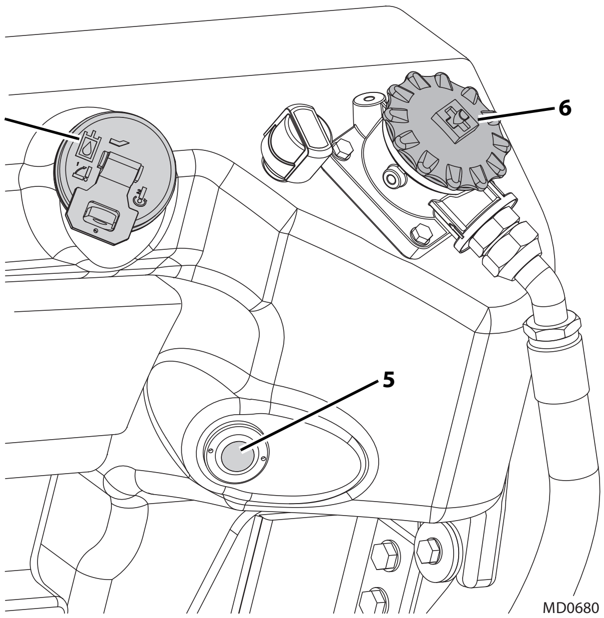


7. Open the filler cap (**3**) on the hydraulic oil reservoir. Remove the drain plug (**4**) on the bottom of the hydraulic oil reservoir.
8. Transfer the used hydraulic oil into a suitable covered container, and label as “Used Oil”. Dispose of used oil at an approved recycling facility. Clean and reinstall 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

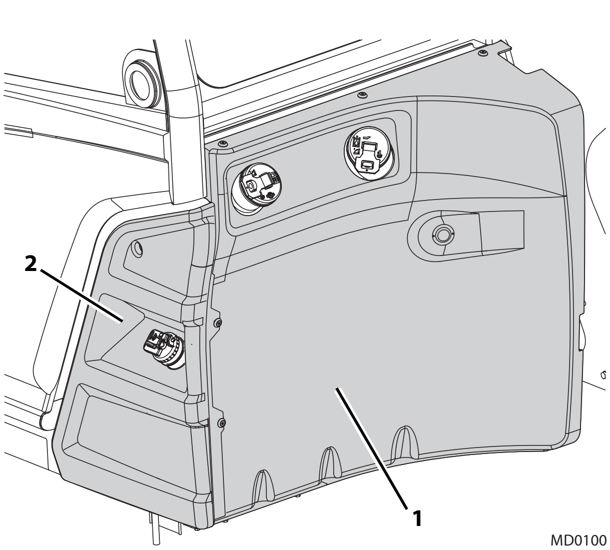
1. Be sure the reservoir is clean and free of all debris.
2. Install a new hydraulic oil filter. Refer to Section 8.7.3, “Hydraulic Filter Replacement”.
3. Fill the reservoir with oil until oil level is visible in the gauge window (**5**). Refer to Section 2.3, “Fluid and Lubricant Capacities”.
4. Properly 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. Close the hydraulic oil filler cab access panel at the bottom left rear of the cab.
8. 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 fuel tank/hydraulic tank access cover (**1**).
6. Remove DEF tank access cover (**2**).
7. Be sure the filter area is clean and free of all debris.
8. Remove the hydraulic filter cap (**6**) on the hydraulic oil reservoir.
9. 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.
10. 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

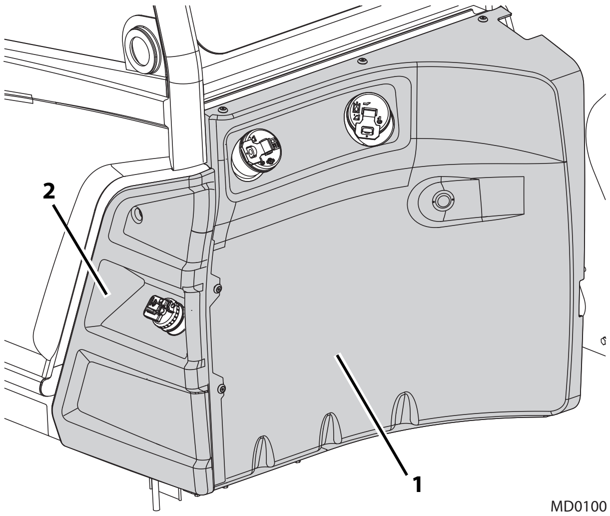
1. Apply a light coating of clean hydraulic oil to the new hydraulic filter base.
2. Remove cover from hydraulic tank filter opening and install filter. Verify filter is seated in reservoir.
3. Install hydraulic filter cap (**6**) and tighten by hand.
4. Properly connect the battery. Refer Section 9.8, “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 (**3**). Refer to Section 2.3, “Fluid and Lubricant Capacities”.
7. Install the cab access covers (**1** and **2**) at the rear of the cab.
8. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

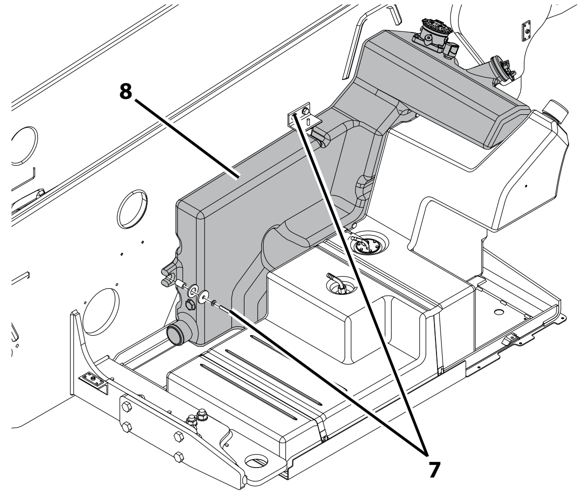
8.7.4 Hydraulic Oil Reservoir Removal/ Installation

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.

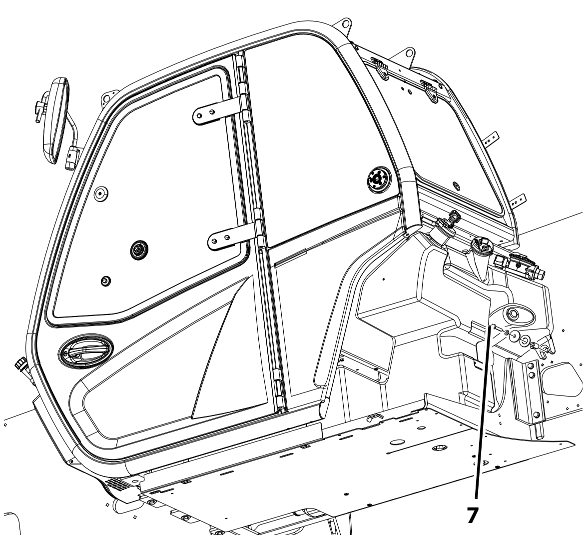
a. Reservoir Removal

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.





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



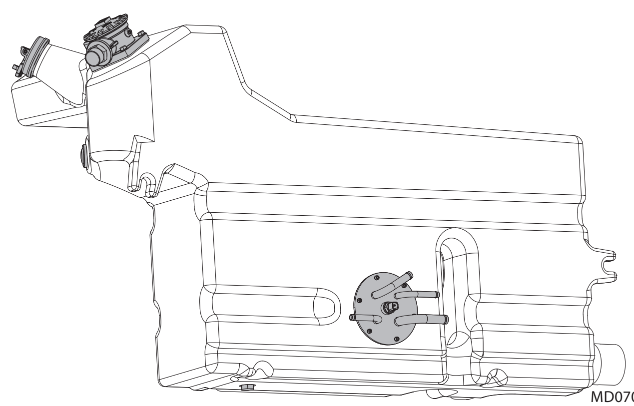
9. Properly support the cab.
10. Loosen and remove cab mounting bolts and pull cab away from frame to allow removal of the hydraulic reservoir (**8**).

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. 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.



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

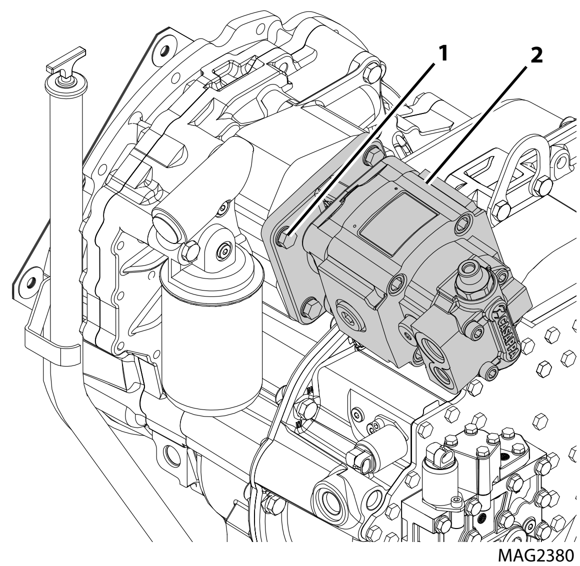
a. Pump Removal

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.

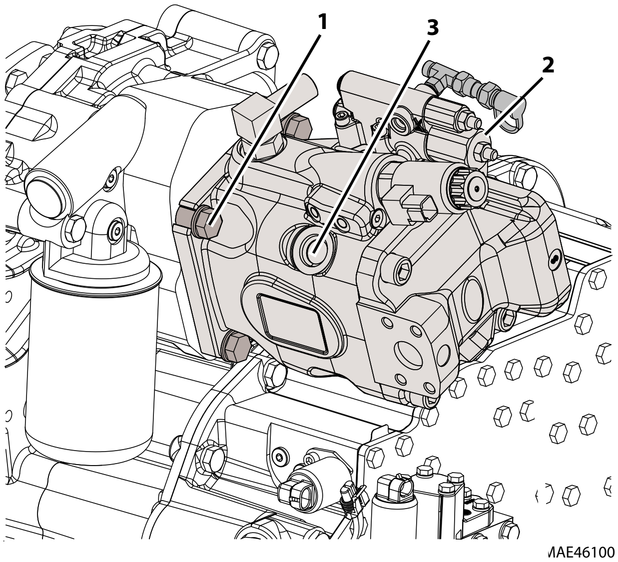
Note: *Cap all hoses as you remove them to prevent unnecessary fluid spillage.*

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

742 (if equipped)



742, 943, 1043, 1055, 1255 (if equipped)



7. Remove the four bolts and lockwashers (**1**) securing the pump (**2**) to the adapter plate. Remove the O-ring located between the plate and the pump. Wipe up any hydraulic oil spillage.
8. If necessary, remove the four bolts securing the adapter plate to the transmission. Remove the adapter plate.

***Note:* DO NOT** *disassemble the operating pump. The pump is preset from the manufacturer.*

b. Pump Installation

1. Refer to Section 2.8.1, "Definitions", for correct 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: For 742, 943, 1043, 1055, 1255 *- Prime the pump by filling the case with fresh, filtered hydraulic oil from a clean container through fill port (**3**) 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

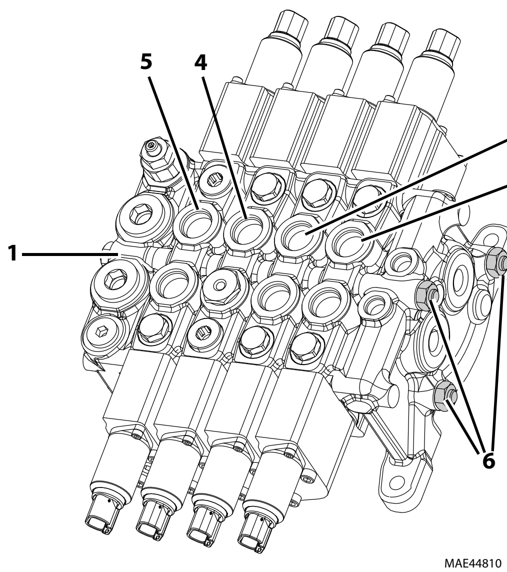
Refer to Section 8.4.1, "Pressure Checks and Adjustments".

8.9 CONTROL VALVES

8.9.1 Main Control Valve

The main control valve is mounted at the rear frame.

742, 943, 1043, 1055, 1255



The main control valve assembly (**1**) consists of working sections with their own valve assemblies, each providing a specific hydraulic function. Those functions are: lift/lower (**2**), extend/retract (**3**), tilt (**4**) and auxiliary (**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 18.5 lb-ft (25 Nm).

f. Main Control Valve Installation

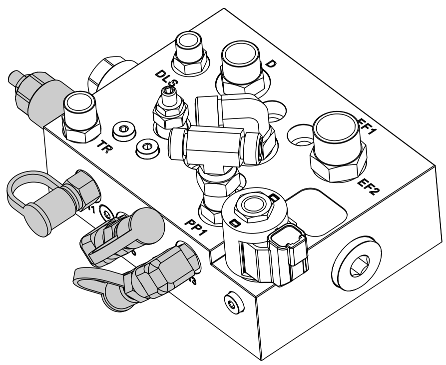
1. Install the main control valve onto the frame, aligning the bolts with the holes in the end sections of the main control valve. Slide the main control valve into position, and tighten the bolts.
2. Prime the main control valve by filling the inlet openings with fresh, filtered hydraulic oil from a 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 - 742, 943, 1043, 1055, 1255

The priority valve is mounted on the inside left frame behind the front axle.



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The function of a priority valve is to supply hydraulic fluid at specific flow rate determined by the supply capacity at different loading conditions. In effect, the priority valve give priority to critical components overt less critical when the demand load is higher than the supply capacity.

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.

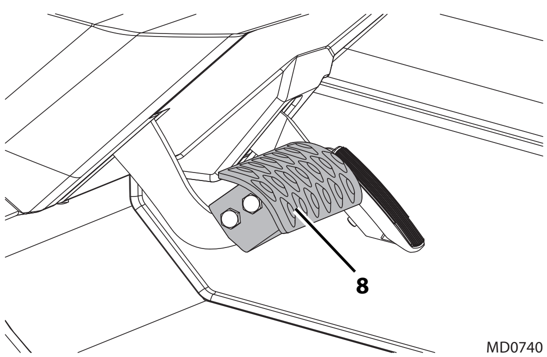
f. Priority Valve Test

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

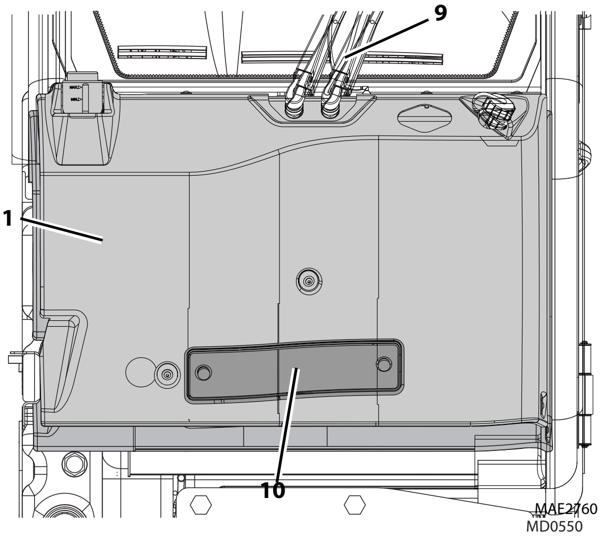
8.9.3 Service Brake Valve

a. Service Brake Valve Removal

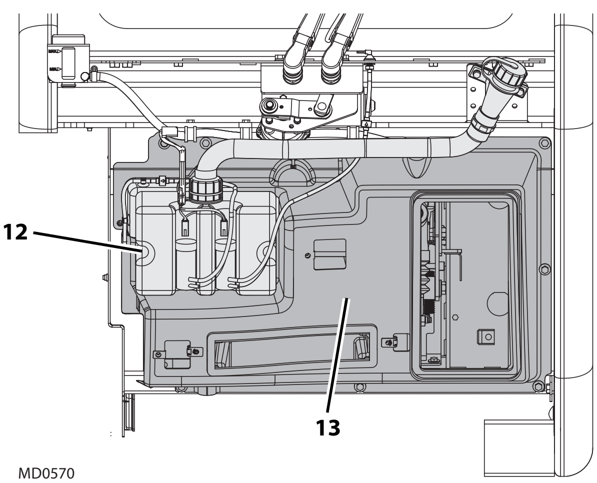
1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel.
3. Open the engine cover.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



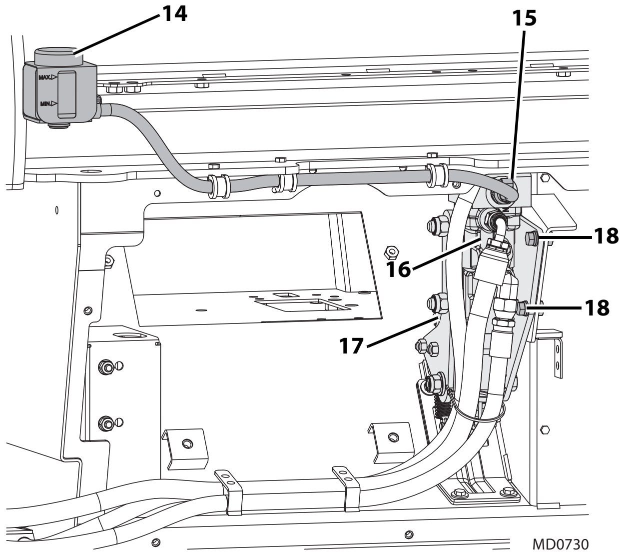
5. Remove brake pedal (**8**).



6. If equipped, remove the windshield wiper assembly (**9**).
7. Remove cab air filter cover (**10**).
8. Remove access covers from front of cab (**11**).



9. If equipped, remove windshield washer assembly (**12**), heater cover (**13**) 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 (**14**) and place a suitable container beneath brake reservoir connection (**15**).
14. Label, disconnect and cap all hoses attached to the service brake valve (**16**).
15. Disconnect and remove the electrical connector (**17**).
16. Remove the two nuts (**18**) 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. 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.
5. Fill the brake reservoir.
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 the service brake valve and connections for leaks, and check the level of the 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 the cover panel in the cab.
11. Install the access covers to the outside of the cab.
12. Close and secure the engine cover.
13. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

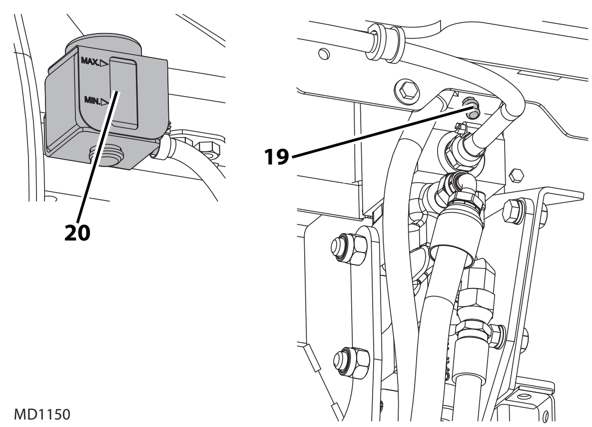
8.9.4 Service Brake Bleeding

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 is one brake bleeder on the brake valve and 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

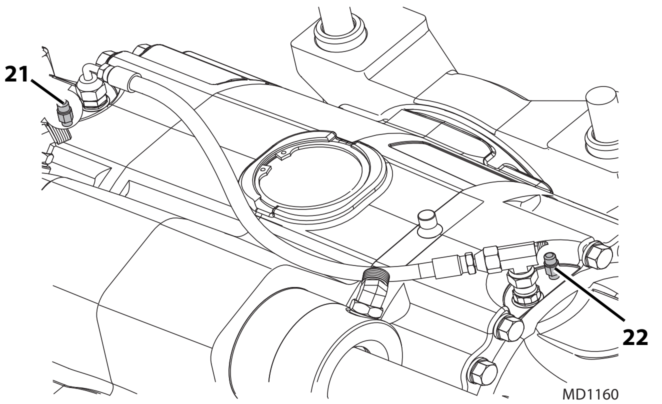
1. Place the transmission in (N) NEUTRAL, engage the park brake, and start the engine.



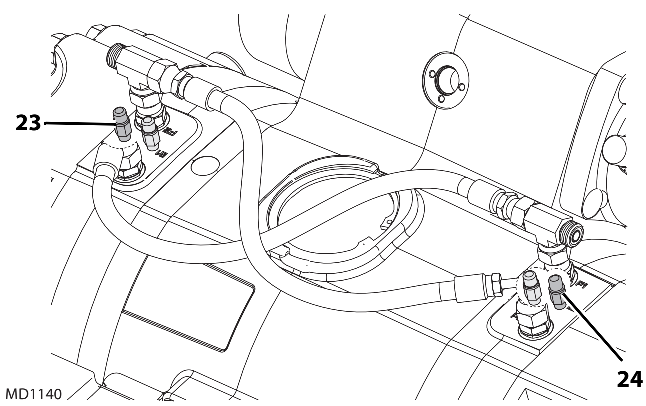
2. Open the master cylinder valve bleeder (**19**) and allow the master cylinder to gravity fill and slowly depress the brake pedal.
3. Close the master cylinder valve bleeder (**19**) when air bubbles no longer appear in the oil.
4. Slowly release the brake pedal completely allowing oil to refill the master cylinder.
5. Refill the brake reservoir (**20**).

b. Bleeding the Front and Rear Axles

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



2. Remove the plastic cap from the right rear brake bleeder (**21**). Attach one end of a length of transparent tubing over the brake bleeder. Place the other end of this tubing in a suitable transparent container that is partially filled with hydraulic oil. The end of the tubing must be below the oil level in the container.
3. **DO NOT** open the brake bleeder without holding the tubing firmly on the bleeder. There is pressure at the brakes. Carefully open the bleeder. Have the assistant depress the brake pedal. Close the brake bleeder when air bubbles no longer appear in the oil. Release the brake pedal. Remove the tubing from the brake bleeder.
4. Repeat steps 2 and 3 for the left rear brake bleeder (**22**).

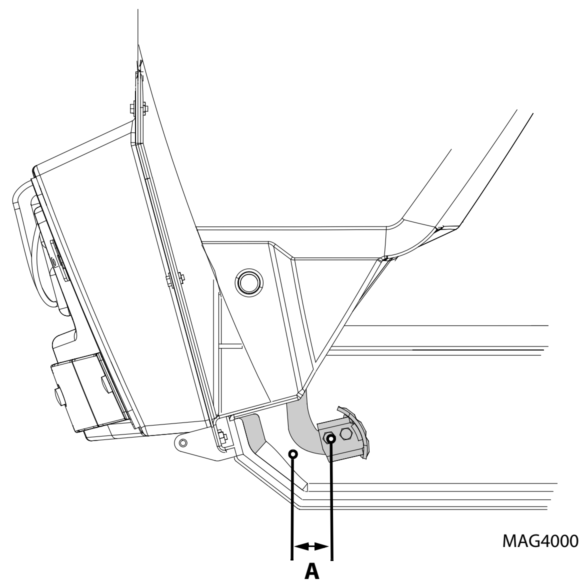


5. Repeat steps **2** and **3** for the right front brake bleeder (**23**).
6. Repeat Steps **2** and **3** for the left front brake bleeder (**24**).
7. Repeat Steps **2** thru **6** three times.
8. Repeat Section Section 8.9.4, "Service Brake Bleeding", one additional time.

c. Brake System Check

1. Connect JLG analyzer tool.
2. Start engine.
3. With JLG analyzer, navigate to; Diagnostics> System> Brk Pedal Prs.
4. Release park brake.
5. Pump brakes several times.
6. Wait approximately 10 seconds (analyzer should read <15 psi (1,0 bar)).
7. Apply service brakes with a single pedal press to "stop" and maintain position. There will be a defined force change, and the analyzer should read as follows:

Machine	Pressure
742	900 - 950 psi (62,1 - 65,5 bar)
943, 1043, 1055, 1255	780 - 850 psi (53,8 - 58,6 bar)



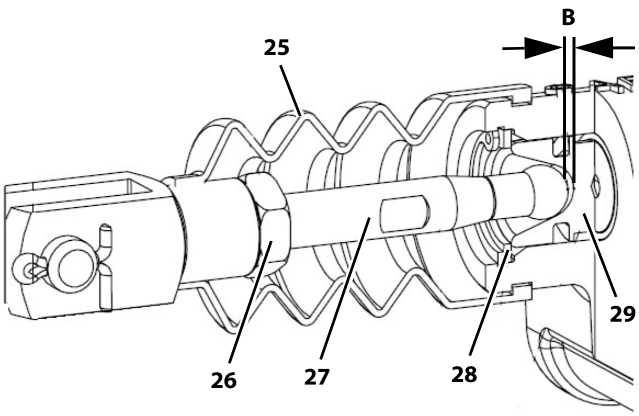
8. Have an assistant measure the distance (**A**) from the back of the pedal arm to the cab firewall. The distance should be equal to or greater than the following:

Machine	Distance (A)
742	2 in (50,8 mm)
943, 1043, 1055, 1255	1.5 in (38,1 mm)

d. Free Play Adjustment

CAUTION

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



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1. Slide boot (**25**) up to reveal locknut (**26**) and pushrod (**27**).
2. Start the engine. This will supply boost pressure and ensure that pushrod (**27**) is fully returned to the stop ring (**28**).
3. Loosen locknut (**26**), swivel the pushrod (**27**) 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 (**29**). 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 (**27**) with pliers and tighten the locknut (**26**). Reinstall the boot (**25**).

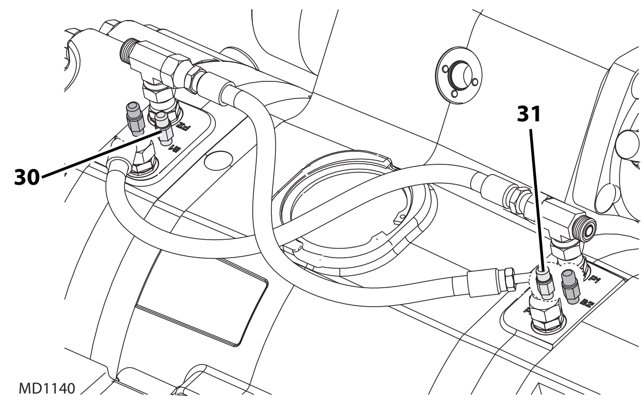
8.9.5 Service Brake Test

1. Start machine and allow to run for a minimum of one minute. Shut machine OFF, wait five seconds and apply service brake hard. The brake pedal should hold for a minimum of two seconds before loosing pressure.
2. If further testing is required, refer to Section 8.5.1, "Hydraulic Pressures" or Section 8.9.4, "Service Brake Bleeding".

8.9.6 Park Brake Bleeding

Bleeding of the park brake is performed on the front axle only.

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. Block both front wheels.



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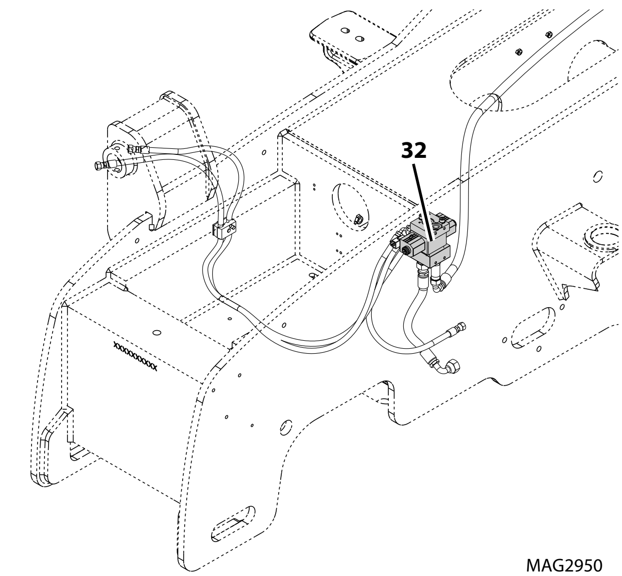
4. Remove the plastic cap from the right park brake bleeder (**30**). Attach one end of a length of transparent tubing over the brake bleeder. Place the other end of this tubing in a suitable transparent container that is partially filled with hydraulic oil. The end of the tubing must be below the oil level in the container.
5. Start the engine and disengage park brake.
6. **DO NOT** open the park brake bleeder without holding the tubing firmly on the bleeder. Carefully open the bleeder.
7. Switch the park brake to engage. Close the park brake bleeder when air bubbles no longer appear in the oil and switch the park brake switch to disengage.
8. Repeat steps **6** and **7** if required.
9. Repeat steps **4** thru **7** on the left park brake (**31**).
10. Repeat steps **6** and **7** if required.

8.9.7 Steering Orbital Valve

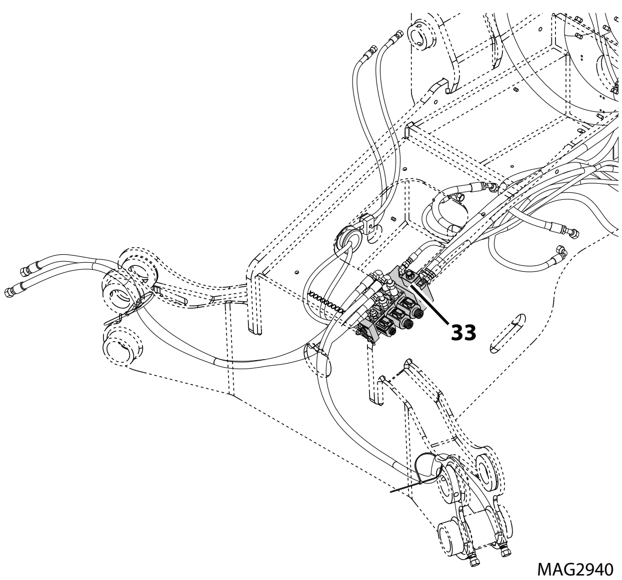
The steering orbital valve is located at the base of the steering wheel shaft, concealed by the front access covers. The valve is not serviceable and must be replaced in it's entirety if defective. For detailed information refer to Section 4.3.2, "Steering Column/Orbital Valve".

8.9.8 Frame Leveling Valve or Outrigger/ Frame Leveling Valve (if equipped)

No Outrigger



With Outrigger



The frame leveling valve (**32**) controls the direction of hydraulic fluid flow to frame leveling cylinder. The frame leveling valve is attached inside the frame behind the front axle.

The outrigger/frame leveling valve (**33**) controls the direction of hydraulic fluid flow to each outrigger cylinder and the frame leveling cylinder. The outrigger/frame leveling valve is attached inside the frame.

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

a. Removal

1. Park the machine on a firm, level surface, level the machine, fully retract the boom, raise and support the boom, place the transmission in (N) NEUTRAL, engage the park brake, lower each outrigger (if equipped) 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. **For Machine with Outriggers:** Remove the access cover from the top front of the frame.
6. Label, disconnect and cap the hydraulic hoses and the electrical plugs connected to the valve.
7. From below the machine, remove the nuts holding the valve to the frame.
8. Remove the valve from the machine. Wipe up any hydraulic fluid spillage in, on, near and around the machine.

b. Disassembly, Cleaning, Inspection and Assembly

1. Place the valve assembly on a suitable work surface.
2. Separate the 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 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 valve housing.

c. Installation

1. Install the 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 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. Remove boom support.
6. 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.
7. Inspect for leaks and check the level of the hydraulic fluid in the reservoir. Shut the engine OFF.

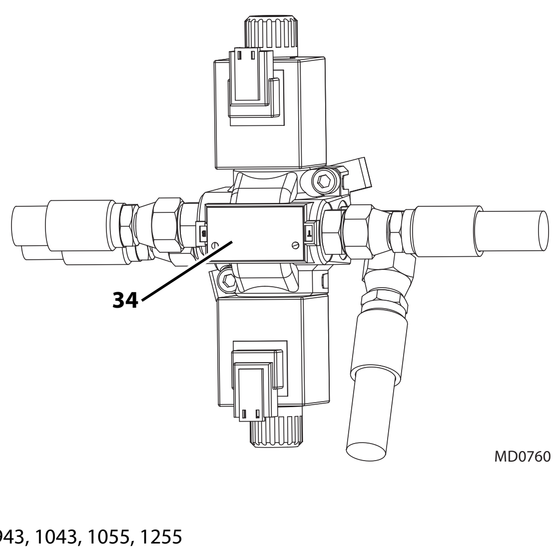
Note: *Check for leaks and repair as required before continuing. Add hydraulic fluid to the reservoir as needed.*

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

d. Test

1. Conduct a performance check of the valve hydraulic circuit. Refer to Section 2.2.4, “Hydraulic Cylinder Performance”, for values.
2. Check each valve mode for proper function.

8.9.9 Steer Select Valve



The machine can be used in the front-wheel, four-wheel or crab steering mode. The steer select valve (**34**) 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 Schematics”. 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”.

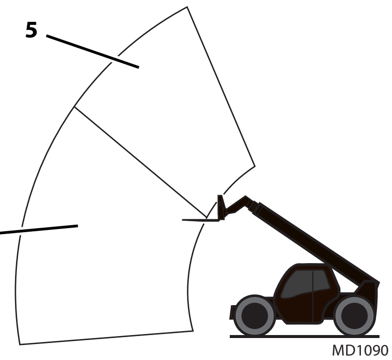
1. Conduct a pressure check of the steering hydraulic circuit.
2. Check each steering mode for proper function.

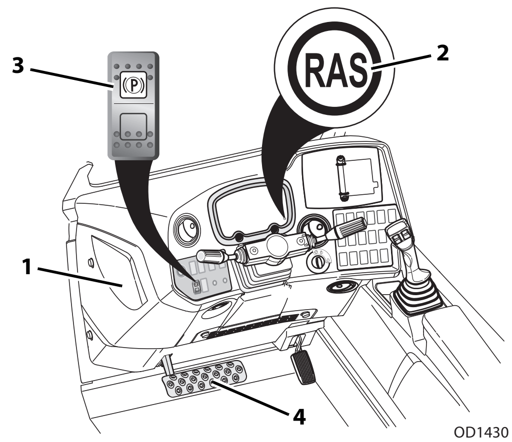
8.10 REAR AXLE STABILIZATION (RAS) SYSTEM

8.10.1 Rear Axle Stabilization System Test

The following procedure is required to verify the proper operation of the Rear Axle Stabilization (RAS) System.

If any of the following test results cannot be achieved, the system is not functioning properly and the machine must be removed from service and repaired before continued operation.





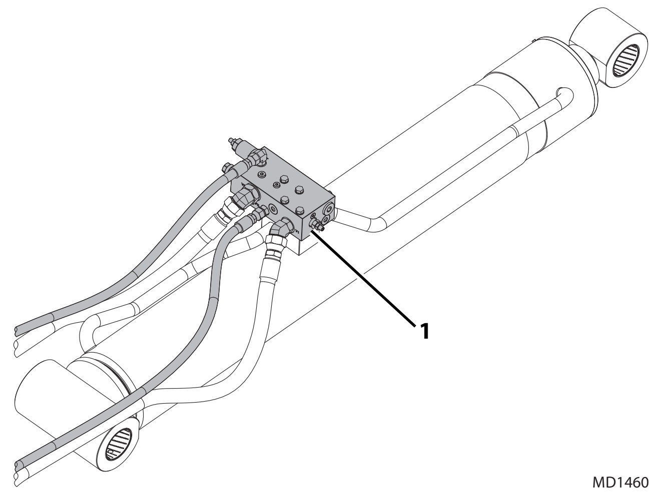
1. Park the machine on a firm, level surface, level the machine (0° Frame Level Angle), fully retract the boom, no load, place the transmission in (N) NEUTRAL, engage the park brake.
2. Connect the JLG analyzer to the XE port on the power distribution board behind the access panel (**1**) on the left side of the dash. Refer to Section , “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 45,72 m (150 ft).”
3. Verify RAS (**2**) indicator is off.
4. Place one 8 in (203 mm) high block in front of left front tire.
5. Release the park brake (**3**), place transmission lever in FORWARD and slowly drive onto block.

6. Stop when tire is resting on top of block
7. Engage park brake (**3**), place the transmission in (N) NEUTRAL.
8. Verify right front and both rear tires are in full contact with ground.
9. Using the frame level function, level the machine back to 0° Frame Level Angle.
10. Fully depress service brake (**4**), release the park brake (**3**) and raise the boom to 60° (**5**).
11. The RAS indicator should illuminate and remain ON when the boom is at or above 40°.
12. Engage park brake (**3**).

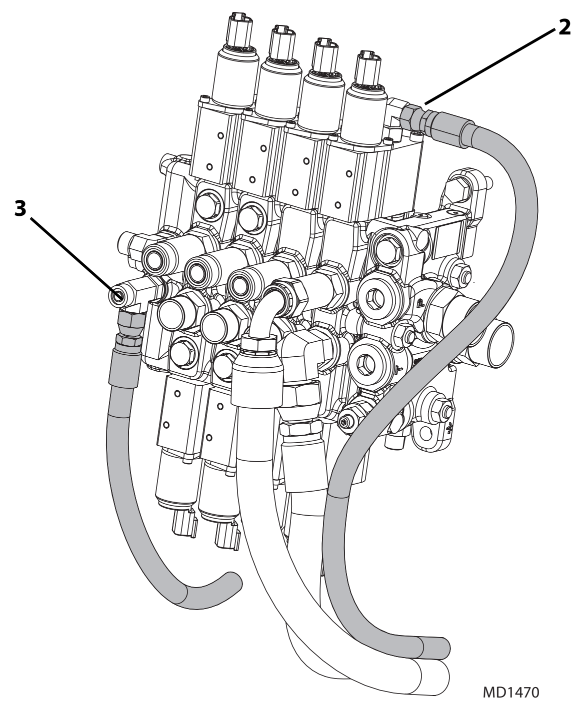
Note: *Perform the following steps at low engine idle unless otherwise noted.*

13. Navigate the JLG analyzer to; Diagnostics>System>Brk Pedal Prs.
14. Fully apply service brake (**4**), release park brake (**2**), place transmission in (R) REVERSE 2nd gear.
15. Slowly release service brake until the JLG analyzer reads 200 - 250 psi (13,8 - 17,2 bar).
16. Increase engine speed to drive through the brake, slowly backing off the eight inch high block while retaining 200 - 250 psi (13,8 - 17,2 bar) service brake pressure.
17. Stop machine when the left front tire is no longer resting on the block.
18. The RAS indicator should remain ON. The rear axle should remain locked while backing off the eight inch high block and the left front tire should remain off the ground.
19. Lower the boom to 45° (**6**).
20. With the transmission still in (R) REVERSE, slowly release the service brake.
21. The rear axle lock system and RAS light should go OFF with the service brake pressure of 145 psi (10 bar).
22. The left front wheel should return to the ground while the machine travels in (R) REVERSE.
23. After all four tires are in full contact with the ground, depress the service brake to stop the machine.
24. Place the transmission in (N) NEUTRAL, engage the park brake.
25. Level the machine.
26. Remove block from in front of left front tire.
27. Disconnect JLG analyzer and replace previously removed cover (**1**).

8.11 PRECISION GRAVITY LOWER SYSTEM (PGLS)



The Precision Gravity Lower System (PGLS) is a hydraulic system utilized on the boom lower function.
The PGLS valve (**1**) mounts directly to the boom lift/lower cylinder.



In addition to the two ports for the boom lower function from the main control valve, there are two additional hoses that are connected to the end cap port (**2**) and sump port (**3**).

The PGLS utilizes pilot pressure from the boom lower section of the main control valve. When the boom lower command is initiated from the joystick, pilot pressure builds at the PGLS valve that is proportional to joystick position. This pilot pressure at the PGLS valve block shifts the main spool in the PGLS valve. When this main spool shifts, oil is able to flows through the PGLS valve block allowing gravity to lower the boom.

The speed at which the boom lowers is dictated by the pilot pressure signal from the joystick.

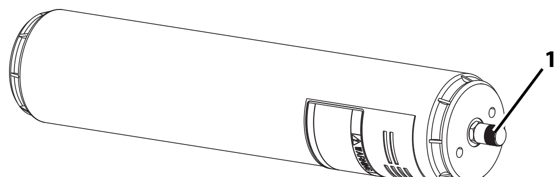
Since the PGLS utilizes gravity and pilot pressure, the boom should be lowered at low engine speed to optimize control and boom lower speeds.

8.12 BOOM RIDE CONTROL

8.12.1 General Accumulator Information

The accumulator is a pneumatic, piston type accumulator that 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.

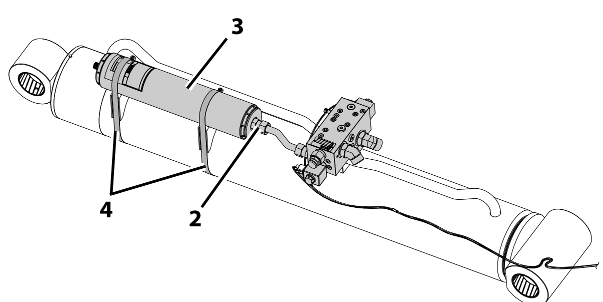


The accumulator comes “pre-charged”. If not charged, accumulator may need to be charged.

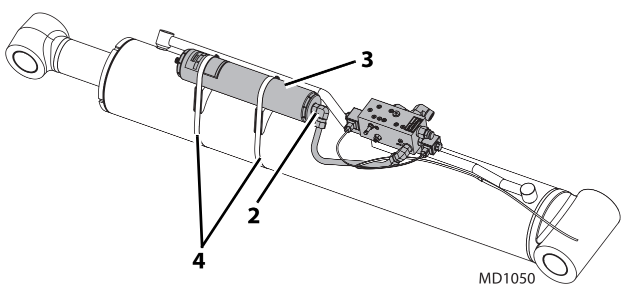
a. Accumulator Removal

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.

943, 1043



1055, 1255



5. Disconnect and cap or plug the hydraulic tube (**2**) at the accumulator (**3**).
6. Remove the two straps (**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 straps (**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 8.12.3, “Pre-Charging Accumulator”, for Accumulator pre-charging instructions.

8.12.2 Accumulators

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.

8.12.3 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-charge 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

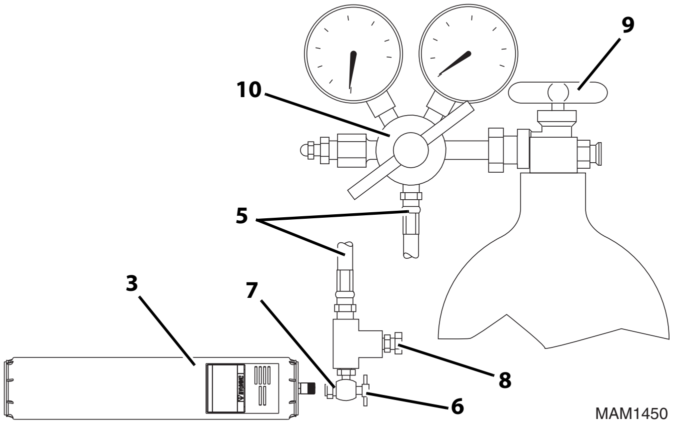
Never fill an accumulator with air. Air contains moisture which can cause corrosion. This corrosion may damage seals and ruin the accumulator.

Never charge an accumulator to a pressure more than specified. The proper pressure for the accumulator is 725 psi (50 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.

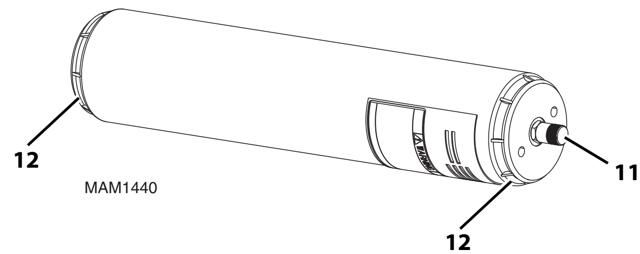
Use the following steps to properly pre-charge each accumulator:



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.
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 (**9**) on the nitrogen bottle.
9. Slowly adjust the regulator (**10**) on the nitrogen bottle to read 797 psi (55 bar).
10. Close the main valve (**9**) on the nitrogen bottle.
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 (**9**) 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.

8.12.4 Checking Pre-Charge

a. Gas Leaks



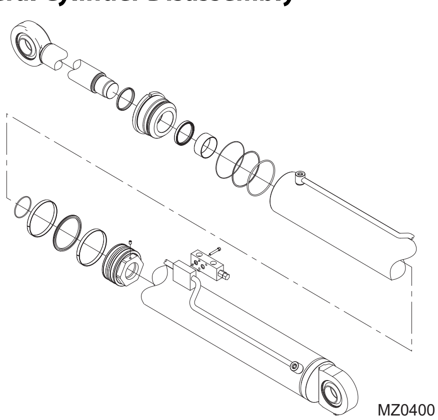
1. If an external leak is suspected, apply soapy water to the gas valve (**11**) and the seams of the gas bottle (**12**). If bubbles form, the accumulator has to be replaced.
2. If an internal leak is suspected, check for foaming oil in the hydraulic reservoir and/or no accumulator action. If any of these signs are evident, the accumulator has to be replaced.

8.13 HYDRAULIC CYLINDERS

8.13.1 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 149 - 204°C (300 - 400°F) will destroy the bond. Avoid overheating, or the parts may become distorted or damaged. Apply sufficient torque for removal while the parts are still hot. The sealant often leaves a white, powdery residue on threads and other parts, which must be removed by brushing with a soft brass wire brush prior to reassembly.

9. Remove the piston head 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 clean with Loctite® Cleaner prior 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 2.8.1, “Definitions”, 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 8.13.4, “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 8.13.4, “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.

8.13.2 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.*

8.13.3 Steering Cylinders

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

8.13.4 Cylinder Torque Specifications

a. Lift/Lower Cylinder

Model	Head	Piston	Piston Set Screw
943, 1043	1052-862 lb-ft (1426.32 - 1168.71 Nm)	1346-1102 lb-ft (1824.93-1494.11 Nm)	9 lb-ft (12 Nm)
1055	1014-1240 lb-ft (1375-1681 Nm)	1269-1551 lb-ft (1721-2103 Nm)	16-20 lb-ft (22-27 Nm)
1255	443 lb-ft (600 Nm)	1844 lb-ft (2500 Nm)	7.3 lb-ft (10 Nm)

b. Extend/Retract Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve
943, 1043	738 lb-ft (1000 Nm)	1844 lb-ft (2500 Nm)	NA	NA	NA
1055, 1255	295-369 lb-ft (400-500 Nm)	1844 lb-ft (2500 Nm)	74 lb-ft (100 Nm)	125 lb-ft (170 Nm)	NA

c. Tilt Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve
943, 1043	264-302 lb-ft (358-409 Nm)	258-295 lb-ft (350-400 Nm)	NA	NA	44-52 lb-ft (60-70 Nm)
1055, 1255	295-369 lb-ft (400-500 Nm)	2682 lb-ft (3636 Nm)	40 lb-ft (54 Nm)	40 lb-ft (54 Nm)	44-52 lb-ft (60-70 Nm)

d. Compensation Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve
943, 1043	755-923 lb-ft (1024-1251 Nm)	984-1186 lb-ft (726-875 Nm)	31-38 lb-ft (42-51 Nm)	31-38 lb-ft (42-51 Nm)	30-37 lb-ft (41-50 Nm)
1055, 1255	1106 lb-ft (1500 Nm)	4056 lb-ft (5500 Nm)	44 lb-ft (60 Nm)	44 lb-ft (60 Nm)	37 lb-ft (50 Nm)

e. Frame Level Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve
943, 1043	332 lb-ft (450 Nm)	1033 lb-ft (1400 Nm)	NA	NA	NA
1055, 1255	332 lb-ft (450 Nm)	295 lb-ft (400 Nm)	NA	NA	NA

f. Outrigger Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	CB Valve
1043	755-923 lb-ft (1024-1251 Nm)	1041-1273 lb-ft (1411-1726 Nm)	41-51 lb-ft (56 - 69 Nm)	41-51 lb-ft (56 - 69 Nm)	NA
1055, 1255	755-923 lb-ft (1024-1251 Nm)	1041- 1273 lb-ft (1411-1726 Nm)	41-51 lb-ft (56-69 Nm)	41-51 lb-ft (56-69 Nm)	NA

g. RAS Cylinder

Model	Head	Piston	V1 Plug	V2 Plug	Relief
943, 1043	332 lb-ft (450 Nm)	1033 lb-ft (1400 Nm)	NA	NA	25 lb-ft (34 Nm)
1055, 1255	332 lb-ft (450 Nm)	1033 lb-ft (1400 Nm)	NA	NA	25 lb-ft (34 Nm)

h. Attachment Cylinders

Attachment	Head	Piston	V1 Plug	V2 Plug
50 in Side Tilt Carriage	NA	NA	NA	NA
60 in Side Tilt Carriage	NA	NA	NA	NA
72 in Side Tilt Carriage	NA	NA	NA	NA
50 in Dual Fork Positioner Carriage	NA	NA	NA	NA

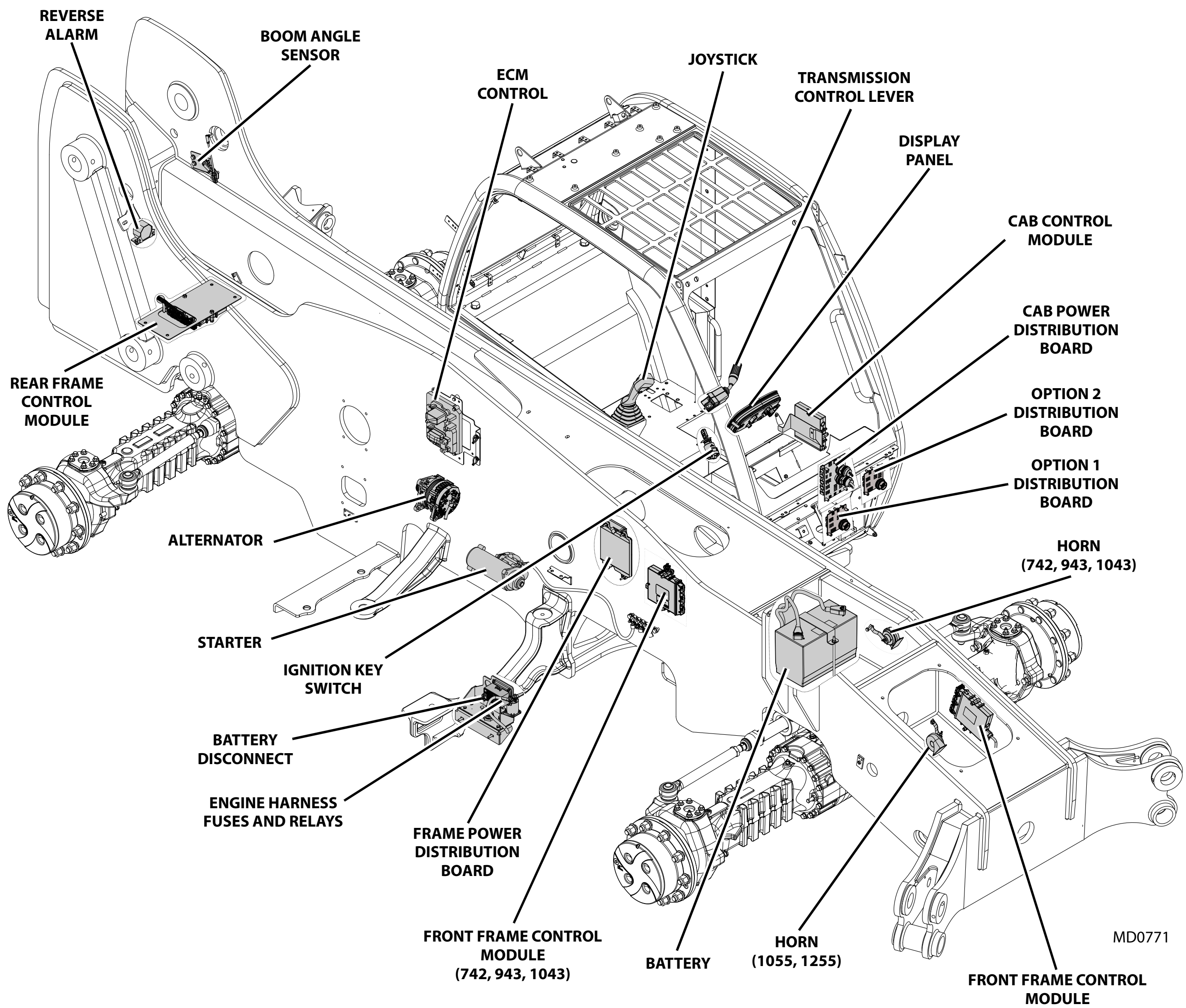
Section 9
Electrical System

Contents

9.1 ELECTRICAL COMPONENT TERMINOLOGY

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

9.1.1 General Overview



TYPICAL ILLUSTRATION

9.2 SPECIFICATIONS

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

9.3 SAFETY INFORMATION

WARNING

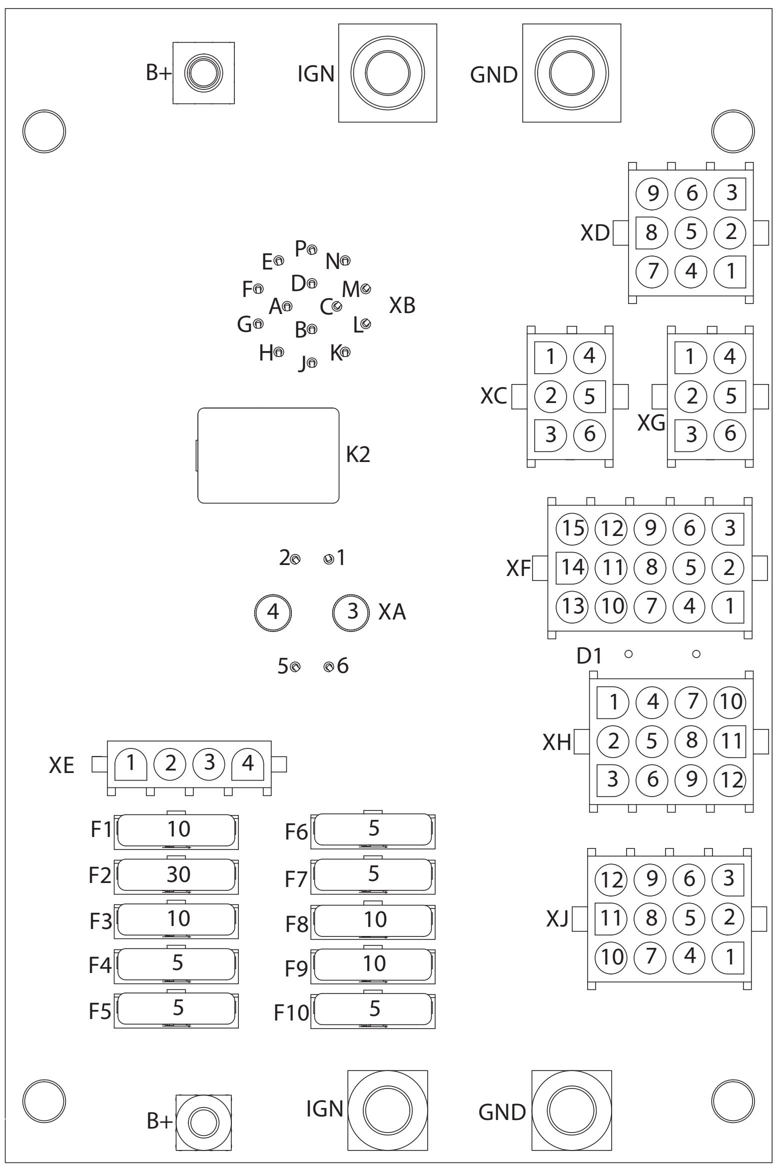
DO NOT service the machine without following all safety precautions as outlined in Section 1, "Safety Practices", of this manual.

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 designation.*



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

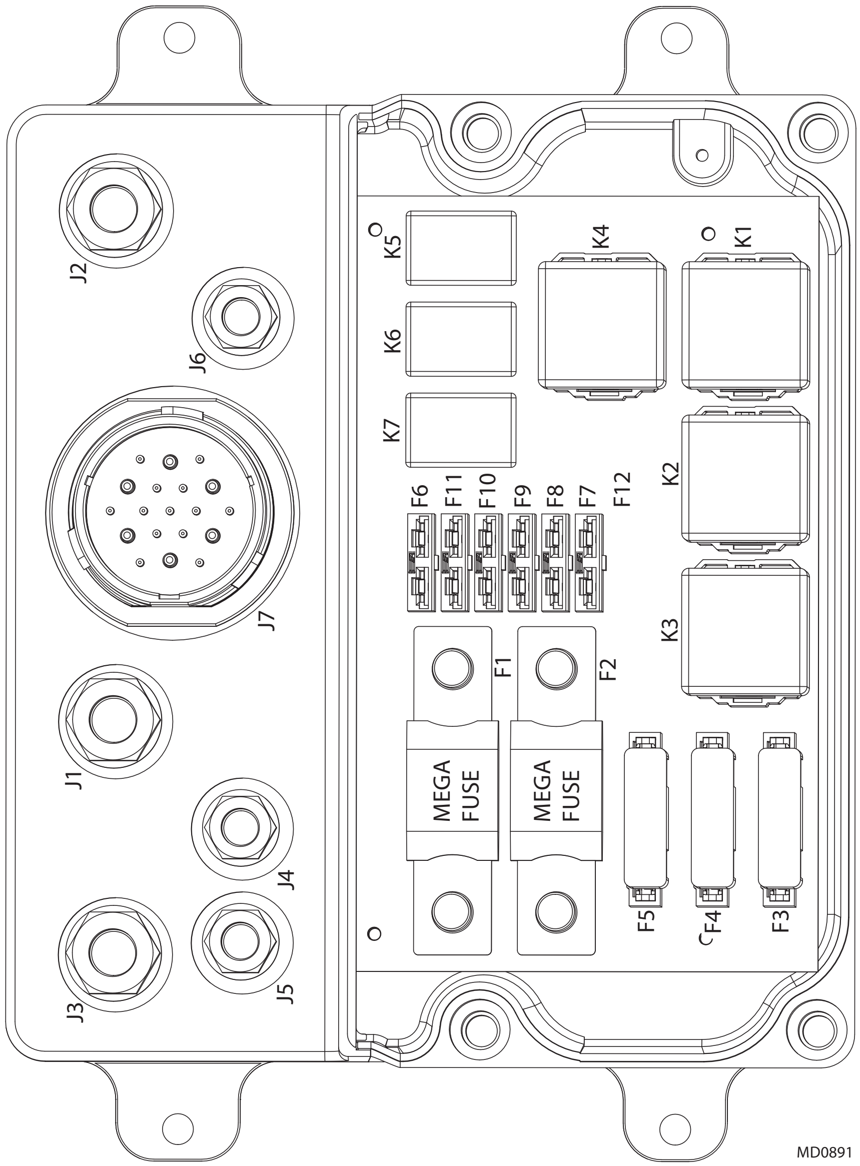
CONNECTOR	PIN	FUNCTION
XB	A	KEY IGNITION
	B	CAN1 HIGH
	C	CAN1 LOW
	D	SPARE
	E	SPARE
	F	KEY PLAT
	G	IGNITION OUT
	H	SPARE
	J	HVAC COMPRESSOR OUT
	K	REVERSE SIGNAL 2
	L	REVERSE SIGNAL 1
	M	BOOM WORK LIGHTS
	N	HORN OUT
	P	SPARE

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 to the right side of the cab, inside the frame.



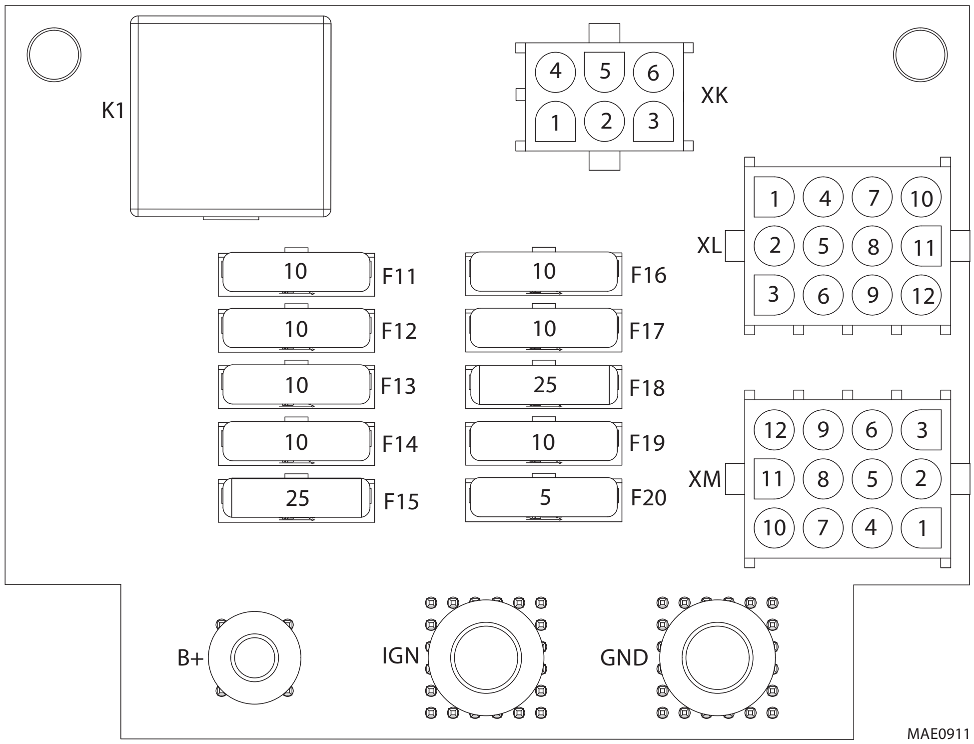
FUSE/RELAY	FUNCTION	AMP RATING
F1	GLOW PLUGS	150
F2	ALTERNATOR	200
F3	REAR FRAME	80
F4	FRONT FRAME	80
F5	CAB	80
F6	ECM IGNITION	25
F7	FRAME IGNITION	15
F8	ECM B+	30
F9	CAB B+	25
F10	AC FANS	30
F11	STARTER	30
F12	CAB MODULE	30
K1	FRONT FRAME IGNITION	70
K2	REAR FRAME IGNITION	70
K3	SYSTEM IGNITION	70
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 designation.*



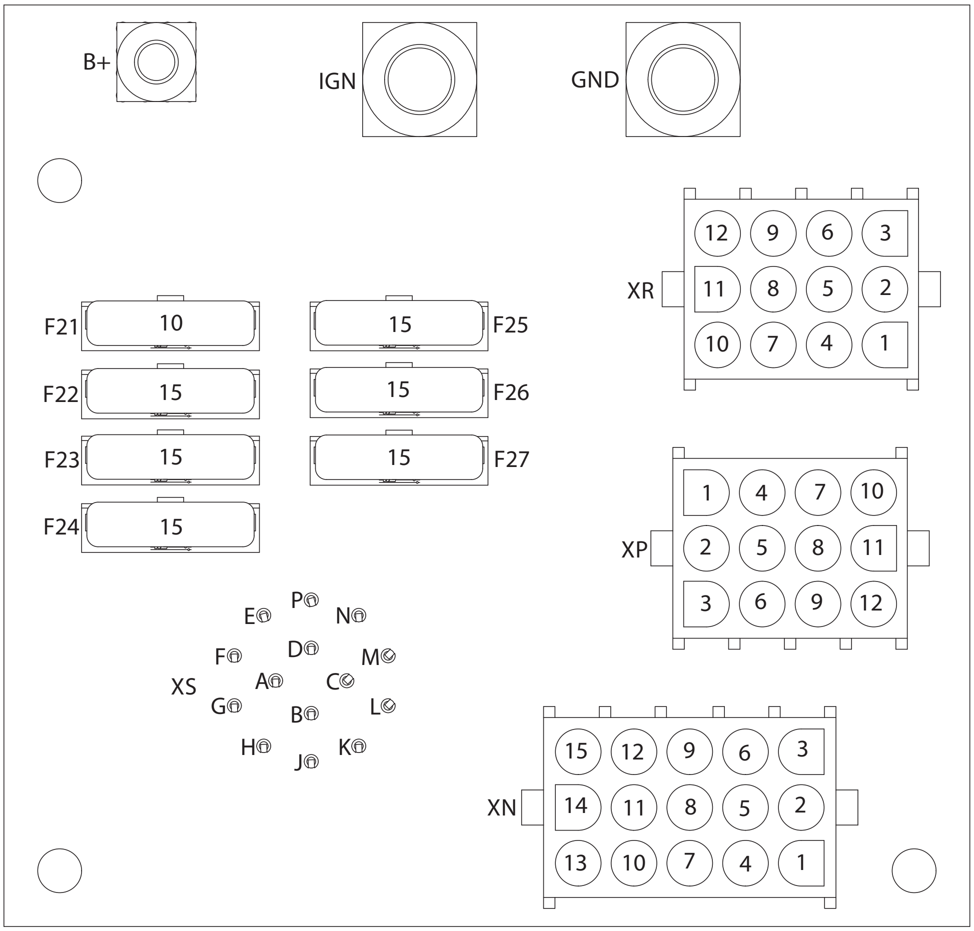
FUSE/RELAY	FUNCTION	AMP RATING
F11	BOOM WORK LIGHTS	10
F12	FRONT WORK LIGHTS	10
F13	REAR WORLK LIGHTS	10
F14	REAR WIPER	10
F15	WIPER POWER	25
F16	IGNITION	10
F17	ROOF WIPER POWER	10
F18	HVAC BLOWER POWER	25
F19	ROOF WIPER POWER	10
F20	AC FANS	5
K1	LIGHTS	

CONNECTOR	PIN	FUNCTION
XK	1	GND
	2	GND
	3	GND
	4	REAR WIPER POWER
	5	WIPER POWER
	6	LIGHTS ON SIGNAL
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 designation.*



MAE0921

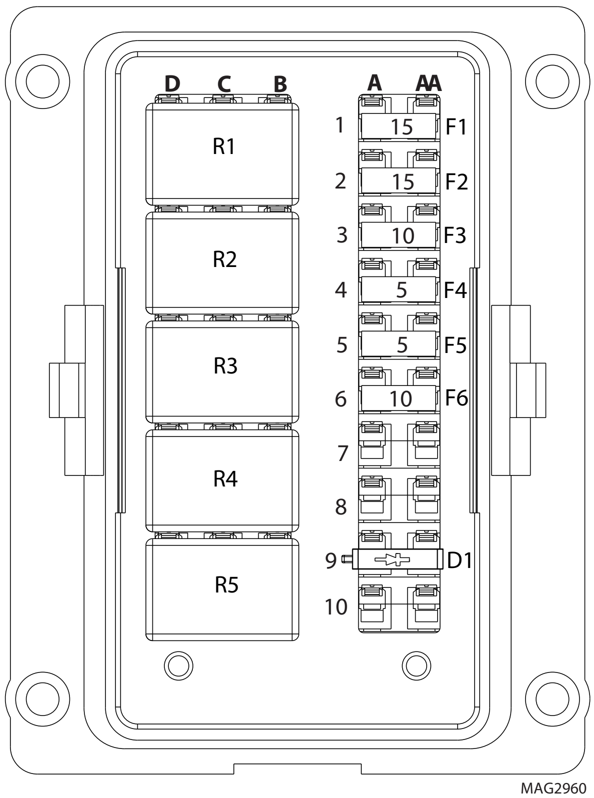
FUSE/RELAY	FUNCTION	AMP RATING
F21	RADIO	10
F22	AIR RIDE SEAT POWER	15
F23	RADIO B+	15
F24	SPARE	15
F25	AUXILARY POWER	15
F26	SPARE (IGNITION SWITCH)	15
F27	SPARE	15

CONNECTOR	PIN	FUNCTION
XS	A	SPARE
	B	SPARE
	C	CAMERA GND
	D	SPARE
	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	SPARE
	2	SPARE
	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	SPARE
	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.

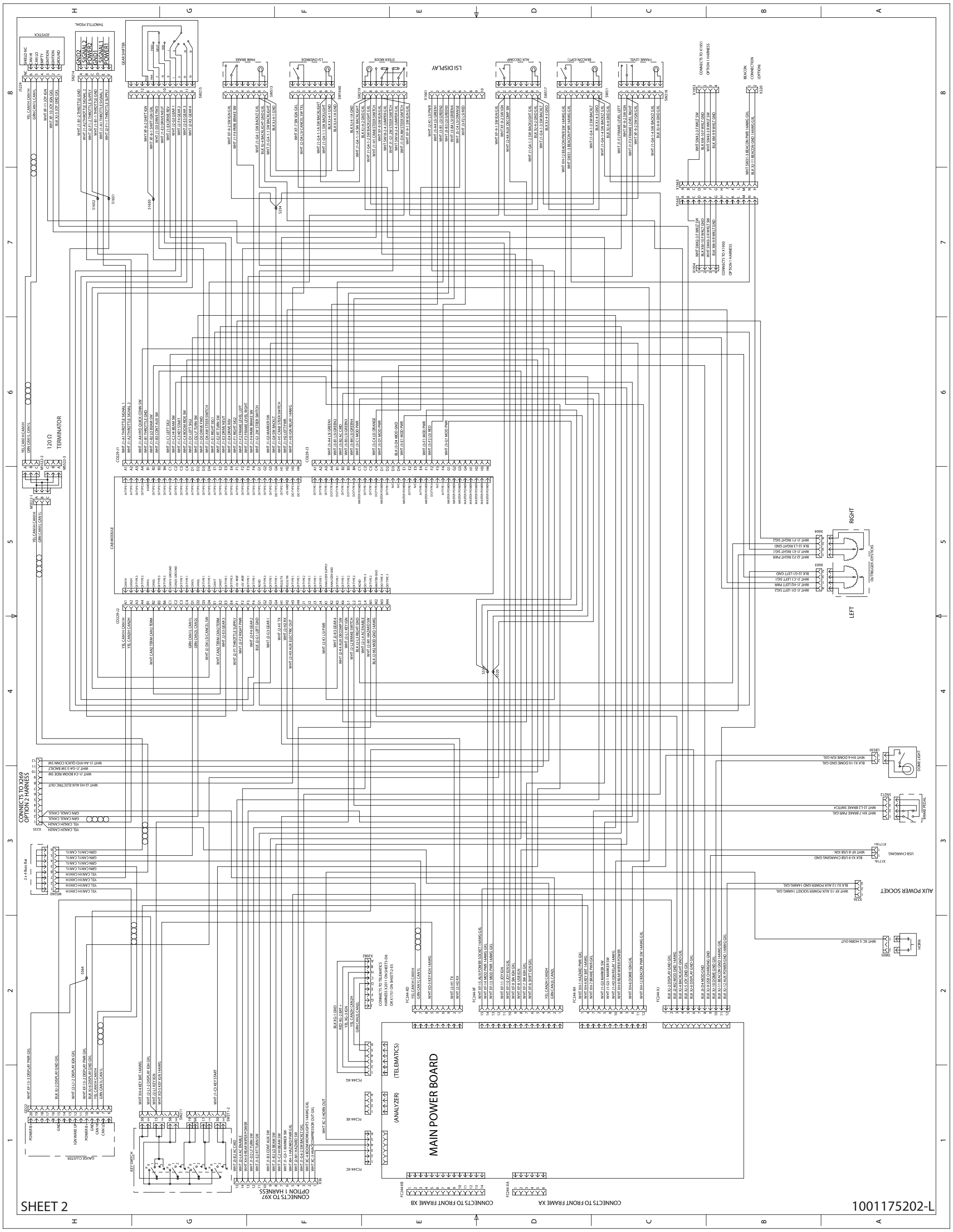


FUSE/RELAY	FUNCTION	AMP RATING
F1	DEF HEATER	15
F2	DEF SUPPLY MODULE	15
F3	DIAGNOSTIC POWER	10
F4	ECM IGNITION POWER	5
F5	ALTERNATE EXCITE POWER	5
F6	AFTER TREATMENT SENSORS POWER	10
D1	ALTERNATE EXCITE POWER	6
R1	STARTER LOCKOUT	35
R2	DEF SUPPLY MODULE	35
R3	DEF HEATER 3	35
R4	DEF HEATER 2	35
R5	DEF HEATER 1	35

9.5 ELECTRICAL SYSTEM SCHEMATICS

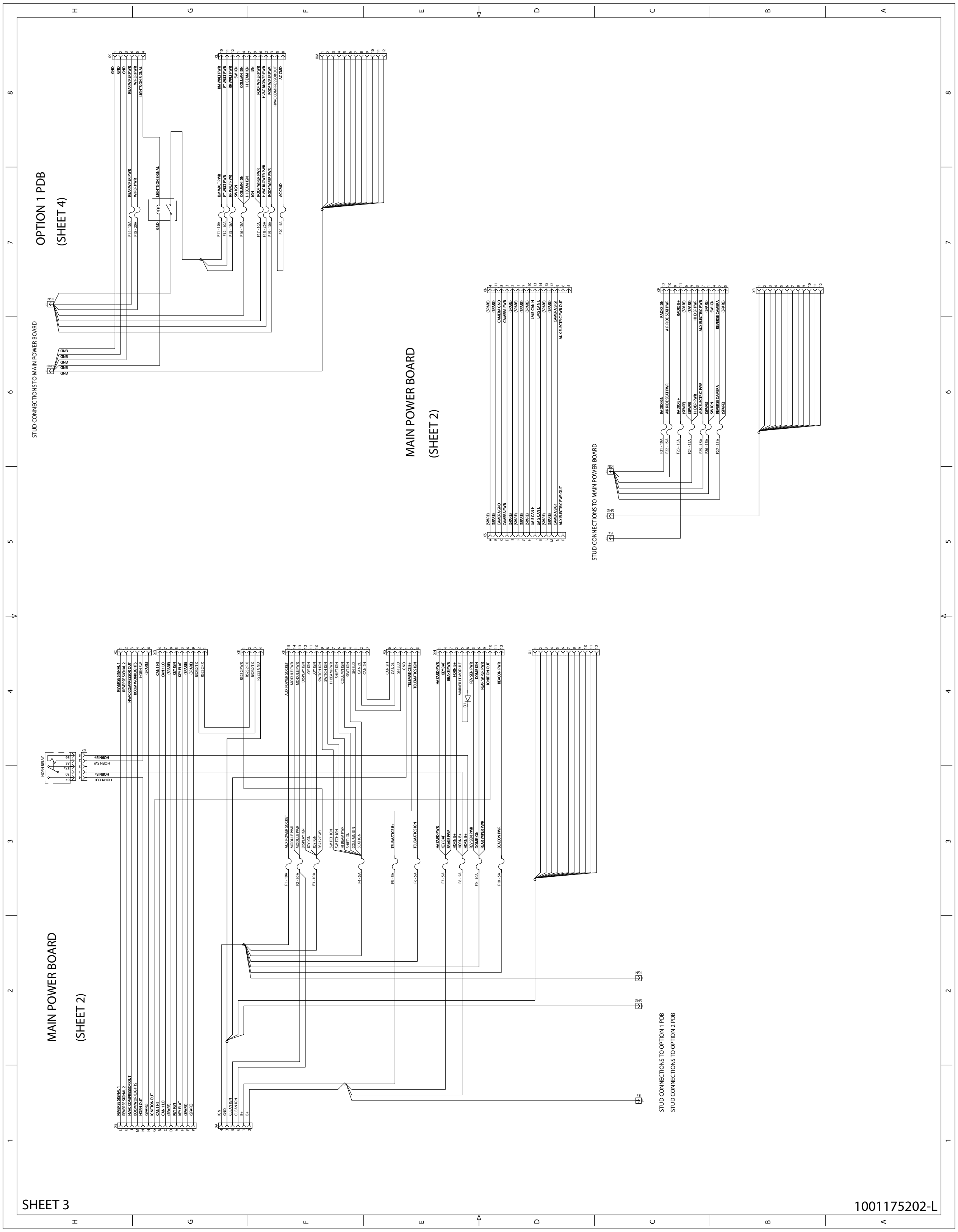
9.5.1 742, 943, 1043

a. Cab Harness Electrical Schematic 1 of 4



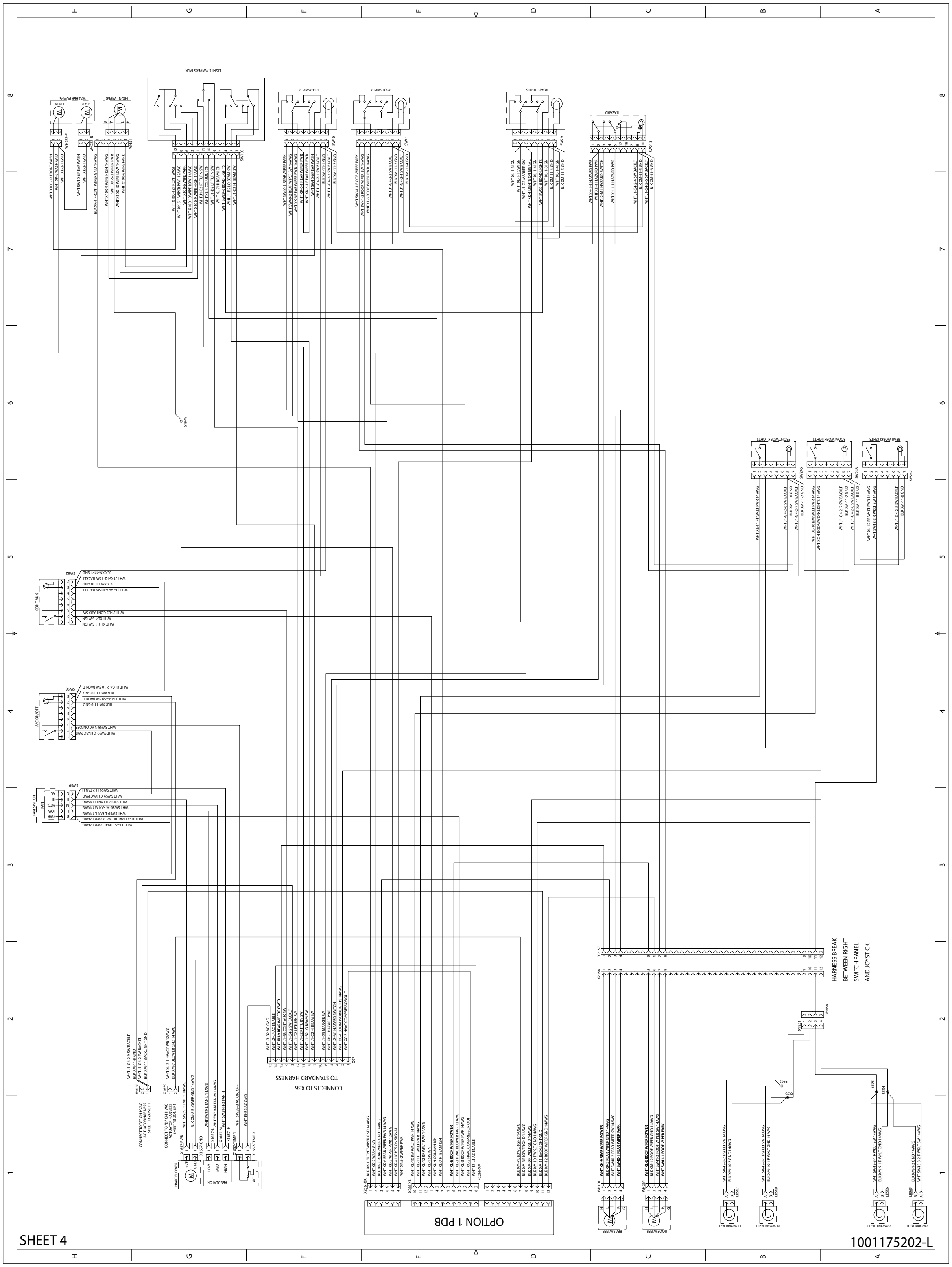
MAE45810L

b. Cab Harness Electrical Schematic 2 of 4



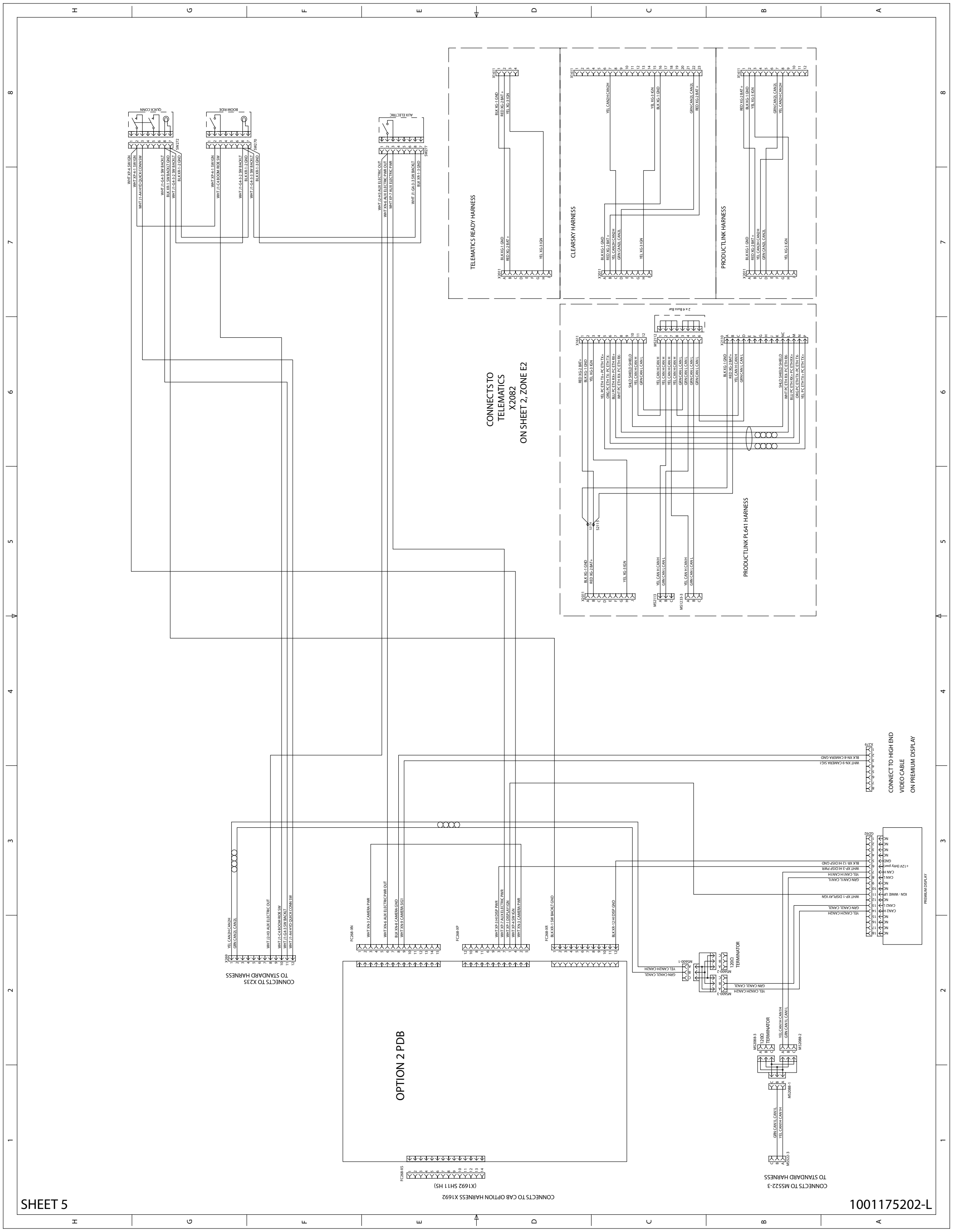
MAE45820L

c. Cab Harness Electrical Schematic 3 of 4



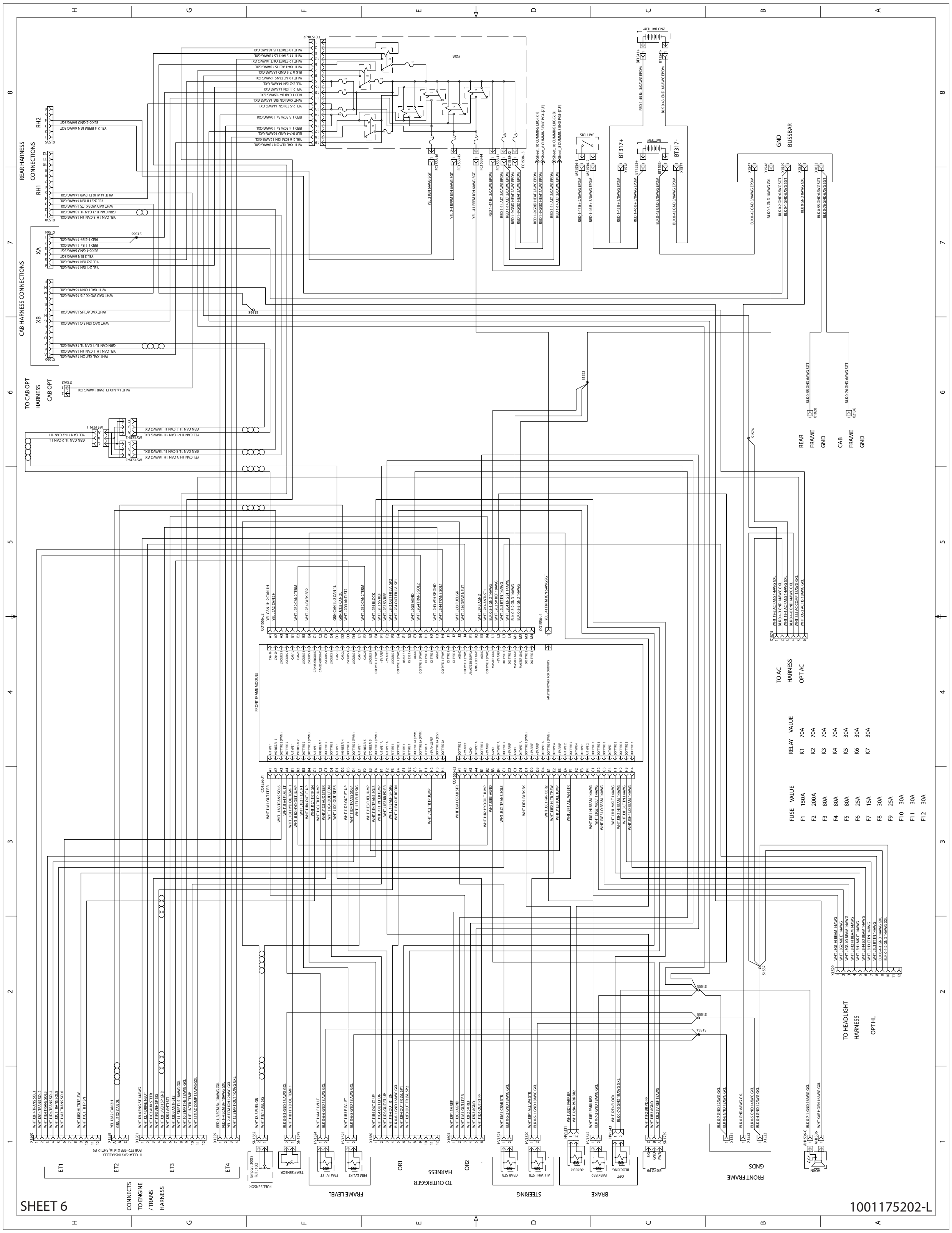
MAE45830L

d. Cab Harness Electrical Schematic 4 of 4



MAE45790L

e. Front Frame

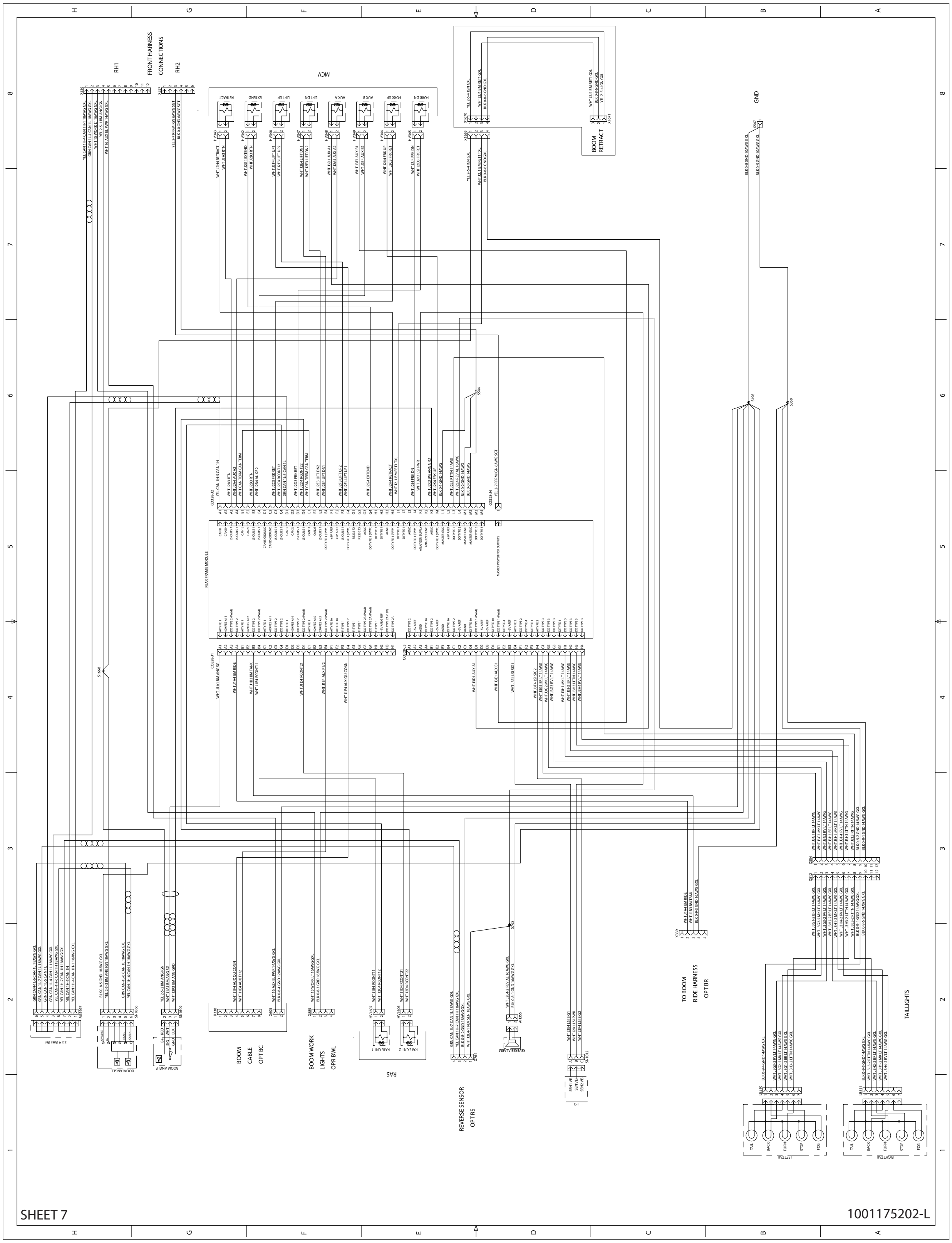


FUSE	VALUE
F1	150A
F2	200A
F3	80A
F4	80A
F5	80A
F6	25A
F7	15A
F8	30A
F9	25A
F10	30A
F11	30A
F12	30A

RELAY	VALUE
K1	70A
K2	70A
K3	70A
K4	70A
K5	30A
K6	30A
K7	30A

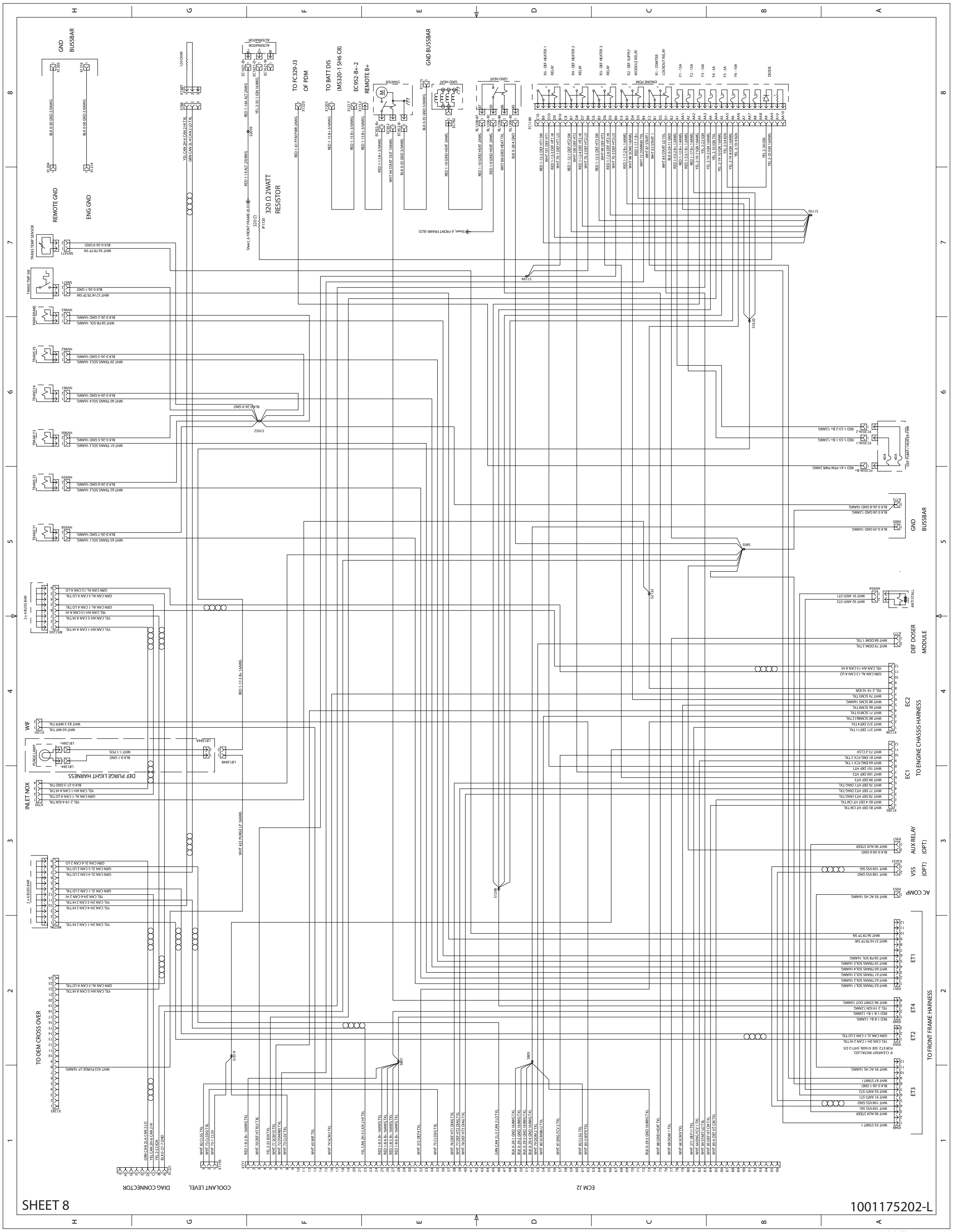
MAE45800L

f. Rear Frame



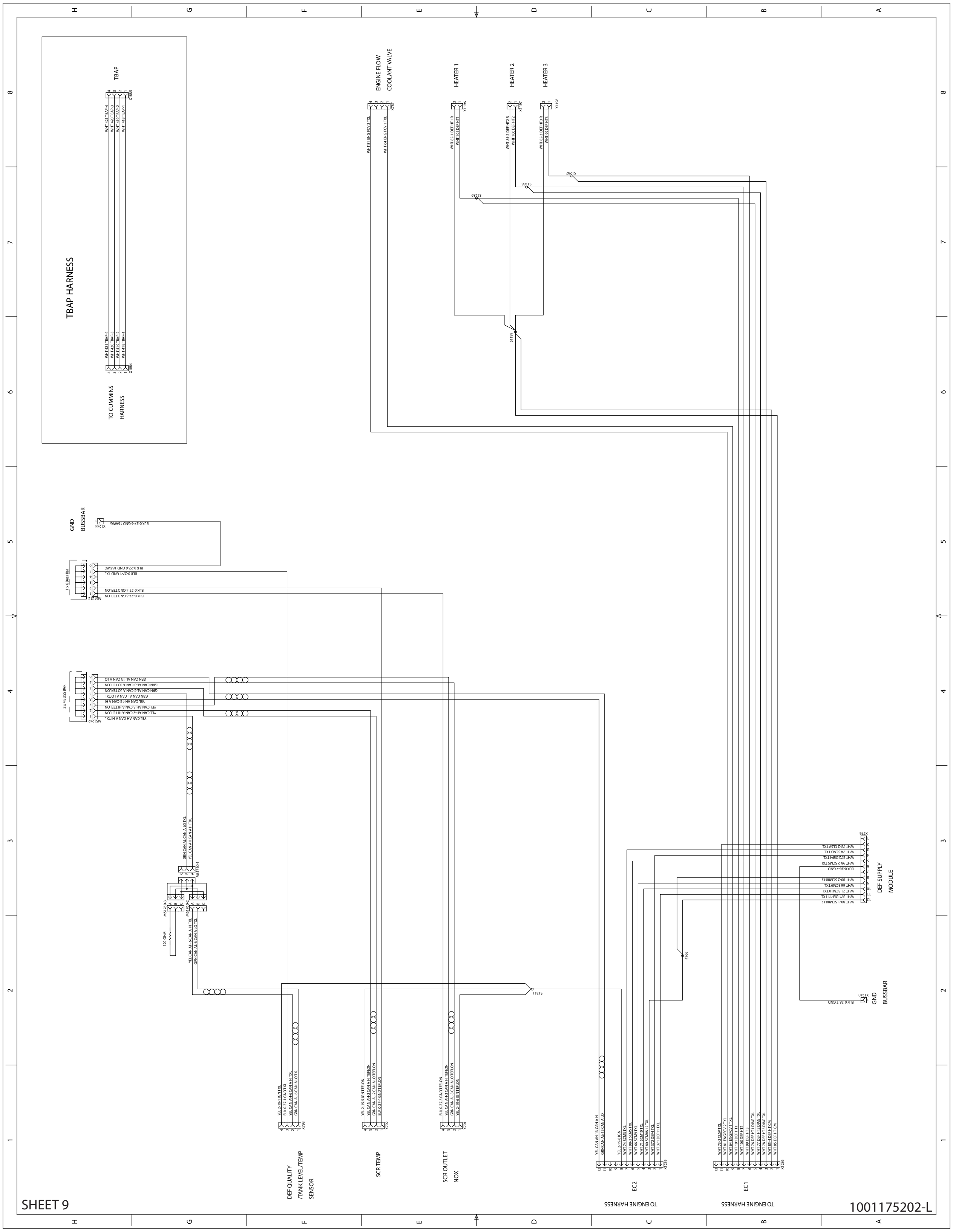
MAE45840L

g. ULS 74HP (55Kw) Engine Harness



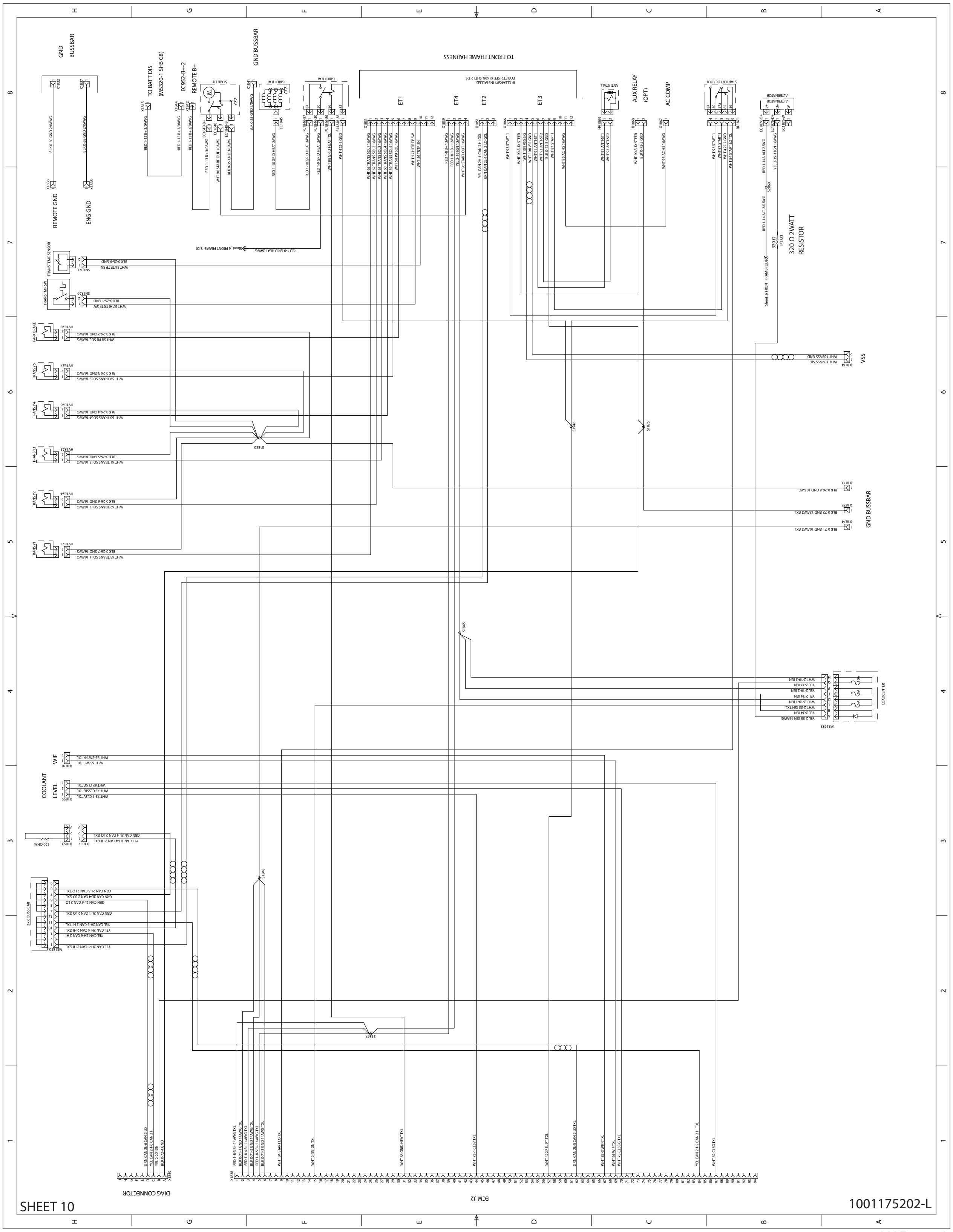
MAE45850L

h. ULS 110HP (82Kw) Engine Harness (1 of 2)



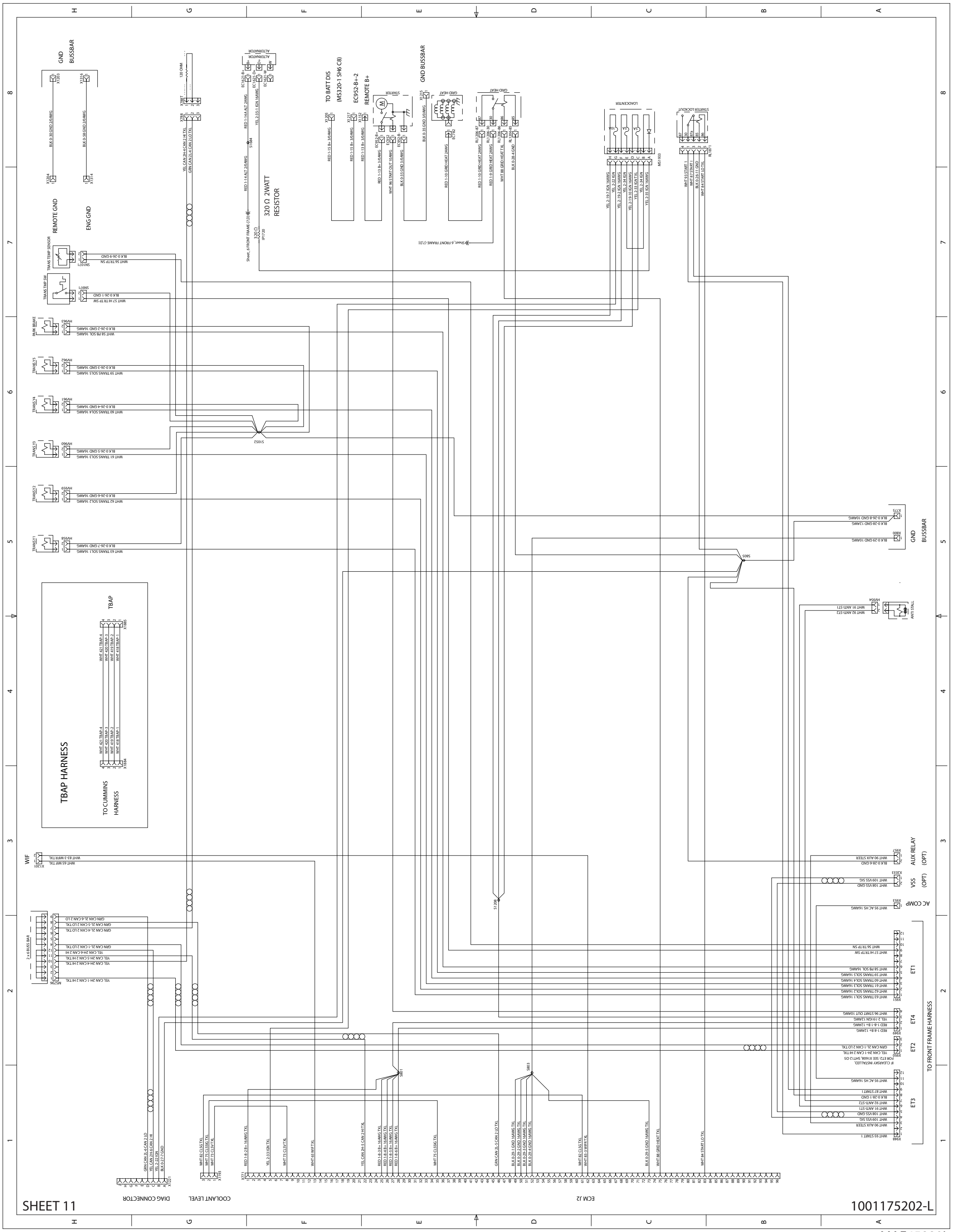
MAE45860L

i. ULS 110HP (82Kw) Engine Harness (2 of 2)



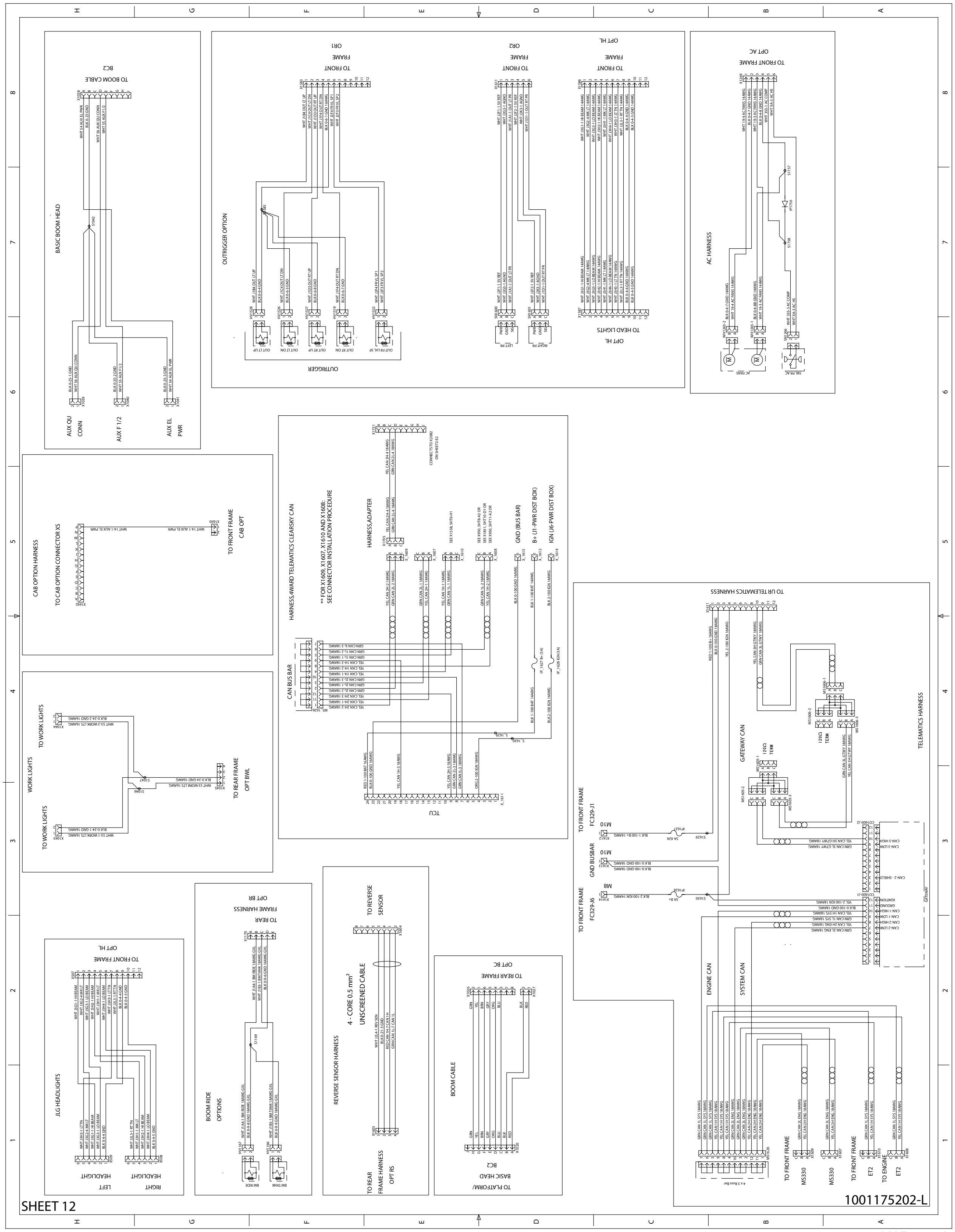
MAE45870L

j. LS 110HP (82Kw) Engine Harness

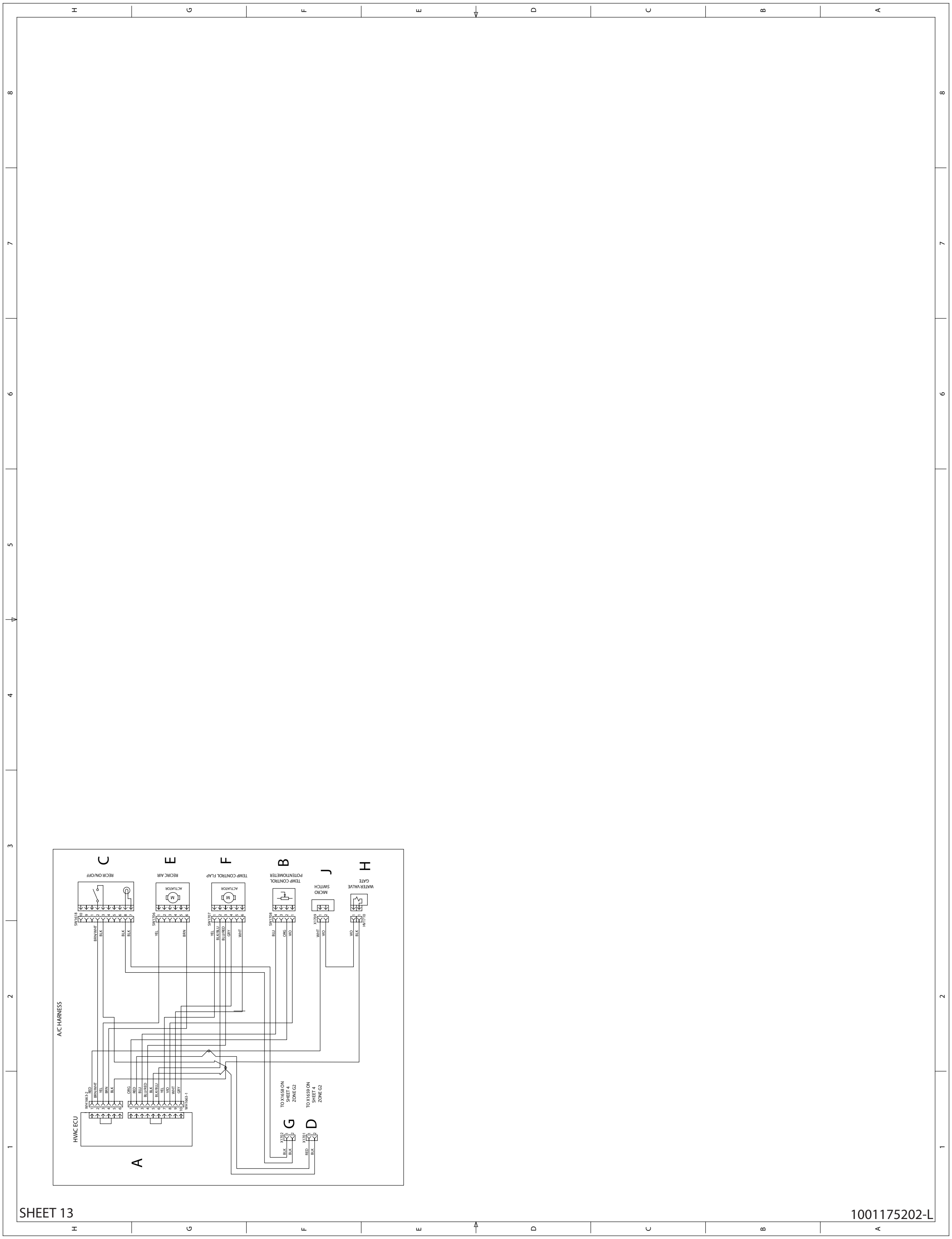


MAE45880L

k. Option Harnesses



MAE45890L

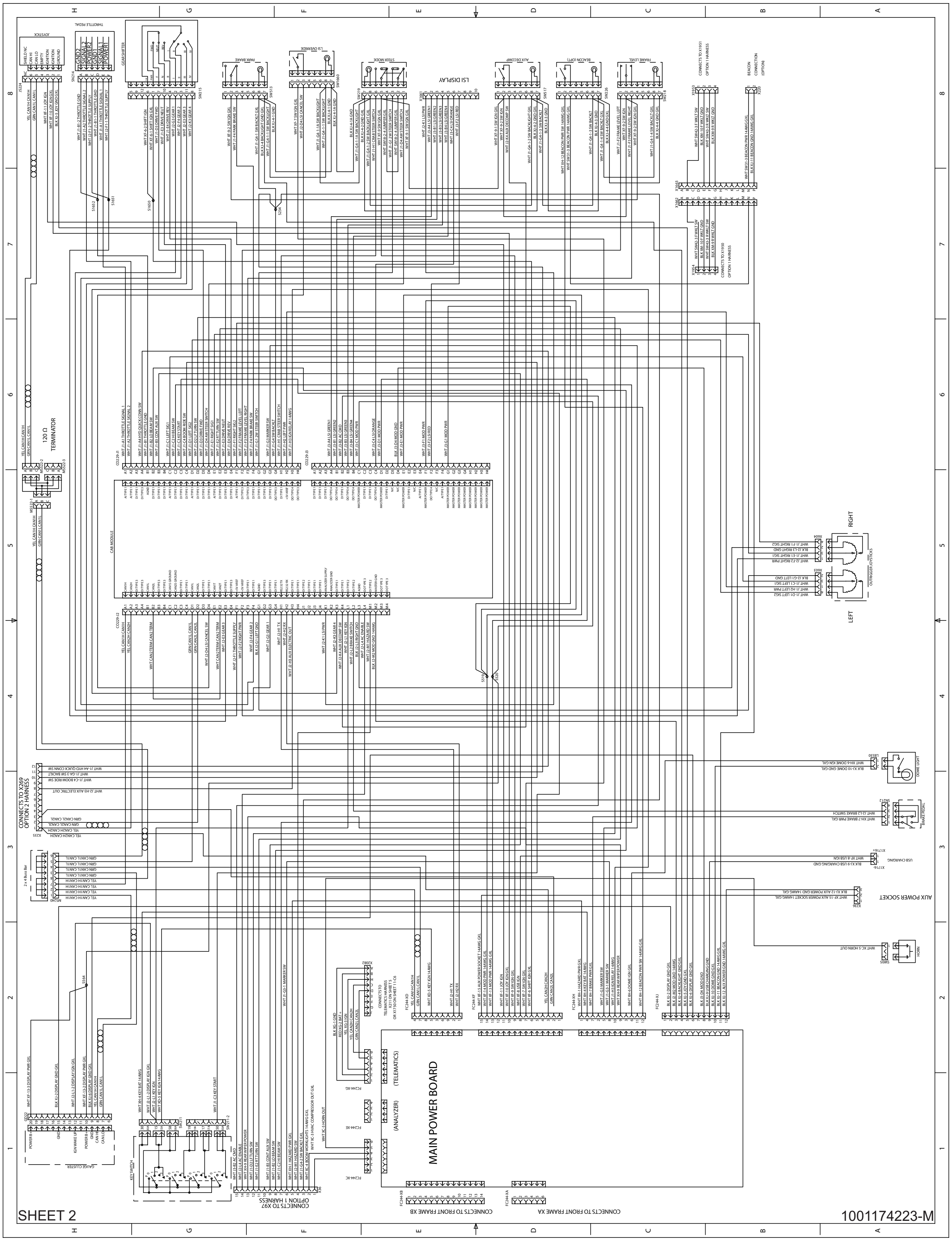


SHEET 13
1001175202-L
A/C HARNESS
HVAC ECU
A
B
C
D
E
F
G
H
J
RECIR ON/OFF
RECIRC AIR
TEMP CONTROL FLAP
TEMP CONTROL POTENTIOMETER
MICRO SWITCH
WATER VALVE GATE

MAE45900L

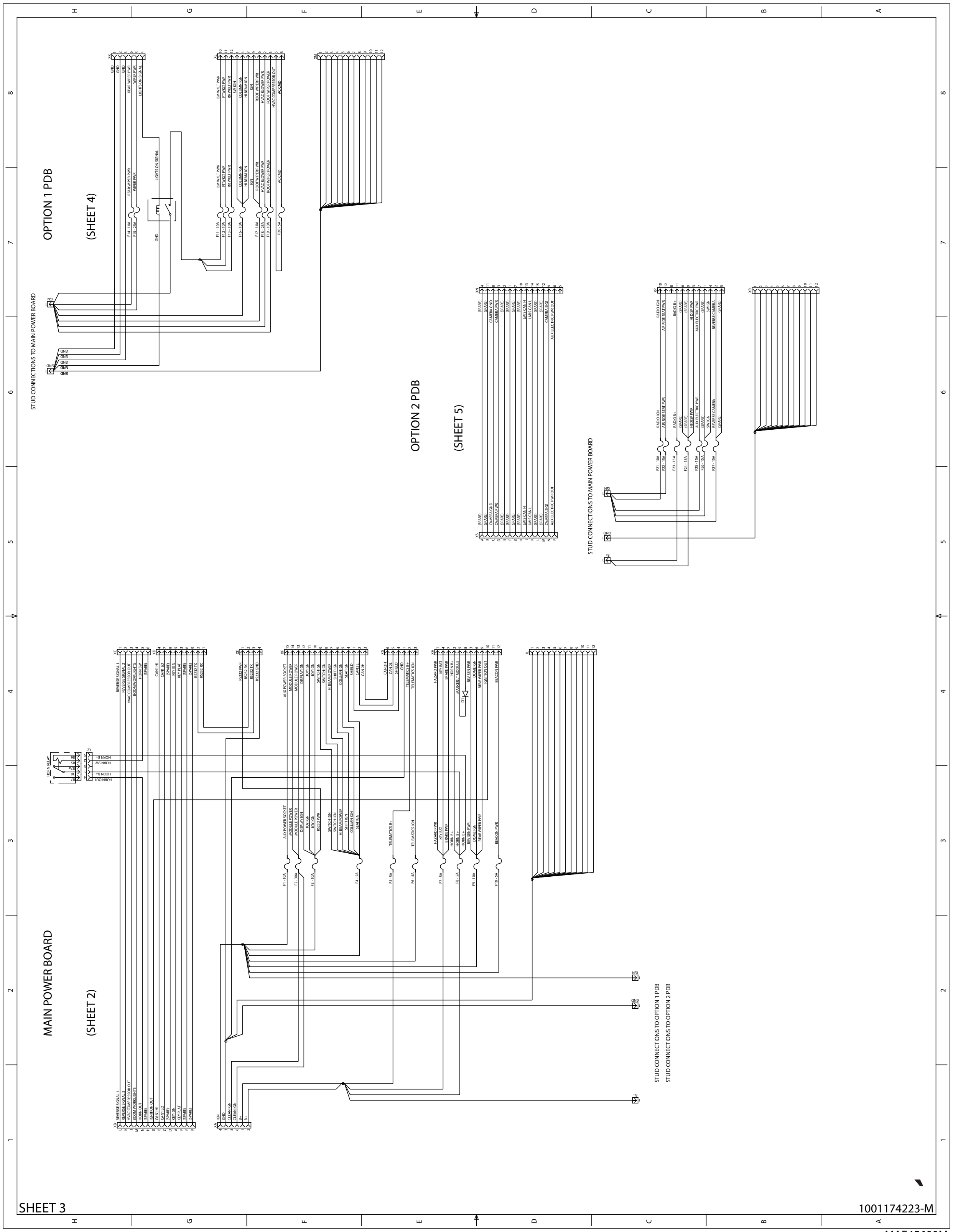
9.5.2 1055, 1255

a. Cab Harness Electrical Schematic 1 of 4



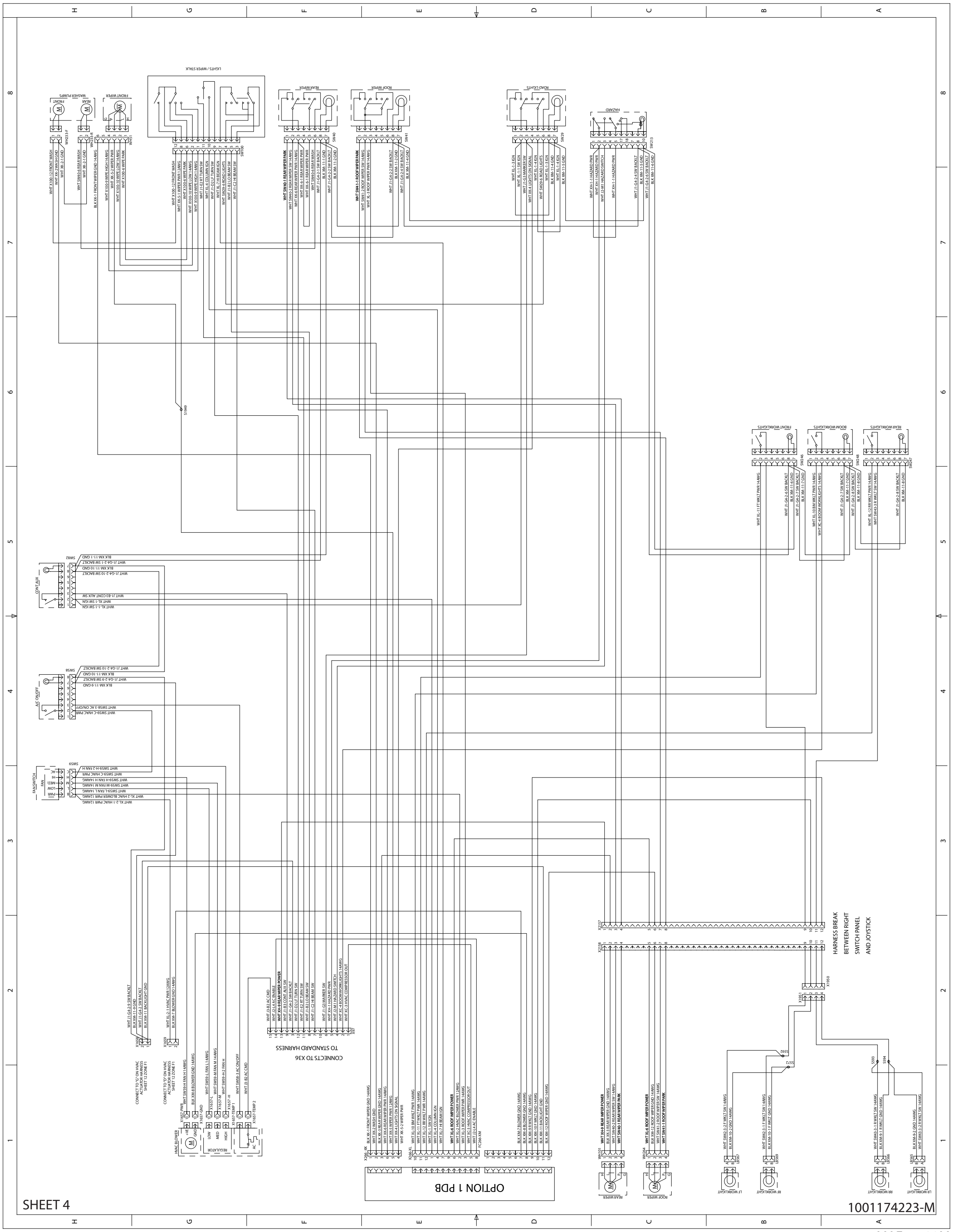
MAE45680M

b. Cab Harness Electrical Schematic 2 of 4



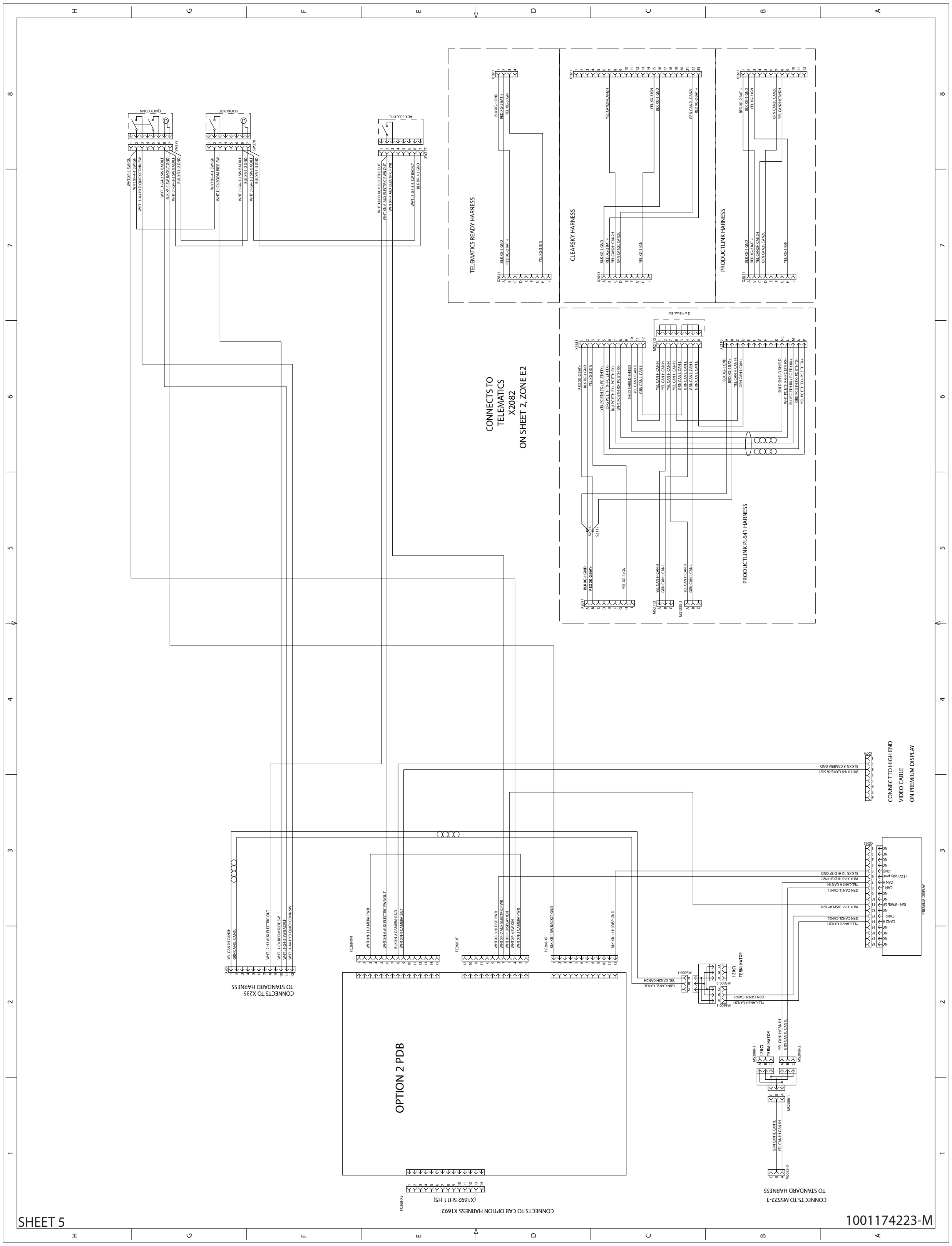
MAE45690M

c. Cab Harness Electrical Schematic 3 of 4



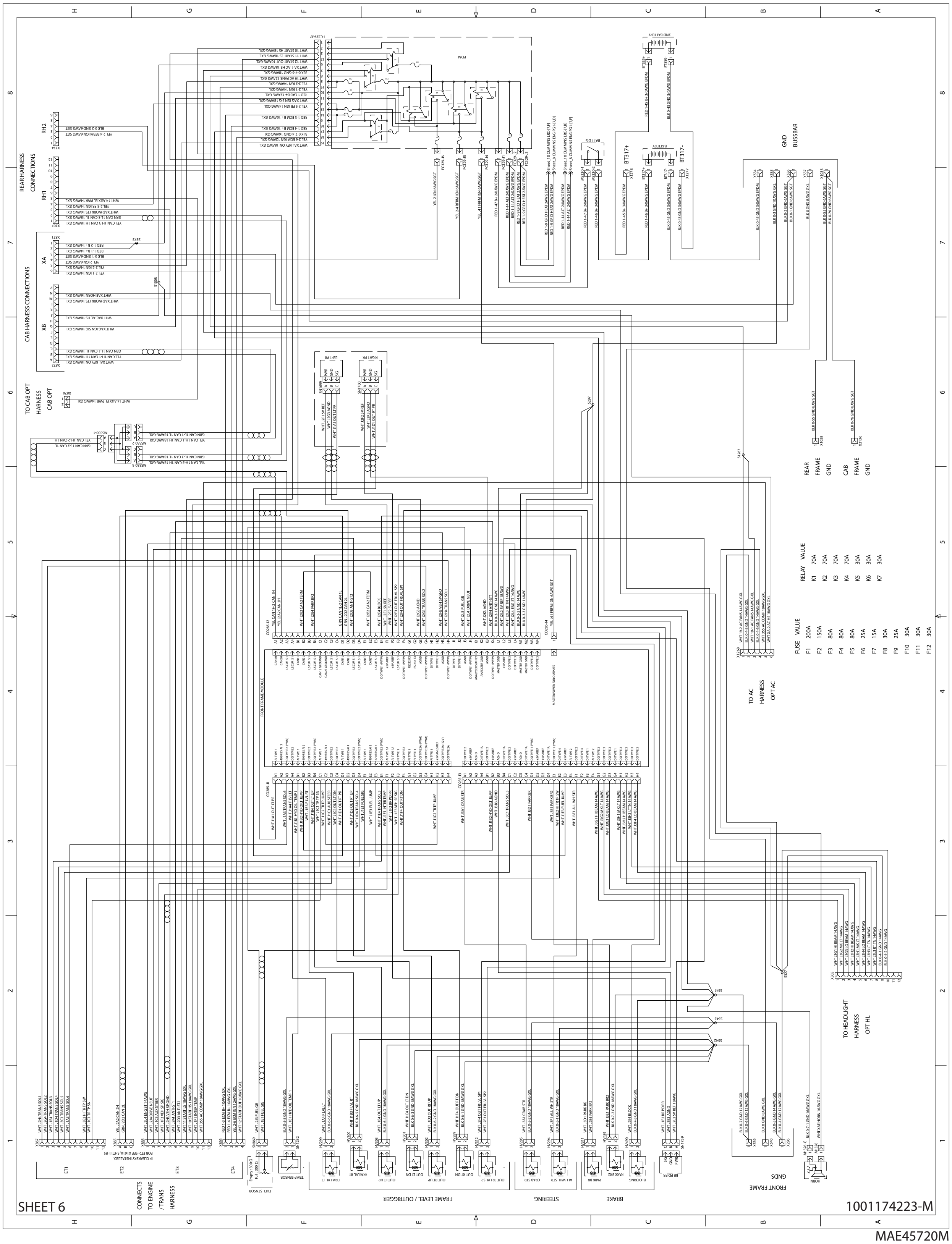
MAE45700M

d. Cab Harness Electrical Schematic 4 of 4



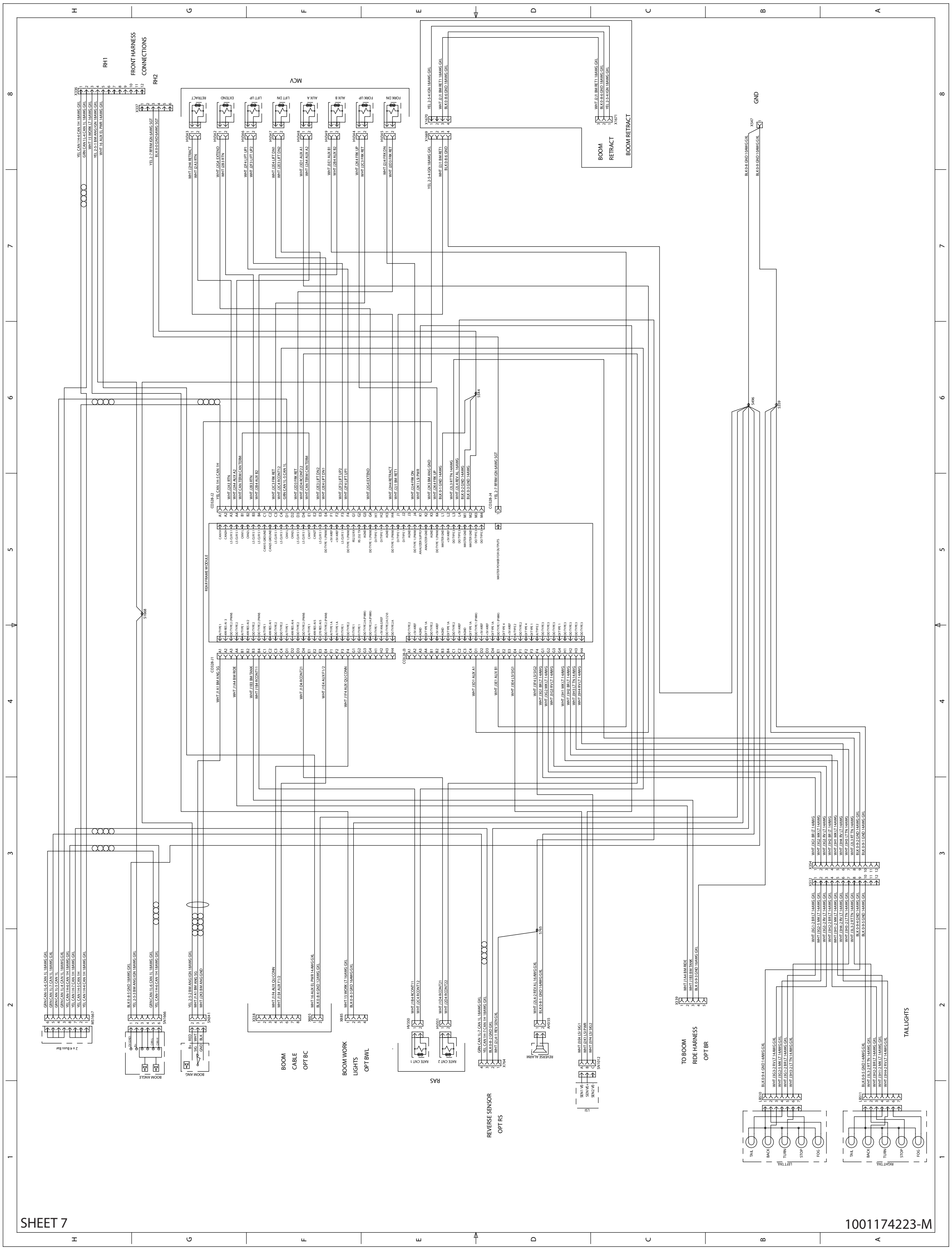
MAE45710M

e. Front Frame



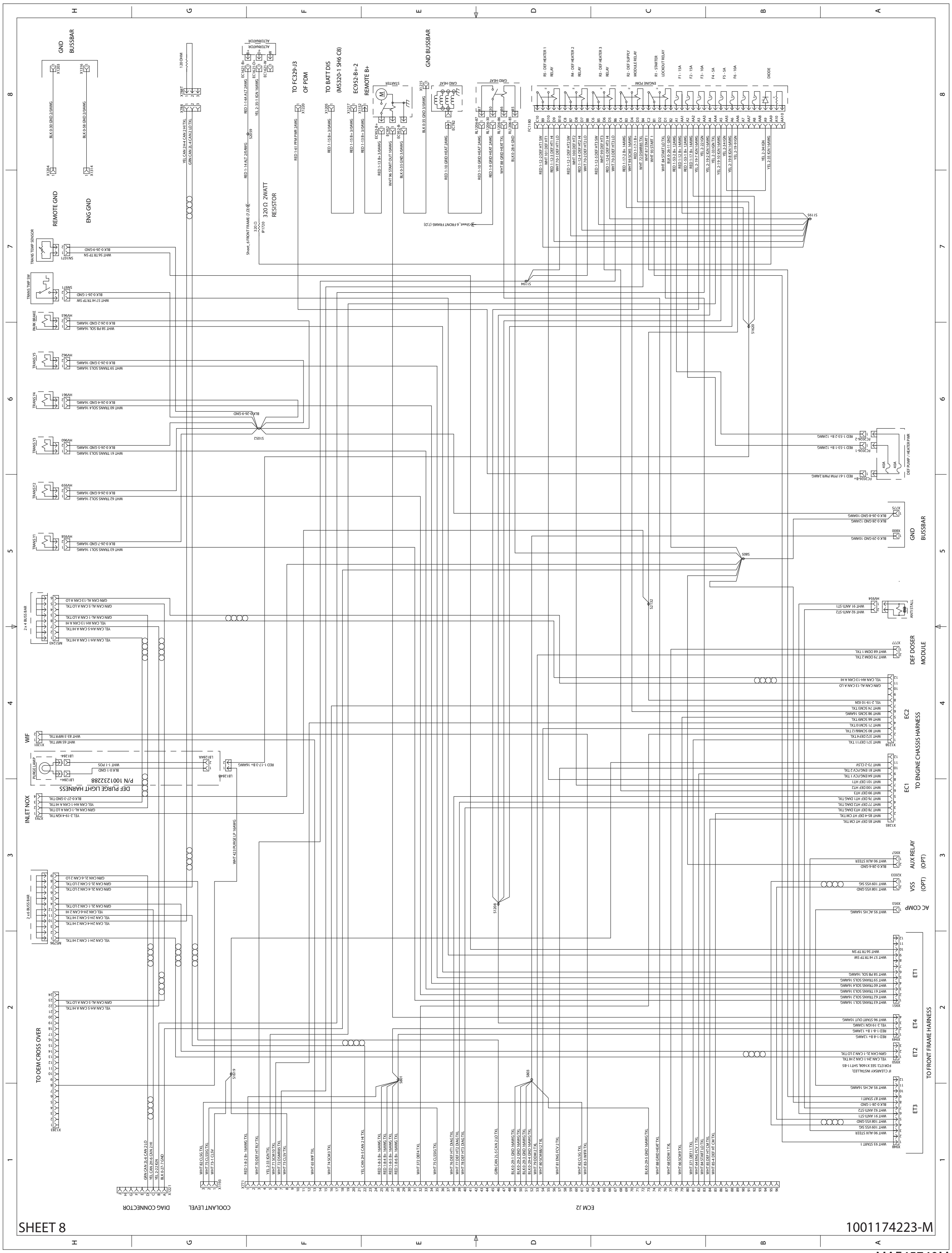
MAE45720M

f. Rear Frame



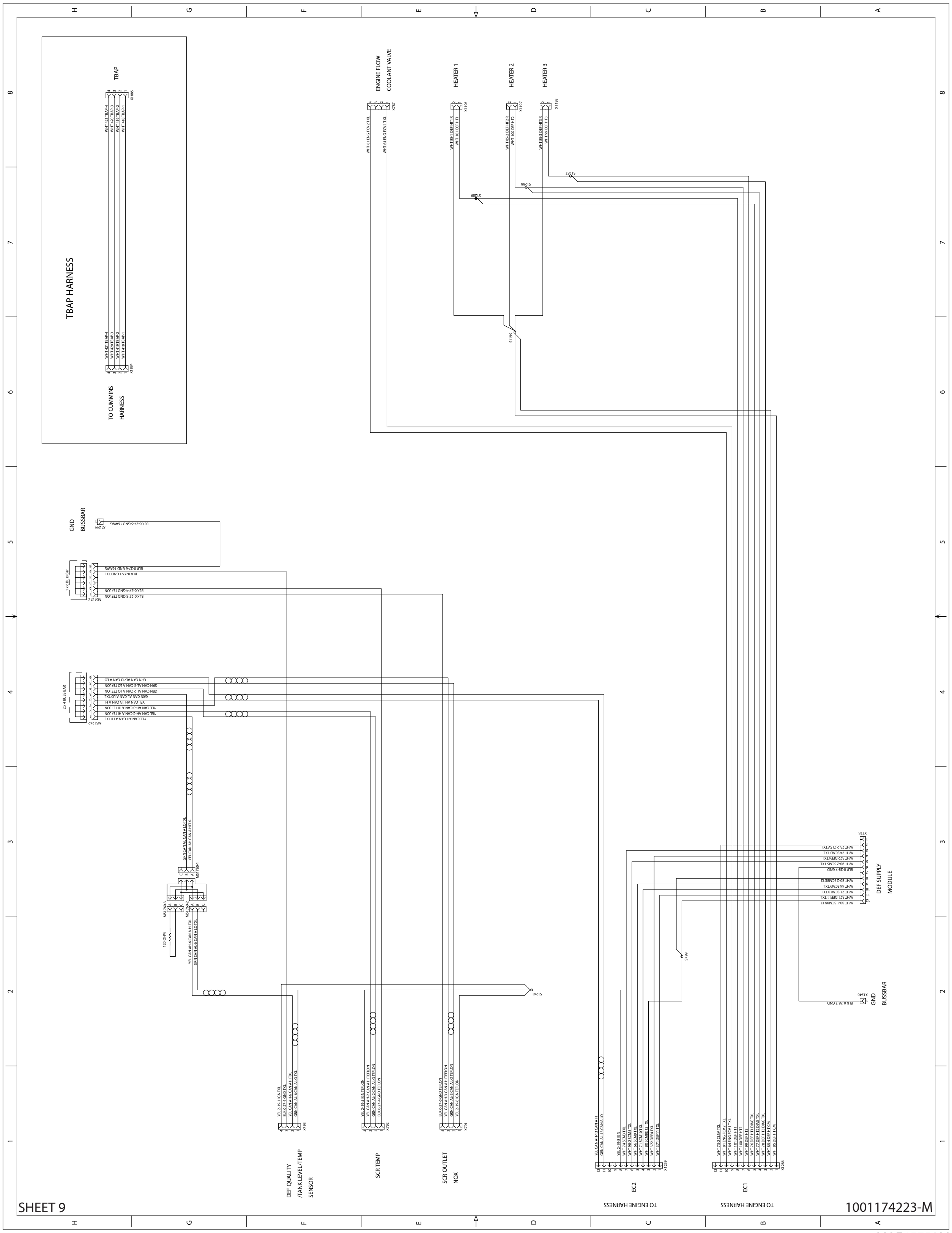
MAE45730M

g. ULS Engine Harness 1 of 2



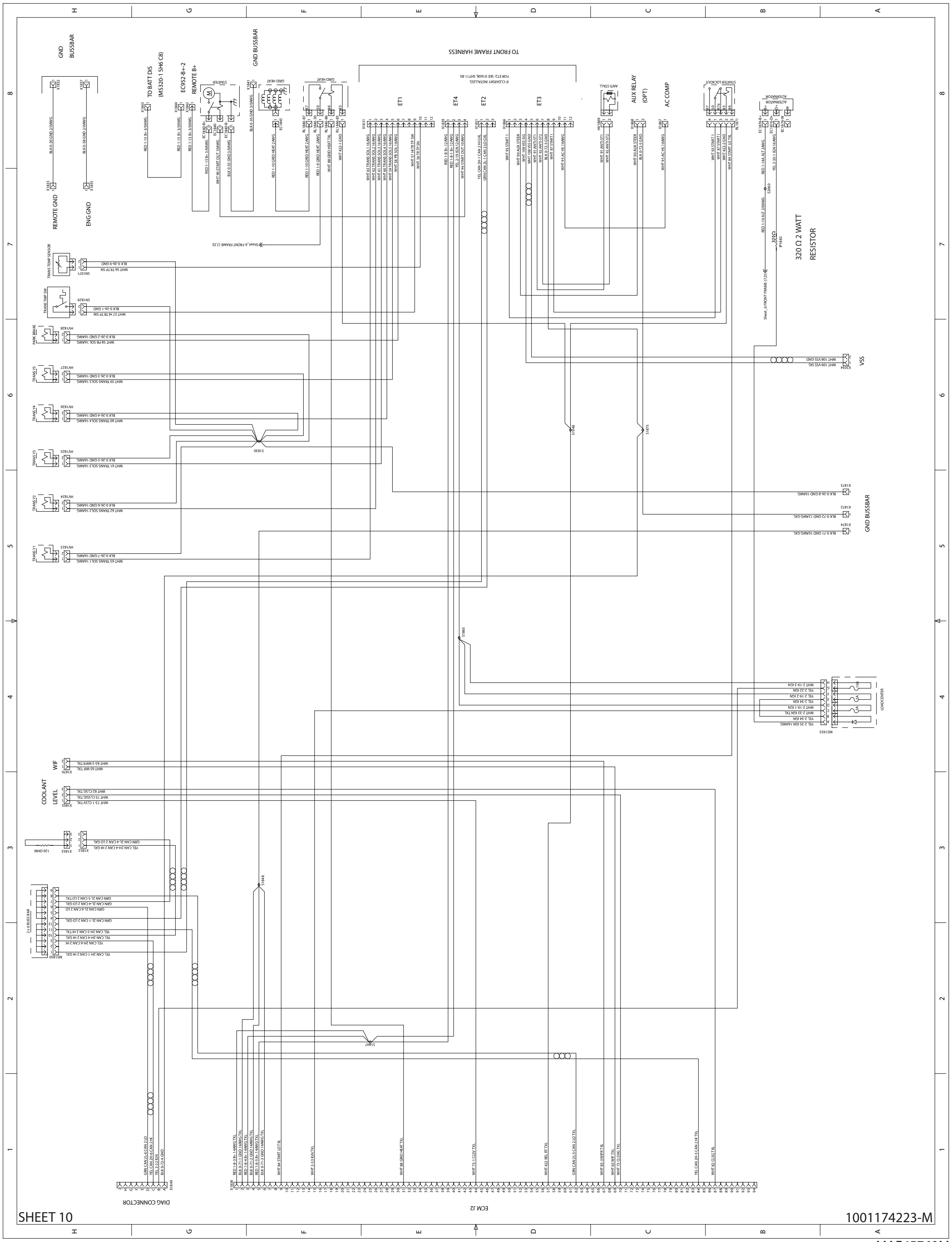
MAE45740M

h. ULS Engine Harness 2 of 2



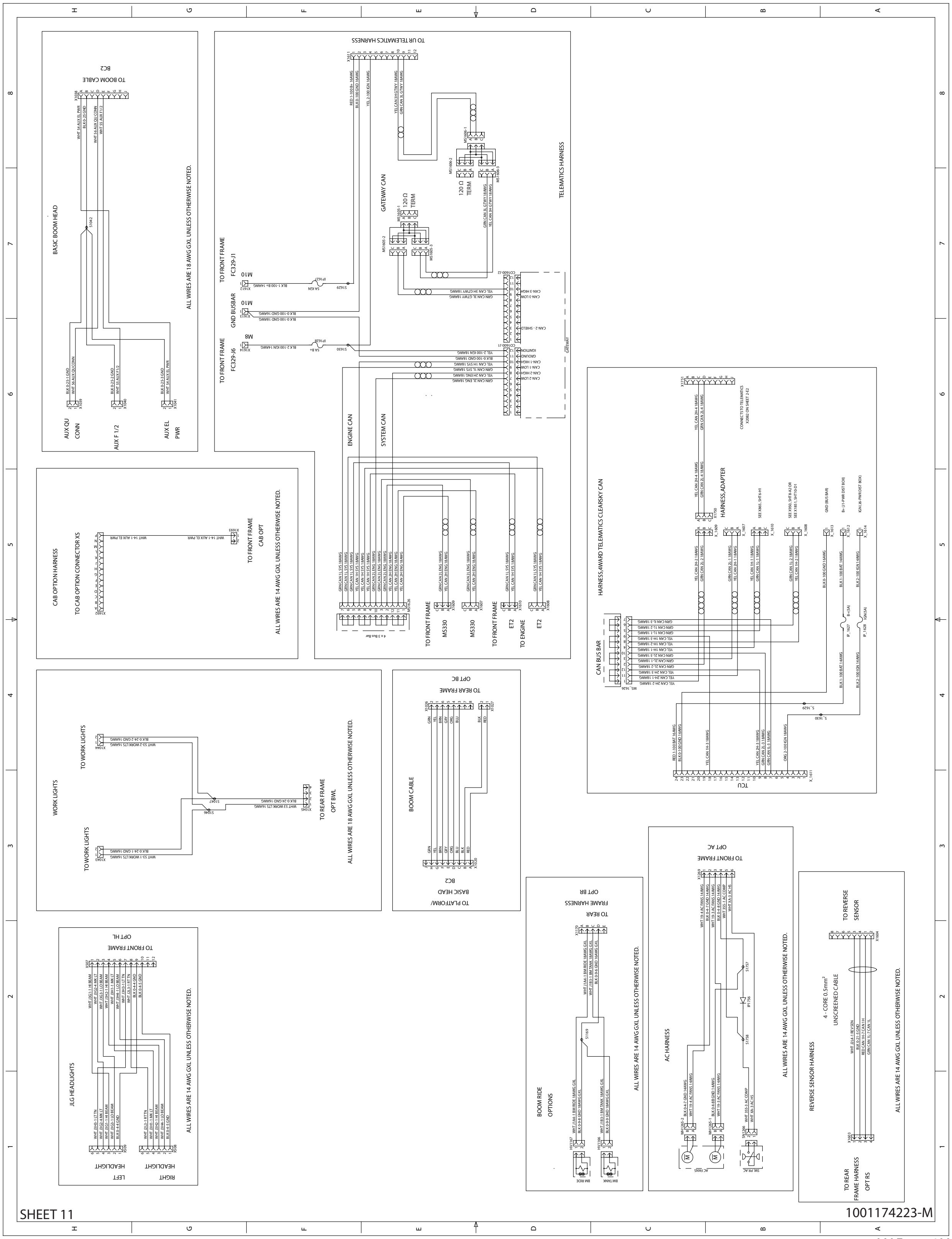
MAE45750M

i. LS Engine Harness

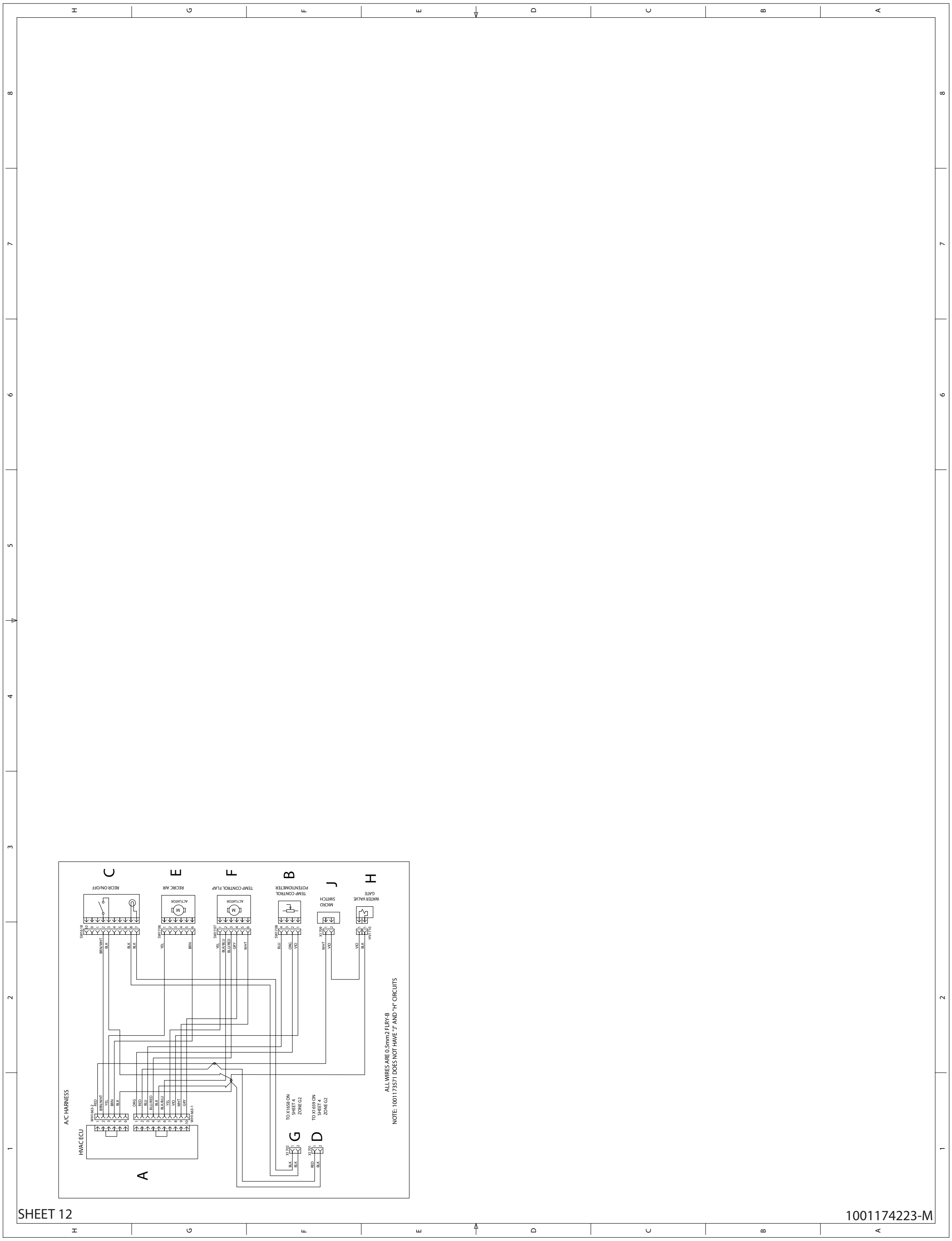


MAE45760M

j. Option Harness



MAE45770M



MAE45780M

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.

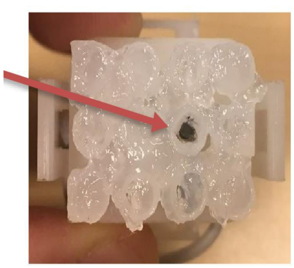
9.6.1 Installation

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.Deutsch HD, DT, DTM, DRC Series

AMP Mate-N-Lok

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

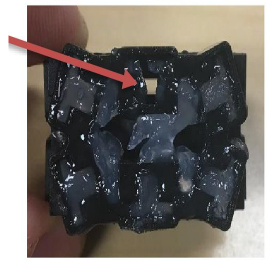


Improper

Proper

AMP Faston

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

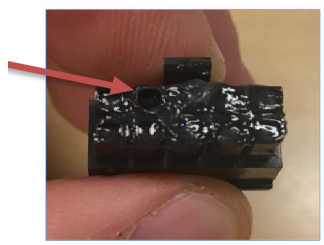


Improper

Proper

AMP Micro-Fit

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

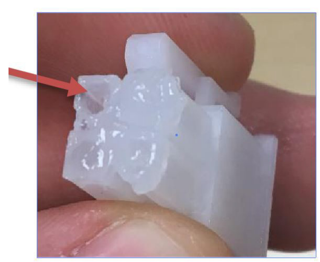


Improper

Proper

AMP Mini Fit Jr

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

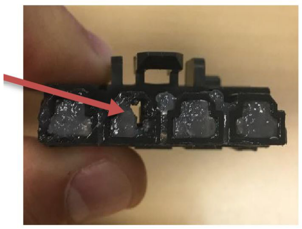


Improper

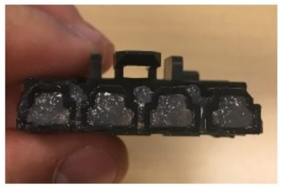
Proper

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

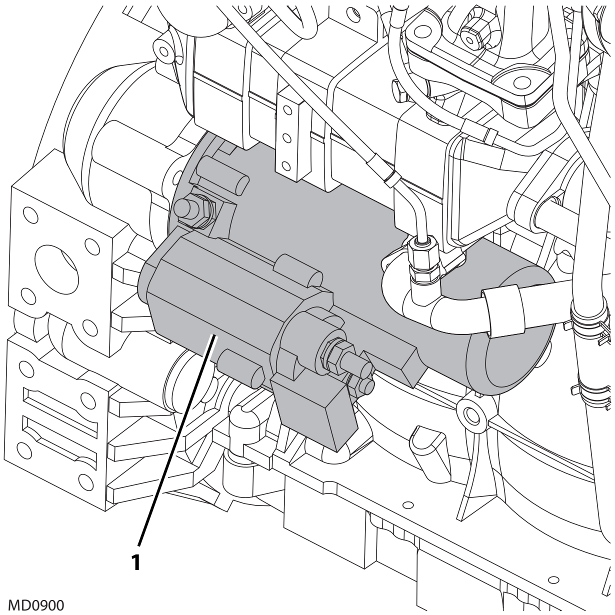
Application of dielectric grease is not required in properly sealed enclosures. To meet criteria, the enclosure must be rated to at least IP56 (dust protected; protected from powerful jets of water).

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.

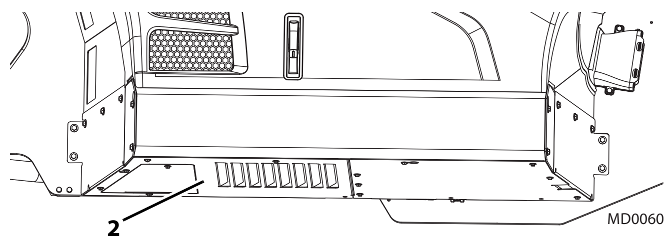
b. Starter Circuit Checks

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 Schematics”.

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 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.



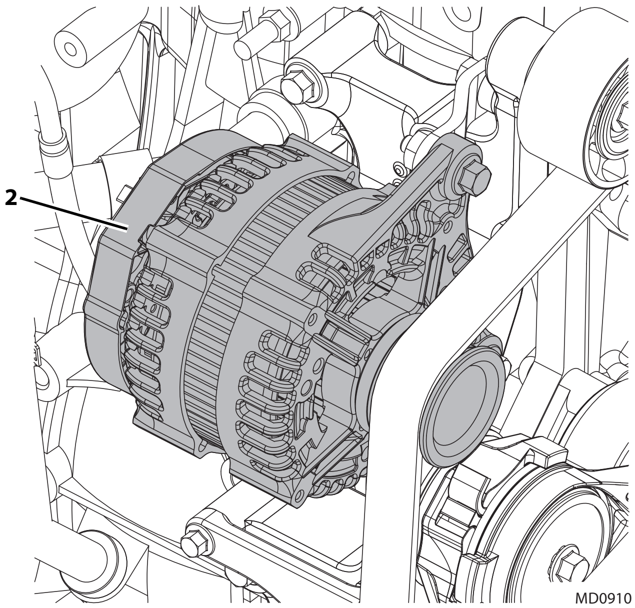
5. Remove belly pans (**2**).
6. Remove wires from solenoid stud. Remove positive (+) battery cable from starter. Label and disconnect wire from starter solenoid housing stud. Record how wires are installed to ensure correct installation later.
7. Loosen but **DO NOT** remove hardware securing starter. 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 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 (**2**) 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 fan 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 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. 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 fan 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.

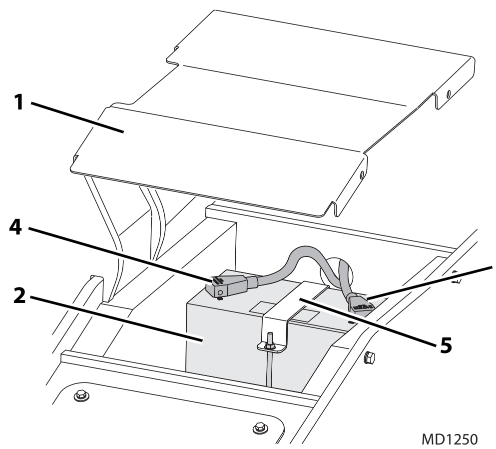
9.8 BATTERY

Note: *Eye protection is recommended before inspecting and/or replacing the battery.*

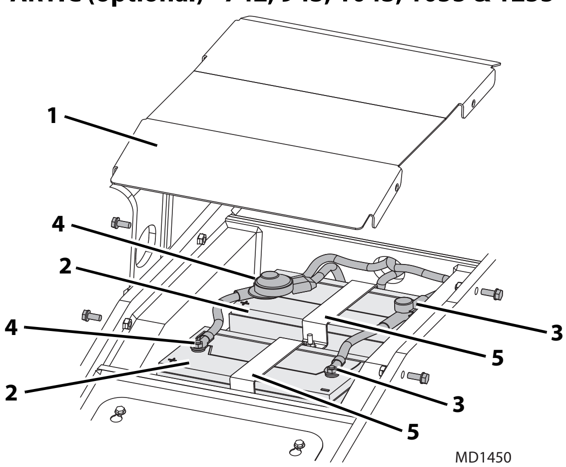
9.8.1 Battery Inspection

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

STANDARD - 742



STANDARD - 943, 1943, 1055 & 1255
ARTIC (optional) - 742, 943, 1043, 1055 & 1255



3. Open engine cover. Allow system fluids to cool.
4. Remove bolts securing access panel (**1**) and remove panel.
5. Visually inspect the battery(s) (**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 park 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(s) (**3**).
8. Disconnect Positive battery cable(s) (**4**).
9. Loosen and remove clamp(s) (**5**) securing battery.
10. Remove battery(s) (**2**).

b. Installation

1. Properly install battery(s) (**2**) and secure in place with previously removed clamp(s) (**5**).
2. Connect Positive battery cable(s) (**4**).
3. Connect Negative battery cable(s) (**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 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. Remove bolts securing access panel (**1**) and remove panel.
5. Disconnect Negative battery cable(s) (**3**).
6. Disconnect Positive battery cable(s) (**4**).

b. Connect

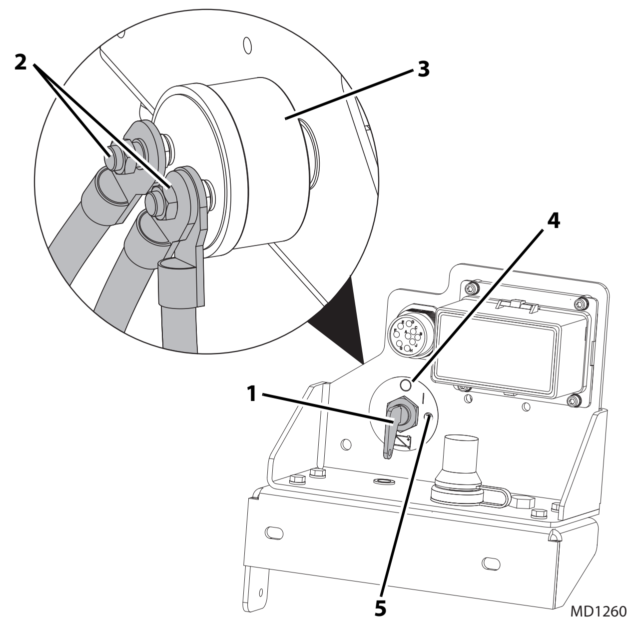
1. Connect Positive battery cable(s) (**4**).
2. Connect Negative battery cable(s) (**3**).
3. Install access cover (**1**) and secure with previously removed bolts.
4. Close and secure engine cover.
5. Remove Do Not Operate Tag from ignition key switch and steering wheel.

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.

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 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 to Section 9.8, “Battery”, for procedure.



5. Remove master electrical switch key (**1**).
6. Label and disconnect the cables (**2**) on the rear of the master electrical switch (**3**).
7. Loosen and remove the nut (**4**) securing the key switch to the mounting bracket.
8. Remove the master switch (**3**).

9.9.2 Electrical Master Switch Installation

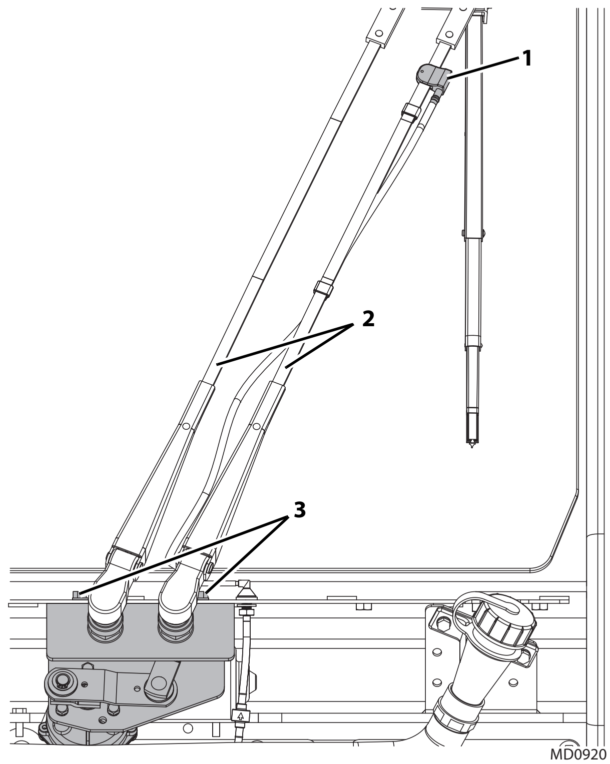
1. Install the master electrical switch (**3**) to the mounting bracket and align the switch locator pin (**5**) in the mounting bracket.
2. Install previously removed master electrical switch mounting nut (**4**) and torque to 14 - 20 lb-ft (18,9 - 27,1 Nm).
3. Connect previously labeled electrical cables (**2**). 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 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 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.

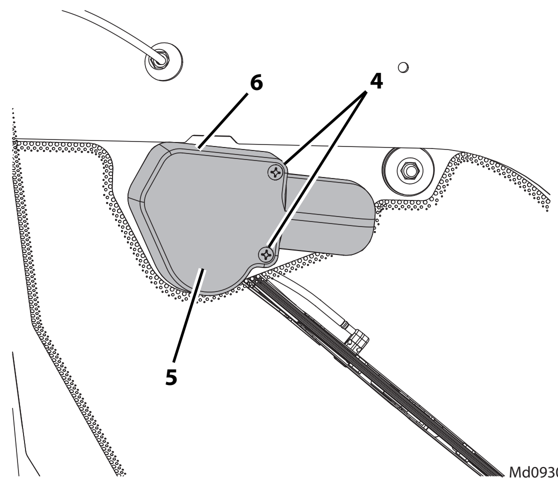
Note: *Align the wiper linkage arm with the flat on the motor shaft to ensure wiper stroke covers window area, and it does not swipe past the glass area.*

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.

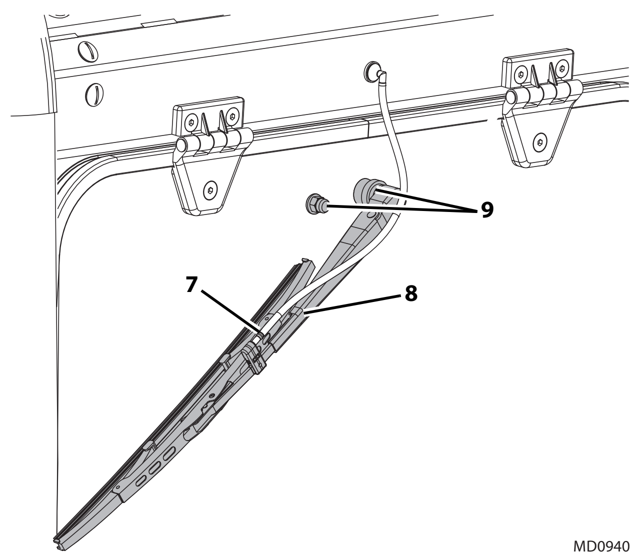
9.10.2 Rear Window Wiper Motor

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage 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 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.

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.

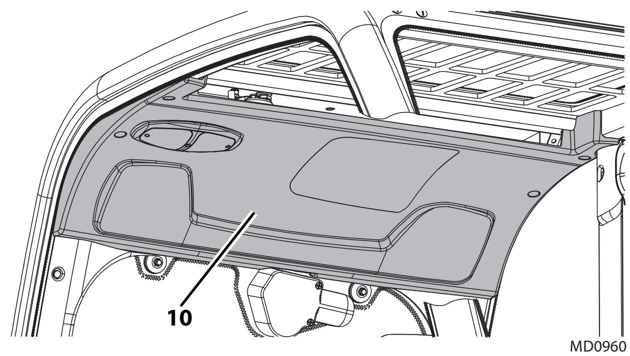
Note: *Align the wiper linkage arm with flat on motor shaft to ensure wiper stroke covers window area, and it does not swipe past the glass area.*

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.

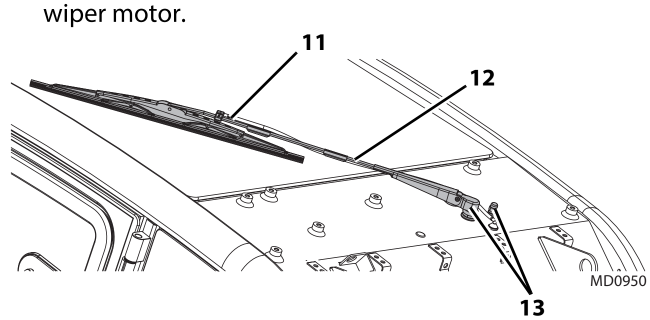
9.10.3 Roof Window Wiper Motor

a. Removal

1. Park machine on a firm, level surface, level machine, fully retract boom, lower boom, place transmission in (N) NEUTRAL, engage 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 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.*

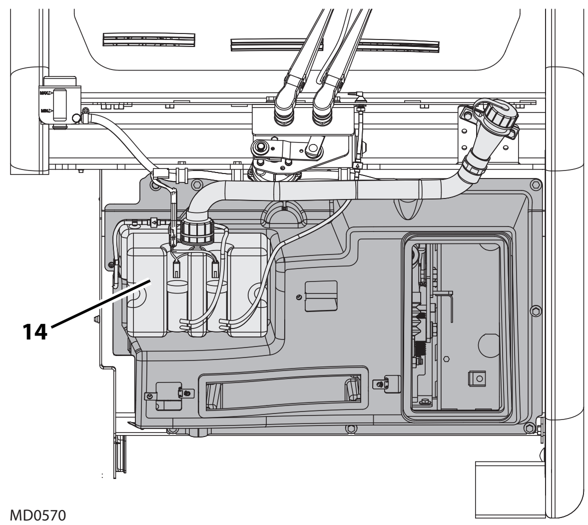
3. Connect reservoir hose to wiper linkage.
4. Connect electrical harness to wiper motor.
5. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
6. Turn ignition key switch to RUN position, and operate windshield wiper in both LOW and HIGH speeds to ensure proper operation and 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 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 the outside cover at the front of the cab.



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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.

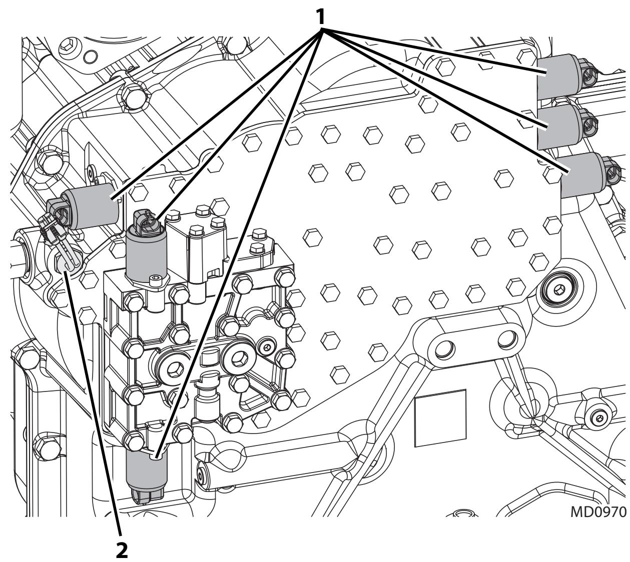
d. Installation and Testing

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 SOLENOIDS, SENSORS AND SENDERS

9.11.1 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.*

9.11.2 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.

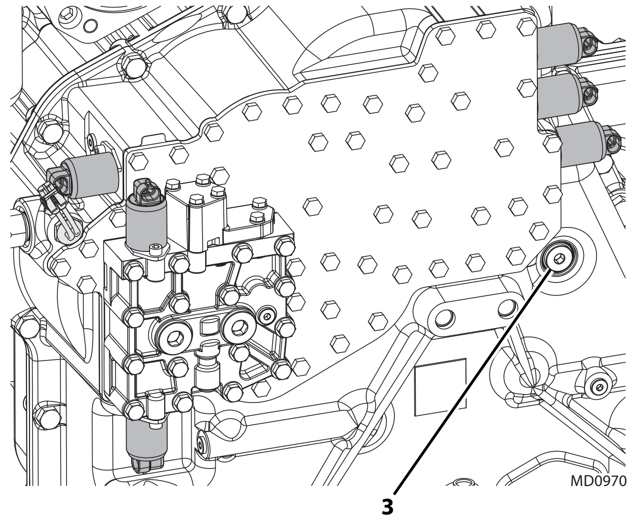
b. Transmission Oil Temperature Switch Inspection and Replacement

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.

9.11.3 Transmission Mounted Speed Sensor



Transmission speed sensor (**3**) is located on the side of the transmission bell 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.

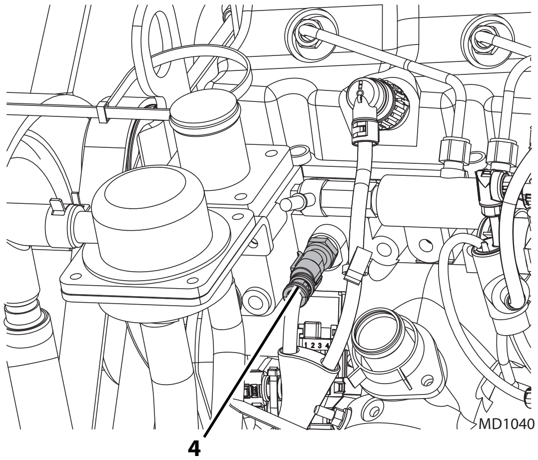
b. Transmission Mounted Speed Sensor Inspection and Replacement

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.

9.11.4 Engine Coolant Temperature Sensor



Engine coolant temperature sensor (**4**) 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 fan belt, defective instrument display, etc.
7. Close and secure engine cover.
8. Remove Do Not Operate Tag from ignition key switch and steering wheel.

9.11.5 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.

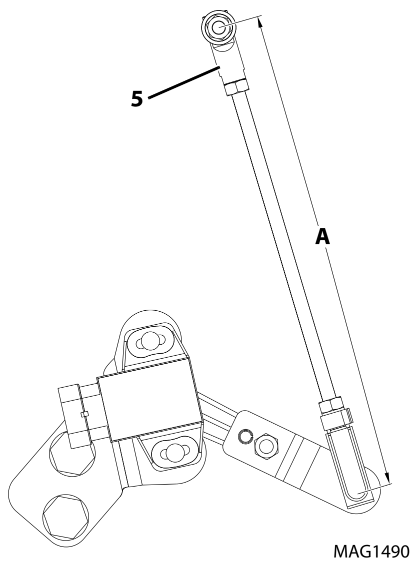
9.11.6 Boom Angle Sensor

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

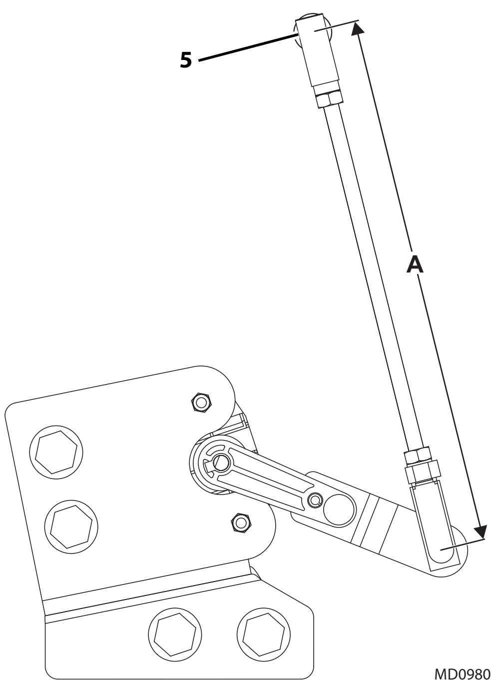
a. Boom Angle Sensor Removal

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.

742, 943, 1043



1055, 1255



6. Loosen and remove the nut holding the rod assembly (**5**) 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.

Machine	Rod Length
742, 943, 1043, 1055, 1255	(**A**) 8.26 - 8.34 in (210 - 212 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.

9.11.7 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 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)".*

9.12.1 Ignition Key Switch

a. Ignition Key Switch Removal

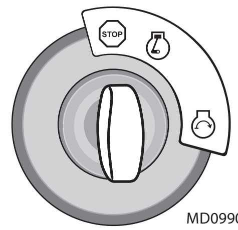
1. Park the machine on a firm, level surface, level the machine, fully retract the boom, lower the boom, place the transmission in (N) NEUTRAL, engage the park brake and shut the engine OFF.
2. Place a Do Not Operate Tag on both the ignition key switch and the steering wheel, stating that the machine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



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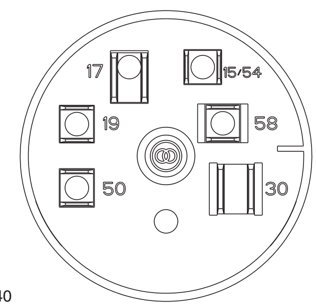


MZ2140

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
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.

9.12.2 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.

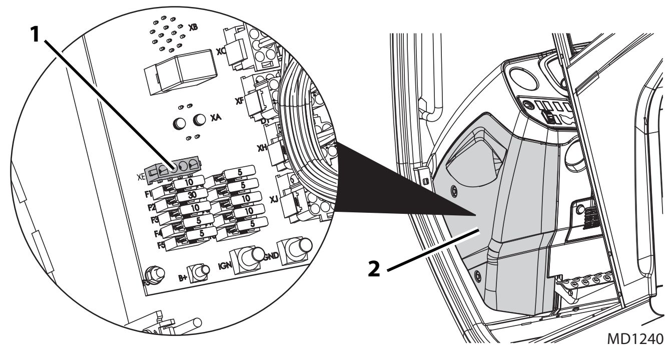
d. Switch Installation

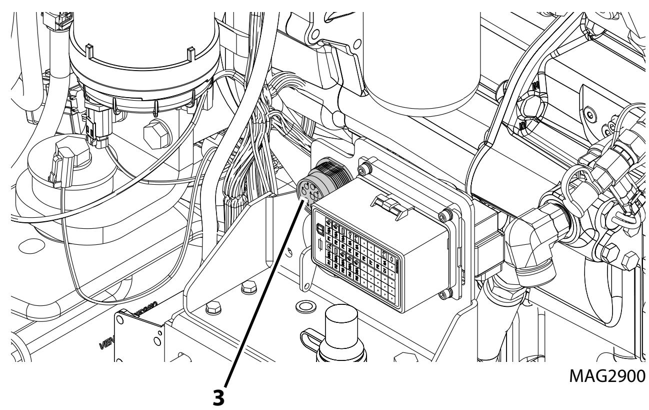
1. Connect the switch to the cab harness connector.
2. Position the switch over the rectangular switch bezel and snap into position.
3. Properly connect the battery. Refer Section 9.8, “Battery”, for procedure.
4. Start the machine and check the replaced switch for proper function.
5. Close and secure the engine cover.
6. Remove the Do Not Operate Tag from the ignition key switch and the steering wheel.

9.13 MACHINE DATA

9.13.1 Machine Data Access

Machine and engine data can be accessed by connecting to the appropriate locations shown below.



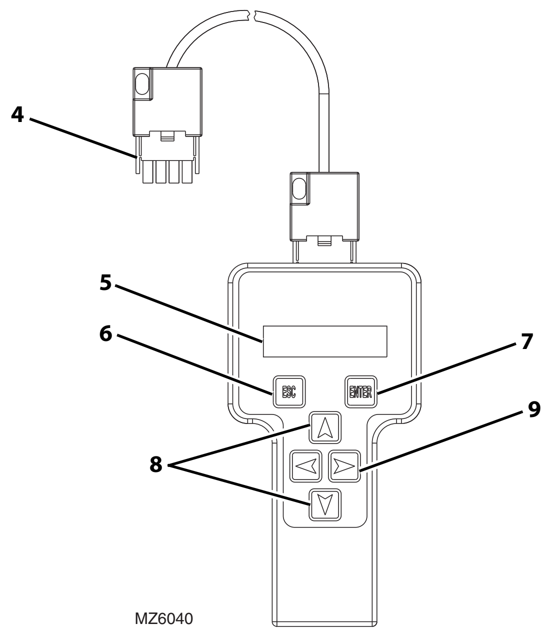


The machine analyzer plugs into the XE connector (**1**) of the Power Distribution Board located behind the left side dash panel (**2**). For machine diagnostics, refer to Section 9.19, “Machine Fault Codes”.

The engine data can be accessed through connector (**3**) in the engine compartment utilizing engine diagnostic tool. For engine diagnostics, refer to Section 9.20, “Engine Diagnostic”.

9.13.2 Hand Held Analyzer

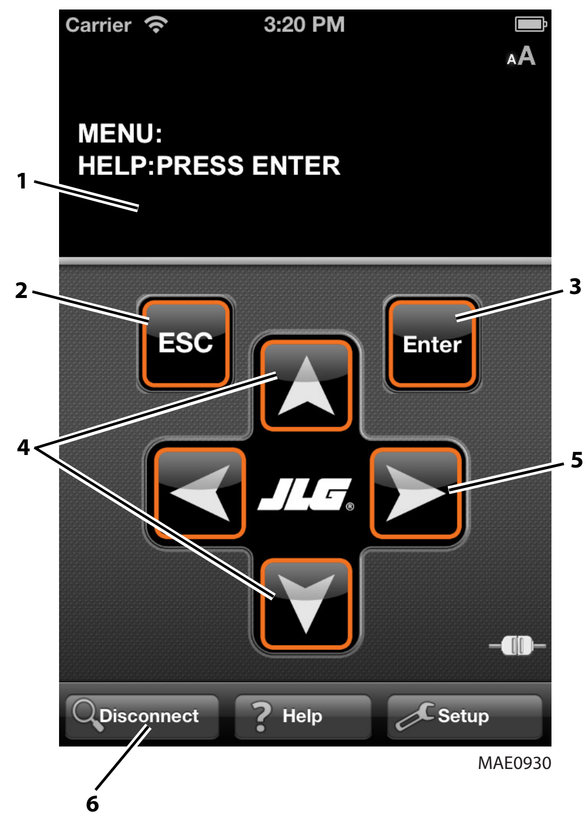
The hand held analyzer (PN 1001249695) provides machine diagnostic, configuration and troubleshooting capabilities.



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.

9.13.3 Mobile Analyzer

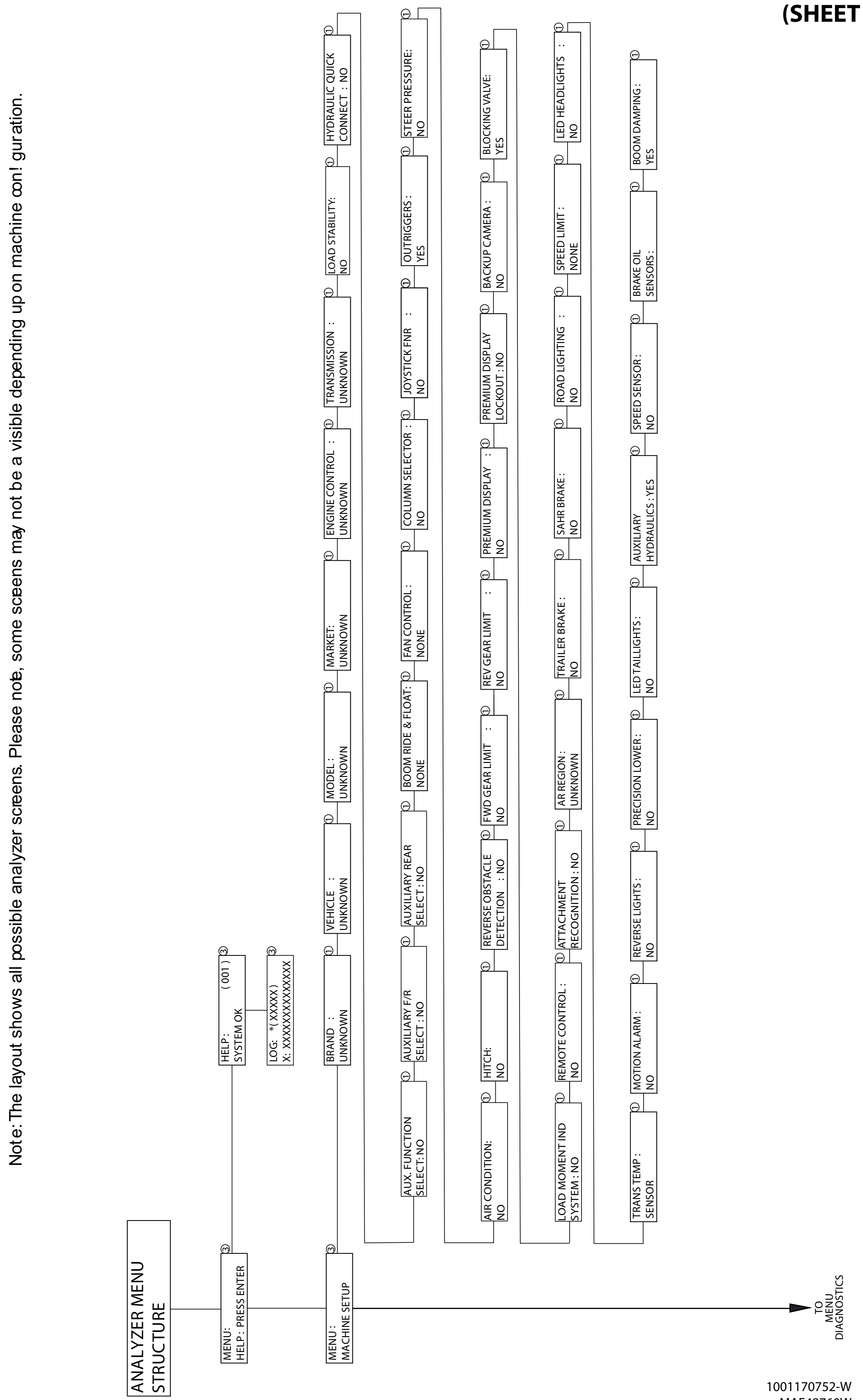
The mobile analyzer (PN 1001147542) is a Wi-Fi enabled evolution of the hand held analyzer kit provides machine diagnostic, configuration and troubleshooting capabilities with an extended operator range of up to 45,72 m (150 ft).



1. Analyzer Display Screen: To display full description readouts.
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.

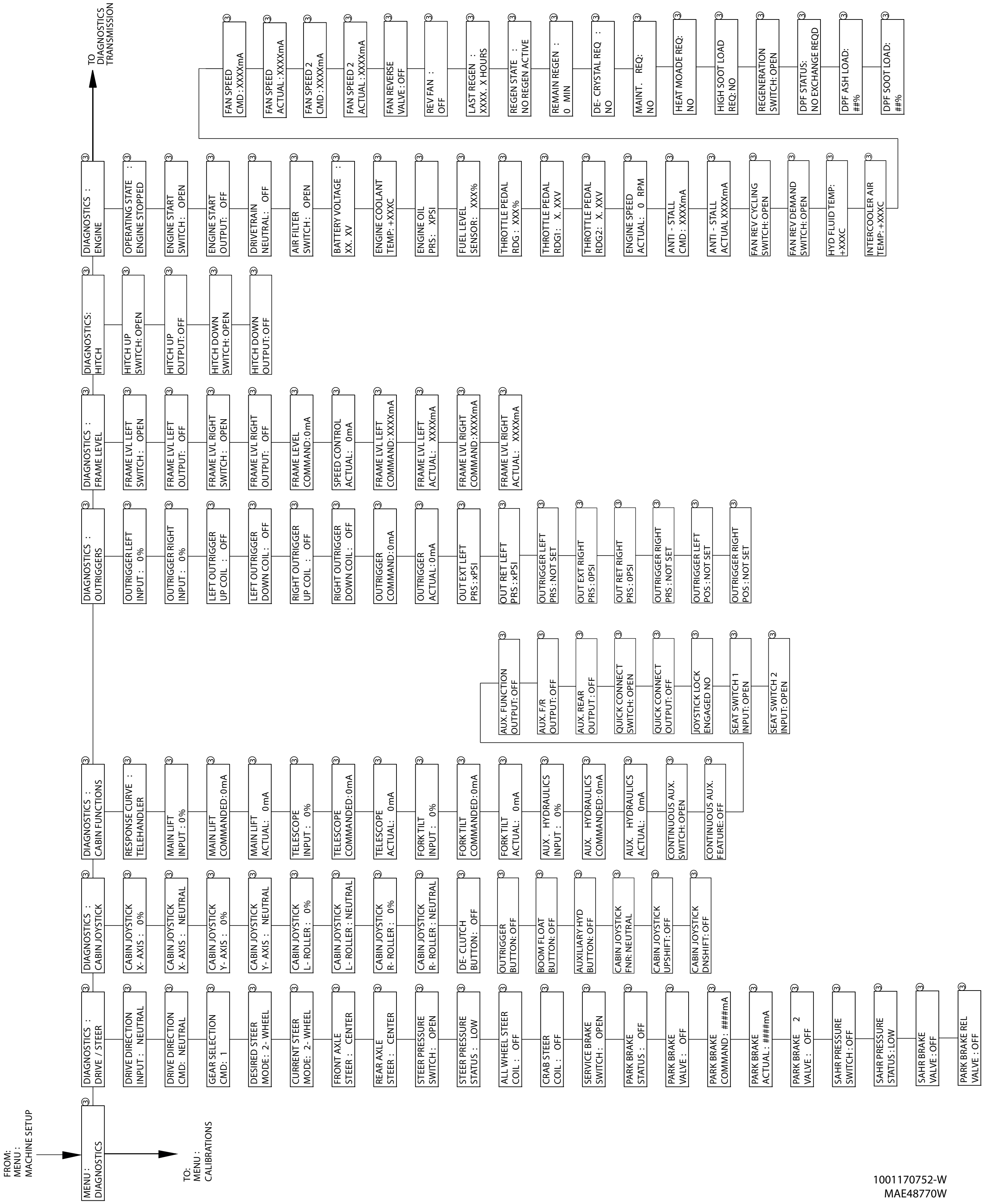
9.13.4 Analyzer Software (Version P18.0)

(SHEET 1 of 8)



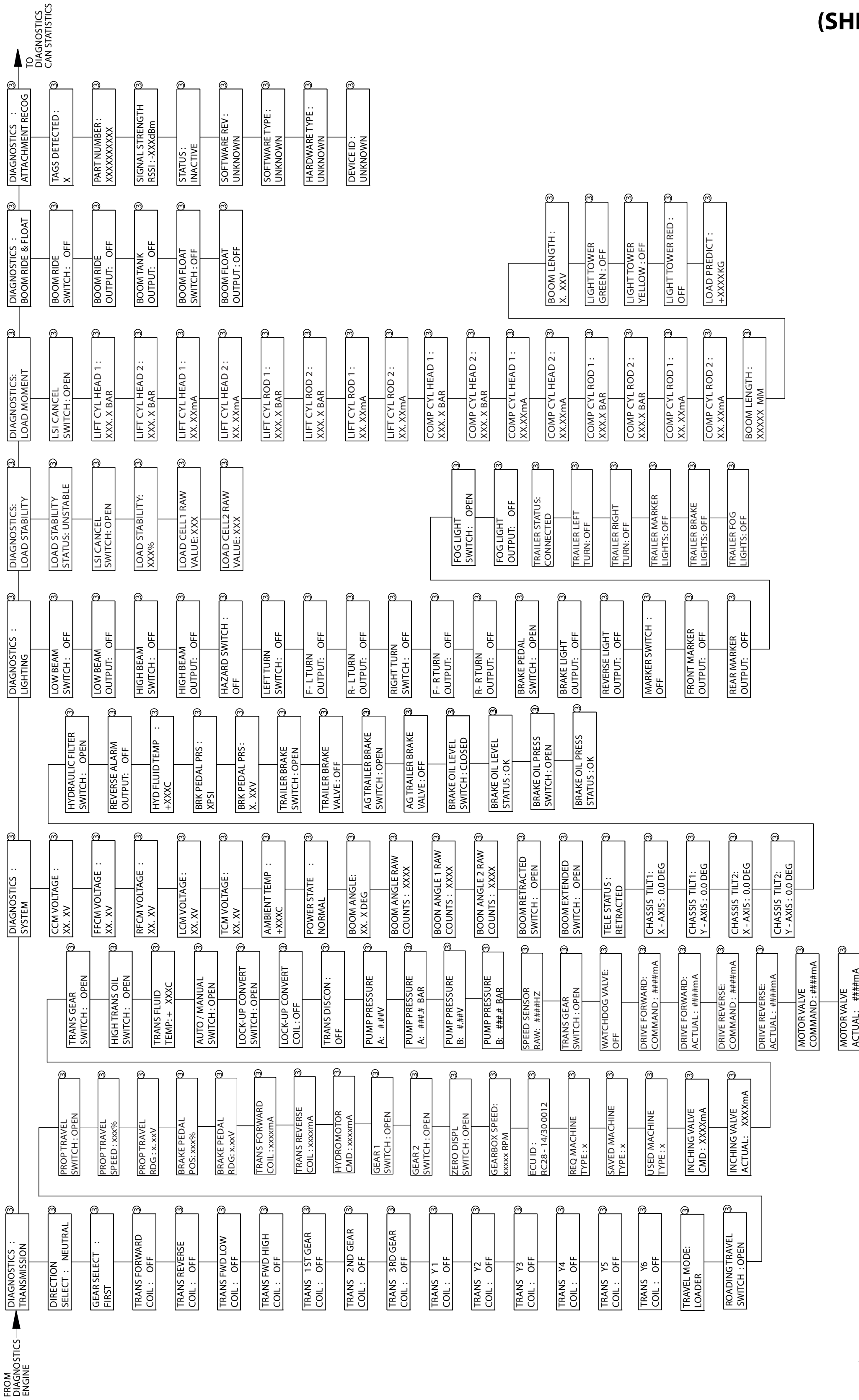
1001170752-W
MAE48760W

(SHEET 2 of 8)



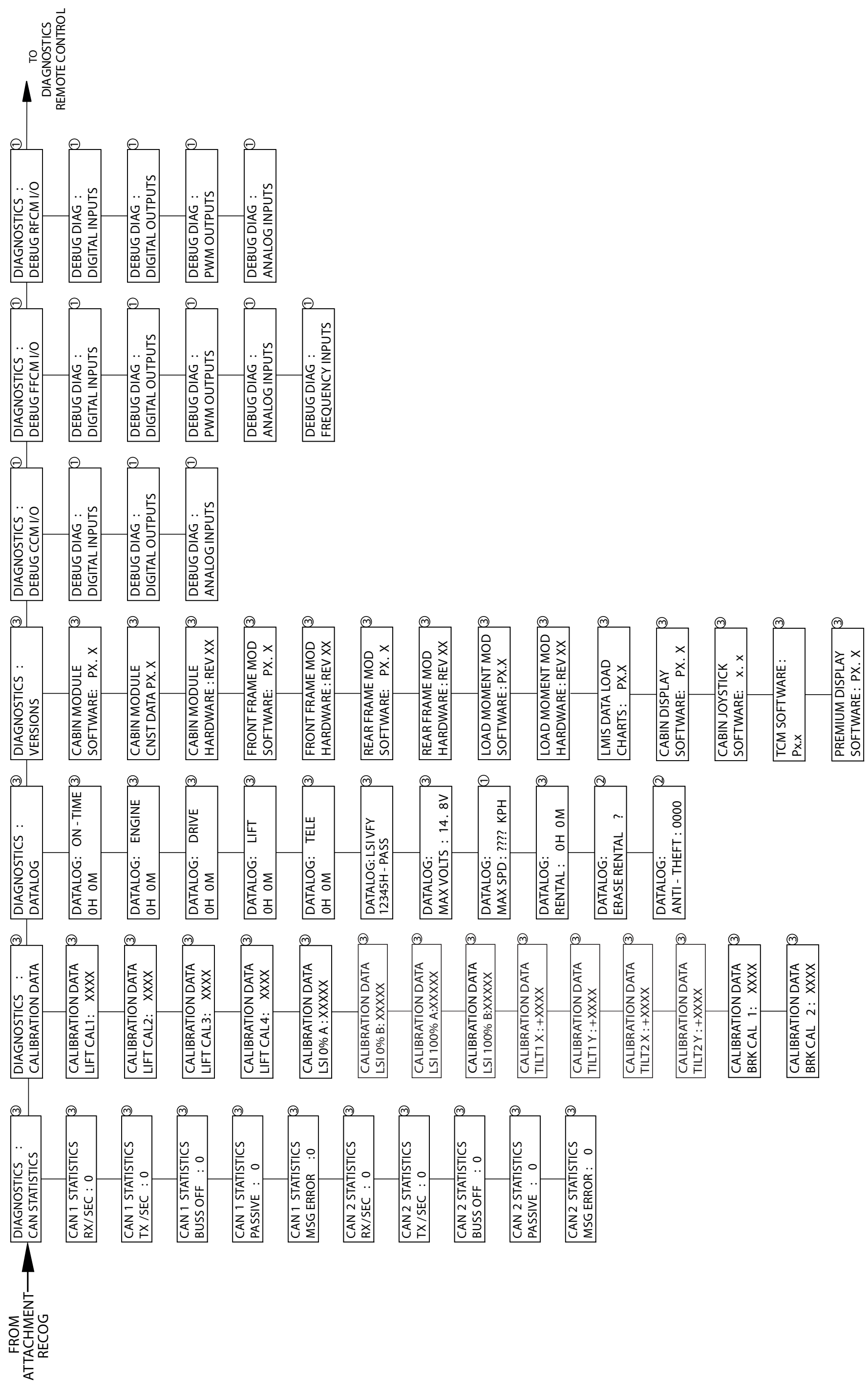
1001170752-W
MAE48770W

(SHEET 3 of 8)

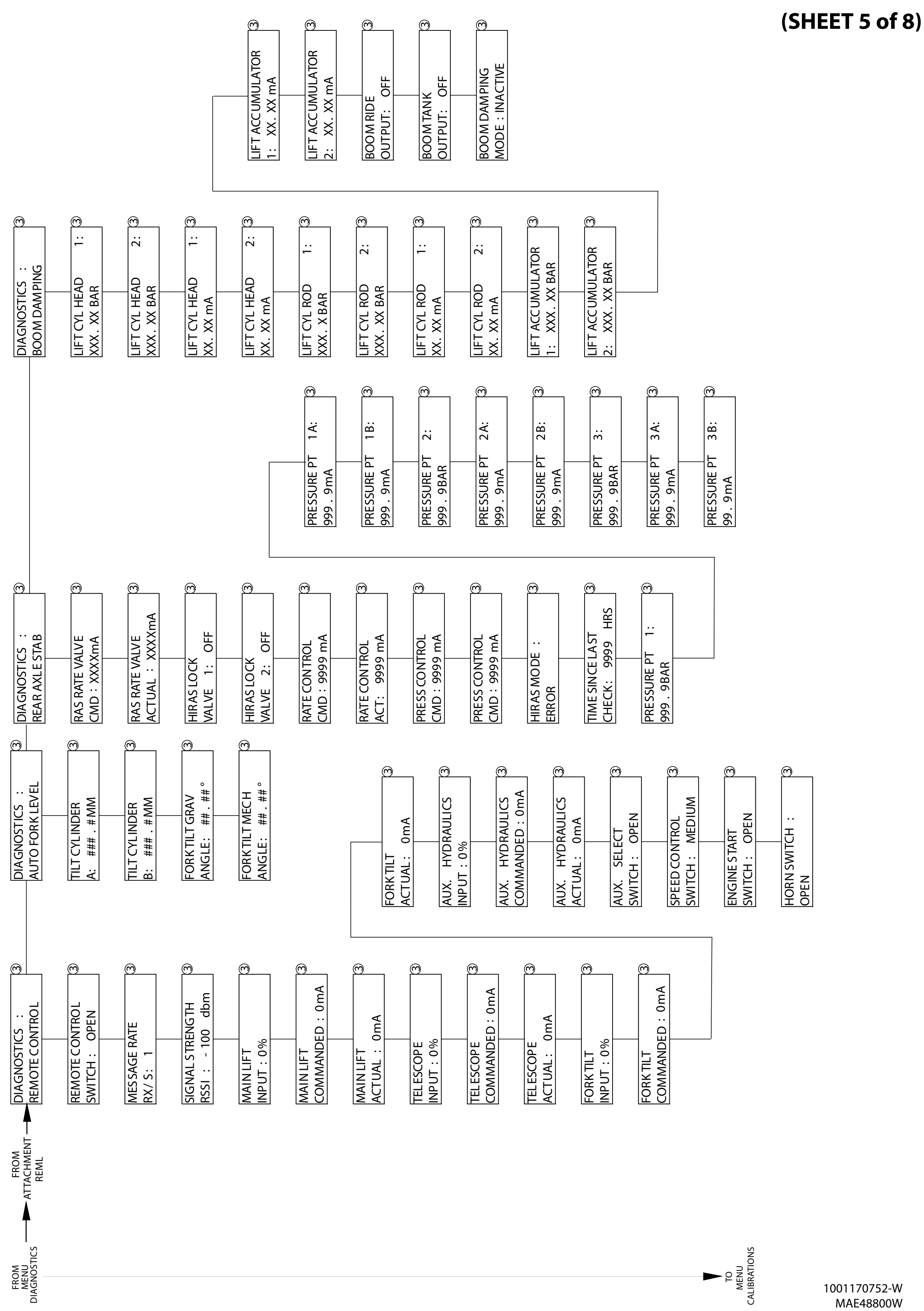


1001170752-W
MAE48780W

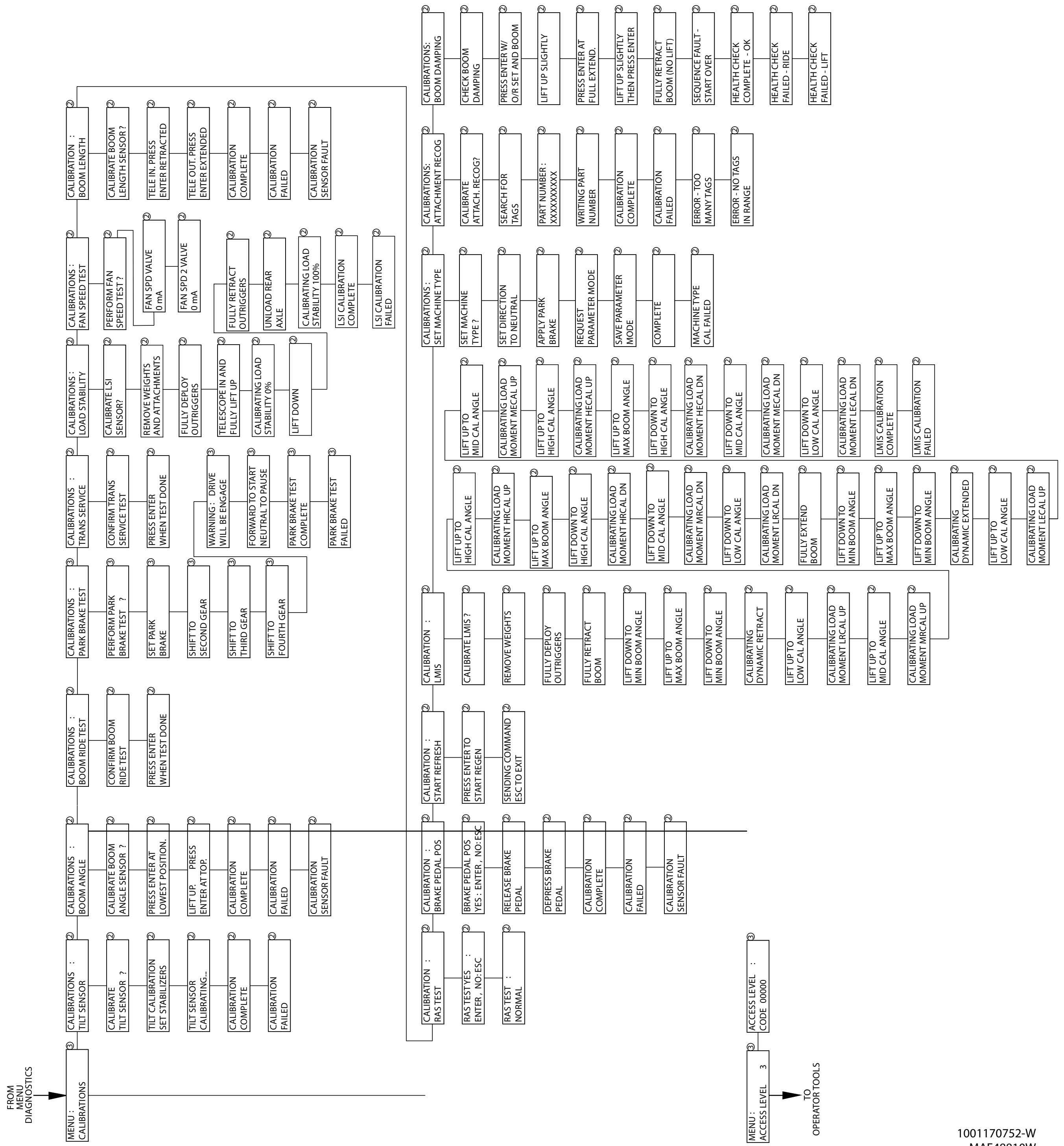
(SHEET 4 of 8)



1001170752-W
MAE48790W

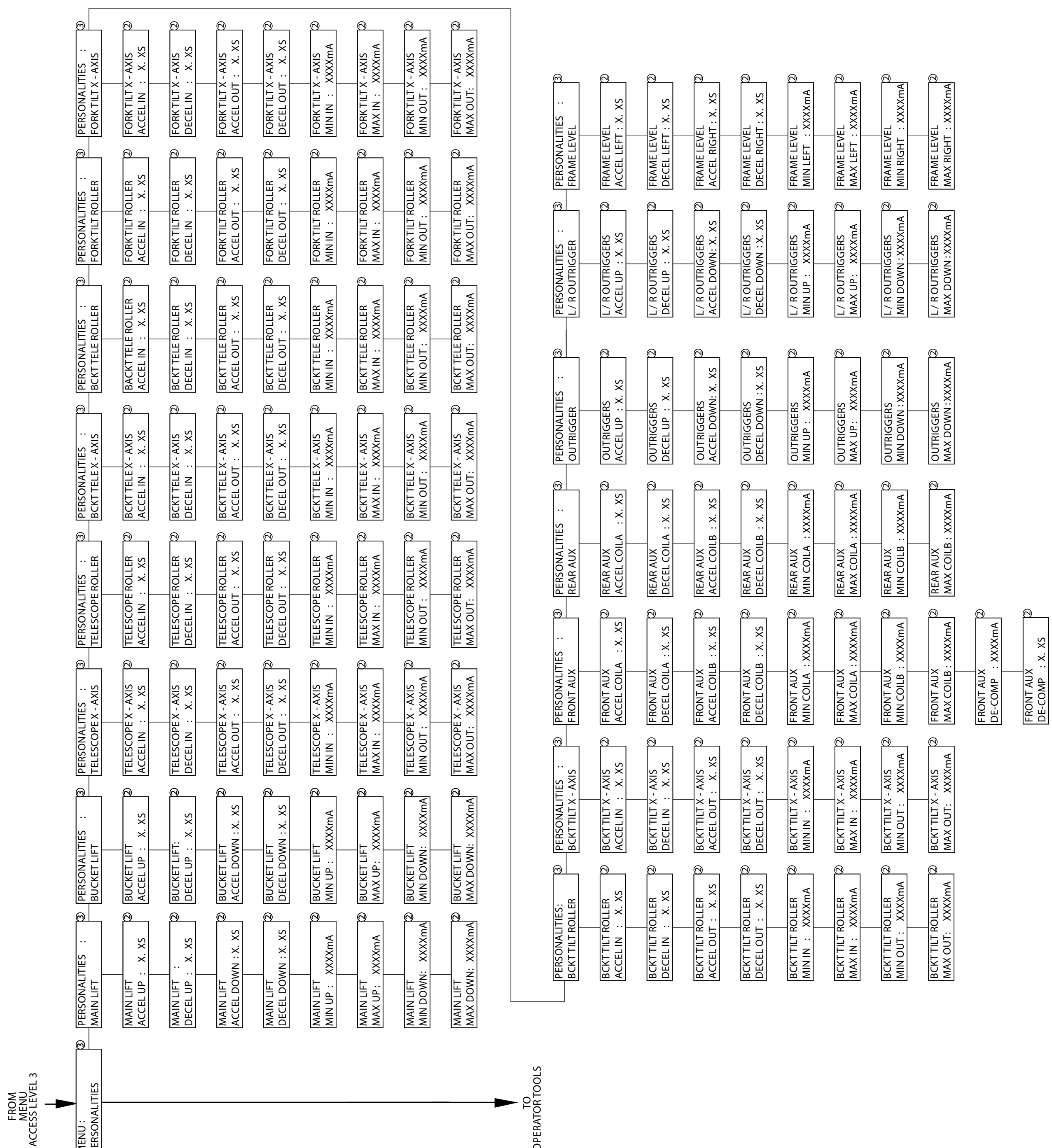

(SHEET 5 of 8)
LIFT ACCUMULATOR 1: XX. XX mA
LIFT ACCUMULATOR 2: XX. XX mA
BOOM RIDE OUTPUT: OFF
BOOM TANK OUTPUT: OFF
BOOM DAMPING MODE : INACTIVE
DIAGNOSTICS : BOOM DAMPING
LIFT CYL HEAD 1: XXX. XX BAR
LIFT CYL HEAD 2: XXX. XX BAR
LIFT CYL HEAD 1: XX. XX mA
LIFT CYL HEAD 2: XX. XX mA
LIFT CYL ROD 1: XXX. X BAR
LIFT CYL ROD 2: XXX. XX BAR
LIFT CYL ROD 1: XX. XX mA
LIFT CYL ROD 2: XX. XX mA
LIFT ACCUMULATOR 1: XXX. XX BAR
LIFT ACCUMULATOR 2: XXX. XX BAR
PRESSURE PT 1A: 999 . 9mA
PRESSURE PT 1B: 999 . 9mA
PRESSURE PT 2: 999 . 9BAR
PRESSURE PT 2A: 999 . 9mA
PRESSURE PT 2B: 999 . 9mA
PRESSURE PT 3: 999 . 9BAR
PRESSURE PT 3A: 999 . 9mA
PRESSURE PT 3B: 99 . 9mA
DIAGNOSTICS : REAR AXLE STAB
RAS RATE VALVE CMD : XXXXmA
RAS RATE VALVE ACTUAL : XXXXmA
HIRAS LOCK VALVE 1: OFF
HIRAS LOCK VALVE 2: OFF
RATE CONTROL CMD : 9999 mA
RATE CONTROL ACT: 9999 mA
PRESS CONTROL CMD : 9999 mA
PRESS CONTROL CMD : 9999 mA
HIRAS MODE : ERROR
TIME SINCE LAST CHECK: 9999 HRS
PRESSURE PT 1: 999 . 9BAR
DIAGNOSTICS : AUTO FORK LEVEL
TILT CYLINDER A: ### . # MM
TILT CYLINDER B: ### . # MM
FORK TILT GRAV ANGLE: ## . ## °
FORK TILT MECH ANGLE: ## . ## °
FORK TILT ACTUAL : 0mA
AUX. HYDRAULICS INPUT : 0%
AUX. HYDRAULICS COMMANDED : 0mA
AUX. HYDRAULICS ACTUAL : 0mA
AUX. SELECT SWITCH : OPEN
SPEED CONTROL SWITCH : MEDIUM
ENGINE START SWITCH : OPEN
HORN SWITCH : OPEN
DIAGNOSTICS : REMOTE CONTROL
REMOTE CONTROL SWITCH : OPEN
MESSAGE RATE RX / S: 1
SIGNAL STRENGTH RSSI : - 100 dbm
MAIN LIFT INPUT : 0%
MAIN LIFT COMMANDED : 0mA
MAIN LIFT ACTUAL : 0mA
TELESCOPE INPUT : 0%
TELESCOPE COMMANDED : 0mA
TELESCOPE ACTUAL : 0mA
FORK TILT INPUT : 0%
FORK TILT COMMANDED : 0mA
FROM ATTACHMENT REML
FROM MENU DIAGNOSTICS
TO MENU CALIBRATIONS
1001170752-W
MAE48800W

(SHEET 6 of 8)



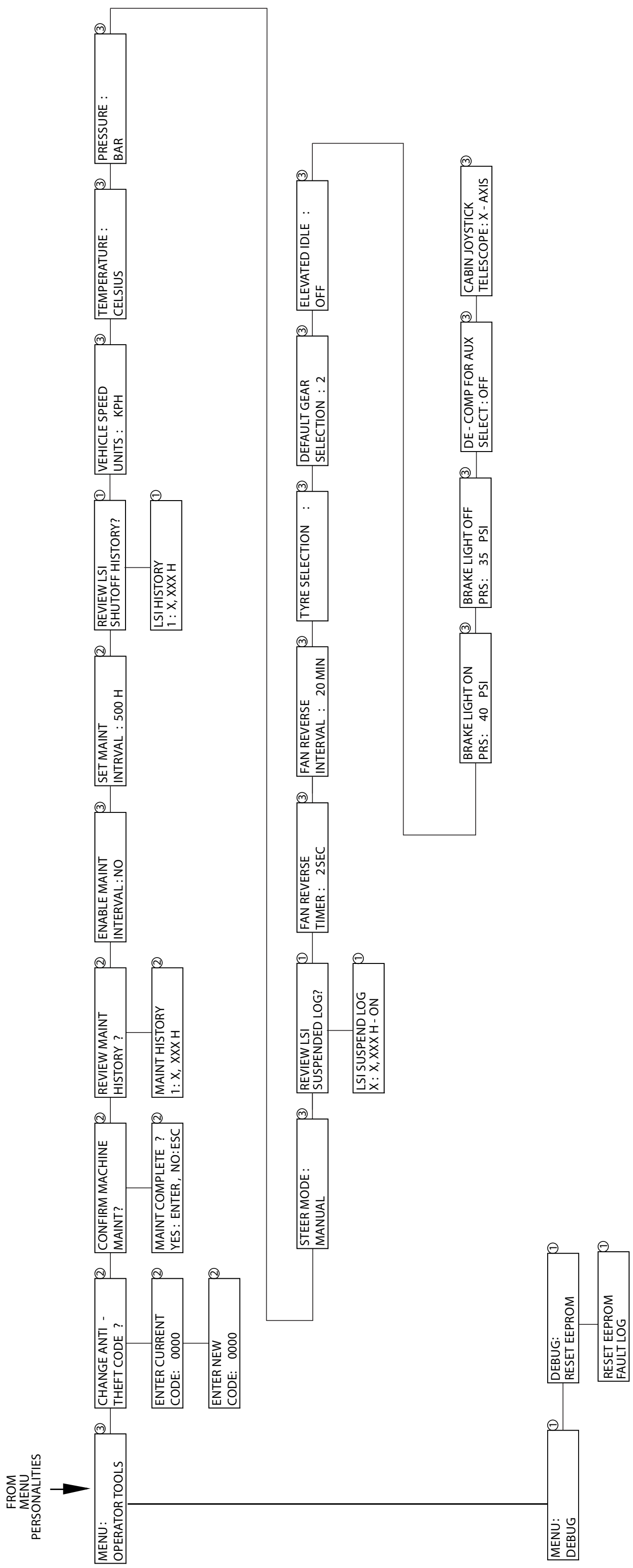
1001170752-W
MAE48810W

(SHEET 7 of 8)



1001170752-W
MAE48820W

(SHEET 8 of 8)



1001170752-W
MAE48830W

9.14 ANALYZER SOFTWARE ACCESSIBILITY

9.14.1 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.

Note: *Options listed in each analyzer menu may vary based on machine configuration.*

9.14.2 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

Menu	Description	Access Level
Debug CCM I/O	Displays the parameters related to the debug CCM I/O	Access Level 3
Debug FFCM I/O	Displays the parameters related to the debug FFCM I/O	Access Level 3
Debug RFCM I/O	Displays the parameters related to the debug RFCM I/O	Access Level 3
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

9.14.3 Machine Set-up

Menu	SETTING	Description	Access Level
Brand	**JLG**	Allows to configure the brand of the telehandler	Access Level 2, 3
Model	**742, 943, 1043, 1055, 1255**	Allows to configure the model number of the telehandler	Access Level 2, 3
Market	**ANSI**, ANSI EXPORT	Allows to set the applicable compliance standard	Access Level 2, 3
Engine Control	**CUMMINS 82kW HRC**	Allows to configure the vehicle's engine	Access Level 2, 3
	CUMMINS 82kW LRC		
	CUMMINS 55kW HRC		
	CUMMINS 97kW HRC		
	CUMMINS 97kW LRC		
Transmission Control	**ZF 4SPD**	Enables transmission auto shift	Access Level 2, 3
	ZF 4SPD AUTO		
Load Stability	**NO**	Enables load Stability Functionality With Rear Axle Load Sensor	Access Level 2, 3
	YES		
Hydraulic Quick Connect	**NO**	Enables hydraulic quick connection functionality	Access Level 2, 3
	YES		
Auxiliary Function Select	**NO**	Enables the auxiliary functionality	Access Level 2, 3
	YES		
Boom Ride and Float	**NONE**	Enables the Boom Ride and Float functionality	Access Level 2, 3
	RIDE		
Operator Presence	**NO**	Enables the operator presence	Access Level 2, 3
	YES		
Outriggers	NO	Enables outrigger functionality	Access Level 2, 3
	YES		
Steer Pressure	**NO**	Enables steer pressure	Access Level 2, 3
	YES		
Air Condition	**NO**	Enables control of the air conditioning functionality	Access Level 2, 3
	YES		

Menu	SETTING	Description	Access Level
Reverse Obstacle Detection	**NO**	Enables the reverse obstacle detection functionality	Access Level 2, 3
	YES		
Fwd Gear Limit	1st, 2nd, 3rd, 4th, 5th, **6th**	Enables a limit on Forward Gear Selection	Access Level 2, 3
Rev Gear Limit	1st, 2nd, 3rd, **4th**	Enables a limit on reverse gear selection	Access Level 2, 3
Premium Display	**NO**	Enables multifunction display functionality	Access Level 2, 3
	YES		
	YES W/ANTI-THEFT		
Premium Display Lockout	**NO**	Disable access level code entry from the premium display to prevent operators from tampering with vehicle settings via the display	Access Level 2, 3
	YES		
Backup Camera	**NO**	Enables reverse camera functionality within multifunction display	Access Level 2, 3
	YES		
Road Lighting	**NO**	Enables Road Lights (SEQ#660)	Access Level 2, 3
	YES		
Load Moment Ind System	**NO**	Enables load moment Ind system	Access Level 2, 3
	YES		
	Disabled		
Attachment Recognition	**NO**	Enables attachment recognition	Access Level 2, 3
	YES		
AR Region:	**North America** **Europe** China Asia **Australia** Russia Brazil Africa Israel India Morocco Malaysia	when market is CE or Australia Select Europe; otherwise select North America	Access Level 2, 3

Menu	SETTING	Description	Access Level
Road Lighting	**NO**	Always select NO	Access Level 2, 3
	YES		
LED Headlights	**NO**	Always select NO	Access Level 2, 3
	YES		
Transmission Temperature	**SWITCH**	Enables switch or sensor-based transmission temperature monitoring	Access Level 2, 3
	SENSOR		
Precision Lower	**NO**	Enables Precision Boom Lower System functionality	Access Level 2, 3
	YES		
LED Taillights	**NO**	Always select NO	Access Level 2, 3
	YES		
Speed Sensor	**NO**	Enables Speed Sensor Functionality	Access Level 2, 3
	YES		

Note: *Settings in BOLD are default values.*

9.14.4 Personalities

Menu/ Sub-menu Items	Function	Description	Default Values (Range)			Access Level
			742	943, 1043	1055, 1255	
Main Lift	Main Lift Accel Up	Screen allows the operator to view parameters (max/min) related to fork tilt and extend/ retract cylinders	0.8 (0.0 – 2.0S)	0.8 (0.0 – 2.0S)	2.0 (0.0 – 2.0S)	Access Level 2
	Main Lift Decel Up		0.4 (0.0 – 1.0S)	0.4 (0.0 – 1.0S)	0.5 (0.0 – 1.0S)	
	Main Lift Accel Down		0.6 (0.0 - 2.0S)	0.6 (0.0 – 2.0S)	0.7 (0.0 – 2.0S)	
	Main Lift Decel Down		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	Main Lift Min Up		630mA (530 - 730mA)	670mA (570 - 770mA)	640mA (540 – 740mA)	
	Main Lift Max Up		1150mA (950 - 1350mA)	1220mA (1020 - 1420mA)	1300mA (1100 -1500mA)	
	Main Lift Min Down		530mA (430 - 630mA)	580mA (480 - 680mA)	620mA (520 – 720mA)	
	Main Lift Max Down		1190mA (990 - 1380mA*)	1220mA (1020 - 1380mA*)	1300mA (1100 -1500mA)	
Telescope (X-Axis)	Telescope Accel In	Fork mode screen allows the operator to view parameters (max/min) related to fork tilt and extend/ retract cylinders	0.8 (0.0 – 2.0S)	0.8 (0.0 – 2.0S)	0.7 (0.0 – 2.0S)	Access Level 2
	Telescope Decel In		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	Telescope Accel Out		0.5 (0.0 – 2.0S)	0.5 (0.0 – 2.0S)	0.7 (0.0 – 2.0S)	
	Telescope Decel Out		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	Telescope Min In		710mA (610 - 810mA)	670mA (570 - 770mA)	640 mA (540 - 740 mA)	
	Telescope Max In		1000mA (800 - 1200mA)	1100mA (900 - 1300mA)	1300mA (1100 -1500mA)	
	Telescope Min Out		680mA (580 - 780mA)	760mA (660 - 860mA)	650 mA (550 - 750 mA)	
	Telescope Max Out		1220mA (1020 - 1420mA)	1220mA (1020 - 1420mA)	1300mA (1100 -1500mA)	

Note: **For vehicles with the gravity lift down feature, the maximum lift down current must be restricted to limit pilot pressure on the GLS valve and permit it remain in compensation.*

Menu/ Sub-menu Items	Function	Description	Default Values (Range)			Access Level
			742	943, 1043	1055, 1255	
Fork Tilt (Roller)	Fork Tilt Accel Up	Fork mode screen allows the operator to view parameters (max/min) related to fork tilt and extend/ retract cylinders	0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	Access Level 2, 3
	Fork Tilt Decel Up		0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	
	Fork Tilt Accel Down		0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	
	Fork Tilt Decel Down		0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	
	Fork Tilt Min Up		640mA (540 – 740mA)	690mA (590 – 790mA)	680mA (580 – 780mA)	
	Fork Tilt Max Up		1100mA (900 – 1300mA)	1300mA (1100 – 1500mA)	1300mA (1100 – 1500mA)	
	Fork Tilt Min Down		660mA (560 – 760mA)	690mA (590 – 790mA)	680mA (580 – 780mA)	
	Fork Tilt Max Down		1100mA (900 – 1300mA)	1300mA (1100 – 1500mA)	1300mA (1100 – 1500mA)	

Menu/ Sub-menu Items	Function	Description	Default Values (Range)			Access Level
			742	943, 1043	1055, 1255	
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)	0.4 (0.0 – 2.0S)	Access Level 2
	Front Auxiliary Decel Coil A		0.2 (0.0 – 1.0S)	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)	0.4 (0.0 – 2.0S)	
	Front Auxiliary Decel Coil B		0.2 (0.0 – 1.0S)	0.2 (0.0 – 1.0S)	0.2 (0.0 – 1.0S)	
	Front Auxiliary Min Coil A		710mA (610 - 910mA)	710mA (610 - 910mA)	700mA (600 – 900mA)	
	Front Auxiliary Max Coil A		1350mA (920 - 1400mA)	1350mA (920 - 1400mA)	1350mA (920 – 1400mA)	
	Front Auxiliary Min Coil B		710mA (610 - 910mA)	710mA (610 - 910mA)	700mA (600 – 900mA)	
	Front Auxiliary Max Coil B		1350mA (900 - 1400mA)	1350mA (920 - 1400mA)	1350mA (920 – 1400mA)	
	Front Aux De-comp xxxxmA		800mA (700 - 900mA)	800mA (700 - 900mA)	800mA (700 - 900mA)	
	Front Aux De-comp x.xs		0.5S (0.4 - 2.0S)	0.5S (0.4 - 2.0S)	0.5S (0.4 - 2.0S)	

Menu/ Sub-menu Items	Function	Description	Default Values (Range)			Access Level
			742	943, 1043	1055, 1255	
L/R Outriggers	L/R Outriggers Accel Up	Outriggers screen allows the operator to view the parameters (min/max values) related to outriggers function speeds	0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	Access Level 2
	L/R Outriggers Decel Up		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	L/R Outriggers Accel Down		0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	
	L/R Outriggers Decel Down		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	L/R Outriggers Min Up		420mA (350 - 550mA)	420mA (350 - 550mA)	420mA (350 - 550mA)	
	L/R Outriggers Max Up		1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	
	L/R Outriggers Min Down		450mA (320 - 520mA)	450mA (320 - 520mA)	450mA (320 - 520mA)	
	L/R Outriggers Max Down		1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	
Frame Level	Frame Level Accel Left	Frame level screen allows the operator to view the parameters (min/max) related to frame level function speeds	1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	Access Level 2
	Frame Level Decel Left		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Frame Level Accel Right		1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	
	Frame Level Decel Right		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Frame Level Min Left		580mA (480 – 680mA)	580mA (480 – 680mA)	580mA (480 – 680mA)	
	Frame Level Max Left		800mA (600 - 1000mA)	800mA (600 - 1000mA)	800mA (600 - 1000mA)	
	Frame Level Min Right		580 mA (480 – 680mA)	580 mA (480 – 680mA)	580 mA (480 – 680mA)	
	Frame Level Max Right		800mA (600 - 1000mA)	800mA (600 - 1000mA)	800mA (600 - 1000mA)	

9.14.5 Operator Tools

Menu	Settings	Description	Access Level
Change Anti-theft Code?	Enter Current CODE: 0000	Requires the existing code to be entered before a new one.	Access Level 1, 2
	Enter New CODE: 0000	Return to top level menu after entry.	
Anti-theft Mode: Cabin + Remote	Cabin + Remote Cabin Only Remote Only	Configures which operator stations will require anti-theft code entry at each startup.	Access Level 1, 2
Confirm Machine Maintenance?	Maintenance Complete? YES:ENTER NO:ESC	Records that preventive maintenance has been performed.	Access Level 1, 2
Review Maintenance History?	Maintenance History nn:X,XXX H	Displays the engine hours for the past fifteen maintenance intervals.	Access Level 1, 2
Enable Maint Interval	YES **NO**	Enables the maintenance interval notification (DTC 874)	Always
Set Maintenance Interval	**500 hrs** (0 to 500 hrs)	Increment or decrement the engine hours before the next maintenance interval; notification (DTC 874)	Access Level 1, 2
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
Vehicle Speed Units	**KPH** MPH	Selects units for vehicle speed display; default to MPH when machine setup's market is ANSI; KPH otherwise.	Access Level 1, 2, 3
Temperature	**Celsius** Fahrenheit	Selects units for temperature display; default to Fahrenheit when machine setup's market is ANSI; Celsius otherwise.	Access Level 1, 2, 3
Pressure	**BAR** PSI	Select units for pressure display; default to PSI when machine setup's market is ANSI; BAR otherwise.	Access Level 1, 2, 3
Steer Mode	**Automatic** Manual	Selects steering mode preference; default to Automatic when machine setup's vehicle is LBP-AG, LBP-PR, or LBP-HC, manual otherwise.	Access Level 1, 2, 3
Review LSI Suspended Log?	LSI Suspend Log nn: X,XXXH - Nn	Displays engine hours when load stability is 100%; on during passive mode and off otherwise (last ten events).	Access Level 1

Menu	Settings	Description	Access Level
Fan Reverse Timer	**2 sec** (2 - 10 sec)	Sets the length of time that the fan will be reversed (cycling or demand).	Access Level 1, 2, 3
Fan Reverse Interval	**20 min** (5 - 60 min)	Sets the interval between cycling fan reversals.	
Tire Selection	(Multiple Tire Selections)	Selects the tire fitted for proper vehicle speed calibration	Access Level 1, 2, 3
Default Gear Selection	1, **2**, 3, 4	Sets the default transmission gear at power-up; required when cabin joystick is used for gear selection (except hydrostatic transmission).	Access Level 1, 2, 3
	1, **2**, 3		Access Level 1, 2, 3
Elevated Idle	**OFF** ON	Requests elevated idle for aftertreatment cleaning; default to off at power-up and when JLG analyzer is disconnected.	Access Level 1, 2, 3
Brake Light On Pressure	**40 PSI** (10 -150 PSI)	Configures the brake light activation pressure; PSI or BAR according to operator tools pressure setting.	Access Level 1, 2, 3
Brake Light Off Pressure	**35 PSI** (10 - 150 PSI)	Configures the brake light de-activation pressure; PSI or BAR according to operator tools pressure setting.	
De-compression For Auxiliary Select	**OFF** ON	Configure auxiliary de-compression during auxiliary select change.	Access Level 1, 2, 3
Cabin Joystick Telescope	**X-Axis** Roller	Selects the cabin joystick resource that will be used to control telescope; fork tilt is controlled by the opposite.	Access Level 1, 2, 3

Note: *Settings in BOLD are default values.*

9.14.6 Calibrations

Menu	Sub-menu/Procedure	Description	Access Level
Tilt Sensor	Calibrate Tilt Sensor?	Used by technicians to calibrate the chassis tilt sensors; ENTER to confirm; ESC to exit	Access Level 1, 2,
	Tilt Calibration Set Stabilizers	Displayed if Machine Setup's OUTRIGGERS is YES; Technician must use stabilizer and digital level to properly position vehicle; ENTER to confirm; ESC to exit	
	Tilt Sensor Calibrating	Displayed while control system acquires readings	
	Calibration Complete	Calibration offset was within +/- 5.0 degrees; ENTER or ESC to exit	
	Calibration Failed	Calibration offset was outside +/- 5.0 degrees; ENTER or ESC to exit	
Boom Angle	Calibrate Boom Angle Sensor?	Used by technicians to calibrate the boom angle sensor; press ENTER to confirm or ESC to exit	Access Level 1, 2
	Press Enter at lowest position	Technician must lower boom to mechanical stop; press ENTER to confirm	
	Lift Up. Press Enter at top	Technician must raise boom to mechanical stop; press ENTER to confirm.	
	Calibration Complete	Calibration was successful; press ESC key to exit	
	Calibration Failed	The minimum or maximum boom angle sensor counts were improper for this vehicle; press ESC key to exit	
	Calibration Sensor Fault	DTC 2344, 2345, 2346,2353, or 6621 was active and calibration could not succeed; press ESC key 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 1, 2
	Press Enter when test done	Activate Boom Ride functionality until technician leaves menu or disconnects JLG Analyze; press ENTER to return to CONFIRM BOOM RIDE TEST menu or ESC to exit	

Menu	Sub-menu/Procedure	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 Converter Stall Test.	Access Level 1, 2
	Set park brake	Prompt technician to apply park brake; press ENTER to continue or ESC to exit; test fails if park brake not applied	
	Shift to second gear	Prompt technician to select proper gear; press ENTER to continue or ESC to exit; test fails if proper gear not selected	
	Shift to third gear		
	Shift to fourth gear		
	Warning: drive will be engaged	Prompt technician that vehicle will drive at next step; menu persists for 2000mS; press ENTER to continue or ESC to exit	
	Forward to start neutral to pause	Prompt technician 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	
Transmission Service	Confirm trans 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 Level 1,2
	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/Procedure	Description	Access Level
Load Stability	Calibrate LSI Sensor?	Used by technicians to calibrate LSI operation; hydraulic functions will not be prevented by LSI during calibration; Press ENTER to continue or ESC to exit; disabled during LSI verification.	Access Level 1,2
	Remove Weights and Attachments	Prompt technician to remove attachment and weights; 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; 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	Prompt technician to place vehicle in most stable position; Press ENTER to continue or ESC to exit.	
	Calibrating Load Stability 0%	Prompt technician to wait for measurement stability; Press ENTER to continue or ESC to exit.	
	Lift Down	Prompt technician 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; prompt technician to pull up the outriggers; Press ENTER to continue or ESC to exit.	
	Unload Rear Axle	Prompt technician to lift rear axle off the ground using overhead crane or jack; Press ENTER to continue or ESC to exit.	
	Calibrating Load Stability 100%	Prompt technician 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 by technicians at the factory for noise testing; press ENTER to begin or ESC to exit	Access Level 1,2
	Fan SPD Valve 0 mA	UP and DOWN keys directly adjust fan speed valve current	
	Fan SPD 2 Valve 0 mA	UP and DOWN keys directly adjust fan speed 2 valve current in same manner as fan speed valve	Access Level 1,2

Menu	Sub-menu/Procedure	Description	Access Level
Boom Length	Calibrate Boom Length Sensor?	Used by technicians to calibrate the boom length sensor; Hydraulic functions will not be prevented by LMIS during calibration; press ENTER to confirm or ESC to exit.	Access Level 1, 2
	TELE In. Press Enter Retracted	Technician must retract boom completely; press ENTER to confirm	
	TELE Out. Press Enter Extended	Technician must extend boom completely; press ENTER to confirm.	
	Calibration Complete	Calibration was successful; press ESC key to exit	
	Calibration Failed	The minimum or maximum boom length sensor counts were improper for this vehicle; press ESC key to exit	
	Calibration Sensor Fault	DTC 845 or 846 was active and calibration could not succeed; press ESC key to exit	
RAS Test	RAS TEST YES:ENTER, NO:ESC	Used by technicians to test the Rear Axle Stability system; press ENTER to confirm or ESC to exit	Access Level 1,2
	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	
START REFRESH	Press ENTER To START REGEN	Used by technicians to trigger aftertreatment refresh; press ENTER to trigger regeneration	Access Level 1,2
	Sending Command ESC To EXIT	Press ESC to exit	

Menu	Sub-menu/Procedure	Description	Access Level
Brake Pedal POS	Brake Pedal POS YES: ENTER, NO: ESC	Used by technicians to calibrate the brake pedal position sensor; press ENTER to confirm or ESC to exit	Access Level 1,2
	Release Brake Pedal	Prompt technician to release brake pedal for 0%; press ENTER to calibrate or ESC to exit	
	Depress Brake Pedal	Prompt technician to depress brake pedal for 100%; press ENTER to calibrate or ESC to exit	
	Calibration Completed	Brake Pedal Position 0% &100% > 0.5V or < 4.50V; Brake Pedal Position 0% -100% > 0.25V; calibration was successful; press ESC key to exit	
	Calibration Failed	Brake Pedal Position 0% / 100% were improper; press ESC key to exit	
	Calibration Sensor Fault	DTC 23167 or 23168 was active and calibration could not succeed; press ESC key to exit	

Menu	Sub-menu/Procedure	Description	Access Level
LMIS (Load Management Indicator System)	Calibrate Load Moment Indicator System?	Used by technicians to calibrate the Load Moment Indication System; Press LEFT or RIGHT to view LMIS PASSIVE menu; Hydraulic functions will not be prevented by LMIS during calibration; press ENTER to continue or ESC to exit; proceed to LMIS CALIBRATION FAIL if calibration is prevented for the selected attachment	Access Level 1, 2
	Remove Weights	Prompt technician to remove weights; press ENTER to continue or ESC to exit	
	Fully Deploy Outriggers	Prompt technician to set the outriggers; Displayed when Machine Setup's OUTRIGGERS is YES; If Machine Setup's OUTRIGGER DETECTION is PRESS or PRESS & PROX, proceed when both left and right outriggers are deployed; If Machine Setup's OUTRIGGER DETECTION is NONE, press ENTER to continue; press ESC to exit	
	Fully Retract Boom	Prompt technician to fully retract boom for next calibration point; press ENTER to continue or ESC to exit	
	Lift Down To MIN Boom Angle	Prompt technician to lift down for next calibration step; press ENTER to continue or ESC to exit	
	Lift Up To MAX Boom Angle	Prompt technician to lift up to maximum boom angle; Press ENTER at maximum boom angle to continue, or ESC to exit	
	Lift Down To MIN Boom Angle	Prompt technician to lift down to minimum boom angle; Press ENTER at minimum boom angle to continue, or ESC to exit	
	Calibrating Dynamic Retract	Record dynamic retracted offsets for the selected attachment, then continue	
	Lift Up To Low CAL Angle	Prompt technician to lift up to low calibration 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	Record Low Retracted Up Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit.	

Menu	Sub-menu/Procedure	Description	Access Level
LMIS (Load Management Indicator System)	Lift Up To MID Call Angle	Prompt technician to lift up to middle calibration angle; lift up prevented when boom angle is greater than or equal to calibration angle; press ENTER to continue or ESC to exit	Access Level 1, 2
	Calibrating Load Moment MRCAL Up	Record Mid Retracted Up Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Up To High CAL Angle	Prompt technician to lift up to high calibration 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 HRCAL UP	Record High Retracted Up Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Up To MAX Boom Angle	Prompt technician to lift up for next calibration step; press ENTER to continue or ESC to exit	
	Lift Down To High CAL Angle	Prompt technician to lift down to high calibration angle; lift down prevented when boom angle is less than or equal to calibration angle; press ENTER to continue or ESC to exit	
	Calibrating Load Moment HRCAL DN	Record High Retracted Down Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Down To MID CAL Angle	Prompt technician to lift down to mid calibration angle; lift down prevented when boom angle is less than or equal to calibration angle; press ENTER to continue or ESC to exit	
	Calibrating Load Moment MRCAL DN	Record Mid Retracted Down Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Down To Low CAL Angle	Prompt technician to lift down to low calibration angle; lift down prevented when boom angle is less than or equal to calibration angle; press ENTER to continue or ESC to exit	

Menu	Sub-menu/Procedure	Description	Access Level
LMIS (Load Management Indicator System)	Calibrating Load Moment LRCAL DN	Record Low Retracted Down Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	Access Level 1, 2
	Fully Extend Boom	Prompt technician to extend boom to Calibration Length for next calibration step; telescope out prevented when boom length is greater than or equal to Calibration Length, press ENTER to continue or ESC to exit	
	Lift Down to Min Boom Angle	Prompt technician to lift down for next calibration step; press ENTER to continue or ESC to exit	
	Lift Up to Max Boom Angle	Prompt technician to lift up to maximum boom angle; Press ENTER at maximum boom angle to continue, or ESC to exit	
	Lift Down to Min Boom Angle	Prompt technician to lift down to minimum boom angle; Press ENTER at minimum boom angle to continue, or ESC to exit	
	Calibrating Dynamic Extended	Record dynamic extended offsets for the selected attachment, then continue	
	Lift Up to Low Cal Angle	Prompt technician to lift up to low calibration 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 LECAL Up	Record Low Extended Up Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Up to Mid Cal Angle	Prompt technician to lift up to mid calibration 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 MECAL Up	Record Mid Extended Up Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Up to High Cal Angle	Prompt technician to lift up to high calibration 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 HECAL Up	Record High Extended Up Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	

Menu	Sub-menu/Procedure	Description	Access Level
LMIS (Load Management Indicator System)	Lift Up	Prompt technician to lift up for next calibration step; press ENTER to continue or ESC to exit	Access Level 1, 2
	Lift Down to High Cal Angle	Prompt technician to lift down to high calibration angle; lift down prevented when boom angle is less than or equal to calibration angle; press ENTER to continue or ESC to exit	
	Calibrating Load Moment HECAL DN	Record High Extended Down Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Down to Mid Cal Angle	Prompt technician to lift down to mid calibration angle; lift down prevented when boom angle is less than or equal to calibration angle; press ENTER to continue or ESC to exit	
	Calibrating Load Moment MECAL DN	Record Mid Extended Down Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	Lift Down to Low Cal Angle	Prompt technician to lift down to low calibration angle; lift down prevented when boom angle is less than or equal to calibration angle; press ENTER to continue or ESC to exit	
	Calibrating Load Moment LECAL DN	Record Static Low Extended Down Calibration for the selected attachment; Proceed if boom is stable enough to collect offset, else proceed to CALIBRATION FAILED; Press ESC to exit	
	LMIS Calibration Complete	Save calibration offsets for current attachment; press ESC to exit	
	LMIS Calibration Failed	The calibration failed due to out of range offset or boom instability; Technician should troubleshoot any active fault codes, then reattempt calibration; 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	

Menu	Sub-menu/Procedure	Description	Access Level
Set Machine Type	Set Machine Type	Used by technicians to set the Bosch Hydrostatic Transmission's Machine Type; press ENTER to continue or ESC to exit	Access Level 1, 2, 3
	Set Direction To NEUTRAL	Prompt technician to set direction selection to neutral; press ENTER to continue or ESC to exit	
	Apply Park Brake	Prompt technician to apply the park brake; press ENTER to continue or ESC to exit	
	Request Parameter Mode	Prompt technician that control system is checking for preconditions; press ENTER to continue or ESC to exit	
	Save Parameter Mode	Prompt technician that control system is saving machine type change; press ENTER to continue or ESC to exit	
	Complete	Prompt technician that machine type change is complete; press ENTER or ESC to exit	
	Machine Type CAL Failed	Prompt technician that machine type change was not accepted; press ENTER or ESC to exit	

Menu	Sub-menu/Procedure	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 Level 1, 2
	Searching For Tags	Search for available tags in range; Continue when finished or press ESC to exit	
	Part Number: 0000000000	Prompt technician to enter attachment part number from attachment serial plate; if part number contains less than 10 digits, enter zeros for unused digits; 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 write 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	

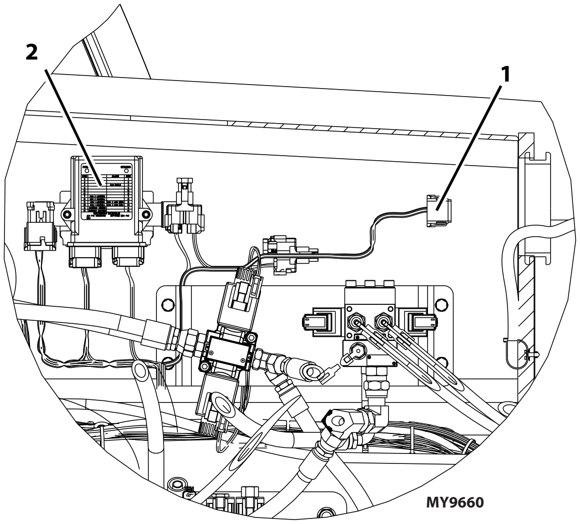
Menu	Sub-menu/Procedure	Description	Access Level
Boom Damping	Check Boom Damping Component Health?	Used by technicians to check the health of Boom Ride Valve and Lift Rod Pressure sensor which are impractical to check during normal system operation; press ENTER to confirm or ESC to exit	Access Level 1, 2
	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	Technician must use lift up to re-balance 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)	Technician 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 re-balance pressures on the lift cylinder at full boom extension; press ENTER to confirm. Press ESC to exit Health Check.	
	Fully 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.	

9.15 TELEMATICS GATEWAY

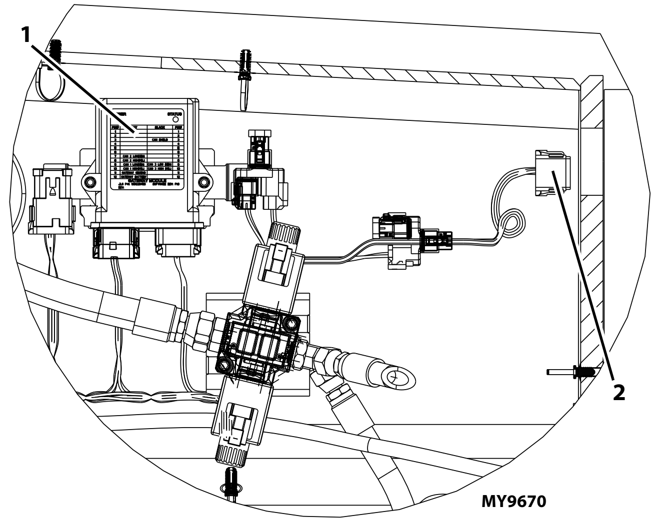
Personnel using machines equipped with an optional telematics gateway will be able to view the following data through their telematics device:

JLG LABEL	DESCRIPTION	UNIT
Engine Speed	Actual engine speed.	RPM
DEF Tank Level (If Equipped)	If machine is equipped, indicates level of DEF (diesel exhaust fluid) within DEF tank. • 0% = Empty • 100% = Full	Percentage (%)
JLG Machine Faults: Active / Not-Active	• 00 - No Machine Faults • 01 - Active Machine Fault • 10 - Error • 11 - Not available	Bit
Total Idle Fuel Used	Total amount of fuel used during vehicle operation during idle conditions.	Liters
Total Idle Hours	Total time of engine operation during idle conditions.	Seconds
Total Engine Hours	Total time of engine operation.	Seconds
Total Fuel Used	Total amount of fuel used during vehicle operation.	Liters
Fuel Rate	Amount of fuel consumed by engine per unit of time.	Liters/Hour
Fuel Level	Ratio of fuel volume to total volume of fuel storage container. When a low fuel limit switch is present, fuel level indicates "full" until switch opens, indicating 10% fuel remaining. When Fuel Level 2 (SPN 38) is not used, Fuel Level 1 represents total fuel in all fuel storage containers. When Fuel Level 2 is used, Fuel Level 1 represents fuel level in primary or left side fuel storage container.	Percentage (%)
DM1 Engine Faults	Shows actual engine fault codes.	N/A

9.15.1 Component Locations



742/943/1043

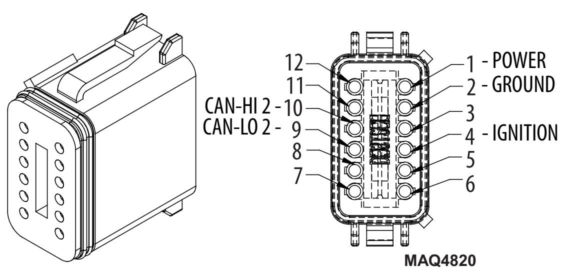


1055/1255

1. Gateway Module
2. Telematics-Ready (TCU) Plug

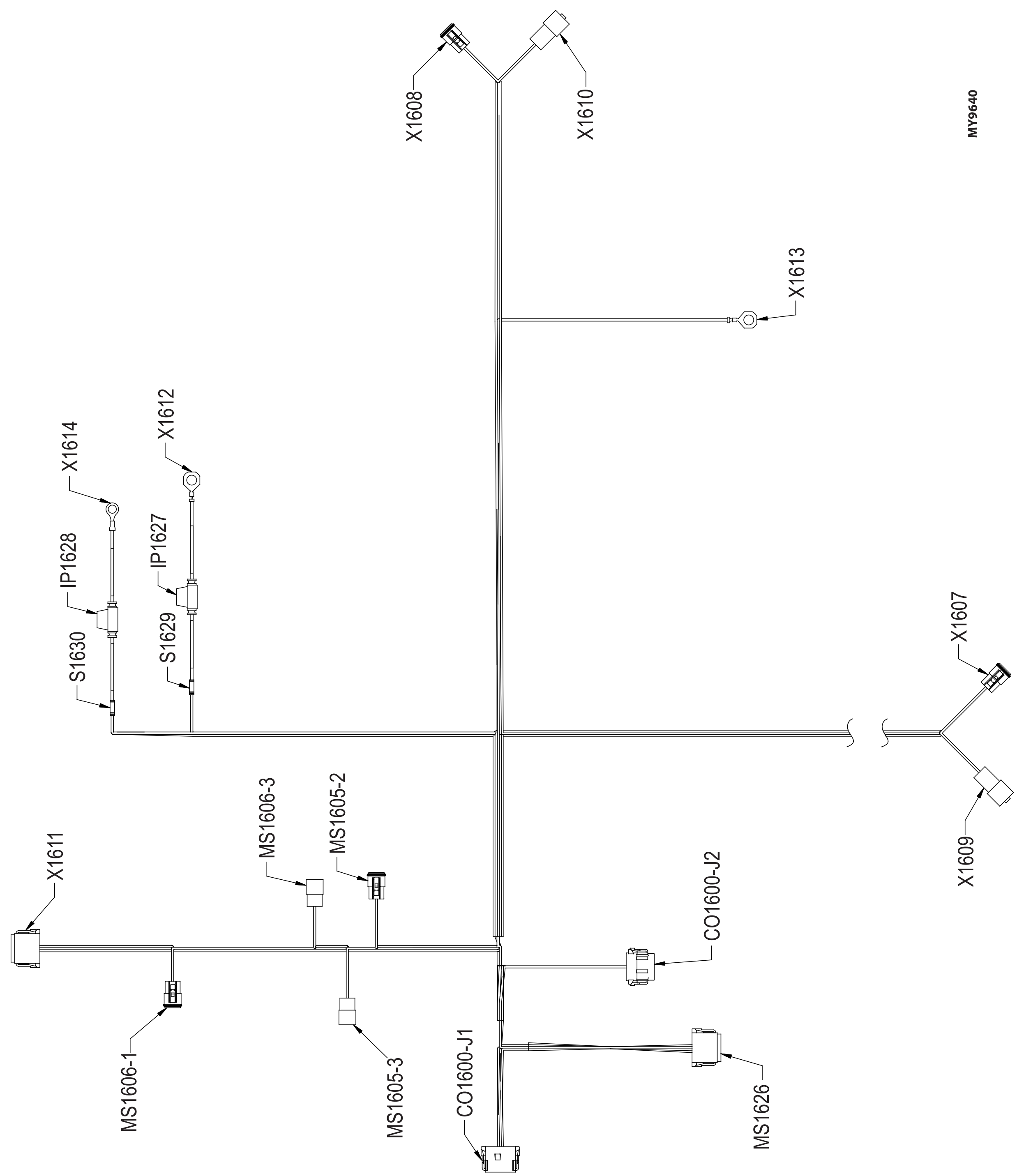
9.15.2 Telematics-Ready (TCU) Plug

The telematics-ready (TCU) plug is a standard 12-pin Deutsch connector. Pin-out locations are shown below:



9.15.3 Telematics Gateway Harness Breakdown

a. 2D Harness View



b. Connector Tables

X1128 (CAN2 TERMINATOR)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
7	GRN	CAN 2L	18 AWG	GXL	MS1626 (10)
8	YEL	CAN 2H	18 AWG	GXL	MS1626 (12)
9	GRN	CAN 1L	18 AWG	GXL	MS1626 (7)
10	YEL	CAN 1H	18 AWG	GXL	MS1626 (9)
11	BLK	0-100	18 AWG	GXL	X1613 (1)
12	YEL	2-100	18 AWG	GXL	S1630 (2)

MS1605-3 (GATEWAY CAN TEE)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 3H	18 AWG	GXL	MS1606-3 (A)
B	GRN	CAN 3L	18 AWG	GXL	MS1606-3 (B)

MS1606-1 (TELEMATICS CAN TEE)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 3H	18 AWG	GXL	X1611 (10)
B	GRN	CAN 3L	18 AWG	GXL	X1611 (9)

MS1603-1 (TELEMATICS CAN TEE)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 2H	18 AWG	GXL	MS1605-3 (A)
B	GRN	CAN 3L	18 AWG	GXL	MS1605-3 (B)

MS1605-2 (GATEWAY CAN TEE)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 3H	18 AWG	GXL	C01600-J2 (10)
B	GRN	CAN 3L	18 AWG	GXL	C01600-J2 (9)

X1611 (TELEMATICS)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	RED	1-100	16 AWG	GXL	S1629 (2)
2	BLK	0-100	16 AWG	GXL	X1613 (1)
4	YEL	2-100	16 AWG	GXL	S1630 (2)
9	GRN	CAN 3L	18 AWG	GXL	MS1606-1 (B)
10	YEL	CAN 3H	18 AWG	GXL	MS1606-1 (A)

S1630					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	2-100	14 AWG	GXL	IP1628 (1)
2	YEL	2-100	16 AWG	GXL	X1611 (4)
2	YEL	2-100	18 AWG	GXL	C01600-J1 (12)

IP1628 (5A B+)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	2-100	14 AWG	GXL	S1630 (1)
2	BLK	2-100	14 AWG	GXL	X1614 (1)

X1614 (IGN)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	2-100	14 AWG	GXL	IP1628 (2)

S1629					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	1-100	14 AWG	GXL	IP1627 (1)
2	RED	1-100	16 AWG	GXL	X1611 (1)

IP1627 (5A IGN)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	1-100	14 AWG	GXL	S1629 (1)
2	BLK	1-100	14 AWG	GXL	X1612 (1)

X1612 (B+)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	1-100	14 AWG	GXL	IP1627 (2)

X1608 (ET2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 1H	18 AWG	GXL	MS1626 (8)
B	GRN	CAN 1L	18 AWG	GXL	MS1626 (6)

X1610 (ET2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 1H	18 AWG	GXL	MS1626 (4)
B	GRN	CAN 1L	18 AWG	GXL	MS1626 (5)

X1613 (GND)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	BLK	0-100	16 AWG	GXL	X1611 (2)
1	BLK	0-100	18 AWG	GXL	C01600-J1 (11)

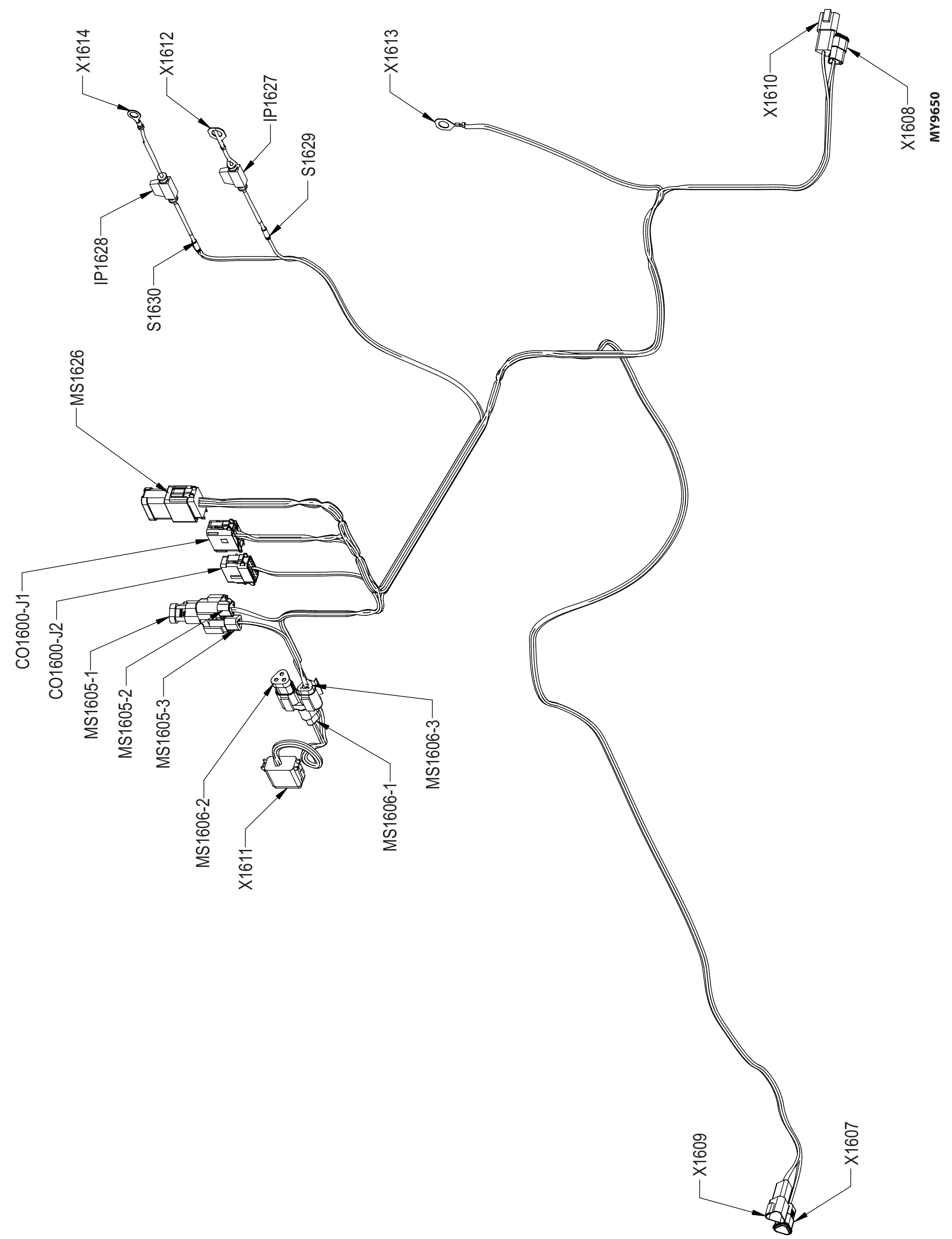
X1607 (MS330)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 2H	18 AWG	GXL	MS1626 (11)
B	GRN	CAN 2L	18 AWG	GXL	MS1626 (3)

CO1600-J2 (GATEWAY 2)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
9	GRN	CAN 3L	18 AWG	GXL	MS1605-2 (B)
10	YEL	CAN 3H	18 AWG	GXL	MS1605-2 (A)

MS1626 (4X3 BUS BAR)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
1	YEL	CAN 2H	18 AWG	GXL	X1609 (A)
2	GRN	CAN 2L	18 AWG	GXL	X1609 (B)
3	GRN	CAN 2L	18 AWG	GXL	X1607 (B)
4	YEL	CAN 1H	18 AWG	GXL	X1610 (A)
5	GRN	CAN 1L	18 AWG	GXL	X1610 (B)
6	GRN	CAN 1L	18 AWG	GXL	X1608 (B)
7	GRN	CAN 1L	18 AWG	GXL	CO1600-J1 (9)
8	YEL	CAN 1H	18 AWG	GXL	X1608 (A)
9	YEL	CAN 1H	18 AWG	GXL	CO1600-J1 (10)
10	GRN	CAN 2L	18 AWG	GXL	CO1600-J1 (7)
11	YEL	CAN 2H	18 AWG	GXL	X1607 (A)
12	YEL	CAN 2H	18 AWG	GXL	CO1600-J1 (8)

X1609 (MS330)					
CONN POS	WIRE COLOR	WIRE LABEL	GAUGE	JACKET	TO
A	YEL	CAN 2H	18 AWG	GXL	MS1626 (1)
B	GRN	CAN 2L	16 AWG	GXL	MS1626 (2)

c. 3D Harness View



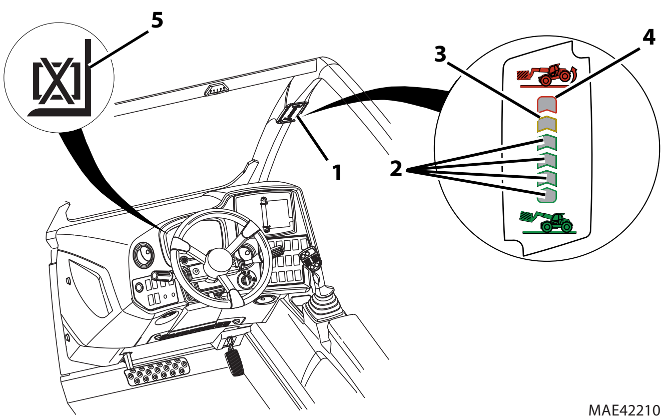
9.16 LOAD STABILITY INDICATOR (LSI) (IF EQUIPPED)

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.*



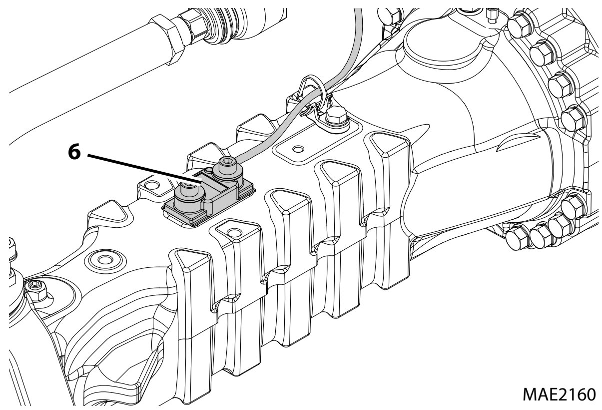
The LSI (**1**) provides visual and audible indication of forward stability limitations when machine is static on firm, level surface.

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

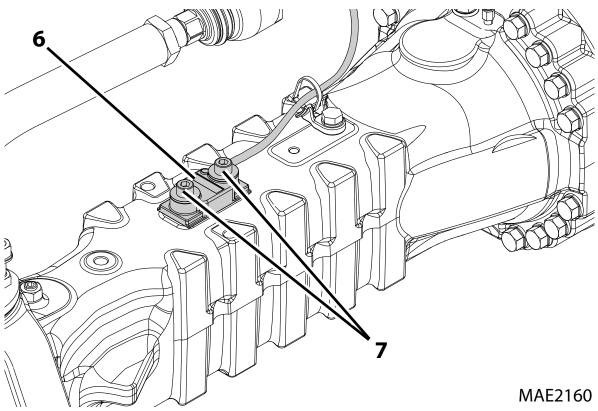


The LSI sensor (**6**) is bolted on the top left of the rear axle.

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. Section 9.8.1, “Battery Inspection”, for procedure



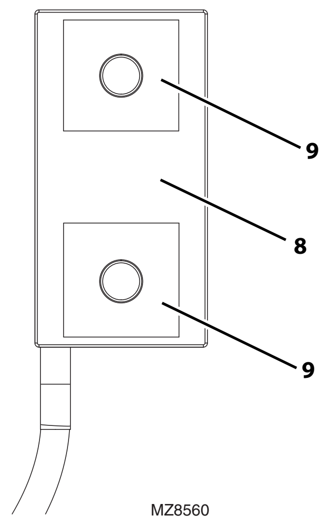
6. Disconnect the LSI electrical connector.
7. Loosen, remove and discard the two bolts (**7**) holding the LSI assembly to the rear axle.
8. Remove and discard the sensor assembly (**6**).

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.*

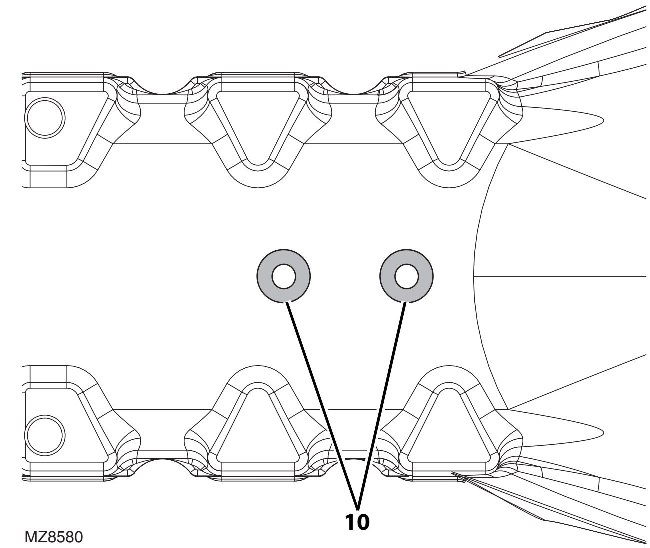
1. Remove any adhesive and/or rust from the mounting area.
2. Ensure threads of both bolt holes are clean and free from rust, water and debris. If necessary, thread an M10 bottom tap through each hole. Verify holes are clean.
3. Clean the bare metal with degreasing agent, threadlocking compound. Only 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 ensure the mounting area is clean.

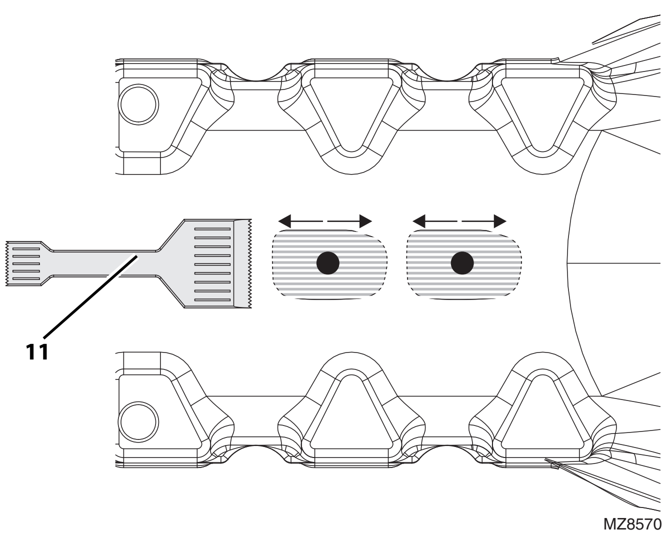
Note: *Install the sensor to the axle within one minute of applying activator and adhesive for optimum adhesion.*

6. Apply a thin film of threadlocking compound (may also be denoted as Initiator #5) activator approximately 1 in² (6 cm²) 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.

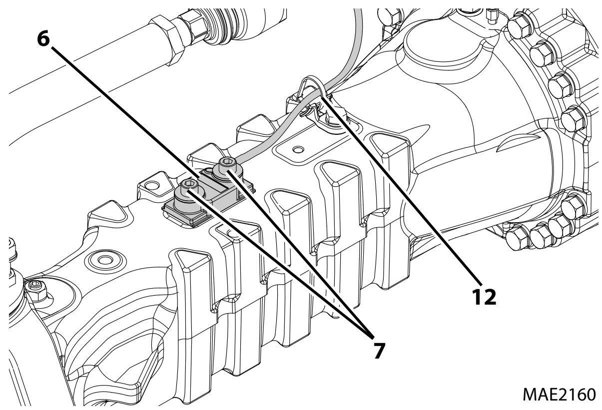
A. Position the spatula (**11**) over the threaded hole.

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**).
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 sensor.

    B. Ensure 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 9.8.1, "Battery Inspection", 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.

The system will display LSI Calibration Complete for successful calibration or LSI Calibration Failed for unsuccessful calibration. Press Enter on analyzer.

9.17 MULTIFUNCTION DISPLAY

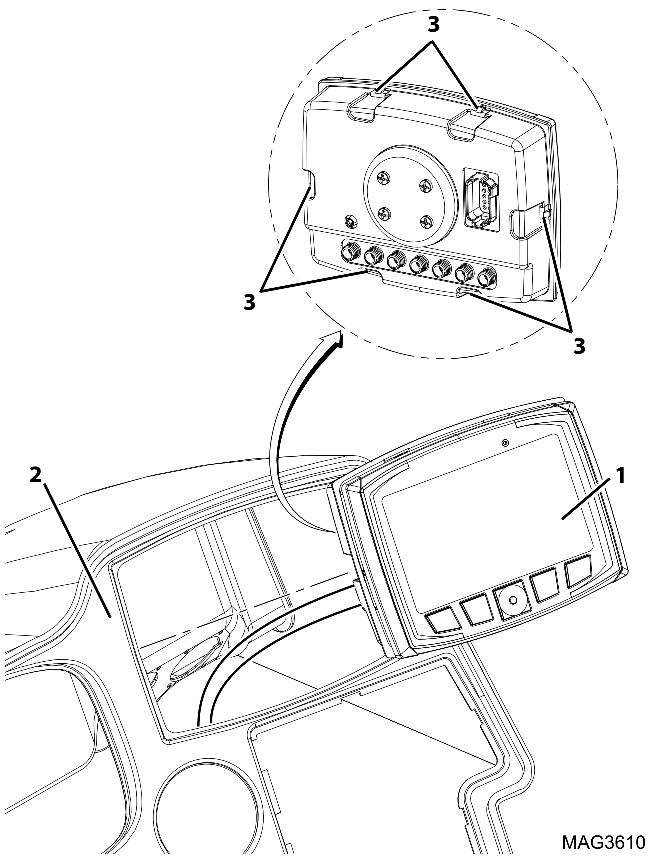
The multifunction display is capable of displaying integrated electronic capacity charts, maintenance charts, reversing camera and onboard diagnostic information of the telehandler. The multifunction display can act as a user interface between the operator and control system.

9.17.1 Technical Specification

Description	Specification
Display	Thin-Film-Transistor Color Liquid-Crystal Display (TFT LCD)
Display Size	7 in (177,8 mm)
Overall Dimensions	8.38 x 6.37 x 2.49 in (213 x 161,9 x 63,4 mm)
Display Resolution	WVGA 800 x 480 Resolution
Features	Sunlight viewable display Equipped with ambient light sensor Real-time clock (RTC) with 15 Years internal battery
Processor	Cortex A8 ARM 800 MHz Processor with 4GB flash and 512 MB RAM
Connections	Video Input (x2) CAN Port (x2) USB Host Port (x1) USB Client Port (x1) Key-on/ Wake Up from Low Power Sleep I/O Pin
Power Supply	8 - 24 V

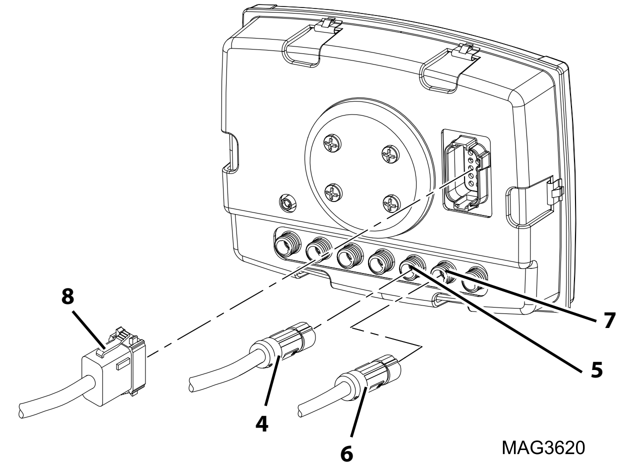
9.17.2 Removal

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 the 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 to Section 9.8, "Battery", for procedure.
5. Remove and retain recirculation grille cover, lower dash panel and left side cover from the dash.



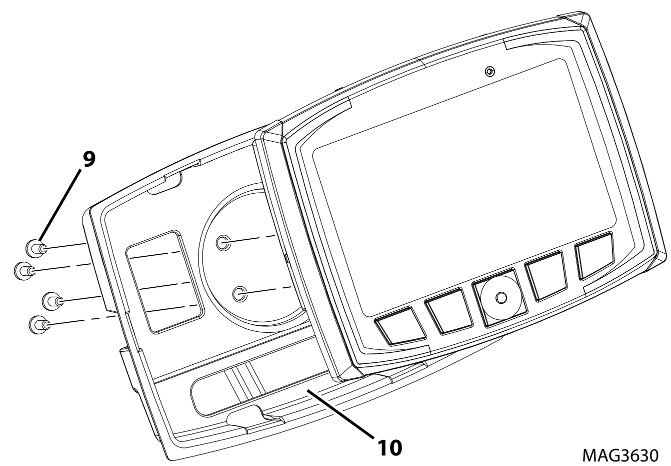
MAG3610

6. Press and release the clips (**3**) to all side of the multifunction display (**1**). Remove multifunction display (**1**) assembly from the dash (**2**).



MAG3620

7. Label and disconnect the USB programming cable (**4**) from the port "E" (**5**).
8. If equipped, label and disconnect the multifunction display video cable (**6**) from the port "F" (**7**).
9. Label and disconnect the electrical conductor (**8**) from the multifunction display (**1**).

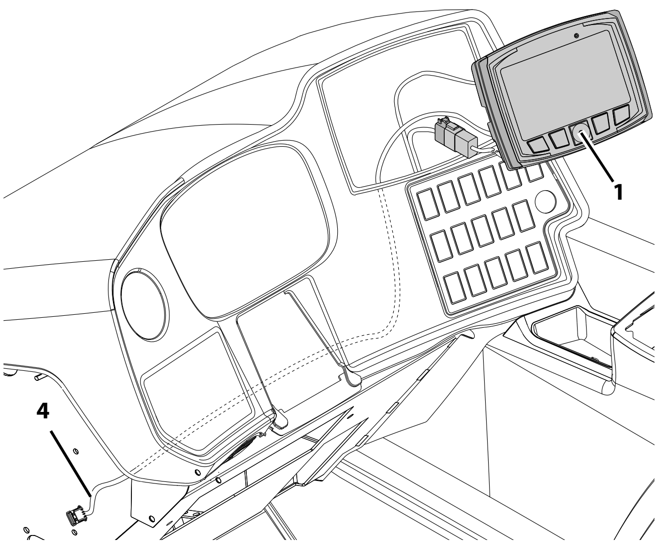


MAG3630

10. Remove and retain four screws (**9**) securing the mounting bracket (**10**).
11. Install four screws (**9**) on the multifunction display.

9.17.3 Installation

1. Remove four screws (**9**) from multifunction display.
2. Install mounting bracket (**10**) to multifunction display (**1**) with four screws (**9**).
3. Connect the electrical harness (**8**) to multifunction display.
4. If equipped, connect the multifunction display video cable (**6**) to the port “F” (**7**).
5. Connect multifunction display USB programming cable (**4**) to the port “E” (**5**).

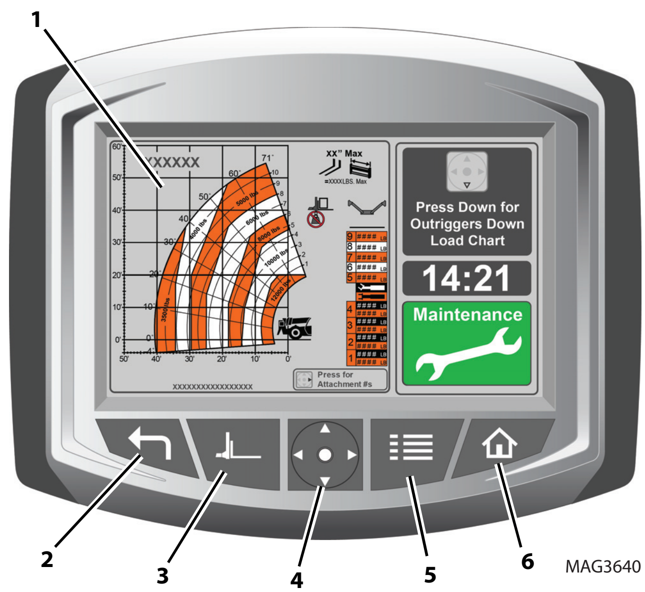


MAG3790

6. Place the multifunction display (**1**) assembly on the dash (**2**). Press all sides of the multifunction display assembly until hear click from all sides.
7. Route and secure the multifunction display USB programming (**4**) to left side of the dash.
8. Install all left side cover, lower dash panel and recirculation grille cover to the dash.
9. Properly connect the battery. Refer to Section 9.8, “Battery”, for procedure.
10. Turn the ignition in position 1 and test the multifunction display for proper functions.
11. Close and secure engine cover.
12. Remove Do Not Operate Tag from ignition key switch and steering wheel.

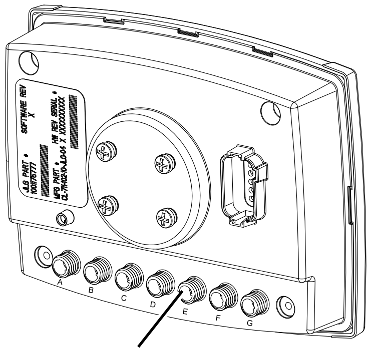
9.17.4 Multifunction Display and Control Buttons

Note: *Refer Operation & Safety Manual for more details.*



MAG3640

1. Display: The display act as a user interface between the operator and control system to perform operation and maintenance.
2. Previous Screen Button: The previous screen button returns the display to the previous menu or screen. The screen will not change if already at the home screen.
3. Attachment Select Button: The attachment selection button allows to select a specific attachment in order to display the applicable capacity chart.
4. Navigation Button: The navigation button has four arrow buttons to navigate up, down, left or right. The center button allows to confirm the selection.
5. Main Menu Button: The main menu button displays the main menu. The operator can navigate the menu using the navigation button. Refer to Section 9.17.5, “Main Menu”, for menu options.
6. Home Screen Button: The home screen button returns display to the home screen. The screen will not change if already at the home scree



7. USB Port: The USB port is port “E” (**7**) located at back of the multifunction display. The USB port used for the following.
   - Downloading maintenance log file. Refer to Section l, “Download Maintenance Log”.
   - Uploading/Updating library files and booklet. Refer to Section b, “USB Programmable Super Library - Upload/Update” and Section c, “USB Programmable Capacity Charts - Upload/Update”.

Note: *An external storage device is required to upload or download the files.*

9.17.5 Main Menu

a. 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. Customer (Access Level 2) - 33271.

b. Maintenance

The maintenance menu displays the maintenance intervals and lubrication requirements to properly maintain the telehandler.

Menu	Description	Access Level
Maintenance Intervals	Displays the maintenance interval chart with all the unique maintenance tasks required when engine hours reach an identified interval or multiples of the intervals	Access Level 2, 3
Lubrication	Displays the lubrication chart consisting of front and side view of telehandler with arrows pointing to areas that need to be lubricated. Red: 50 Hours; Blue: 250 Hours; Green: 1000 Hours;	Access Level 2, 3
Maintenance Log Entry	Records the maintenance interval with the date and engine hours once completed	Access Level 2
Recorded Maintenance	Displays the details of all the recorded maintenance intervals such as maintenance interval, date and engine hours	Access Level 2
Download Maintenance Log	Downloads the maintenance log file on an external storage device. Downloading files requires a FAT32 format external storage device.	Access Level 2

c. Advanced Diagnostics

The advanced diagnostics menu allows to view the diagnostic information for machine control system.

Menu	Description	Access Level
Communication	Displays the status of all CAN modules in the control system; monitors the DTC error messages corresponding to each module to display the status; Red: DTC error detected; CAN loss Green: No error detected; Good communication	Access Level 2, 3
Versions	Displays the version of the software, hardware and constant data of control modules in the machine	Access Level 2, 3
Debug I/O	Displays the status of all inputs/outputs and assigned function names for the Cabin Control Module (CCM), Front Frame Facing Control Module (FFCM) and Rear Frame Facing Control Module (RFCM)	Access Level 2, 3
Engine	Displays parameter related to the engine	Access Level 2, 3
Joystick	Displays parameter related to the joystick	Access Level 2, 3
Transmission	Displays parameter related to the drive/transmission	Access Level 2, 3
Hydraulics	Displays parameter related to the hydraulic functions related to outriggers, frame level and cabin function	Access Level 2, 3
Calibration Data	Displays calibration values for all the calibrated sensors in the control system	Access Level 2, 3
System	Displays parameter related to the control system	Access Level 2, 3
Drive/Steer	Displays parameter related to the steering system	Access Level 2, 3
Lights	Displays parameter related to the lighting	Access Level 2, 3
Boom Ride & Float	Displays parameters related to the boom ride & float	Access Level 2, 3
CAN Statistics	CAN statistics screen displays the parameters of the system bus and diagnostic bus	Access Level 2, 3
Datalog	Displays all the logged values defined in the global parameter database	Access Level 2, 3

d. Display Settings

The display settings menu allows to set up the language, maintenance status icon (enable/disable), real-time clock (RTC), and screen brightness. Additionally, the operator can view the revision number for capacity charts, maintenance charts, booklet, access file, and application file.

Menu	Description	Access Level
Brightness Settings	Allows to adjust the screen brightness	Access Level 2, 3
Clock Format 24 Hours	Allows to set the real-time clock in 12 or 24 hour format	Access Level 2, 3
RTC	Allows to set the real-time clock (RTC)	Access Level 2, 3
Language	Allows to set the language for multifunction display	Access Level 2, 3
Maintenance Icon Enable	Allows to set the maintenance status icon to enable or disable mode on the home screen. Enable: Maintenance status icon Disable: Brand logo	Access Level 2, 3
Revision#	Displays the revision numbers of all library files	Access Level 2, 3

e. Machine Set-Up

The machine set-up menu displays configuration (brand, model, engine, transmission, etc.) of the machine.

Menu	Description	Access Level
Brand	Displays the brand name of the telehandler	Access Level 2, 3
Vehicle	Displays the type of vehicle based on boom configuration and market preferences	Access Level 2, 3
Model	Displays the model number of the telehandler	Access Level 2, 3
Market	Displays applicable compliance standard	Access Level 2, 3
Options	Displays the telehandler configuration details for transmission, engine control, auxiliary functions and all other controls	Access Level 2, 3

f. Personalities

The personalities menu displays various electrically controlled parameters that drive the hydraulic functions related to outriggers, frame level, boom lift, extend/retract and auxiliary.

Menu/ Sub-menu Items		Function	Description	Default Values (Range)			Access Level
				742	943, 1043	1055, 1255	
Fork Mode	Fork Tilt (Roller)	Fork Tilt Accel Up	Fork mode screen allows the operator to view parameters (max/min) related to fork tilt and extend/retract cylinders	0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	Access Level 2, 3
		Fork Tilt Decel Up		0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	
		Fork Tilt Accel Down		0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	0.0 (0.0 – 2.0S)	
		Fork Tilt Decel Down		0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	0.0 (0.0 – 1.0S)	
		Fork Tilt Min Up		640mA (540 – 740mA)	690mA (590 – 790mA)	680mA (580 – 780mA)	
		Fork Tilt Max Up		1100mA (900 – 1300mA)	1300mA (1100 – 1500mA)	1300mA (1100 – 1500mA)	
		Fork Tilt Min Down		660mA (560 – 760mA)	690mA (590 – 790mA)	680mA (580 – 780mA)	
		Fork Tilt Max Down		1100mA (900 – 1300mA)	1300mA (1100 – 1500mA)	1300mA (1100 – 1500mA)	

Menu/ Sub-menu Items		Function	Description	Default Values (Range)			Access Level
				742	943, 1043	1055, 1255	
Fork Mode	Main Lift	Main Lift Accel Up	Screen allows the operator to view parameters (max/min) related to fork tilt and extend/retract cylinders	0.8 (0.0 – 2.0S)	0.8 (0.0 – 2.0S)	2.0 (0.0 – 2.0S)	Access Level 2, 3
		Main Lift Decel Up		0.4 (0.0 – 1.0S)	0.4 (0.0 – 1.0S)	0.5 (0.0 – 1.0S)	
		Main Lift Accel Down		0.6 (0.0 - 2.0S)	0.6 (0.0 – 2.0S)	0.7 (0.0 – 2.0S)	
		Main Lift Decel Down		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
		Main Lift Min Up		630mA (530 - 730mA)	670mA (570 - 770mA)	640mA (540 – 740mA)	
		Main Lift Max Up		1150mA (950 - 1350mA)	1220mA (1020 - 1420mA)	1300mA (1100 -1500mA)	
		Main Lift Min Down		530mA (430 - 630mA)	580mA (480 - 680mA)	620mA (520 – 720mA)	
		Main Lift Max Down		1190mA (990 - 1380mA*)	1220mA (1020 - 1380mA*)	1300mA (1100 -1500mA)	
Note: **For vehicles with the gravity lift down feature, the maximum lift down current must be restricted to limit pilot pressure on the GLS valve and permit it remain in compensation.*							
Fork Mode	Telescope (X-Axis)	Telescope Accel In	Fork mode screen allows the operator to view parameters (max/min) related to fork tilt and extend/retract cylinders	0.8 (0.0 – 2.0S)	0.8 (0.0 – 2.0S)	0.7 (0.0 – 2.0S)	Access Level 2, 3
		Telescope Decel In		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
		Telescope Accel Out		0.5 (0.0 – 2.0S)	0.5 (0.0 – 2.0S)	0.7 (0.0 – 2.0S)	
		Telescope Decel Out		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
		Telescope Min In		710mA (610 - 810mA)	670mA (570 - 770mA)	640 mA (540 - 740 mA)	
		Telescope Max In		1000mA (800 - 1200mA)	1100mA (900 - 1300mA)	1300mA (1100 -1500mA)	
		Telescope Min Out		680mA (580 - 780mA)	760mA (660 - 860mA)	650 mA (550 - 750 mA)	
		Telescope Max Out		1220mA (1020 - 1420mA)	1220mA (1020 - 1420mA)	1300mA (1100 -1500mA)	

Menu/ Sub-menu Items	Function	Description	Default Values (Range)			Access Level
			742	943, 1043	1055, 1255	
L/R Outriggers	L/R Outriggers Accel Up	Outriggers screen allows the operator to view the parameters (min/max values) related to outriggers function speeds	0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	Access Level 2, 3
	L/R Outriggers Decel Up		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	L/R Outriggers Accel Down		0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	0.3 (0.0 – 2.0S)	
	L/R Outriggers Decel Down		0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	0.3 (0.0 – 1.0S)	
	L/R Outriggers Min Up		420mA (350 - 550mA)	420mA (350 - 550mA)	420mA (350 - 550mA)	
	L/R Outriggers Max Up		1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	
	L/R Outriggers Min Down		450mA (320 - 520mA)	450mA (320 - 520mA)	450mA (320 - 520mA)	
	L/R Outriggers Max Down		1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	1200mA (1000 - 1400mA)	
Frame Level	Frame Level Accel Left	Frame level screen allows the operator to view the parameters (min/max) related to frame level function speeds	1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	Access Level 2, 3
	Frame Level Decel Left		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Frame Level Accel Right		1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	1.2 (0.0 – 2.0S)	
	Frame Level Decel Right		0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	0.2 (0.0 - 1.0S)	
	Frame Level Min Left		580 mA (480 – 680mA)	580 mA (480 – 680mA)	580 mA (480 – 680mA)	
	Frame Level Max Left		800mA (600 - 1000mA)	800mA (600 - 1000mA)	800mA (600 - 1000mA)	
	Frame Level Min Right		580mA (480 – 680mA)	580mA (480 – 680mA)	580mA (480 – 680mA)	
	Frame Level Max Right		800mA (600 - 1000mA)	800mA (600 - 1000mA)	800mA (600 - 1000mA)	

Menu/ Sub-menu Items	Function	Description	Default Values (Range)			Access Level
			742	943, 1043	1055, 1255	
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)	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)	0.2 (0.0 – 1.0S)	
	Front Auxiliary Accel Coil B		0.4 (0.0 – 2.0S)	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)	0.2 (0.0 – 1.0S)	
	Front Auxiliary Min Coil A		710mA (610 - 910mA)	710mA (610 - 910mA)	700mA (600 – 900mA)	
	Front Auxiliary Max Coil A		1350mA (920 - 1400mA)	1350mA (920 - 1400mA)	1350mA (920 – 1400mA)	
	Front Auxiliary Min Coil B		710mA (610 - 910mA)	710mA (610 - 910mA)	700mA (600 – 900mA)	
	Front Auxiliary Max Coil B		1350mA (900 - 1400mA)	1350mA (920 - 1400mA)	1350mA (920 – 1400mA)	
	Front Aux De-comp xxxxmA		800mA (700 - 900mA)	800mA (700 - 900mA)	800mA (700 - 900mA)	
	Front Aux De-comp x.xs		0.5S (0.4 - 2.0S)	0.5S (0.4 - 2.0S)	0.5S (0.4 - 2.0S)	

g. Operator Tools

The operator tools menu allows to set various machine settings.

Menu	Description	Default Settings	Access Level
Anti-Theft Enable	Allows to set the anti-theft feature to enable/disable mode	Disable	Access Level 2
Anti-Theft Set Password	Allows to set the anti-theft password	0000	Access Level 2
Anti-Theft Timer Enable	Allows to set the anti-theft timer feature to enable/disable mode	Disable	Access Level 2
Anti-Theft Timer	Allows to set the anti-theft timer	N/A	Access Level 2
Steer Mode	Allows to select desired steer mode. The submenu options are manual and automatic.	Manual	Access Level 2, 3
Fan Reverse Timer	Not utilized on current model	N/A	Access Level 2, 3
Fan Reverse Interval	Not utilized on current model	N/A	Access Level 2, 3
Default Gear	Not utilized on current model	N/A	Access Level 2, 3
Elevated Idle	Allows to set the elevated idle. The submenu options are Yes and No.	No	Access Level 2, 3
Vehicle Speed Units	Not utilized on current model	MPH	Access Level 2, 3
Temperature Units	Temperature units allows to set the units for temperature in Fahrenheit (F) or Celsius (C).	FAHRENHEIT (F)	Access Level 2, 3
Pressure Units	Pressure units allows to set the units for pressure in PSI or BAR.	PSI	Access Level 2, 3
Backup Camera (if equipped)	Displays the area behind the telehandler on the home screen	N/A	Access Level 2, 3

h. Calibrations

The calibrations menu allows to perform functionality checks for various machine controls.

Follow the on-screen instructions and press center of the Navigation button after completion of each step, to proceed to the next step.

Menu	Sub-menu/Procedure	Description	Access Level
Transmission Service	Confirm Trans Service Test	Transmission service is required for diagnostics or to limp a vehicle home after a transmission solenoid issue. Press center of the Navigation button to continue.	Access Level 2
	Press Enter When Done	Press center of the Navigation button when the test is completed.	
Park Brake	-	Allows to test the park brake. Refer to the Operation & Safety Manual for test procedure.	Access Level 2, 3
Boom Ride & Float	Confirm Boom Ride Test	Allows to check the hydraulic accumulator gas charge. Press center of the Navigation button to start the test.	Access Level 2
	Press Enter When Test Done	Press center of the Navigation button when the test is completed.	
Backup Camera (if equipped)	Press Okay to start calibrations	Press center of the Navigation button to start the calibration.	Access Level 2
	Set a cone at 5 feet behind vehicle along the hitch	Place the cone 5 feet behind the vehicle along the hitch. Press center of the Navigation button to confirm.	
	Align Red Line cross hair to base of cone (Use Arrow Keys to Adjust)	Press center of the Navigation button to confirm.	
	[Show Camera to Adjust Overlay]	Adjust the red line cross hair to base of the cone by pressing arrow keys.	
	Set a cone at 15 feet behind vehicle along the hitch	Press the up/down arrow of the Navigation button to select the cone at 15 feet behind vehicle along the hitch.	
	Align Yellow Line cross hair to base of cone (Use Arrow Keys to Adjust)	Press center of the Navigation button to confirm.	
	[Show Camera to Adjust Overlay]	Adjust the yellow line cross hair to base of the cone by pressing arrow keys.	
	Save Calibration	Press center of the Navigation button to save the calibration.	
	Calibration Complete	Press center of the Navigation button when the test is completed.	

i. Error Messages

Error messages screen displays up to 25 recently logged Diagnostic Trouble Code (DTC)/Diagnostics Message 1 (DM1) fault codes along with a text description. The fault codes are displayed in the order in which they are received. Active fault codes are shown with an asterisk symbol.

Menu	Description
DTC Messages	DTC messages display all machine related fault codes. The DTC message consists of a three to five digit number and corresponding message. ***Note:*** *The DTC error code "32766" is considered as "Blank" message and the corresponding row is hidden on the screen.* Refer to Section 9.19, "Machine Fault Codes", for the complete list of codes.
DM1 Messages	DM1 messages display all engine related fault codes. The DM1 message consists of the Suspect Parameter Number (SPN) and Fault Mode Indicator (FMI) component. Refer to Section 9.19, "Machine Fault Codes", for the complete list of codes.

Note: *If there is no DTC/DM1 message, the screen with "No DTC Messages" or "No DM1 Messages" is displayed.*

j. Programming

The programming menu allows to update the capacity chart library, maintenance chart library and application file. All these files are programmed through the USB port E. Refer to Section 9.17.4, "Multifunction Display and Control Buttons", for USB port E and USB cable.

Menu	Description	Access Level
Super Library	Update all the libraries and files of the super library in a single operation; Super library includes latest revision of capacity chart library, maintenance chart library and application file. Refer to Section b, "USB Programmable Super Library - Upload/Update", for updating the super library.	Access Level 2
Capacity Charts	Update the capacity chart library and booklet with latest revision.	Access Level 2
Maintenance Charts	Update the maintenance chart library with latest revision.	Access Level 2
Application	Update the application file of the multifunction display with latest revision.	Access Level 2

9.17.6 Setup and Maintenance

a. Access Level 2

1. Turn ignition switch to position 1.
2. Press Main Menu button and select Access Level.
3. Enter access level 2 passcode. Refer to Section 9.17.5.a, “Access Level”, for passcode.

b. USB Programmable Super Library - Upload/Update

1. Use access level 2 passcode to upload/update the super library. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Programming under Main Menu.
3. Scroll and select Super Library.

Note: *The multifunction display checks the revision number of current and new libraries, and displays the corresponding message. The message will display for confirmation to update the super libraries. If the library file extension is incorrect, the screen displays the message “Failed to find files on USB”.*

4. Press center of the Navigation button to update/upload the files.
5. The screen displays “Super Library Update Successful” message when programming is successfully completed.

c. USB Programmable Capacity Charts - Upload/ Update

1. Use access level 2 passcode to upload/update the Capacity Charts. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Programming under Main Menu.
3. Scroll and select Capacity Charts.
4. Select Capacity Chart Library or Capacity Chart Booklet under Capacity Charts as required.

Note: *The multifunction display checks the revision number of current and new capacity charts, and displays the corresponding message. The message will display for confirmation to update the Capacity Charts. If the library file extension is incorrect, the screen displays the message “Failed to find files on USB”.*

5. Press center of the Navigation button to update/upload the files.
6. The screen displays “Capacity Charts Update Successful” message when programming is successfully completed.

d. USB Programmable Maintenance Charts - Upload/ Update

1. Use access level 2 passcode to upload/update the Maintenance Charts. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Programming under Main Menu.
3. Scroll and select Maintenance Charts.

Note: *The multifunction display checks the revision number of current and new maintenance charts, and displays the corresponding message. The message will display for confirmation to update the Maintenance Charts. If the library file extension is incorrect, the screen displays the message “Failed to find files on USB”.*

4. Press center of the Navigation button to update/upload the files.
5. The screen displays “Maintenance Charts Update Successful” message when programming is successfully completed.

e. Anti-theft - Enable/Disable

1. Use access level 2 passcode to enable/disable the anti-theft feature. Refer Section Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Operator Tools under Main Menu.
3. Scroll and select the Anti-Theft Enable.
4. Select Enable/Disable and press center of the Navigation button to confirm the selection.

f. Anti-theft - Password Setup

1. Use access level 2 passcode to change the anti-theft password. Refer Section Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Operator Tools under Main Menu.
3. Scroll and select Anti-theft Set Password.

Note: *If the machine does not have an anti-theft code set, the default code is “0000”.*

4. Press the up/down arrows of the Navigation button to select the first digit.
5. Press the right arrow of the Navigation button to move to the next digit.
6. Continue until the code is complete. Press the center of the Navigation button to confirm the code.

g. Anti-theft - Password Reset

If the anti-theft feature is enabled and the anti-theft password is not known, it may change with customer or service level passcode. Refer to Section 9.17.5.c, “Advanced Diagnostics”.

1. Turn ignition switch to position 1.
2. Display shows Anti-theft Code Entry screen.
3. Press and hold the Main Menu button for 3 seconds.

Note: *To exit the “Anti-theft Code Entry” screen and change the anti-theft code.*

4. The screen changes to the Access Level Input screen. Enter access level passcode. Refer to Section 9.17.5.c, “Advanced Diagnostics”.
5. Select Operator Tools under Main Menu.
6. Scroll and select Anti-theft Set Password.
7. Press the up/down arrows of the Navigation button to select the first digit.
8. Press the right arrow of the Navigation button to move to the next digit.
9. Continue until the code is complete. Press the center of the Navigation button to confirm the code.

h. Anti-theft - Timer Enable/Disable

1. Use access level 2 passcode to enable/disable the anti-theft timer. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Operator Tools under Main Menu.
3. Select the Anti-Theft Timer Enable.
4. Select Enable/Disable and press center of the Navigation button to confirm the selection.

i. Anti-theft - Timer Setup

1. Use access level 2 passcode to set anti-theft timer. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Operator Tools under Main Menu.
3. Scroll and select Anti-Theft Timer.
4. Press the up/down arrows of the Navigation button to select the required values as 5, 10, 15 and 30 minutes.
5. Press center of the Navigation button to confirm the selection.

j. Maintenance Log Entry

1. Use access level 2 passcode to record the maintenance interval. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select the Maintenance under Main Menu.
3. Scroll and select Maintenance Log Entry.
4. Scroll and select the specific maintenance interval.

Note: *The screen displays the details of all the previous recorded maintenance and the current engine hours to be recorded.*

5. Press center of the Navigation button to record the maintenance interval.

k. Recorded Maintenance

1. Use access level 2 passcode to view the recorded maintenance intervals. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select the Maintenance under Main Menu.
3. Scroll and select Recorded Maintenance.

Note: *The screen displays the list of all the recorded maintenance intervals along with the dates and engine hours when they were completed.*

4. Press up/down arrow of the Navigation button to view all the recorded maintenance.

l. Download Maintenance Log

Download Maintenance Log menu allows to download the maintenance log file in CSV format to an external storage device via USB port. Refer to Section 9.17.4, “Multifunction Display and Control Buttons”, for USB port and USB cable.

The maintenance log file consists of following details:

- Maintenance Interval
- Date (YYYY-MM-DD)
- Engine Hours

To download the maintenance log file:

1. Use access level 2 passcode to download the maintenance log file. Refer Section a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select the Maintenance under Main Menu.
3. Scroll and select Download Maintenance Log.

Note: *The screen displays recorded maintenance log files with date and engine hours.*

4. Press center of the Navigation button to start the download.
5. Select Download Maintenance Log File to continue with the download or select Cancel to cancel the download. Press center of the Navigation button to confirm the selection.
6. The “Maintenance Log Download Progress” screen displays the progress of the download. Wait till the downloading is completed.
7. After the download is completed, press center of the Navigation button to return to Main Menu.

m. Language - Setup

1. Use access level 2 passcode to set the language for multifunction display. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Display Setting under Main Menu.
3. Scroll and select Language.
4. Scroll and select the required language from the list. Press center of the Navigation button to confirm the selection.

Note: *English is the default language.*

n. Maintenance Icon - Enable/Disable

1. Use access level 2 passcode to set the maintenance status icon to enable or disable mode. Refer Section 9.17.6.a, “Access Level 2”, to change the access level of the multifunction display to access level 2.
2. Select Display Setting under Main Menu.
3. Scroll and select Maintenance Icon Enable.
4. Select Enable/Disable and press center of the Navigation button to confirm the selection.

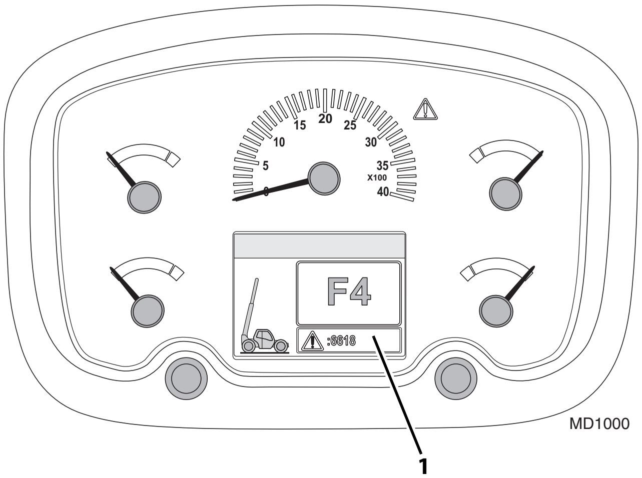
Note: *Brand icon is displayed when the maintenance status icon is disabled.*

9.17.7 Troubleshooting

a. Error in CAN Bus Connection

Communication error screen will be displayed if there is a communication failure. Wait for a few moments and restart the machine. If the communication error continues to display, contact the local JLG dealer.

9.18 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 9.19, “Machine Fault Codes”, for a full list of fault codes.

If LCD display (**1**) shows 437 SPN:FMI fault (for example: 437 27:2), refer to Section 9.20, “Engine Diagnostic”, for a full list of fault codes.

9.19 MACHINE FAULT CODES

Note: *Some fault codes may not be available depending upon machine configuration.*

9.19.1 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

9.19.2 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 (XAxisRi-ght) • X-Axis Position not zero (XAxis-Value) • Y-Axis Forward switch closed (YAx-isForward) • Y-Axis Backward switch closed (YAxisBackward) • Y-Axis Position not zero (YAxis-Value) • 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 (Lef-tRollerValue) • Left Roller Neutral switch not closed (LeftRollerNeutral)	Left Roller neutral for 150mS • Left Roller Neutral switch closed (Lef-tRollerNeutral) • Left Roller Posi-tion zero (Lef-tRollerValue)
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 Neu-tral switch closed (RightRollerNeu-tral) • Right Roller Posi-tion zero (Right-RollerValue)
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 (Pri-mary) 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 (Pri-mary) 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

9.19.3 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 Joystick neutral • Platform Tele-scope 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 Func-tion Enable Switch not engaged • Remote Control Joysticks are Neutral
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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 prevented • Platform Telescope In & Out prevented	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 prevented • Platform Telescope In & Out prevented	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 Joystick center tap is out of range	Power cycled

9.19.4 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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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 aximum 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: • Outrig-gers 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 • Left Roller Value is ERROR (1022) or N/A (1023) • Left Roller Neutral, Left Roller Forward, or Left Roller Backward is ERROR (2) or N/A (3) • Left Roller Neutral, Left Roller-Forward, or Left Roller Backward are CLOSED (1) at the same time • Left Roller Neutral, Left Roller-Forward, and Left Roller Backward 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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

9.19.5 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

9.19.6 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

9.19.7 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

9.19.8 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

9.19.9 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

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<tr><th>Help Message</th><th>DTC</th><th>Cabin Alarm</th><th>Actions</th><th>Trigger</th><th>Latch Condition</th></tr>
<tr><td>REAR AXLE PRESSURE CONTROL VALVE – CURRENT FEEDBACK READING TOO LOW</td><td>33813</td><td>5000mS</td><td>• 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</td><td>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</td><td>Power cycled</td></tr>
</table>

9.19.10 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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

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 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
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

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
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
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

9.19.11 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

9.19.12 Transmission & Drive System (46x)

Help Message	DTC	Cabin Alarm	Actions	Trigger	Latch Condition
HIGH TRANSMISSIO N OIL TEMPERATUR E 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 > 102ºC for 250mS • (Default) Transmission Oil Temperature >120ºC for 250mS	• Machine Setup's TRANSMISSION is HC HYSTAT and Transmission Oil Temperature < 100ºC • (Default) Transmission Oil Temperature < 110ºC
HIGH TRANSMISSIO N OIL TEMPERATUR E 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 ≥75ºC for 250mS	One of the following occur: • Drive Selection is Forward or Reverse; Transmission Oil Temp < 73ºC • 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 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 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, 2nd or 3rd gear, and FFCM J1-F3 Vehicle Speed counts not detected for 40,000mS • Automatic Transmission Mode is selected, Gear Selection is 4th, 5th, or 6th 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
TRANSMISSIO N 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
TRANSMISSIO N 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
TRANSMISSIO N 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 ≥125ºC for 3000mS (both ConstantData)	Transmission Oil Temperature < 110ºC 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

9.19.13 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 – TRANSMISSIO N 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 – TRANSMISSIO N 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

9.19.14 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

9.19.15 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

9.19.16 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 – DISAGREEMEN T	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 – DISAGREEMEN T	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 – DISAGREEMEN T	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)

9.19.17 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

9.19.18 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

9.19.19 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 CONFIGURATIO N 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 CONFIGURATIO N 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 CONFIGURATIO N 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 CONFIGURATIO N 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 CONFIGURATIO N 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

9.20 ENGINE DIAGNOSTIC

Note: *For more information, contact your local authorized engine service distributor.*

SPN	FMI	Fault Code	SPN Description	Description
27	2	1228	Engine Exhaust Gas Recirculation 1 Valve Position	EGR Valve Position - Data erratic, intermittent or incorrect
27	4	2272	Engine Exhaust Gas Recirculation 1 Valve Position	EGR Valve Position Circuit - Voltage below normal, or shorted to low source
51	3	6497	Engine Intake Throttle Actuator Position Sensor Circuit	Engine Intake Throttle Actuator Position Sensor Circuit- Voltage above normal, or shorted to high source
51	4	6498	Engine Intake Throttle Actuator Position Sensor Circuit	Engine Intake Throttle Actuator Position Sensor Circuit- Voltage above normal, or shorted to low source
81	16	2754	Engine Diesel Particulate Filter Intake Pressure	Engine Diesel Particulate Filter Intake Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
84	2	241	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Data erratic, intermittent or incorrect
84	10	242	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed Sensor Circuit tampering has been detected - Abnormal rate of change
84	19	3525	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Received Network Data In Error
84	9	3526	Wheel-Based Vehicle Speed	Wheel-Based Vehicle Speed - Abnormal update rate
91	3	131	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
91	4	132	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
91	1	147	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position 1 Sensor Circuit Frequency - Data valid but below normal operating Range
91	0	148	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 - Data valid but above normal operational range - Most Severe Level
91	2	1242	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 - Data erratic, intermittent or incorrect
91	3	1358	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
91	4	1359	Accelerator Pedal Position 1	Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
91	19	1515	Accelerator Pedal Position 1	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Received Network Data In Error
91	9	3326	Accelerator Pedal Position 1	SAE J1939 Multiplexed Accelerator Pedal or Lever Sensor System - Abnormal update rate
93	2	528	Engine Net Brake Torque	Auxiliary Alternate Torque Validation Switch - Data erratic, intermittent or incorrect
94	3	546	Engine Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage above normal, or shorted to high source
94	4	547	Engine Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit - Voltage below normal, or shorted to low source
94	18	2215	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
94	15	2261	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
94	17	2262	Engine Fuel Delivery Pressure	Fuel Pump Delivery Pressure - Data Valid But Below Normal Operating Range - Least Severe Level
94	0	4615	Engine Fuel Delivery Pressure	Engine Fuel Delivery Pressure - Data Valid but Above Normal Operational Range - Most Severe Level
95	16	2372	Engine Fuel Filter Differential Pressure	Fuel Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
97	15	418	Water In Fuel Indicator	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Least Severe Level
97	3	428	Water In Fuel Indicator	Water in Fuel Indicator Sensor Circuit - Voltage above normal, or shorted to high source
97	4	429	Water In Fuel Indicator	Water in Fuel Indicator Sensor Circuit - Voltage below normal, or shorted to low source
97	16	1852	Water In Fuel Indicator	Water in Fuel Indicator - Data Valid But Above Normal Operating Range - Moderately Severe Level
98	1	253	Engine Oil Level	Engine Oil Level - Data valid but below normal operational range - Most Severe Level

SPN	FMI	Fault Code	SPN Description	Description
98	17	471	Engine Oil Level	Engine Oil Level - Data Valid But Below Normal Operating Range - Least Severe Level
98	0	688	Engine Oil Level	Engine Oil Level - Data valid but above normal operational range - Most Severe Level
100	3	135	Engine Oil Pressure	Engine Oil Rifle Pressure 1 Sensor Circuit - Voltage above normal, or shorted to high source
100	4	141	Engine Oil Pressure	Engine Oil Rifle Pressure 1 Sensor Circuit - Voltage below normal, or shorted to low source
100	18	143	Engine Oil Pressure	Engine Oil Rifle Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
100	1	415	Engine Oil Pressure	Engine Oil Rifle Pressure - Data valid but below normal operational range - Most Severe Level
100	2	435	Engine Oil Pressure	Engine Oil Rifle Pressure - Data erratic, intermittent or incorrect
101	16	555	Engine Crankcase Pressure	Crankcase Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
101	0	556	Engine Crankcase Pressure	Crankcase Pressure - Data valid but above normal operational range - Most Severe Level
101	3	1843	Engine Crankcase Pressure	Crankcase Pressure Circuit - Voltage above normal, or shorted to high source
101	4	1844	Engine Crankcase Pressure	Crankcase Pressure Circuit - Voltage below normal, or shorted to low source
101	2	1942	Engine Crankcase Pressure	Crankcase Pressure - Data erratic, intermittent or incorrect
101	15	1974	Engine Crankcase Pressure	Crankcase Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
102	3	122	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
102	4	123	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
102	16	124	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
102	18	125	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

SPN	FMI	Fault Code	SPN Description	Description
102	2	2973	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Data erratic, intermittent or incorrect
102	10	3361	Engine Intake Manifold #1 Pressure	Intake Manifold 1 Pressure - Abnormal rate of change
103	16	595	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level
103	2	686	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data erratic, intermittent or incorrect
103	18	687	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level
103	15	2288	Engine Turbocharger 1 Speed	Turbocharger 1 Speed - Data Valid But Above Normal Operating Range - Least Severe Level
104	18	3917	Engine Turbocharger Lube Oil Pressure 1	Engine Turbocharger Lube Oil Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
105	3	153	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature Sensor Circuit - Voltage above normal, or shorted to high source
105	4	154	Engine Intake Manifold 1Temperature	Intake Manifold 1 Temperature Sensor Circuit - Voltage below normal, or shorted to low source
105	0	155	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data valid but above normal operational range - Most Severe Level
105	2	436	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data erratic, intermittent or incorrect
105	16	488	Engine Intake Manifold Temperature	Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
105	15	2964	Engine Intake Manifold #1 Temperature	Intake Manifold 1 Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
105	18	3385	Engine Intake Manifold 1 Temperature	Intake Manifold 1 Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
107	16	3341	Engine Air Filter 1 Differential Pressure	Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
107	15	5576	Engine Air Filter 1 Differential Pressure	Engine Air Filter Differential Pressure - Data Valid But Above Normal Operating Range - Least Severe Level

SPN	FMI	Fault Code	SPN Description	Description
108	3	221	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage above normal, or shorted to high source
108	4	222	Barometric Pressure	Barometric Pressure Sensor Circuit - Voltage above normal, or shorted to low source
108	2	295	Barometric Pressure	Barometric Pressure - Data erratic, intermittent or incorrect
109	3	231	Engine Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage above normal, or shorted to high source
109	4	232	Engine Coolant Pressure	Coolant Pressure Sensor Circuit - Voltage below normal, or shorted to low source
109	18	233	Engine Coolant Pressure	Coolant Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level
110	3	144	Engine Coolant Temperature	Engine Coolant Temperature 1 Sensor Circuit - Voltage above normal, or shorted to high source
110	4	145	Engine Coolant Temperature	Engine Coolant Temperature 1 Sensor Circuit - Voltage below normal, or shorted to low source
110	16	146	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
110	0	151	Temperature	Engine Coolant Temperature - Data valid but above normal operational range - Most Severe Level
110	2	334	Engine Coolant Temperature	Engine Coolant Temperature - Data erratic, intermittent or incorrect
110	14	1847	Engine Coolant Temperature	Engine Coolant Temperature - Special Instructions
110	31	2646	Engine Coolant Temperature	Engine Coolant Temperature - Condition Exists
110	31	2659	Engine Coolant Temperature	Engine Coolant Temperature - Condition Exists
110	18	2789	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
110	15	2963	Engine Coolant Temperature	Engine Coolant Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
111	3	195	Engine Coolant Level	Coolant Level Sensor 1 Circuit - Voltage above normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
111	4	196	Engine Coolant Level	Coolant Level Sensor 1 Circuit - Voltage below normal, or shorted to low source
111	18	197	Engine Coolant Level	Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
111	1	235	Engine Coolant Level	Coolant Level - Data valid but below normal operational range - Most Severe Level
111	2	422	Engine Coolant Level	Coolant Level - Data erratic, intermittent or incorrect
111	17	2448	Engine Coolant Level	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
111	18	3366	Engine Coolant Level	Coolant Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
111	9	3613	SAE J1939 Multiplexing PGN Timeout	SAE J1939 Multiplexing PGN Timeout Error - Abnormal update rate
111	19	3614	SAE J1939 Multiplexing PGN Timeout	Coolant Level Sensor - Received Network Data in Error
111	17	5167	Engine Coolant Level	Coolant Level - Data Valid But Below Normal Operating Range - Least Severe Level
111	3	6522	Engine Coolant Level	Coolant Level Sensor 1 Circuit - Voltage above normal, or shorted to high source
111	4	6523	Engine Coolant Level	Coolant Level Sensor 1 Circuit - Voltage below normal, or shorted to low source
157	0	449	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data valid but above normal operational range - Most Severe Level
157	3	451	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
157	4	452	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
157	16	553	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderately Severe Level
157	2	554	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data erratic, intermittent or incorrect
157	18	559	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Below Normal Operating Range - Moderately Severe Level

SPN	FMI	Fault Code	SPN Description	Description
157	7	755	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Mechanical system not responding or out of adjustment
157	1	2249	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data valid but below normal operational range - Most Severe Level
157	15	4727	Engine Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Least Severe Level
168	18	441	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level
168	16	442	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level
168	17	3724	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Least Severe Level
168	15	6256	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Above Normal Operating Range - Moderately Severe Level
168	17	6257	Battery Potential / Power Input 1	Battery 1 Voltage - Data Valid But Below Normal Operating Range - Moderately Severe Level
171	3	249	Ambient Air Temperature	Ambient Air Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
171	4	256	Ambient Air Temperature	Ambient Air Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
171	2	2398	Ambient Air Temperature	Ambient Air Temperature - Data erratic, intermittent or incorrect
171	9	3531	Ambient Air Temperature	Ambient Air Temperature - Abnormal update rate
171	19	3532	Ambient Air Temperature	Ambient Air Temperature - Received Network Data In Error
174	16	261	Engine Fuel Temperature 1	Engine Fuel Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
174	3	263	Engine Fuel Temperature 1	Engine Fuel Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
174	4	265	Engine Fuel Temperature 1	Engine Fuel Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
174	0	266	Engine Fuel Temperature 1	Engine Fuel Temperature - Data valid but above normal operational range - Most Severe Level

SPN	FMI	Fault Code	SPN Description	Description
174	2	535	Engine Fuel Temperature 1	Engine Fuel Temperature - Data erratic, intermittent or incorrect
175	3	212	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
175	4	213	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
175	0	214	Engine Oil Temperature 1	Engine Oil Temperature - Data valid but above normal operational range - Most Severe Level
175	16	421	Engine Oil Temperature 1	Engine Oil Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
175	2	425	Engine Oil Temperature 1	Engine Oil Temperature - Data erratic, intermittent or incorrect
175	3	6524	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage above normal, or shorted to high source
175	4	6525	Engine Oil Temperature 1	Engine Oil Temperature Sensor 1 Circuit - Voltage below normal, or shorted to low source
188	16	3715	Engine Speed At Idle, Point 1 (Engine Configuration)	Engine Speed At Idle - Data Valid But Above Normal Operating Range - Moderately Severe Level
188	18	3716	Engine Speed At Idle, Point 1 (Engine Configuration)	Engine Speed At Idle - Data Valid But Below Normal Operating Range - Moderately Severe Level
190	0	234	Engine Speed	Engine Crankshaft Speed/Position - Data valid but above normal operational range - Most Severe Level
190	2	689	Engine Speed	Engine Crankshaft Speed/Position - Data erratic, intermittent or incorrect
190	16	1992	Engine Speed	Engine Crankshaft Speed/Position - Data Valid But Above Normal Operating Range - Moderately Severe Level
190	2	2321	Engine Speed	Engine Crankshaft Speed/Position - Data erratic, intermittent or incorrect
190	16	2468	Engine Speed	Engine Crankshaft Speed/Position - Data Valid But Above Normal Operating Range - Moderately Severe Level
191	16	349	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid But Above Normal Operating Range - Moderately Severe Level

SPN	FMI	Fault Code	SPN Description	Description
191	18	489	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Data Valid But Below Normal Operating Range - Moderately Severe Level
191	9	3328	Transmission Output Shaft	Transmission Output Shaft Speed - Abnormal update rate
191	19	3418	Transmission Output Shaft Speed	Transmission Output Shaft Speed - Received Network Data In Error
237	13	4517	Vehicle Identification Number	Vehicle Identification Number - Out of Calibration
237	31	4721	Vehicle Identification Number	Vehicle Identification Number - Condition Exists
237	2	4722	Vehicle Identification Number	Vehicle Identification Number - Data erratic, intermittent or incorrect
251	2	319	Real Time Clock	Real Time Clock - Data erratic, intermittent or incorrect
411	2	1866	Engine Exhaust Gas Recirculation 1 Differential Pressure	Exhaust Gas Recirculation Differential Pressure - Data erratic, intermittent or incorrect
411	3	2273	Engine Exhaust Gas Recirculation 1 Differential Pressure	Exhaust Gas Recirculation Differential Pressure Sensor Circuit - Voltage above normal, or shorted to high source
411	4	2274	Engine Exhaust Gas Recirculation 1 Differential Pressure	Exhaust Gas Recirculation Differential Pressure Sensor Circuit - Voltage below normal, or shorted to low source
412	2	1867	Engine Exhaust Gas Recirculation 1 Temperature	Exhaust Gas Recirculation Temperature - Data erratic, intermittent or incorrect
412	3	2375	Engine Exhaust Gas Recirculation 1 Valve Position	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage above normal, or shorted to high source
412	4	2376	Engine Exhaust Gas Recirculation 1 Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit - Voltage below normal, or shorted to low source
412	15	2961	Engine Exhaust Gas Recirculation 1 Temperature	Exhaust Gas Recirculation Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
412	16	2962	Engine Exhaust Gas Recirculation 1 Temperature	Exhaust Gas Recirculation Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
441	14	292	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions

SPN	FMI	Fault Code	SPN Description	Description
441	3	293	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 Circuit - Voltage above normal, or shorted to high source
441	4	294	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 Circuit - Voltage below normal, or shorted to low source
441	14	6583	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 - Special Instructions
442	3	3765	Auxiliary Temperature 2	Auxiliary Temperature Sensor Input 2 Circuit - Voltage above normal, or shorted to high source
442	4	3766	Auxiliary Temperature 2	Auxiliary Temperature Sensor Input 2 Circuit - Voltage below normal, or shorted to low source
521	2	4526	Brake Pedal Position	Brake Pedal Position - Data erratic, intermittent or incorrect
558	2	431	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Data erratic, intermittent or incorrect
558	13	432	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch Circuit - Out of Calibration
558	19	3527	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Received Network Data In Error
558	9	3528	Accelerator Pedal 1 Low Idle Switch	Accelerator Pedal or Lever Idle Validation Switch - Abnormal update rate
563	9	3488	Anti-Lock Braking (ABS) Active	Anti-Lock Braking (ABS) Controller - Abnormal update rate
563	31	4215	Anti-Lock Braking (ABS) Active	Anti-Lock Braking (ABS) Active - Condition Exists
596	7	3839	Cruise Control Enable Switch	Cruise Control Enable Switch - Mechanical system not responding or out of adjustment
596	2	3841	Cruise Control Enable Switch	Cruise Control Enable Switch - Data erratic, intermittent or incorrect
596	13	3842	Cruise Control Enable Switch	Cruise Control Enable Switch - Out of Calibration
597	3	769	Brake Switch	Brake Switch Circuit - Voltage above normal, or shorted to high source
597	4	771	Brake Switch	Brake Switch Circuit - Voltage below normal, or shorted to low source

SPN	FMI	Fault Code	SPN Description	Description
599	2	2721	Cruise Control Set Switch	Cruise Control Set Switch - Data erratic, intermittent or incorrect
611	2	523	System Diagnostic Code #1	Auxiliary Intermediate (PTO) Speed Switch Validation - Data erratic, intermittent or incorrect
612	2	115	System Diagnostic Code #2	Engine Magnetic Speed/Position Lost Both of Two Signals - Data erratic, intermittent or incorrect
625	9	291	Proprietary Datalink	Proprietary Datalink Error (OEM/Vehicle Datalink) - Abnormal update rate
626	18	487	Engine Start Enable Device 1	Start Enable Device 1 Canister Empty (Ether Injection) - Data Valid But Below Normal Operating Range
626	3	2738	Engine Start Enable Device 1	Start Enable Device 1 Circuit (Ether Injection) - Voltage above normal, or shorted to high source
626	4	2739	Engine Start Enable Device 1	Start Enable Device 1Circuit (Ether Injection) - Voltage below normal, or shorted to low source
629	12	111	Controller #1	Engine Control Module Critical Internal Failure - Bad intelligent device or component
629	12	343	Controller #1	Engine Control Module Warning Internal Hardware Failure - Bad intelligent device or component
629	31	2661	Controller #1	At Least One Unacknowledged Most Severe Fault - Condition Exists
629	31	2662	Controller #1	At Least One Unacknowledged Moderately Severe Fault - Condition Exists
630	12	3697	Engine Control Module Calibration Memory	Engine Control Module Calibration Memory - Bad intelligent device or component
633	31	2311	Engine Fuel Actuator 1 Control Command	Electronic Fuel Injection Control Valve Circuit - Condition Exists
639	9	285	J1939 Network #1, Primary Vehicle Network (previously SAE J1939 Data Link)	SAE J1939 Multiplexing PGN Timeout Error - Abnormal update rate
639	13	286	J1939 Network #1, Primary Vehicle Network (previously SAE J1939 Data Link)	SAE J1939 Multiplexing Configuration Error - Out of Calibration
639	2	426	J1939 Network #1, Primary Vehicle Network (previously SAE J1939 Data Link)	J1939 Network #1 - Data erratic, intermittent or incorrect

SPN	FMI	Fault Code	SPN Description	Description
639	9	427	J1939 Network #1, Primary Vehicle Network (previously SAE J1939 Data Link)	SAE J1939 Datalink - Abnormal update rate
640	14	599	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown - Special Instructions
641	9	1894	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Abnormal update rate
641	13	1898	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Out of Calibration
641	15	1962	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Over Temperature (Calculated) - Data Valid But Above Normal Operating Range - Least Severe Level
641	15	1976	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Over Temperature (Calculated) - Data Valid But Above Normal Operating Range - Least Severe Level
641	11	2198	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Root Cause Not Known
641	7	2387	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit (Motor) - Mechanical system not responding or out of adjustment
641	13	2449	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Out of Calibration
641	12	2634	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Controller - Bad intelligent device or component
641	31	2635	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Condition Exists
641	9	2636	Engine Variable Geometry Turbocharger Actuator #1	VGT Actuator Driver Circuit - Abnormal update rate
644	2	237	Engine External Speed Command Input	External Speed Command Input (Multiple Unit Synchronization) - Data erratic, intermittent or incorrect
647	4	245	Engine Fan Clutch 1 Output Device Driver	Fan Control Circuit - Voltage below normal, or shorted to low source
647	3	2377	Engine Fan Clutch 1 Output Device Driver	Fan Control Circuit - Voltage above normal, or shorted to high source
647	3	6263	Engine Fan Clutch 1 Output Device Driver	Fan Control Circuit - Voltage above normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
647	4	6264	Engine Fan Clutch 1 Output Device Driver	Fan Control Circuit - Voltage below normal, or shorted to low source
649	3	5271	Engine Exhaust Back Pressure Regulator Control Circuit	Engine Exhaust Back Pressure Regulator Control Circuit - Voltage Above Normal, or Shorted to High Source
649	4	5272	Engine Exhaust Back Pressure Regulator Control Circuit	Engine Exhaust Back Pressure Regulator Control Circuit - Voltage Below Normal, or Shorted to Low Source
649	5	5273	Engine Exhaust Back Pressure Regulator Control Circuit	Engine Exhaust Back Pressure Regulator Control Circuit - Current Below Normal or Open Circuit
651	5	322	Engine Injector Cylinder #01	Injector Solenoid Driver Cylinder 1 Circuit - Current below normal or open circuit
651	7	1139	Engine Injector Cylinder #01	Injector Solenoid Driver Cylinder 1 - Mechanical system not responding or out of adjustment
652	5	331	Engine Injector Cylinder #02	Injector Solenoid Driver Cylinder 2 Circuit - Current below normal or open circuit
652	7	1141	Engine Injector Cylinder #02	Injector Solenoid Driver Cylinder 2 - Mechanical system not responding or out of adjustment
653	5	324	Engine Injector Cylinder #03	Injector Solenoid Driver Cylinder 3 Circuit - Current below normal or open circuit
653	7	1142	Engine Injector Cylinder #03	Injector Solenoid Driver Cylinder 3 - Mechanical system not responding or out of adjustment
654	5	332	Engine Injector Cylinder #04	Injector Solenoid Driver Cylinder 4 Circuit - Current below normal or open circuit
654	7	1143	Engine Injector Cylinder #04	Injector Solenoid Driver Cylinder 4 - Mechanical system not responding or out of adjustment
655	5	323	Engine Injector Cylinder #05	Injector Solenoid Driver Cylinder 5 Circuit - Current below normal or open circuit
655	7	1144	Engine Injector Cylinder #05	Injector Solenoid Driver Cylinder 5 - Mechanical system not responding or out of adjustment
656	5	325	Engine Injector Cylinder #06	Injector Solenoid Driver Cylinder 6 Circuit - Current below normal or open circuit
656	7	1145	Engine Injector Cylinder #06	Injector Solenoid Driver Cylinder 6 - Mechanical system not responding or out of adjustment
657	5	1548	Engine Injector Cylinder #7	Injector Solenoid Driver Cylinder 7 Circuit - Current below normal or open circuit

SPN	FMI	Fault Code	SPN Description	Description
658	5	1549	Engine Injector Cylinder #8	Injector Solenoid Driver Cylinder 8 Circuit - Current below normal or open circuit
659	5	1622	Engine Injector Cylinder #9	Injector Solenoid Driver Cylinder 9 Circuit - Current below normal or open circuit
660	5	1551	Engine Injector Cylinder #10	Injector Solenoid Driver Cylinder 10 Circuit - Current below normal or open circuit
661	5	1552	Engine Injector Cylinder #11	Injector Solenoid Driver Cylinder 11 Circuit - Current below normal or open circuit
662	5	1553	Engine Injector Cylinder #12	Injector Solenoid Driver Cylinder 12 Circuit - Current below normal or open circuit
663	5	1554	Engine Injector Cylinder #13	Injector Solenoid Driver Cylinder 13 Circuit - Current below normal or open circuit
664	5	1555	Engine Injector Cylinder #14	Injector Solenoid Driver Cylinder 14 Circuit - Current below normal or open circuit
665	5	1556	Engine Injector Cylinder #15	Injector Solenoid Driver Cylinder 15 Circuit - Current below normal or open circuit
666	5	1557	Engine Injector Cylinder #16	Injector Solenoid Driver Cylinder 16 Circuit - Current below normal or open circuit
677	3	584	Engine Starter Motor Relay	Starter Relay Driver Circuit - Voltage above normal, or shorted to high source
677	4	585	Engine Starter Motor Relay	Starter Relay Driver Circuit - Voltage below normal, or shorted to low source
697	3	2557	Auxiliary PWM Driver #1	Auxiliary PWM Driver 1 Circuit - Voltage above normal, or shorted to high source
697	4	2558	Auxiliary PWM Driver #1	Auxiliary PWM Driver 1 Circuit - Voltage below normal, or shorted to low source
701	14	4734	Auxiliary I/O #01	Auxiliary Input/Output 1 - Special Instructions
702	3	527	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Voltage above normal, or shorted to high source
702	5	4724	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Current below normal or open circuit
702	6	4725	Auxiliary I/O #02	Auxiliary Input/Output 2 Circuit - Current above normal or grounded circuit

SPN	FMI	Fault Code	SPN Description	Description
703	3	529	Auxiliary I/O #03	Auxiliary Input/Output 3 Circuit - Voltage above normal, or shorted to high source
723	7	731	Engine Speed 2	Engine Speed / Position Camshaft and Crankshaft Misalignment - Mechanical system not responding or out of adjustment
723	2	778	Engine Speed 2	Engine Camshaft Speed / Position Sensor - Data erratic, intermittent or incorrect
723	2	2322	Engine Speed 2	Engine Camshaft Speed / Position Sensor - Data erratic, intermittent or incorrect
729	3	2555	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage above normal, or shorted to high source
729	4	2556	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage below normal, or shorted to low source
729	3	6556	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage above normal, or shorted to high source
729	4	6557	Engine Intake Air Heater Driver #1	Engine Intake Air Heater 1 Circuit - Voltage below normal, or shorted to low source
748	9	3641	Transmission Output Retarder	Transmission Output Retarder - Abnormal update rate
862	3	3733	Crankcase breather Heater Circuit	Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source
862	4	3734	Crankcase breather Heater Circuit	Crankcase Breather Filter Heater Circuit - Voltage below normal, or shorted to low source
862	3	6336	Crankcase breather Heater Circuit	Crankcase Breather Filter Heater Circuit - Voltage above normal, or shorted to high source
862	4	6337	Crankcase breather Heater Circuit	Crankcase Breather Filter Heater Circuit - Voltage below normal, or shorted to low source
974	3	133	Remote Accelerator Pedal Position	Remote Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage above normal, or shorted to high source
974	4	134	Remote Accelerator Pedal Position	Remote Accelerator Pedal or Lever Position Sensor 1 Circuit - Voltage below normal, or shorted to low source
974	19	288	Remote Accelerator Pedal Position	SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Position Sensor System - Received Network Data In Error

SPN	FMI	Fault Code	SPN Description	Description
976	2	6563	PTO Governor State	Auxiliary Intermediate (PTO) Speed Switch Validation - Data erratic, intermittent or incorrect
1072	3	2182	Engine (Compression) Brake Output #1	Engine Brake Actuator Driver 1 Circuit - Voltage above normal, or shorted to high source
1072	4	2183	Engine (Compression) Brake Output #1	Engine Brake Actuator Driver 1 Circuit - Voltage below normal, or shorted to low source
1072	3	6418	Engine (Compression) Brake Output #1	Engine Brake Actuator Driver 1 Circuit - Voltage above normal, or shorted to high source
1072	4	6419	Engine (Compression) Brake Output #1	Engine Brake Actuator Driver 1 Circuit - Voltage below normal, or shorted to low source
1073	4	2363	Engine (Compression) Brake Output #2	Engine Brake Actuator Driver Output 2 Circuit - Voltage below normal, or shorted to low source
1073	3	2367	Engine (Compression) Brake Output #2	Engine Brake Actuator Driver Output 2 Circuit - Voltage above normal, or shorted to high source
1073	3	6421	Engine (Compression) Brake Output #2	Engine Brake Actuator Driver Output 2 Circuit - Voltage above normal, or shorted to high source
1073	4	6422	Engine (Compression) Brake Output #2	Engine Brake Actuator Driver Output 2 Circuit - Voltage below normal, or shorted to low source
1075	3	2265	Engine Electric Lift Pump for Engine Fuel Supply	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage above normal, or shorted to high source
1075	4	2266	Engine Electric Lift Pump for Engine Fuel Supply	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage below normal, or shorted to low source
1075	3	6258	Engine Electric Lift Pump for Engine Fuel Supply	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage above normal, or shorted to high source
1075	4	6259	Engine Electric Lift Pump for Engine Fuel Supply	Electric Lift Pump for Engine Fuel Supply Circuit - Voltage below normal, or shorted to low source
1081	7	3494	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Mechanical system not responding or out of adjustment
1081	9	3555	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Abnormal update rate
1081	19	3556	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Received Network Data In Error
1081	31	4252	Engine Wait to Start Lamp	Engine Wait to Start Lamp - Condition Exists

SPN	FMI	Fault Code	SPN Description	Description
1109	0	3931	Engine Protection System Approaching Shutdown	Engine Protection System Approaching Shutdown - Data valid but above normal operational range - Most
1112	4	2365	Engine (Compression) Brake Output #3	Engine Brake Actuator Driver Output 3 Circuit - Voltage below normal, or shorted to low source
1112	3	2368	Engine (Compression) Brake Output #3	Engine Brake Actuator Driver 3 Circuit - Voltage above normal, or shorted to high source
1127	7	3683	Engine Turbocharger 1 Boost Pressure	Engine Turbocharger 1 Boost Pressure - Mechanical system not responding or out of adjustment
1136	3	697	Engine ECU Temperature	Engine ECU Temperature Sensor Circuit - Voltage above normal, or shorted to high source
1136	4	698	Engine ECU Temperature	Engine ECU Temperature Sensor Circuit - Voltage below normal, or shorted to low source
1136	2	699	Engine ECU Temperature	Engine ECU Temperature - Data erratic, intermittent or incorrect
1172	3	691	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Circuit - Voltage above normal, or shorted to high source
1172	4	692	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Circuit - Voltage below normal, or shorted to low source
1172	2	693	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature - Data erratic, intermittent or incorrect
1172	9	3369	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Sensor - Abnormal update rate
1172	19	3371	Engine Turbocharger 1 Compressor Intake Temperature	Turbocharger 1 Compressor Intake Temperature Sensor - Received Network Data In Error
1176	18	629	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data Valid But Below Normal Operating Range - Moderately
1176	3	741	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure Circuit - Voltage above normal, or shorted to high source
1176	4	742	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure Circuit - Voltage below normal, or shorted to low source
1176	2	743	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data erratic, intermittent or incorrect

SPN	FMI	Fault Code	SPN Description	Description
1176	1	3348	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Data valid but below normal operational range - Most Severe Level
1176	9	3372	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Abnormal update rate
1176	19	3373	Engine Turbocharger 1 Compressor Intake Pressure	Turbocharger 1 Compressor Intake Pressure - Received Network Data In Error
1194	13	3298	Anti-theft Encryption Seed Present Indicator	Anti-theft Encryption Seed - Out of Calibration
1195	2	269	Anti-theft Password Valid Indicator	Antitheft Password Valid Indicator - Data erratic, intermittent or incorrect
1209	3	2373	Engine Exhaust Gas Pressure 1	Exhaust Gas Pressure Sensor 1 Circuit - Voltage above normal, or shorted to high source
1209	4	2374	Engine Exhaust Gas Pressure 1	Exhaust Gas Pressure Sensor 1 Circuit - Voltage below normal, or shorted to low source
1209	2	2554	Engine Exhaust Gas Pressure 1	Exhaust Gas Pressure 1 - Data erratic, intermittent or incorrect
1209	16	2764	Engine Exhaust Gas Pressure 1	Exhaust Gas Pressure 1 - Data Valid But Above Normal Operating Range - Moderately Severe Level
1213	9	3535	Malfunction Indicator Lamp	Malfunction Indicator Lamp - Abnormal update rate
1231	2	3329	J1939 Network #2	J1939 Network #2 - Data erratic, intermittent or incorrect
1235	2	3331	J1939 Network #3	J1939 Network #3 - Data erratic, intermittent or incorrect
1239	16	4726	Engine Fuel Leakage 1	Engine Fuel Leakage - Data Valid But Above Normal Operating Range - Moderately Severe Level
1267	3	338	Idle Shutdown Vehicle Accessories Relay Driver Circuit	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage above normal, or shorted to high source
1267	4	339	Idle Shutdown Vehicle Accessories Relay Driver Circuit	Idle Shutdown Vehicle Accessories Relay Driver Circuit - Voltage below normal, or shorted to low source
1322	31	1718	Engine Misfire for Multiple Cylinders	Engine Misfire for Multiple Cylinders - Condition Exists
1323	31	1654	Engine Misfire Cylinder #1	Engine Misfire Cylinder 1 - Condition Exists

SPN	FMI	Fault Code	SPN Description	Description
1324	31	1655	Engine Misfire Cylinder #2	Engine Misfire Cylinder 2 - Condition Exists
1325	31	1656	Engine Misfire Cylinder #3	Engine Misfire Cylinder 3 - Condition Exists
1326	31	1657	Engine Misfire Cylinder #4	Engine Misfire Cylinder 4 - Condition Exists
1327	31	1658	Engine Misfire Cylinder #5	Engine Misfire Cylinder 5 - Condition Exists
1328	31	1659	Engine Misfire Cylinder #6	Engine Misfire Cylinder 6 - Condition Exists
1347	4	271	Engine Fuel Pump Pressurizing Assembly #1	Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage below normal, or shorted to low source
1347	3	272	Engine Fuel Pump Pressurizing Assembly #2	Engine Fuel Pump Pressurizing Assembly 1 Circuit - Voltage above normal, or shorted to high source
1347	7	281	Engine Fuel Pump Pressurizing Assembly #3	Engine Fuel Pump Pressurizing Assembly 1 - Mechanical system not responding or out of adjustment
1349	3	483	Engine Injector Metering Rail 2 Pressure	Injector Metering Rail 2 Pressure Sensor Circuit - Voltage above normal, or shorted to high source
1349	4	484	Engine Injector Metering Rail 2 Pressure	Injector Metering Rail 2 Pressure Sensor Circuit - Voltage below normal, or shorted to low source
1377	2	497	Engine Synchronization Switch	Multiple Unit Synchronization Switch - Data erratic, intermittent or incorrect
1378	31	649	Engine Oil Change Interval	Engine Oil Change Interval - Condition Exists
1383	31	611	Engine was Shut Down Hot	Engine Shut Down Hot - Condition Exists
1387	3	1539	Auxiliary Pressure #1	Auxiliary Pressure Sensor Input 1 Circuit - Voltage above normal, or shorted to high source
1387	4	1621	Auxiliary Pressure #1	Auxiliary Pressure Sensor Input 1 Circuit - Voltage below normal, or shorted to low source
1388	14	296	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 - Special Instructions
1388	3	297	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 Circuit - Voltage above normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
1388	4	298	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 Circuit - Voltage below normal, or shorted to low source
1388	14	6584	Auxiliary Pressure #2	Auxiliary Pressure Sensor Input 2 - Special Instructions
1563	2	1256	Incompatible Monitor/Controller	Control Module Identification Input State Error - Data erratic, intermittent or incorrect
1563	2	1257	Incompatible Monitor/Controller	Control Module Identification Input State Error - Data erratic, intermittent or incorrect
1569	31	3714	Engine Protection Torque Derate	Engine Protection Torque Derate - Condition Exists
1590	2	784	Adaptive Cruise Control Mode	Adaptive Cruise Control Mode - Data erratic, intermittent or incorrect
1623	9	3186	Tachograph output shaft speed	Tachograph Output Shaft Speed - Abnormal update rate
1623	19	3213	Tachograph output shaft speed	Tachograph Output Shaft Speed - Received Network Data In Error
1623	13	5248	Tachograph Output Shaft Speed	Tachograph Output Shaft Speed - Out of Calibration
1632	14	2998	Engine Torque Limit Feature	Engine Torque Limit Feature - Special Instructions
1632	31	5193	Engine Torque Limit Feature	Engine Torque Limit Feature - Condition Exists
1639	0	4789	Fan Speed	Fan Speed - Data Valid but Above Normal Operational Range - Most Severe Level
1639	1	4791	Fan Speed	Fan Speed - Data Valid but Below Normal Operational Range - Most Severe Level
1639	15	6467	Fan Speed	Fan Speed - Data Valid but Above Normal Operational Range - Most Severe Level
1639	17	6468	Fan Speed	Fan Speed - Data Valid but Below Normal Operational Range - Most Severe Level
1639	2	6469	Fan Speed	Fan Speed – Data Erratic, Intermittent, or Incorrect
1668	2	4437	J1939 Network #4 - Data erratic	J1939 Network #4 - Data erratic, intermittent or incorrect

SPN	FMI	Fault Code	SPN Description	Description
1675	31	3737	Engine Starter Mode	Engine Starter Mode Overcrank Protection - Condition Exists
1761	4	1668	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor Circuit - Voltage below normal, or shorted to low source
1761	3	1669	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor Circuit - Voltage above normal, or shorted to high source
1761	1	1673	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level - Data valid but below normal operational range -Most Severe Level
1761	2	1699	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Data erratic, intermittent or incorrect
1761	17	3497	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level - Data Valid But Below Normal Operating Range - Least Severe Level
1761	18	3498	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level - Data Valid But Below Normal Operating Range - Moderately Severe Level
1761	9	4677	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	SAE J1939 Multiplexing PGN Timeout Error - Abnormal update rate
1761	5	4679	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor Circuit - Current below normal or open circuit
1761	13	4732	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Out of Calibration
1761	6	4738	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor Circuit - Current above normal or grounded circuit
1761	11	4739	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Root Cause Not Known
1761	10	4769	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Abnormal Rate of Change
1761	13	6526	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Out of Calibration
1761	11	6562	Aftertreatment 1 Diesel Exhaust Fluid Tank Level	Aftertreatment 1 Diesel Exhaust Fluid Tank Level Sensor - Root Cause Not Known
1800	16	2263	Battery 1 Temperature	Battery Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level

SPN	FMI	Fault Code	SPN Description	Description
1800	18	2264	Battery 1 Temperature	Battery Temperature - Data Valid But Below Normal Operating Range - Moderately Severe Level
1818	31	3374	ROP Brake Control active	Roll Over Protection Brake Control Active - Condition Exists
2006	9	5133	Source Address 6	Source Address 6 - Abnormal Update Rate
2623	3	1239	Accelerator Pedal #1 Channel 2	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage above normal, or shorted to high source
2623	4	1241	Accelerator Pedal #1 Channel 2	Accelerator Pedal or Lever Position Sensor 2 Circuit - Voltage below normal, or shorted to low source
2629	15	2347	Engine Turbocharger 1 Compressor Outlet Temperature	Turbocharger Compressor Outlet Temperature (Calculated) - Data Valid But Above Normal Operating Range
2630	3	2571	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Voltage above normal, or shorted to high source
2630	4	2572	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Voltage below normal, or shorted to low source
2630	2	3478	Engine Charge Air Cooler 1 Outlet Temperature	Engine Charge Air Cooler Outlet Temperature - Data erratic, intermittent or incorrect
2633	7	3616	Engine Variable Geometry Turbocharger (VGT) 1 Nozzle Position	Engine VGT Nozzle Position - Mechanical system not responding or out of adjustment
2634	3	1776	Power Relay	Power Relay Driver Circuit - Voltage above normal, or shorted to high source
2634	4	1777	Power Relay	Power Relay Driver Circuit - Voltage below normal, or shorted to low source
2789	15	2346	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Least Severe
2789	16	2451	Engine Turbocharger 1 Calculated Turbine Intake Temperature	Turbocharger Turbine Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
2791	9	1893	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Control Circuit - Abnormal update rate
2791	13	1896	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Controller - Out of Calibration

SPN	FMI	Fault Code	SPN Description	Description
2791	15	1961	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Control Circuit Over Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
2791	5	2349	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Control Circuit - Current below normal or open circuit
2791	6	2353	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Control Circuit - Current above normal or grounded circuit
2791	7	2357	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Control Circuit - Mechanical system not responding or out of adjustment
2791	7	6555	Engine Exhaust Gas Recirculation 1 (EGR1) Valve Control	EGR Valve Control Circuit - Mechanical system not responding or out of adjustment
2797	13	2765	Engine Injector Group 1	Engine Injector Bank 1 Barcodes - Out of Calibration
2884	9	3735	Engine Auxiliary Governor Switch	Engine Auxiliary Governor Switch - Abnormal update rate
2978	9	3838	Estimated Engine Parasitic Losses - Percent Torque	Estimated Engine Parasitic Losses - Percent Torque - Abnormal update rate
3031	4	1677	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor - Voltage below normal, or shorted to low source
3031	3	1678	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor - Voltage above normal, or shorted to high source
3031	2	1679	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature - Data erratic, intermittent or incorrect
3031	9	4572	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature - Abnormal Update Rate
3031	5	4682	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor Circuit - Current below normal or open circuit
3031	13	4731	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor - Out of Calibration
3031	6	4736	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor Circuit - Current above normal or grounded circuit
3031	11	4737	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature - Root Cause Not Known

SPN	FMI	Fault Code	SPN Description	Description
3031	4	6559	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature	Aftertreatment 1 Diesel Exhaust Fluid Tank Temperature Sensor - Voltage below normal, or shorted to low source
3060	18	3243	Engine Cooling System Monitor	Engine Cooling System Monitor - Data Valid But Below Normal Operating Range - Moderately Severe Level
3216	4	1885	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor Circuit - Voltage below normal, or shorted to low source
3216	2	3228	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Data erratic, intermittent or incorrect
3216	9	3232	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Abnormal update rate
3216	13	3718	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx - Out of Calibration
3216	10	3725	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Abnormal rate of change
3216	16	3726	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx - Data Valid But Above Normal Operating Range - Moderately Severe Level
3216	20	3748	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Data not Rational - Drifted High
3216	20	6458	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Data not Rational - Drifted High
3216	21	6459	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Data not Rational - Drifted High
3216	10	6621	Aftertreatment 1 Intake NOx	Aftertreatment 1 Intake NOx Sensor - Abnormal rate of change
3217	2	1861	Aftertreatment 1 Intake O2	Aftertreatment Intake Oxygen Sensor - Data erratic, intermittent or incorrect
3218	2	3682	Aftertreatment 1 Intake Gas Sensor Power Status	Aftertreatment 1 Intake NOx Sensor Power Supply - Data erratic, intermittent or incorrect
3226	2	1694	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Data erratic, intermittent or incorrect
3226	4	1887	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor Circuit - Voltage below normal, or shorted to low source
3226	9	2771	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Abnormal update rate

SPN	FMI	Fault Code	SPN Description	Description
3226	10	3545	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Abnormal rate of change
3226	13	3717	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Out of Calibration
3226	20	3749	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Data not Rational - Drifted High
3226	20	6462	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Data not Rational - Drifted High
3226	21	6463	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Data not Rational - Drifted High
3226	2	6464	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Data not Rational - Drifted High
3226	4	6521	Aftertreatment Outlet NOx Sensor Circuits	Aftertreatment Outlet NOx Sensor Circuit- Voltage below normal or shorted to low source
3226	10	6565	Aftertreatment 1 Outlet NOx	Aftertreatment 1 Outlet NOx Sensor - Abnormal rate of change
3227	9	2683	Aftertreatment 1 Outlet O2	Aftertreatment Outlet Oxygen Sensor Circuit - Abnormal update rate
3228	2	3681	Aftertreatment 1 Outlet Gas Sensor Power Status	Aftertreatment 1 Outlet NOx Sensor Power Supply - Data erratic, intermittent or incorrect
3228	2	6582	Aftertreatment 1 Outlet Gas Sensor Power Status	Aftertreatment 1 Outlet NOx Sensor Power Supply - Data erratic, intermittent or incorrect
3242	16	3253	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Valid But Above Normal Operating Range
3242	15	3254	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data Valid But Above Normal Operating Range
3242	0	3311	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data valid but above normal operation
3242	4	3316	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage below normal, or shorted to low source
3242	3	3317	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Intake Temperature Sensor Circuit - Voltage above normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
3242	2	3318	Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Intake Temperature - Data erratic, intermittent or incorrect
3246	16	3255	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range
3246	15	3256	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data Valid But Above Normal Operating Range
3246	0	3312	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data valid but above normal operation
3246	3	3319	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage above normal, or shorted to high source
3246	4	3321	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Outlet Temperature Sensor Circuit - Voltage below normal, or shorted to low source
3246	2	3322	Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature	Aftertreatment 1 Diesel Particulate Filter Outlet Temperature - Data erratic, intermittent or incorrect
3249	17	2742	Aftertreatment 1 Exhaust Gas Temperature 2	Aftertreatment Exhaust Gas Temperature 2 - Data Valid But Below Normal Operating Range - Least Severe Level
3249	18	2743	Aftertreatment 1 Exhaust Gas Temperature 2	Aftertreatment Exhaust Gas Temperature 2 - Data Valid But Below Normal Operating Range - Moderately Severe Level
3251	3	1879	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Aftertreatment Diesel Particulate Filter Differential Pressure Sensor Circuit - Voltage above normal
3251	4	1881	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Aftertreatment Diesel Particulate Filter Differential Pressure Sensor Circuit - Voltage below normal
3251	2	1883	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Aftertreatment Diesel Particulate Filter Differential Pressure Sensor - Data erratic, intermittent or incorrect
3251	16	1921	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Aftertreatment Diesel Particulate Filter Differential Pressure - Data Valid But Above Normal Operating Range
3251	0	1922	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Aftertreatment Diesel Particulate Filter Differential Pressure - Data valid but above normal Operating Range
3251	15	2639	Aftertreatment 1 Diesel Particulate Filter Differential Pressure	Aftertreatment Diesel Particulate Filter Differential Pressure - Data valid but above normal Operating Range
3255	9	4145	Aftertreatment 2 Intake NOx	Aftertreatment 2 Intake NOx Sensor - Abnormal update rate

SPN	FMI	Fault Code	SPN Description	Description
3265	9	3988	Aftertreatment 2 Outlet NOx	Aftertreatment 2 Outlet NOx - Abnormal Update Rate
3353	3	4953	Alternator 1 Status	Alternator 1 Status - Voltage Above Normal, or Shorted to High Source
3353	4	4954	Alternator 1 Status	Alternator 1 Status - Voltage Below Normal, or Shorted to Low Source
3361	2	2976	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Temperature - Data erratic, intermittent or incorrect
3361	3	3558	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage above normal, or shorted to high source
3361	4	3559	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit - Voltage below normal, or shorted to low source
3362	31	1682	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Input Lines	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Input Lines - Condition Exists
3363	3	1683	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage above normal, or shorted to high source
3363	4	1684	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage below normal, or shorted to low source
3363	18	1712	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Data Valid But Below Normal Operating Range - Moderately Severe Level
3363	16	1713	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Data Valid But Above Normal Operating Range - Moderately Severe Level
3363	7	3242	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Mechanical system not responding or out of adjustment
3363	7	6475	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Mechanical system not responding or out of adjustment
3363	18	6476	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Data Valid But Below Normal Operating Range - Moderately Severe Level
3363	3	6479	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage above normal, or shorted to high source
3363	4	6481	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Tank Heater - Voltage below normal, or shorted to low source

SPN	FMI	Fault Code	SPN Description	Description
3364	4	1685	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality Sensor Circuit - Voltage below normal, or shorted to low source
3364	3	1686	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality Sensor Circuit - Voltage above normal, or shorted to high source
3364	13	1714	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Out of Calibration
3364	11	1715	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Root Cause Not Known
3364	1	3866	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Data valid but below normal operational range - Most Severe Level
3364	18	3867	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Data Valid But Below Normal Operating Range - Moderate Severe Level
3364	9	3868	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Abnormal update rate
3364	7	3876	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality Sensor - Mechanical system not responding or out of adjustment
3364	12	3877	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality Sensor - Bad intelligent device or component
3364	2	3878	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Data erratic, intermittent or incorrect
3364	19	4241	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Received Network Data In Error
3364	10	4277	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Abnormal Rate of Change
3364	5	4741	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality Sensor Circuit - Current below normal or open circuit
3364	6	4742	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality Sensor Circuit - Current above normal or grounded circuit
3364	15	4842	Aftertreatment Diesel Exhaust Fluid Quality	Aftertreatment Diesel Exhaust Fluid Quality - Data Valid But Above Normal Operating Range - Least Severe Level
3364	18	6752	Aftertreatment 1 Diesel Exhaust Fluid Tank 1 Quality	Aftertreatment Diesel Exhaust Fluid Quality - Data Valid But Below Normal Operating Range - Moderate Severe Level

SPN	FMI	Fault Code	SPN Description	Description
3464	3	6493	Electronic Throttle Control Actuator Driver Circuit	Electronic Throttle Control Actuator Driver Circuit-Voltage above normal, or shorted to high source
3464	4	6494	Electronic Throttle Control Actuator Driver Circuit	Electronic Throttle Control Actuator Driver Circuit-Voltage above normal, or shorted to low source
3464	5	6496	Electronic Throttle Control Actuator Driver Circuit	Electronic Throttle Control Actuator Driver Circuit-Voltage above normal, or shorted to high source
3480	2	1926	Aftertreatment Fuel Pressure	Aftertreatment Fuel Pressure Sensor - Data erratic, intermittent or incorrect
3480	3	1927	Aftertreatment Fuel Pressure	Aftertreatment Fuel Pressure Sensor Circuit - Voltage above normal, or shorted to high source
3480	4	1928	Aftertreatment Fuel Pressure	Aftertreatment Fuel Pressure Sensor Circuit - Voltage below normal, or shorted to low source
3480	17	2881	Aftertreatment Fuel Pressure	Aftertreatment Fuel Pressure Sensor - Data Valid But Below Normal Operating Range - Least Severe Level
3481	16	2778	Aftertreatment 1 Fuel Rate	Aftertreatment Fuel Rate - Data Valid But Above Normal Operating Range - Moderately Severe Level
3482	3	1923	Aftertreatment 1 Fuel Enable Actuator	Aftertreatment Fuel Shutoff Valve Circuit - Voltage above normal, or shorted to high source
3482	4	1924	Aftertreatment 1 Fuel Enable Actuator	Aftertreatment Fuel Shutoff Valve Circuit - Voltage below normal, or shorted to low source
3482	2	1925	Aftertreatment 1 Fuel Enable Actuator	Aftertreatment Fuel Shutoff Valve - Data erratic, intermittent or incorrect
3482	7	1963	Aftertreatment 1 Fuel Enable Actuator	Aftertreatment Fuel Shutoff Valve - Mechanical system not responding or out of adjustment
3482	13	2741	Aftertreatment 1 Fuel Enable Actuator	Aftertreatment Fuel Shutoff Valve Swapped - Out of Calibration
3482	16	4568	Aftertreatment 1 Fuel Enable Actuator	Aftertreatment Fuel Shutoff Valve - Data Valid But Above Normal Operating Range - Moderately Severe
3490	4	3223	Aftertreatment 1 Purge Air Actuator	Aftertreatment Purge Air Actuator Circuit - Voltage below normal, or shorted to low source
3490	3	3224	Aftertreatment 1 Purge Air Actuator	Aftertreatment Purge Air Actuator Circuit - Voltage above normal, or shorted to high source
3490	7	3225	Aftertreatment 1 Purge Air Actuator	Aftertreatment Purge Air Actuator - Mechanical system not responding or out of adjustment

SPN	FMI	Fault Code	SPN Description	Description
3509	4	352	Sensor supply voltage 1	Sensor Supply 1 Circuit - Voltage below normal, or shorted to low source
3509	3	386	Sensor supply voltage 1	Sensor Supply 1 Circuit - Voltage above normal, or shorted to high source
3510	4	187	Sensor supply voltage 2	Sensor Supply 2 Circuit - Voltage below normal, or shorted to low source
3510	3	227	Sensor supply voltage 2	Sensor Supply 2 Circuit - Voltage above normal, or shorted to high source
3511	4	238	Sensor supply voltage 3	Sensor Supply 3 Circuit - Voltage below normal, or shorted to low source
3511	3	239	Sensor supply voltage 3	Sensor Supply 3 Circuit - Voltage above normal, or shorted to high source
3512	3	2185	Sensor supply voltage 4	Sensor Supply 4 Circuit - Voltage above normal, or shorted to high source
3512	4	2186	Sensor supply voltage 4	Sensor Supply 4 Circuit - Voltage below normal, or shorted to low source
3513	3	1695	Sensor supply voltage 5	Sensor Supply 5 - Voltage above normal, or shorted to high source
3513	4	1696	Sensor supply voltage 5	Sensor Supply 5 - Voltage below normal, or shorted to low source
3514	3	515	Sensor supply voltage 6	Sensor Supply 6 Circuit - Voltage above normal, or shorted to high source
3514	4	516	Sensor supply voltage 6	Sensor Supply 6 Circuit - Voltage below normal, or shorted to low source
3515	3	4233	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 Sensor Circuit - Voltage above normal, or shorted to high source
3515	4	4234	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 Sensor Circuit - Voltage below normal, or shorted to low source
3515	2	4242	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 - Data erratic, intermittent or incorrect
3515	10	4243	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 - Abnormal Rate of Change
3515	5	4743	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 Sensor Circuit - Current below normal or open circuit

SPN	FMI	Fault Code	SPN Description	Description
3515	6	4744	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 Sensor Circuit - Current above normal or grounded
3515	11	4745	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 - Root Cause Not Known
3515	10	6619	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2	Aftertreatment 1 Diesel Exhaust Fluid Temperature 2 - Abnormal Rate of Change
3521	31	4235	Aftertreatment 1 Diesel Exhaust Fluid Property	Aftertreatment 1 Diesel Exhaust Fluid Property - Condition Exists
3521	11	4768	Aftertreatment 1 Diesel Exhaust Fluid Property	Aftertreatment 1 Diesel Exhaust Fluid Property - Root Cause Not Known
3555	17	1943	Ambient Air Density	Ambient Air Density - Data Valid But Below Normal Operating Range - Least Severe Level
3556	2	1932	Aftertreatment Hydrocarbon Doser	Aftertreatment Doser - Data erratic, intermittent or incorrect
3556	7	1964	Aftertreatment Hydrocarbon Doser	Aftertreatment Doser - Mechanical system not responding or out of adjustment
3556	5	1977	Aftertreatment Hydrocarbon Doser	Aftertreatment Doser Circuit - Current below normal or open circuit.
3556	18	3167	Aftertreatment Hydrocarbon Doser	Aftertreatment Doser - Data Valid But Below Normal Operating Range - Moderately Severe Level
3597	12	351	ECU Power Output Supply Voltage #1	Injector Power Supply - Bad intelligent device or component
3597	2	1117	ECU Power Output Supply Voltage #1	Power Supply Lost With Ignition On - Data erratic, intermittent or incorrect
3597	18	1938	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Data Valid But Below Normal Operating Range - Moderately Severe Level
3597	3	1939	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Voltage above normal, or shorted to high source
3597	4	1941	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Voltage below normal, or shorted to low source
3597	17	6499	ECU Power Output Supply Voltage #1	ECU Power Output Supply Voltage 1 - Data Valid But Below Normal Operating Range - Moderately Severe Level

SPN	FMI	Fault Code	SPN Description	Description
3610	3	3133	Aftertreatment Diesel Particulate Filter Outlet Pressure	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage above normal, or shorted to high source
3610	4	3134	Aftertreatment Diesel Particulate Filter Outlet Pressure	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage below normal, or shorted to low source
3610	2	3135	Aftertreatment Diesel Particulate Filter Outlet Pressure	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure - Data erratic, intermittent or incorrect
3610	3	6551	Aftertreatment Diesel Particulate Filter Outlet Pressure	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage above normal, or shorted to high source
3610	4	6552	Aftertreatment Diesel Particulate Filter Outlet Pressure	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure Sensor Circuit - Voltage below normal, or shorted to low source
3610	2	6553	Aftertreatment Diesel Particulate Filter Outlet Pressure	Aftertreatment 1 Diesel Particulate Filter Outlet Pressure - Data erratic, intermittent or incorrect
3667	3	3139	Engine Air Shutoff Status	Engine Air Shutoff Circuit - Voltage above normal, or shorted to high source
3667	4	3141	Engine Air Shutoff Status	Engine Air Shutoff Circuit - Voltage below normal, or shorted to low source
3667	7	4484	Engine Air Shutoff	Engine Air Shutoff - Mechanical System Not Responding or Out of Adjustment
3667	2	5221	Engine Air Shutoff Status	Engine Air Shutoff Status - Data erratic, intermittent or incorrect
3695	2	4213	Aftertreatment Regeneration Inhibit Switch	Aftertreatment Regeneration Inhibit Switch - Data erratic, intermittent or incorrect
3695	2	6568	Aftertreatment Regeneration Inhibit Switch	Aftertreatment Regeneration Inhibit Switch - Data erratic, intermittent or incorrect
3703	31	2777	Diesel Particulate Filter Active Regeneration Inhibited Due to Inhibit Switch	Particulate Trap Active Regeneration Inhibited Due to Inhibit Switch - Condition Exists
3713	31	3753	Diesel Particulate Filter Active Regeneration Inhibited Due to System Timeout	Diesel Particulate Filter Active Regeneration Inhibited Due to System Timeout - Condition Exists
3713	31	6596	Diesel Particulate Filter Active Regeneration Inhibited Due to System Timeout	Diesel Particulate Filter Active Regeneration Inhibited Due to System Timeout - Condition Exists

SPN	FMI	Fault Code	SPN Description	Description
3750	31	3396	Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration	Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration - Condition Exists
3750	14	5938	Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration	Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration – Condition Exists
3826	18	4573	Aftertreatment 1 Diesel Exhaust Fluid Average Consumption	Aftertreatment 1 Diesel Exhaust Fluid Average Consumption - Data Valid But Below Normal Operating Range
3936	15	1981	Aftertreatment Diesel Particulate Filter System	Aftertreatment 1 Diesel Particulate Filter System - Data Valid But Above Normal Operating Range - Level
3936	7	3245	Aftertreatment 1 Diesel Particulate Filter System	Aftertreatment 1 Diesel Particulate Filter System - Mechanical system not responding or out of adjustment
3936	14	4584	Aftertreatment Diesel Particulate Filter System	Aftertreatment Diesel Particulate Filter System - Special Instructions
3936	7	6265	Aftertreatment 1 Diesel Particulate Filter System	Aftertreatment 1 Diesel Particulate Filter System - Mechanical system not responding or out of adjustment
4094	31	3543	NOx limits exceeded due to Insufficient Diesel Exhaust Fluid Quality	NOx limits exceeded due to Insufficient Reagent Quality - Condition Exists
4096	31	3547	NOx limits exceeded due to Empty Diesel Exhaust Fluid Tank	Aftertreatment Diesel Exhaust Fluid Tank Empty - Condition Exists
4097	3	2732	Aftertreatment 1 Fuel Drain Actuator	Aftertreatment Fuel Drain Valve Circuit - Voltage above normal, or shorted to high source
4097	4	2733	Aftertreatment 1 Fuel Drain Actuator	Aftertreatment Fuel Drain Valve Circuit - Voltage below normal, or shorted to low source
4097	7	2878	Aftertreatment 1 Fuel Drain Actuator	Aftertreatment Fuel Drain Valve - Mechanical system not responding or out of adjustment
4182	4	3695	Generator Output Frequency Adjust Potentiometer Circuit	Generator Output Frequency Adjust Potentiometer Circuit - Voltage below normal, or shorted to low source
4183	4	3696	Droop Adjust Potentiometer Circuit	Droop Adjust Potentiometer Circuit - Voltage below normal, or shorted to low source
4184	4	3694	Gain Adjust Potentiometer Circuit	Gain Adjust Potentiometer Circuit - Voltage below normal, or shorted to low source

SPN	FMI	Fault Code	SPN Description	Description
4185	31	1427	Overspeed Shutdown Relay Driver	Overspeed Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
4186	31	1428	Low Oil Pressure Shutdown Relay Driver	Low Oil Pressure (LOP) Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
4187	31	1429	High Engine Temperature Shutdown Relay Driver	High Engine Temperature (HET) Shutdown Relay Driver Diagnostic has detected an error - Condition Exists
4188	31	1431	Pre-Low Oil Pressure Indicator Relay Driver	Pre-Low Oil Pressure Warning Relay Driver Diagnostic has detected an error - Condition Exists
4223	31	1432	Pre-High Engine Temperature Warning Relay Driver	Pre-High Engine Temperature Warning Relay Driver Diagnostic has detected an error - Condition Exists
4331	18	4658	Aftertreatment 1 Diesel Exhaust Fluid Actual Dosing Quantity	Aftertreatment SCR Actual Dosing Reagent Quantity - Data Valid But Below Normal Operating Range - Mo
4334	3	3571	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor - Voltage above normal, or shorted to high source
4334	4	3572	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor - Voltage below normal, or shorted to low source
4334	18	3574	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor - Data Valid But Below Normal Operating Range
4334	16	3575	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor - Data Valid But Above Normal Operating Range
4334	2	3596	Aftertreatment 1 Diesel Exhaust Fluid Doser Absolute Pressure	Aftertreatment 1 Diesel Exhaust Fluid Pressure Sensor - Data erratic, intermittent or incorrect
4337	3	4174	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature Sensor	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature Sensor - Voltage Above Normal, or Shorted to High Source
4337	4	4175	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature Sensor	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature Sensor - Voltage below normal, or shorted to low source
4337	2	4244	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature - Data erratic, intermittent or incorrect
4337	10	4249	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature	Aftertreatment 1 Diesel Exhaust Fluid Dosing Temperature - Abnormal Rate of Change

SPN	FMI	Fault Code	SPN Description	Description
4339	31	4586	Aftertreatment 1 SCR Feedback Control Status	Aftertreatment 1 SCR Feedback Control Status - Condition Exists
4340	3	3237	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage above normal, or shorted to high source
4340	4	3238	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage below normal, or shorted to low source
4340	5	3258	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Current below normal or open circuit
4340	5	6482	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Current below normal or open circuit
4340	3	6531	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage above normal, or shorted to high source
4340	4	6532	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 1 Circuit - Voltage below normal, or shorted to low source
4342	3	3239	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Voltage above normal, or shorted to high source
4342	4	3241	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Voltage below normal, or shorted to low source
4342	5	3261	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Current below normal or open circuit
4342	5	6483	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Current below normal or open circuit
4342	3	6533	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Voltage above normal, or shorted to high source
4342	4	6534	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 State	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 2 Circuit - Voltage below normal, or shorted to low source
4344	3	3422	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	Aftertreatment Diesel Exhaust Fluid Line Heater 3 Circuit - Voltage above normal, or shorted to high source
4344	4	3423	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	Aftertreatment Diesel Exhaust Fluid Line Heater 3 Circuit - Voltage below normal, or shorted to low source

SPN	FMI	Fault Code	SPN Description	Description
4344	5	3425	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	Aftertreatment Diesel Exhaust Fluid Line Heater 3 Circuit - Current below normal or open circuit
4344	5	6484	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	Aftertreatment Diesel Exhaust Fluid Line Heater 3 Circuit - Current below normal or open circuit
4344	3	6535	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	Aftertreatment Diesel Exhaust Fluid Line Heater 3 Circuit - Voltage above normal, or shorted to high source
4344	4	6536	Aftertreatment 1 Diesel Exhaust Fluid Line Heater 3 State	Aftertreatment Diesel Exhaust Fluid Line Heater 3 Circuit - Voltage below normal, or shorted to low source
4360	3	3142	Aftertreatment 1 SCR Catalyst Intake Gas Temperature	Aftertreatment 1 SCR Intake Temperature Sensor Circuit - Voltage above normal, or shorted to high source
4360	4	3143	Aftertreatment 1 SCR Catalyst Intake Gas Temperature	Aftertreatment 1 SCR Intake Temperature Sensor Circuit - Voltage below normal, or shorted to low source
4360	2	3144	Aftertreatment 1 SCR Catalyst Intake Gas Temperature	Aftertreatment 1 SCR Intake Temperature Sensor - Data erratic, intermittent or incorrect
4360	15	3164	Aftertreatment 1 SCR Catalyst Intake Gas Temperature	Aftertreatment 1 SCR Intake Temperature - Data Valid But Above Normal Operating Range - Least Severe
4360	0	3229	Aftertreatment 1 SCR Catalyst Intake Gas Temperature	Aftertreatment 1 SCR Intake Temperature - Data valid but above normal operational range - Most Severe Level
4360	16	3231	Aftertreatment 1 SCR Catalyst Intake Gas Temperature	Aftertreatment 1 SCR Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
4360	16	5247	Aftertreatment 1 SCR Intake Temperature	Aftertreatment 1 SCR Intake Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
4363	3	3146	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage above normal, or shorted to high source
4363	4	3147	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage below normal, or shorted to low source
4363	2	3148	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature Sensor - Data erratic, intermittent or incorrect
4363	0	3165	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature - Data valid but above normal operational range - Most Severe

SPN	FMI	Fault Code	SPN Description	Description
4363	16	3235	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
4363	3	6569	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage above normal, or shorted to high source
4363	4	6571	Aftertreatment 1 SCR Catalyst Outlet Gas Temperature	Aftertreatment 1 SCR Outlet Temperature Sensor Circuit - Voltage below normal, or shorted to low source
4364	18	3582	Aftertreatment 1 SCR Conversion Efficiency	Aftertreatment SCR Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level
4364	17	6517	Aftertreatment 1 SCR Conversion Efficiency	Aftertreatment SCR Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level
4376	3	3577	Aftertreatment 1 Diesel Exhaust Fluid Return Valve	Aftertreatment Diesel Exhaust Fluid Return Valve - Voltage above normal, or shorted to high source
4376	4	3578	Aftertreatment 1 Diesel Exhaust Fluid Return Valve	Aftertreatment Diesel Exhaust Fluid Return Valve - Voltage below normal, or shorted to low source
4376	7	4157	Aftertreatment 1 Diesel Exhaust Fluid Return Valve	Aftertreatment Diesel Exhaust Fluid Return Valve - Mechanical system not responding or out of adjust
4376	7	6527	Aftertreatment 1 Diesel Exhaust Fluid Return Valve	Aftertreatment Diesel Exhaust Fluid Return Valve - Mechanical system not responding or out of adjust
4490	9	3367	Specific Humidity	Specific Humidity Sensor - Abnormal update rate
4490	19	3368	Specific Humidity	Specific Humidity Sensor - Received Network Data In Error
4765	16	3251	Aftertreatment Diesel Oxidation Catalyst Intake Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data Valid But Above Normal Operating Range
4765	4	3313	Aftertreatment Diesel Oxidation Catalyst Intake Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage below normal, or shorted to low source
4765	3	3314	Aftertreatment Diesel Oxidation Catalyst Intake Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage above normal, or shorted to high source
4765	2	3315	Aftertreatment Diesel Oxidation Catalyst Intake Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data erratic, intermittent or incorrect

SPN	FMI	Fault Code	SPN Description	Description
4765	13	3325	Aftertreatment Diesel Oxidation Catalyst Intake Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature Swapped - Out of Calibration
4765	2	6539	Aftertreatment Diesel Oxidation Catalyst Intake Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Intake Temperature - Data erratic, intermittent or incorrect
4766	3	4533	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature Sensor Circuit	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature Sensor Circuit - Voltage above normal, or shorted to high source
4766	4	4534	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature Sensor Circuit	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature Sensor Circuit - Voltage below normal, or shorted to low source
4766	2	5386	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature - Data Erratic, Intermittent, or Incorrect
4766	0	5387	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature - Data Valid But Above Normal Operating Range - Most Severe Level
4766	16	5388	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature - Data Valid But Above Normal Operating Range - Moderately Severe Level
4766	15	5389	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature	Aftertreatment 1 Diesel Oxidation Catalyst Outlet Gas Temperature - Data Valid But Above Normal Operating Range - Least Severe Level
4792	7	3751	Aftertreatment SCR Catalyst System	Aftertreatment SCR Catalyst System - Mechanical system not responding or out of adjustment
4792	14	4585	Aftertreatment 1 SCR Catalyst System	Aftertreatment 1 SCR Catalyst System - Special Instructions
4793	31	3158	Aftertreatment Warm Up Diesel Oxidation Catalyst	Aftertreatment Warm Up Diesel Oxidation Catalyst Missing - Condition Exists
4794	31	3151	Aftertreatment 1 SCR Catalyst System	Aftertreatment 1 SCR Catalyst System Missing - Condition Exists
4795	31	1993	Aftertreatment 1 Diesel Particulate Filter Missing	Aftertreatment 1 Diesel Particulate Filter Missing - Condition Exists
4796	31	1664	Aftertreatment 1 Diesel Oxidation Catalyst Missing	Aftertreatment 1 Diesel Oxidation Catalyst Missing - Condition Exists
4796	31	6726	Aftertreatment 1 Diesel Oxidation Catalyst Missing	Aftertreatment 1 Diesel Oxidation Catalyst Missing - Condition Exists

SPN	FMI	Fault Code	SPN Description	Description
4809	3	3152	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage above normal
4809	4	3153	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature Sensor Circuit - Voltage below normal
4809	2	3154	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature - Data erratic, intermittent or incorrect
4809	13	3166	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature Sensor Swapped - Out of Calibration
4809	16	3247	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Intake Temperature - Data Valid But Above Normal Operating Range
4810	3	3155	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature Sensor Circuit - Voltage above normal
4810	4	3156	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature Sensor Circuit - Voltage below normal
4810	2	3157	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature - Data erratic, intermittent or incorrect
4810	0	3162	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature - Data valid but above normal operating Range –Most Severe level
4810	16	3169	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature - Data Valid But Above Normal Operating Range
4810	15	3249	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature	Aftertreatment Warm Up Diesel Oxidation Catalyst Outlet Temperature - Data Valid But Above Normal Operating Range
5018	11	2637	Aftertreatment Diesel Oxidation Catalyst	Aftertreatment 1 Diesel Oxidation Catalyst Face Plugged - Root Cause Not Known
5019	3	3136	Engine Exhaust Gas Recirculation 1 Outlet Pressure	Engine Exhaust Gas Recirculation Outlet Pressure Sensor Circuit - Voltage above normal, or shorted to high source
5019	4	3137	Engine Exhaust Gas Recirculation 1 Outlet Pressure	Engine Exhaust Gas Recirculation Outlet Pressure Sensor Circuit - Voltage below normal, or shorted to low source
5019	2	3138	Engine Exhaust Gas Recirculation 1 Outlet Pressure	Engine Exhaust Gas Recirculation Outlet Pressure - Data erratic, intermittent or incorrect

SPN	FMI	Fault Code	SPN Description	Description
5024	10	3649	Aftertreatment 1 Intake Gas NOx Sensor Heater Ratio	Aftertreatment 1 Intake NOx Sensor Heater - Abnormal rate of change
5031	10	3583	Aftertreatment 1 Outlet Gas NOx Sensor Heater Ratio	Aftertreatment 1 Outlet NOx Sensor Heater - Abnormal rate of change
5031	10	6581	Aftertreatment 1 Outlet Gas NOx Sensor Heater Ratio	Aftertreatment 1 Outlet NOx Sensor Heater - Abnormal rate of change
5097	3	4293	Engine Brake Active Lamp Data	Engine Brake Active Lamp - Voltage Above Normal, or Shorted to High Source
5097	4	4294	Engine Brake Active Lamp Data	Engine Brake Active Lamp - Voltage below normal, or shorted to low source
5125	3	3419	Sensor supply voltage 7	Sensor Supply 7 Circuit - Voltage above normal, or shorted to high source
5125	4	3421	Sensor supply voltage 7	Sensor Supply 7 Circuit - Voltage below normal, or shorted to low source
5245	31	4863	Aftertreatment Selective Catalytic Reduction Operator Inducement Active	Aftertreatment Diesel Exhaust Fluid Tank Low Level Indicator
5246	0	3712	Aftertreatment SCR Operator Inducement Severity	Aftertreatment SCR Operator Inducement - Data valid but above normal operational range - Most Severe level
5298	18	1691	Aftertreatment 1 Diesel Oxidation Catalyst Conversion Efficiency	Aftertreatment 1 Diesel Oxidation Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level
5298	17	2638	Aftertreatment 1 Diesel Oxidation Catalyst Conversion Efficiency	Aftertreatment 1 Diesel Oxidation Catalyst Conversion Efficiency - Data Valid But Below Normal Operating Range - Moderately Severe Level
5319	31	3376	Aftertreatment 1 Diesel Particulate Filter Incomplete Regeneration	Aftertreatment Diesel Particulate Filter Incomplete Regeneration - Condition Exists
5357	31	4713	Engine Fuel Injection Quantity Error for Multiple Cylinders	Engine Fuel Injection Quantity Error for Multiple Cylinders - Condition Exists
5380	11	4936	Engine Fuel Valve 1	Engine Fuel Valve 1 - Root Cause Not Known
5380	13	4937	Engine Fuel Valve 1	Engine Fuel Valve 1 - Out of Calibration

SPN	FMI	Fault Code	SPN Description	Description
5394	5	3567	Aftertreatment Diesel Exhaust Fluid Dosing Valve	Aftertreatment Diesel Exhaust Fluid Dosing Valve - Current below normal or open circuit
5394	7	3568	Aftertreatment Diesel Exhaust Fluid Dosing Valve	Aftertreatment Diesel Exhaust Fluid Dosing Valve - Mechanical system not responding or out of adjustment
5394	2	3755	Aftertreatment Diesel Exhaust Fluid Dosing Valve	Aftertreatment Diesel Exhaust Fluid Dosing Valve - Data erratic, intermittent or incorrect
5395	16	3337	Engine Idle Fuel Quantity	Engine Idle Fuel Quantity - Data Valid But Above Normal Operating Range - Moderately Severe Level
5395	18	3338	Engine Idle Fuel Quantity	Engine Idle Fuel Quantity - Data Valid But Below Normal Operating Range - Moderately Severe Level
5396	31	3377	Engine Crankcase Ventilation Hose Disconnected	Engine Crankcase Ventilation Hose Disconnected - Condition Exists
5397	31	3375	Aftertreatment 1 Diesel Particulate Filter Regeneration too Frequent	Aftertreatment Diesel Particulate Filter Regeneration too Frequent - Condition Exists
5484	3	3633	Engine Fan Clutch 2 Output Device Driver	Engine Fan Clutch 2 Control Circuit - Voltage above normal, or shorted to high source
5484	4	3634	Engine Fan Clutch 2 Output Device Driver	Engine Fan Clutch 2 Control Circuit - Voltage below normal, or shorted to low source
5484	3	6456	Engine Fan Clutch 2 Output Device Driver	Engine Fan Clutch 2 Control Circuit - Voltage above normal, or shorted to high source
5484	4	6457	Engine Fan Clutch 2 Output Device Driver	Engine Fan Clutch 2 Control Circuit - Voltage below normal, or shorted to low source
5491	3	3562	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay	Aftertreatment Diesel Exhaust Fluid Line Heater Relay - Voltage above normal, or shorted to high source
5491	4	3563	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay	Aftertreatment Diesel Exhaust Fluid Line Heater Relay - Voltage below normal, or shorted to low source
5491	7	3713	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay - Mechanical system not responding or out of adjustment
5491	3	6477	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay	Aftertreatment Diesel Exhaust Fluid Line Heater Relay - Voltage above normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
5491	4	6478	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay	Aftertreatment Diesel Exhaust Fluid Line Heater Relay - Voltage below normal, or shorted to low source
5491	7	6537	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay	Aftertreatment 1 Diesel Exhaust Fluid Line Heater Relay - Mechanical system not responding or out of adjustment
5571	7	3727	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Mechanical system not responding or out of adjustment
5571	0	3741	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Data valid but above normal operational range
5571	3	4262	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Voltage Above Normal, or Shorted to High Source
5571	4	4263	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Voltage below normal, or shorted to low source
5571	11	4265	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Root Cause Not Known
5571	31	4867	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Condition Exists
5571	15	5585	High Pressure Common Rail Fuel Pressure Relief Valve	High Pressure Common Rail Fuel Pressure Relief Valve - Data Valid But Above Normal Operating Range - Least Severe Level
5585	18	4691	Engine Injector Metering Rail 1 Cranking Pressure	Engine Injector Metering Rail 1 Cranking Pressure - Data Valid But Below Normal Operating Range - Mo
5603	9	3843	Cruise Control Disable Command	Cruise Control Disable Command - Abnormal update rate
5603	31	3845	Cruise Control Disable Command	Cruise Control Disable Command - Condition Exists
5605	31	3844	Cruise Control Pause Command	Cruise Control Pause Command - Condition Exists
5625	2	5274	Engine Exhaust Back Pressure Regulator Position	Engine Exhaust Back Pressure Regulator Position - Data Erratic, Intermittent or Incorrect
5625	3	5275	Engine Exhaust Back Pressure Regulator Position Sensor Circuit	Engine Exhaust Back Pressure Regulator Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source

SPN	FMI	Fault Code	SPN Description	Description
5625	4	5276	Engine Exhaust Back Pressure Regulator Position Sensor Circuit	Engine Exhaust Back Pressure Regulator Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
5626	13	5277	Engine Exhaust Back Pressure Regulator	Engine Exhaust Back Pressure Regulator - Out of Calibration
5741	3	4143	Aftertreatment 1 Outlet Soot Sensor	Aftertreatment 1 Outlet Soot Sensor - Voltage Above Normal, or Shorted to High Source
5741	4	4144	Aftertreatment 1 Outlet Soot Sensor	Aftertreatment 1 Outlet Soot Sensor - Voltage below normal, or shorted to low source
5741	2	4451	Aftertreatment 1 Outlet Soot	Aftertreatment 1 Outlet Soot - Data erratic, intermittent or incorrect
5742	9	4151	Aftertreatment Diesel Particulate Filter Temperature Sensor Module	Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Abnormal update rate
5742	12	4158	Aftertreatment Diesel Particulate Filter Temperature Sensor Module	Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Bad intelligent device or component
5742	3	4161	Aftertreatment Diesel Particulate Filter Temperature Sensor Module	Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Voltage Above Normal, or Shorted to high source
5742	4	4162	Aftertreatment Diesel Particulate Filter Temperature Sensor Module	Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Voltage below normal, or shorted to low source
5742	16	4163	Aftertreatment Diesel Particulate Filter Temperature Sensor Module	Aftertreatment Diesel Particulate Filter Temperature Sensor Module- Data Valid But Above Normal Operating Range
5742	11	4259	Aftertreatment Diesel Particulate Filter Temperature Sensor Module	Aftertreatment Diesel Particulate Filter Temperature Sensor Module - Root Cause Not Known
5743	9	4152	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Abnormal update rate
5743	12	4159	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Bad intelligent device or component
5743	3	4164	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Voltage Above Normal, or Shorted to high source
5743	4	4165	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Voltage below normal, or Shorted to low source

SPN	FMI	Fault Code	SPN Description	Description
5743	16	4166	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Data Valid But Above Normal
5743	11	4261	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module	Aftertreatment Selective Catalytic Reduction Temperature Sensor Module - Root Cause Not Known
5745	3	4168	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater - Voltage Above Normal, or Shorted to High
5745	4	4169	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater - Voltage below normal, or shorted to low source
5745	18	4171	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater - Data Valid But Below Normal Operating Range
5745	17	6513	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater - Data Valid But Below Normal Operating Range
5746	3	4155	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Relay	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Relay - Voltage Above Normal, or Shorted to high source
5746	4	4156	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Relay	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Relay - Voltage below normal, or shorted to low source
5746	3	6529	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Relay	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Relay - Voltage Above Normal, or Shorted to high source
5747	3	4153	Aftertreatment 1 Outlet Soot Sensor Heater	Aftertreatment 1 Outlet Soot Sensor Heater - Voltage Above Normal, or Shorted to High Source
5747	4	4154	Aftertreatment 1 Outlet Soot Sensor Heater	Aftertreatment 1 Outlet Soot Sensor Heater - Voltage below normal, or shorted to low source
5747	10	4449	Aftertreatment 1 Outlet Soot Sensor Heater	Aftertreatment 1 Outlet Soot Sensor Heater - Abnormal rate of change
5793	9	4284	Desired Engine Fueling State	Desired Engine Fueling State - Abnormal Update Rate
5797	12	4253	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module - Bad intelligent device
5797	3	4254	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module - Voltage Above Normal, or shorted to high source

SPN	FMI	Fault Code	SPN Description	Description
5797	4	4255	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module - Voltage below normal, or shorted to low source
5797	16	4256	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module - Data Valid But Above Normal Operating Range – Moderately Severe Level
5797	11	4258	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Warm Up Diesel Oxidation Catalyst Temperature Sensor Module - Root Cause Not Known
5798	2	4245	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Temperature	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Temperature - Data erratic, intermittent or incorrect
5798	10	4251	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Temperature	Aftertreatment 1 Diesel Exhaust Fluid Dosing Unit Heater Temperature - Abnormal Rate of Change
5838	31	4485	EGR Valve Malfunction	EGR Valve Malfunction - Condition Exists
5839	31	4486	Diesel Exhaust Fluid Consumption Malfunction	Diesel Exhaust Fluid Consumption Malfunction - Condition Exists
5840	31	4487	Diesel Exhaust Fluid Dosing Malfunction	Diesel Exhaust Fluid Dosing Malfunction - Condition Exists
5841	31	4488	Diesel Exhaust Fluid Quality Malfunction	Diesel Exhaust Fluid Quality Malfunction - Condition Exists
5842	31	4489	SCR Monitoring System Malfunction	SCR Monitoring System Malfunction - Condition Exists
6301	3	4688	Water in Fuel Indicator 2 Sensor Circuit	Water in Fuel Indicator 2 Sensor Circuit - Voltage above normal, or shorted to high source
6301	4	4689	Water in Fuel Indicator 2 Sensor Circuit	Water in Fuel Indicator 2 Sensor Circuit - Voltage below normal, or shorted to low source
6653	16	4841	Cold Start Injector Metering Rail 1 Pressure	Cold Start Injector Metering Rail 1 Pressure - Data Valid But Above Normal Operating Range - Moderate Severe Level
6655	3	4951	ECU Power Lamp	Maintain ECU Power Lamp - Voltage Above Normal, or Shorted to High Source
6655	4	4952	ECU Power Lamp	Maintain ECU Power Lamp - Voltage Below Normal, or Shorted to Low Source

SPN	FMI	Fault Code	SPN Description	Description
6655	3	6511	ECU Power Lamp	Maintain ECU Power Lamp - Voltage Above Normal, or Shorted to High Source
6655	4	6512	ECU Power Lamp	Maintain ECU Power Lamp - Voltage Below Normal, or Shorted to Low Source
6713	13	4956	Variable Geometry Turbocharger Actuator	Variable Geometry Turbocharger Actuator Software - Out of Calibration
6713	31	4957	Variable Geometry Turbocharger Actuator	Variable Geometry Turbocharger Actuator Software - Condition Exists
6713	9	5177	VGT Actuator Driver Circuit	VGT Actuator Driver Circuit - Abnormal update rate
6799	3	5183	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
6799	4	5184	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
6799	7	5185	Engine Fan Blade Pitch	Fan Blade Pitch - Mechanical system not responding or out of adjustment
6799	3	6471	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Above Normal, or Shorted to High Source
6799	4	6472	Engine Fan Blade Pitch	Fan Blade Pitch Position Sensor Circuit - Voltage Below Normal, or Shorted to Low Source
6799	2	6473	Engine Fan Blade Pitch	Fan Blade Pitch - Mechanical system not responding or out of adjustment
6802	31	5278		Aftertreatment 1 Diesel Exhaust Fluid Dosing System Frozen - Condition Exists
6881	9	5653	SCR Operator Inducement Override Switch	SCR Operator Inducement Override Switch - Abnormal Update Rate
6881	13	5654	SCR Operator Inducement Override Switch	SCR Operator Inducement Override Switch - Out of Calibration
6882	9	5391	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module - Abnormal Update Rate

SPN	FMI	Fault Code	SPN Description	Description
6882	12	5392	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module - Bad Intelligent Device or Component
6882	3	5393	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module - Voltage Above Normal or Shorted to High Source
6882	4	5394	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module - Voltage Below Normal or Shorted to Low Source
6882	11	5395	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module - Root Cause Not Known
6882	16	5396	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module	Aftertreatment Diesel Oxidation Catalyst Temperature Sensor Module - Data Valid But Above Normal Operating Range - Moderately Severe Level
6918	31	5632	SCR System Cleaning Inhibited Due to Inhibit Switch	SCR System Cleaning Inhibited Due to Inhibit Switch - Condition Exists
6928	31	5631	SCR System Cleaning Inhibited Due to System Timeout	SCR System Cleaning Inhibited Due to System Timeout - Condition Exists
6928	31	6597	SCR System Cleaning Inhibited Due to System Timeout	SCR System Cleaning Inhibited Due to System Timeout - Condition Exists
7848	31	6634	Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration	Diesel Particulate Filter 1 Conditions Not Met for Active Regeneration - Condition Exists
520199	3	193	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage above normal, or shorted to high source
520199	4	194	Cruise Control	Cruise Control (Resistive) Signal Circuit - Voltage below normal, or shorted to low source
520320	7	2699	Crankcase Depression Valve	Crankcase Depression Valve - Mechanical system not responding or out of adjustment
520332	3	2755	Cruise Control	Cruise Control (Resistive) #2 Signal Circuit - Voltage above normal, or shorted to high source
520332	4	2756	Cruise Control	Cruise Control (Resistive) #2 Signal Circuit - Voltage below normal, or shorted to low source
520435	12	3222	Glow Plug Module	Glow Plug Module - Bad intelligent device or component

SPN	FMI	Fault Code	SPN Description	Description
520595	3	4286	Closed Crankcase Ventilation System Pressure Sensor	Closed Crankcase Ventilation System Pressure Sensor - Voltage Above Normal, or Shorted to High Source
520595	4	4287	Closed Crankcase Ventilation System Pressure Sensor	Closed Crankcase Ventilation System Pressure Sensor - Voltage below normal, or shorted to low source
520595	2	4288	Closed Crankcase Ventilation System Pressure	Closed Crankcase Ventilation System Pressure - Data erratic, intermittent or incorrect
520668	31	4452	Aftertreatment 1 Outlet NOx Sensor Closed Loop Operation	Aftertreatment 1 Outlet NOx Sensor Closed Loop Operation - Condition Exists
520716	3	4752	Aftertreatment 1 Diesel Exhaust Fluid Dosing Valve 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Dosing Valve 1 Heater - Voltage Above Normal, or Shorted to High Source
520716	4	4753	Aftertreatment 1 Diesel Exhaust Fluid Dosing Valve 1 Heater	Aftertreatment 1 Diesel Exhaust Fluid Dosing Valve 1 Heater - Voltage Below Normal, or Shorted to Low Source
520791	2	5215	Engine Boost Curve Selection	Engine Boost Curve Selection - Data erratic, intermittent or incorrect
520808	31	5291	Engine Emergency Shutdown Switch Activated	Engine Emergency Shutdown Switch Activated - Condition Exists
520809	31	5292	Excessive Time Since Last Engine Air Shutoff Maintenance Test	Excessive Time Since Last Engine Air Shutoff Maintenance Test - Condition Exists
520953	3	5866		Aftertreatment Diesel Exhaust Fluid Dosing Unit Relay Feedback- Voltage Above Normal or Shorted to High Source.
520953	4	5867		Aftertreatment Diesel Exhaust Fluid Dosing Unit Relay Feedback- Voltage Below Normal or Shorted to Low Source.
520968	9	5939		Machine Constrained Operation- Abnormal Update Rate. No Communication or an invalid data transfer rate has been detected on the J1939 data link between the ECM and the machine electronic control unit.
520968	19	5941		Machine Constrained Operation- Received Network Data in Error. The received J1939 datalink message was not valid.
524286	31	5617	Aftertreatment 1 Diesel Oxidation Catalyst System	Aftertreatment 1 Diesel Oxidation Catalyst System- Special Instruction
524286	31	9491		Reserved for temporary use - Condition Exists

SPN	FMI	Fault Code	SPN Description	Description
524286	31	9999		Reserved for temporary use - Condition Exists

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