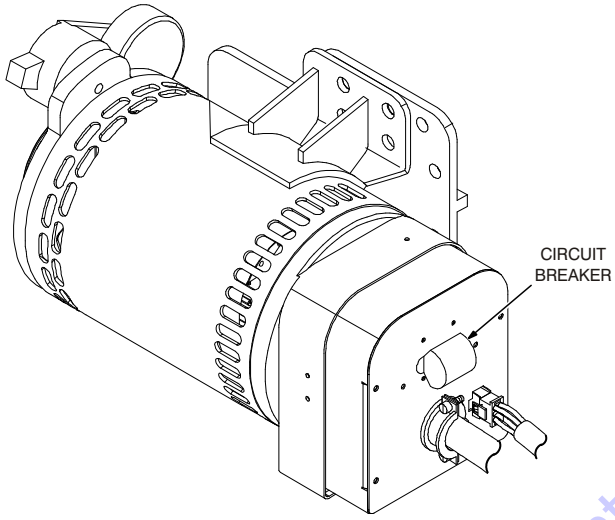
Overload Protection

⚠ CAUTION

STOP ENGINE WHENEVER CHECKING OR INSPECTING THE CIRCUIT BREAKER.

The circuit breaker protects generator windings from overload. If the circuit breaker opens, generator output stops. If the circuit breaker continues to open, check for faulty equipment connected to platform receptacles.



Inspecting Brushes, Replacing Brushes, and Cleaning Slip Rings

Refer to Figure 3-76., Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings.

INSPECTING BRUSH POSITION

Inspect brush alignment with slip rings. View alignment through the air vents in the stator barrel. The brushes must ride completely on the slip rings.

INSPECTING BRUSHES

Remove the end panel. Inspect the wires. Remove the brush holder assembly. Pull brushes from the holders.

Replace the brushes if damaged, or if the brush is at or near minimum length.

CLEANING SLIP RINGS

Visually inspect slip rings. Under normal use, the rings turn dark brown.

If slip rings are corroded or their surface is uneven, remove the belt and turn the shaft by hand for cleaning.

Clean rings with 220 grit emery paper. Remove as little material as possible. If rings are deeply pitted and do not clean up, consult generator factory service.

Reinstall belt, brush holder assembly, and end panel.

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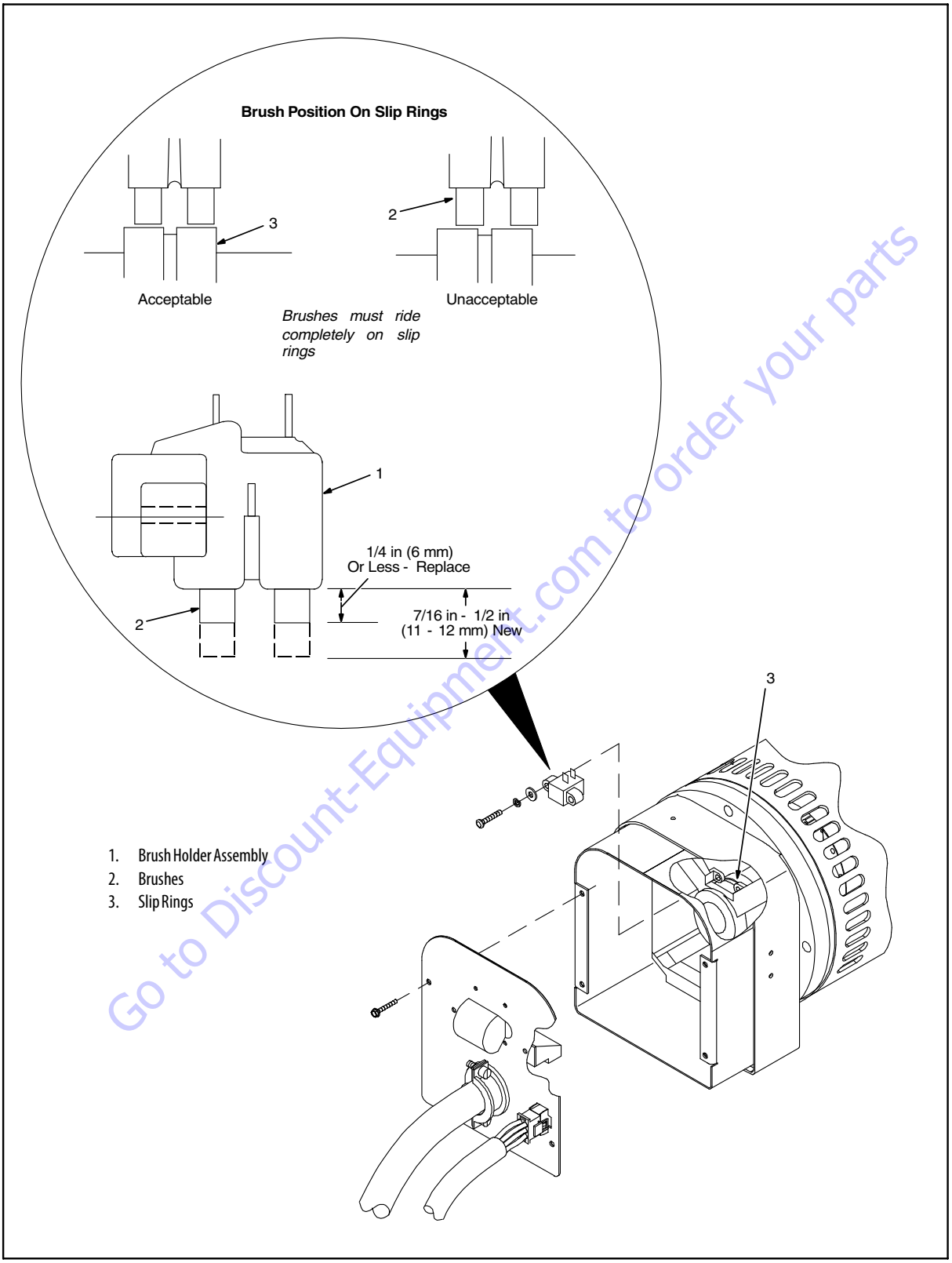

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Figure 3-76. Inspecting Generator Brushes, Replacing Brushes, and Cleaning Slip Rings

3.27 COLD WEATHER PACKAGE

As an option, a cold weather package is available to allow the machine to be operated in lower temperatures. The package consists of battery heaters, a hydraulic tank heater, Exxon Univis hydraulic oil, and diesel fuel conditioner. See Figure 3-79., Cold Weather Package.

3.28 ENGINE

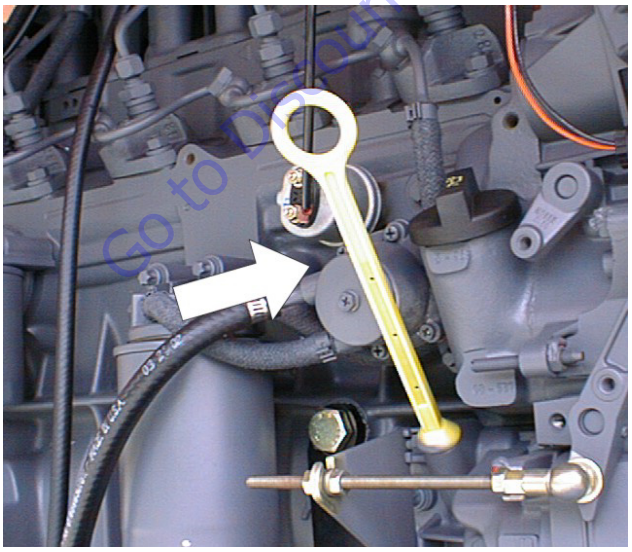
NOTE: *Refer to the engine manufacturer's manual for detailed operating and maintenance instructions.*

Glow Plugs

If the glow plug option is enabled in the JLG Control System, the glow plug and indicator lamp will be energized when the Power/Emergency Stop switch is pulled on if the ambient air temperature is less than 50° F (10° C) and engine coolant temperature is less than 140° F (60° C). This determination occurs one second after the Power/Emergency Stop switch has been pulled on. The lamp and glow plugs remain energized for the period of time specified by the setting in the JLG Control System. Engine start shall be disabled during this period. On Deutz engines, glow plugs will continue (post glow) after engine has started for three times the machine digit setting.

Checking Oil Level

1. Switch engine off before checking oil level.
2. Make sure machine and engine are level.
3. Remove dipstick.
4. Wipe dipstick with non-fibrous, clean cloth.
5. Insert dipstick to the stop and remove again.



6. Check oil level, and if necessary, top oil level up to MAX mark with an approved grade and type of oil as outlined in the engine manufacturer's operator's manual. Refer to Figure 3-77., Deutz Engine Dipstick.

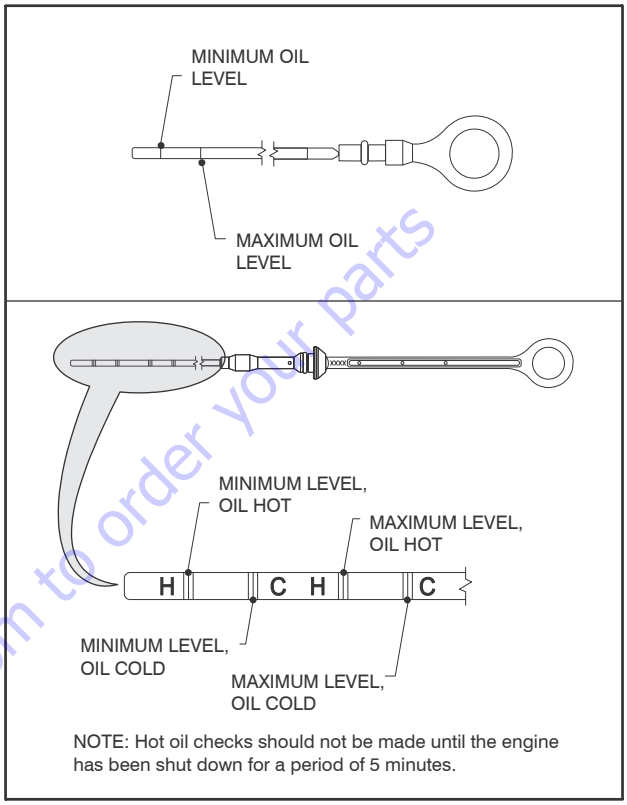


Figure 3-77. Deutz Engine Dipstick

7. Replace dipstick. Make sure it is fully seated in the dipstick tube to seal off the crankcase.

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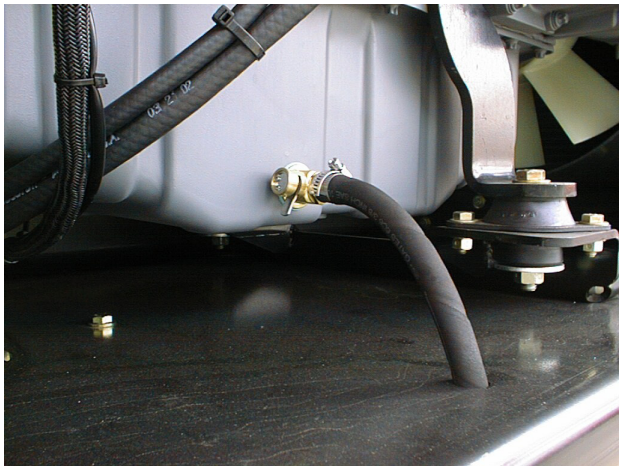
Changing Engine Oil

1. Allow engine to warm up. Engine oil should reach approximately 176° F (80° C).
2. Make sure machine and engine are level.
3. Switch off engine.
4. Place an oil tray under the engine.
5. Open oil drain valve.



⚠ WARNING

WHEN DRAINING HOT ENGINE OIL THERE IS A RISK OF SCALDING.

⚠ CAUTION

DO NOT LET USED OIL RUN INTO SOIL; COLLECT USED OIL IN A CONTAINER SUITABLE FOR DISPOSAL OR RECYCLING. DISPOSE OF USED ENGINE OIL IN ACCORDANCE WITH ENVIRONMENTAL REGULATIONS.

6. Drain oil.
7. Close oil drain valve.
8. Pour in new engine oil. Refer to Section 1 for capacity and refer to Figure 3-78., Engine Oil Viscosity for the proper grade.

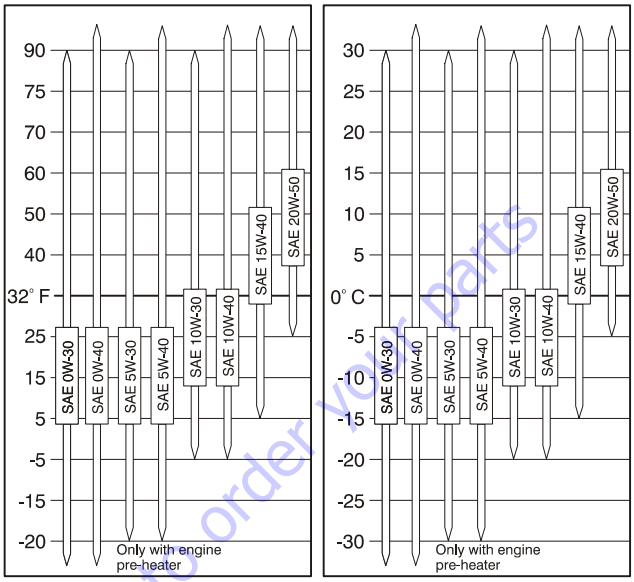


Figure 3-78. Engine Oil Viscosity

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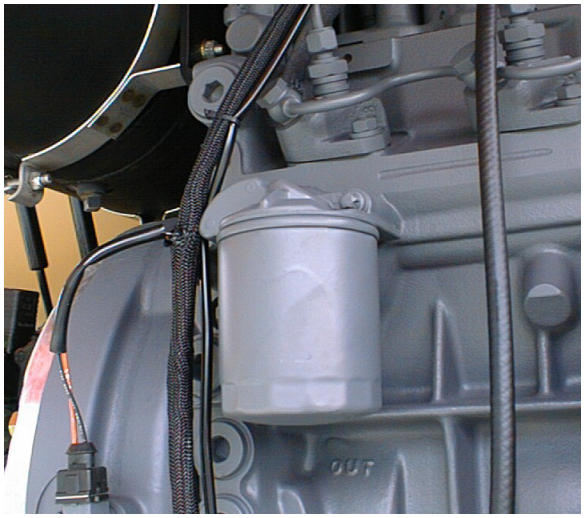
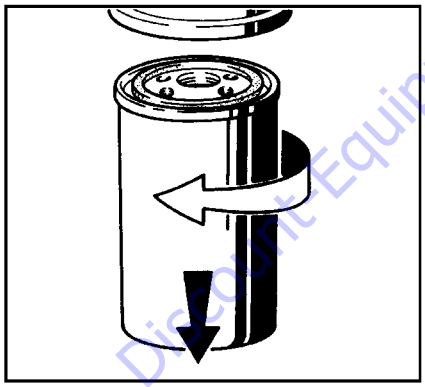
Changing Oil Filter

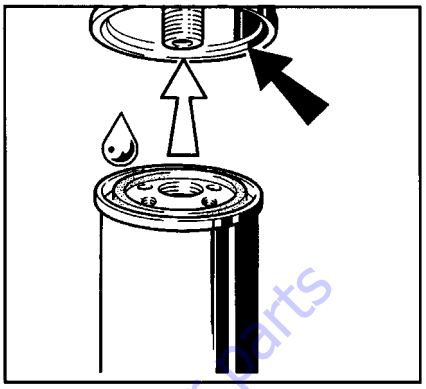
Most engine oil filters are mounted vertically. Tier 4 engine oil filters are mounted horizontally. Removal and installation is identical.



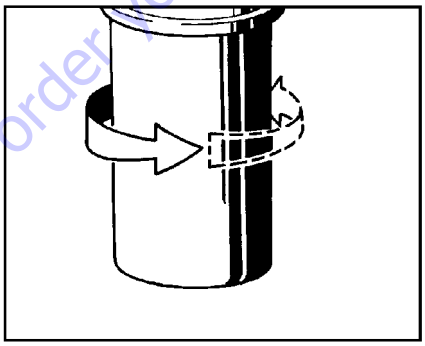
1. Wipe area around filter to remove dirt and other contaminants.
2. Using a suitable oil filter removal tool, loosen the lube oil filter cartridge and spin off.



3. Catch any escaping oil.
4. Clean any dirt from filter carrier sealing surface.
5. Lightly oil rubber gasket on new oil filter.



6. Manually screw in new filter until gasket is flush.



7. Tighten filter another half-turn.
8. Check oil level.
9. Check oil pressure.
10. Check oil filter cartridge for leaks.

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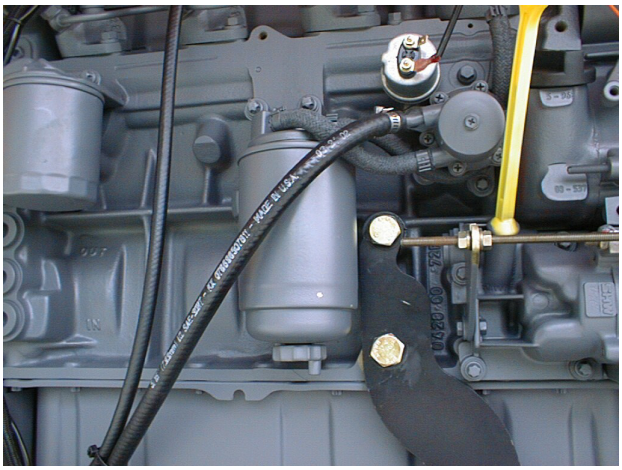
Replacing Fuel Filter or Pre-Filter

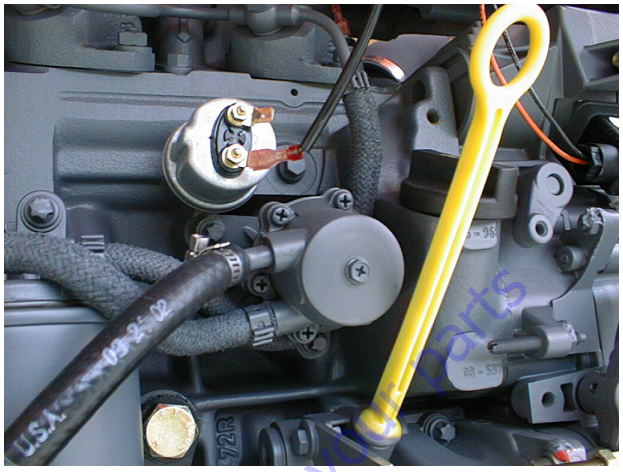


⚠ WARNING

WHEN WORKING ON FUEL SYSTEM, MAKE SURE THERE ARE NO OPEN FLAMES OR SPARKS IN THE AREA. DO NOT SMOKE WHEN WORKING ON FUEL SYSTEM.

1. Wipe area around filter to clean any dirt from area.
2. Undo fuel filter cartridge and spin off.
3. Catch any escaping fuel.
4. Clean any dirt from the filter carrier sealing surface.
5. Apply a light film of oil or diesel fuel to rubber gasket of new filter cartridge.
6. Manually screw in new filter until gasket is flush.
7. Tighten fuel filter cartridge a final half-turn.
8. Open fuel shut-off valve.
9. Check for leaks.

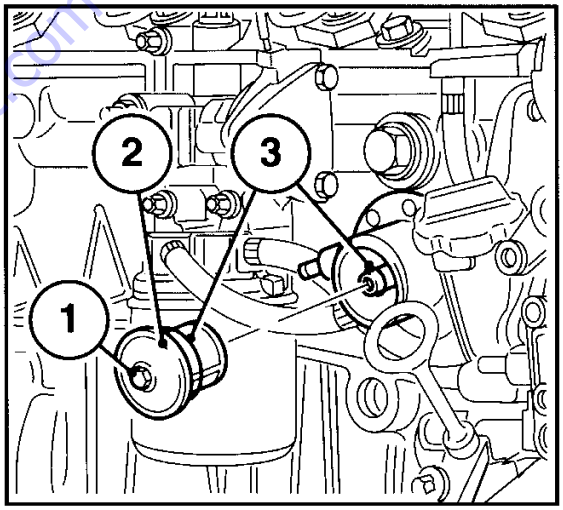
Cleaning Fuel Strainer (D2011 L03 Only)



⚠ WARNING

WHEN WORKING ON FUEL SYSTEM, MAKE SURE THERE ARE NO OPEN FLAMES OR SPARKS IN THE AREA. DO NOT SMOKE WHEN WORKING ON FUEL SYSTEM.

1. Unscrew hexagonal nut (1).



2. Remove fuel strainer cover (2).
3. Clean fuel strainer with diesel fuel, replace if necessary.
4. Place seal (3) in position.
5. Install fuel strainer cover (2) in position and tighten the hexagonal screw (1).
6. Check for leaks.

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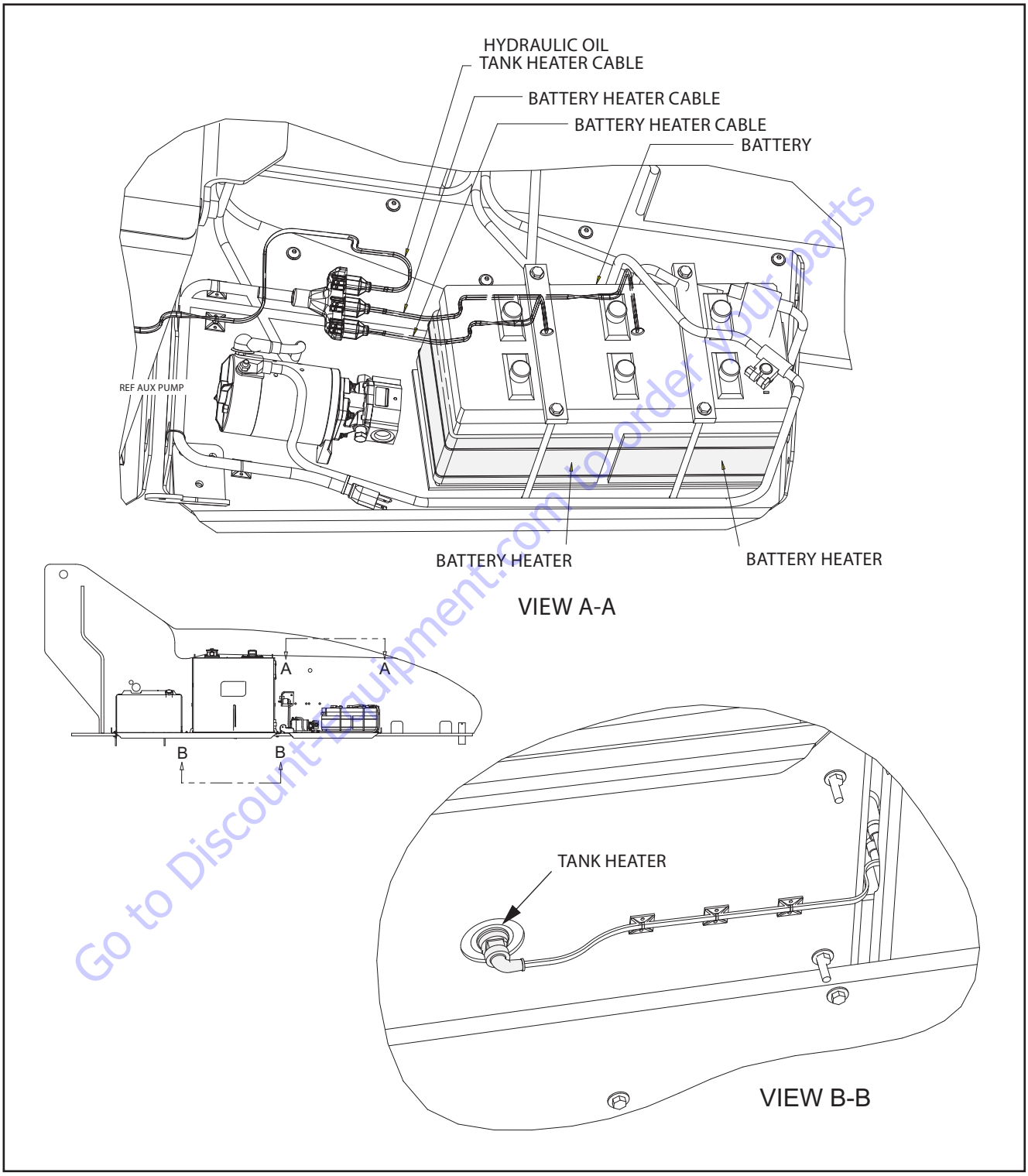

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Figure 3-79. Cold Weather Package

Removal

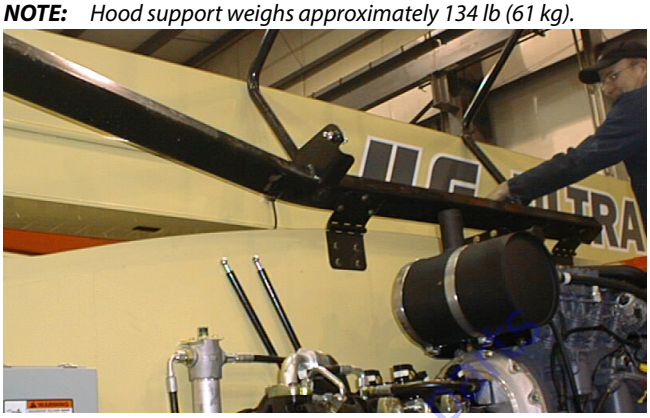
1. Disconnect battery.
2. Use a tie strap as shown below to secure hood support while hood is being removed.

3. Remove bolts and clamps that secure engine hood assembly to hood support.
4. Carefully lift engine hood assembly away from machine.

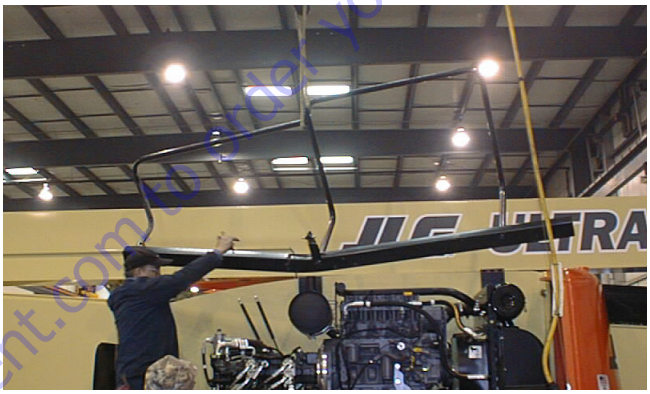
NOTE: *Engine hood assembly weighs approximately 84 lb (38 kg).*

5. Using an adequate lifting device, support weight of hood support. Disconnect gas springs and remove bolts and washers that secure hood support to hinges.

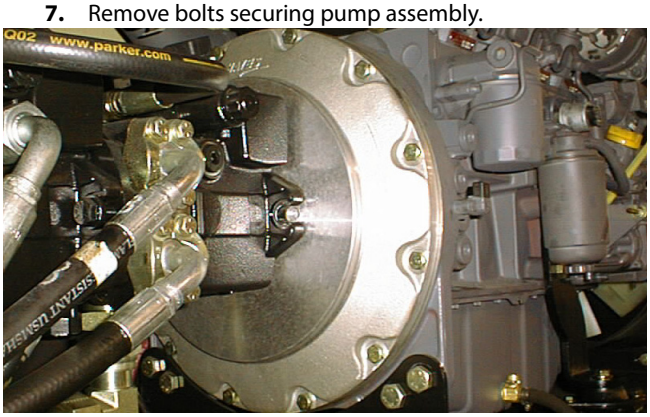
NOTE: *Hood support weighs approximately 134 lb (61 kg).*



6. When all bolts are removed, lift hood support away from machine.



7. Remove bolts securing pump assembly.



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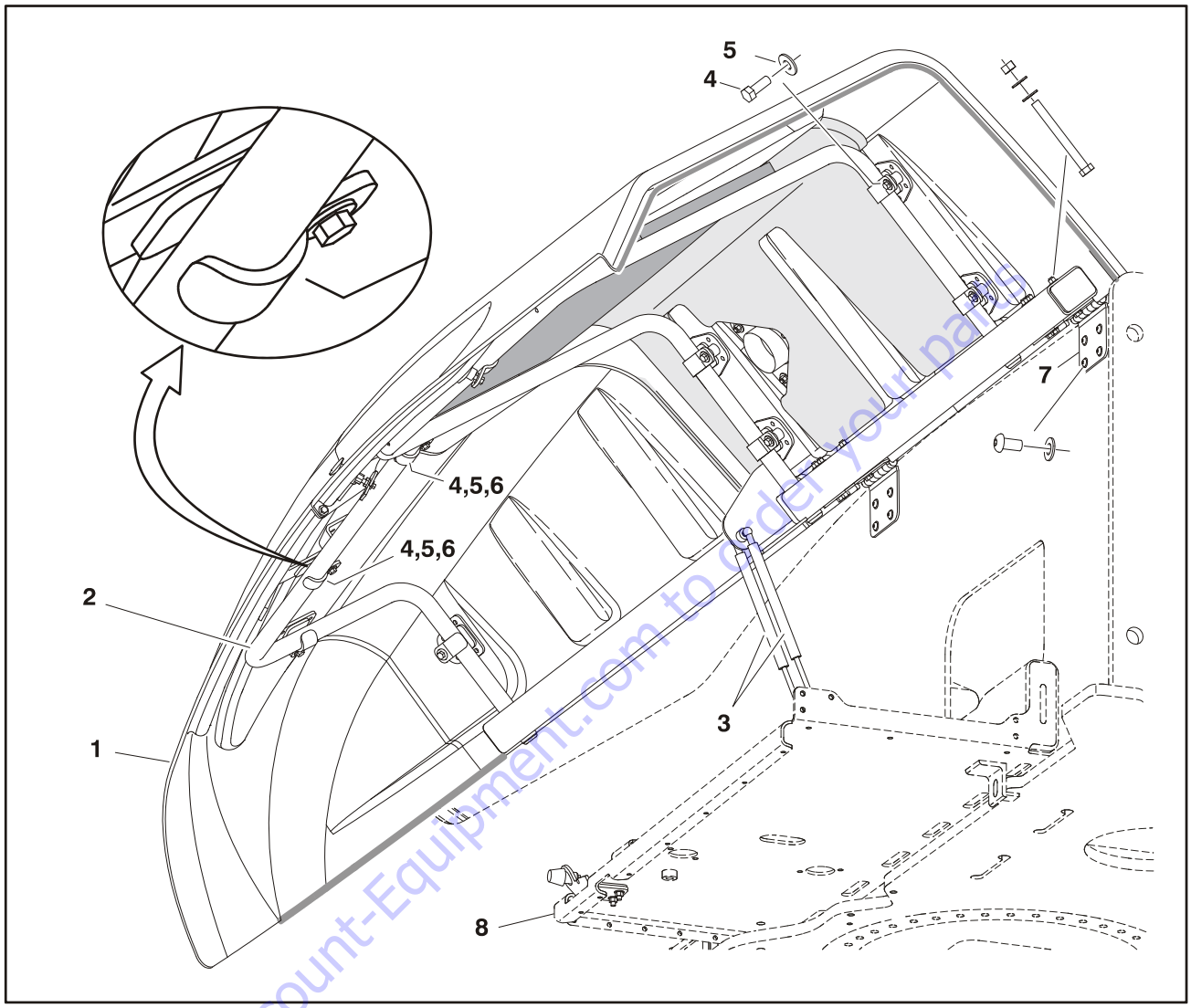

1. Hood
2. Hood Support
3. Gas Spring
4. Bolt
5. Washer
6. Clamp
7. Hinge
8. Engine Tray

Figure 3-80. Engine Hood

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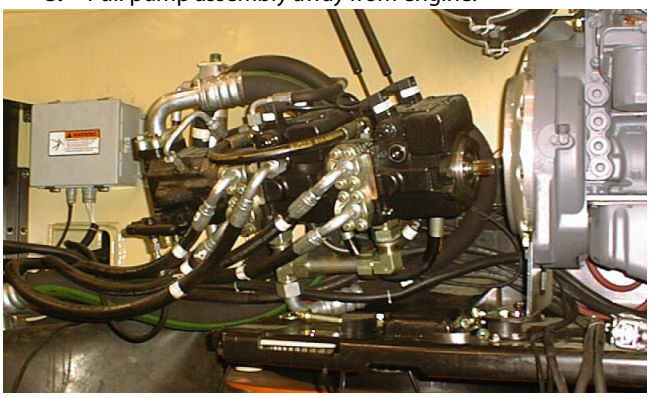
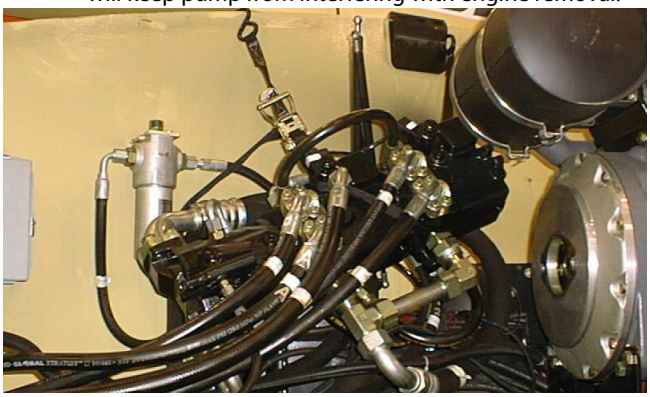
8. Pull pump assembly away from engine.

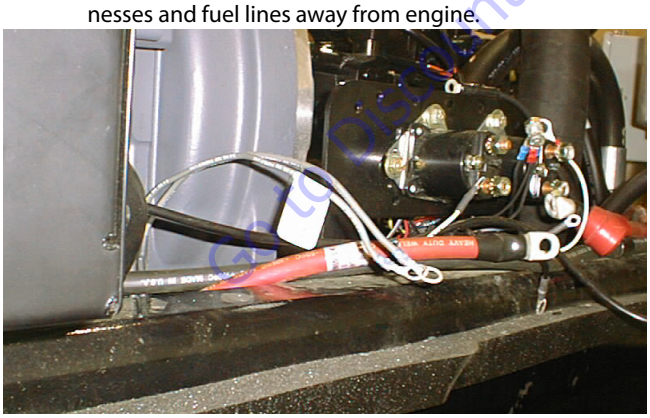


9. Using a ratchet strap, support pump in a position that will keep pump from interfering with engine removal.



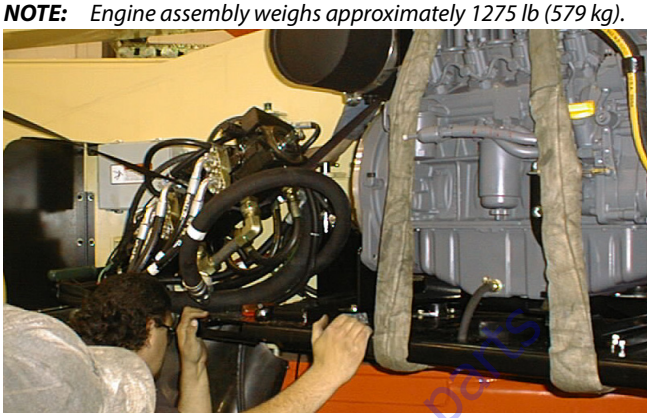
10. Disconnect all fuel lines from engine. Cap all open hoses to prevent fuel leakage.

11. Swing engine out to gain access to the back of the engine, and tag and disconnect all electrical wiring from relays, switches, etc. Carefully pull disconnected harnesses and fuel lines away from engine.

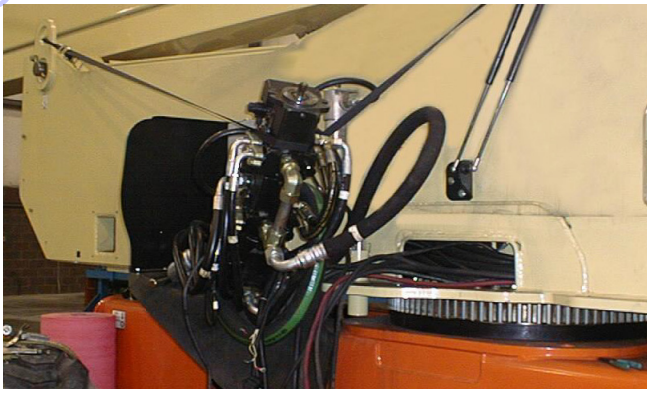


12. Using an adequate lifting device, support weight of the engine assembly. Remove pivot pin.

NOTE: *Engine assembly weighs approximately 1275 lb (579 kg).*



13. Carefully lift engine assembly away from machine.



14. If installing a new engine, transfer any necessary components from the old engine assembly onto the new Engine Assembly.

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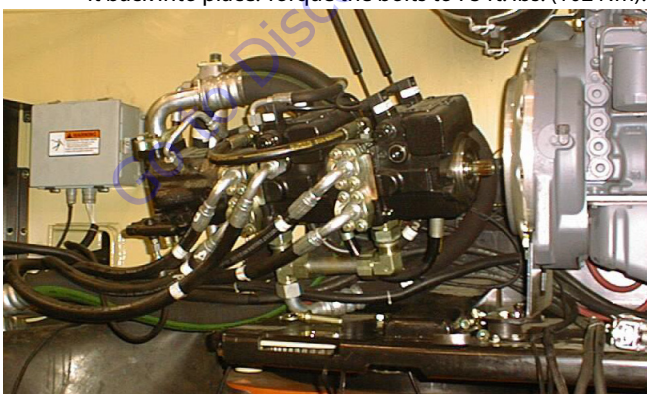
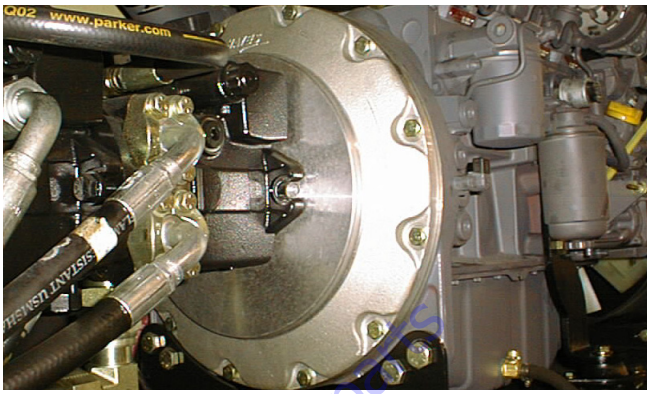
Installation

1. Using an adequate lifting device, support weight of the engine assembly and position it in place on the machine. Install engine pivot pin.

NOTE: *Engine assembly weighs approximately 1275 lb (579 kg)*

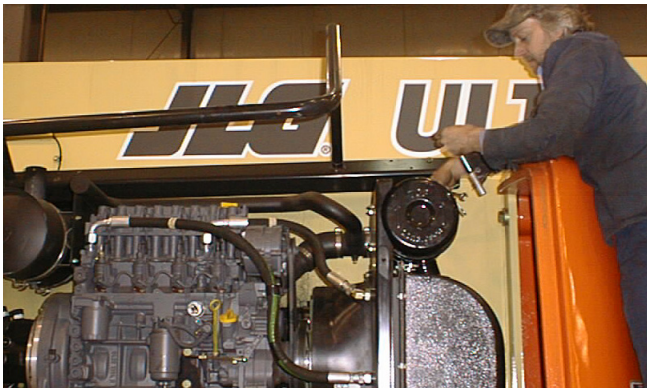
2. Route all wiring and fuel lines and connect them as tagged during removal.
3. Unstrap the pump, re-connect it to the engine and bolt it back into place. Torque the bolts to 75 ft. lbs. (102 Nm).





4. Lift hood support back into position. Install bolts and washers that secure hood support to hinges. Re-connect gas springs to hood support

NOTE: *Hood support weighs approximately 134 lb (61 kg)*



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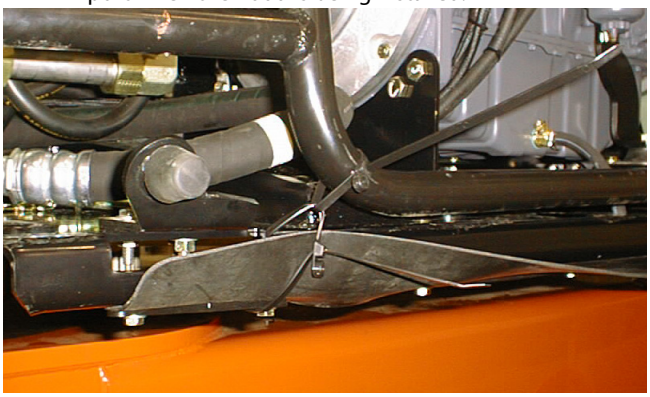
5. Use a tie strap as shown below to secure the hood support when the hood is being installed.



6. Carefully lift engine hood assembly onto hood support.

NOTE: *Engine hood assembly weighs approximately 84 lb (38 kg).*

7. Install bolts and clamps that secure engine hood assembly to hood support.

8. Start engine and check for proper operation and any leakage. If engine does not start immediately, fuel lines may need primed.

NOTE: *The delay in starting the engine can be reduced by removing the fuel filter, pre-filling the filter with fuel, and reinstalling the filter before attempting to start engine.*

3.29 DEUTZ EMR 2 (SN 87575 TO PRESENT)

NOTE: *SN's 85693 & 85910 also incorporated EMR2.*

The EMR2 consists of the sensors, the control unit and the actuator. Engine-side controls as well as the JLG Control System are connected by means of separate cable harnesses to the EMR control unit.

The sensors attached to the engine provide the electronics in the control unit with all the relevant physical parameters In accordance with the information of the current condition of the engine and the preconditions (throttle position etc.), the EMR2 controls an actuator that operates the control rod of the injection pump and thus doses the fuel quantity in accordance with the performance requirements.

The exact position of the regulating rod is reported back and, if necessary, is corrected, by means of the control rod travel sensor, situated together with the rotation magnets in a housing of the actuator.

The EMR2 is equipped with safety devices and measures in the hardware and software in order to ensure emergency running (Limp home) functions.

In order to switch the engine off, the EMR2 is switched in a de-energized fashion over the ignition switch. A strong spring in the actuator presses the control rod in the de-energized condition into the zero position. As a redundancy measure, an additional solenoid serves for switching off and this, independently of the actuator, also moves the control rod in the de-energized condition into the zero position.

After programming, carried out over the ISO9141 interface, the EMR2 is possesses a motor-specific data set and this is then fixedly assigned to the engine. Included in this are the various application cases as well as the customer's wishes regarding a particular scope of function.

Each EMR2 module is matched by serial number to the engine. Modules cannot be swapped between engines.

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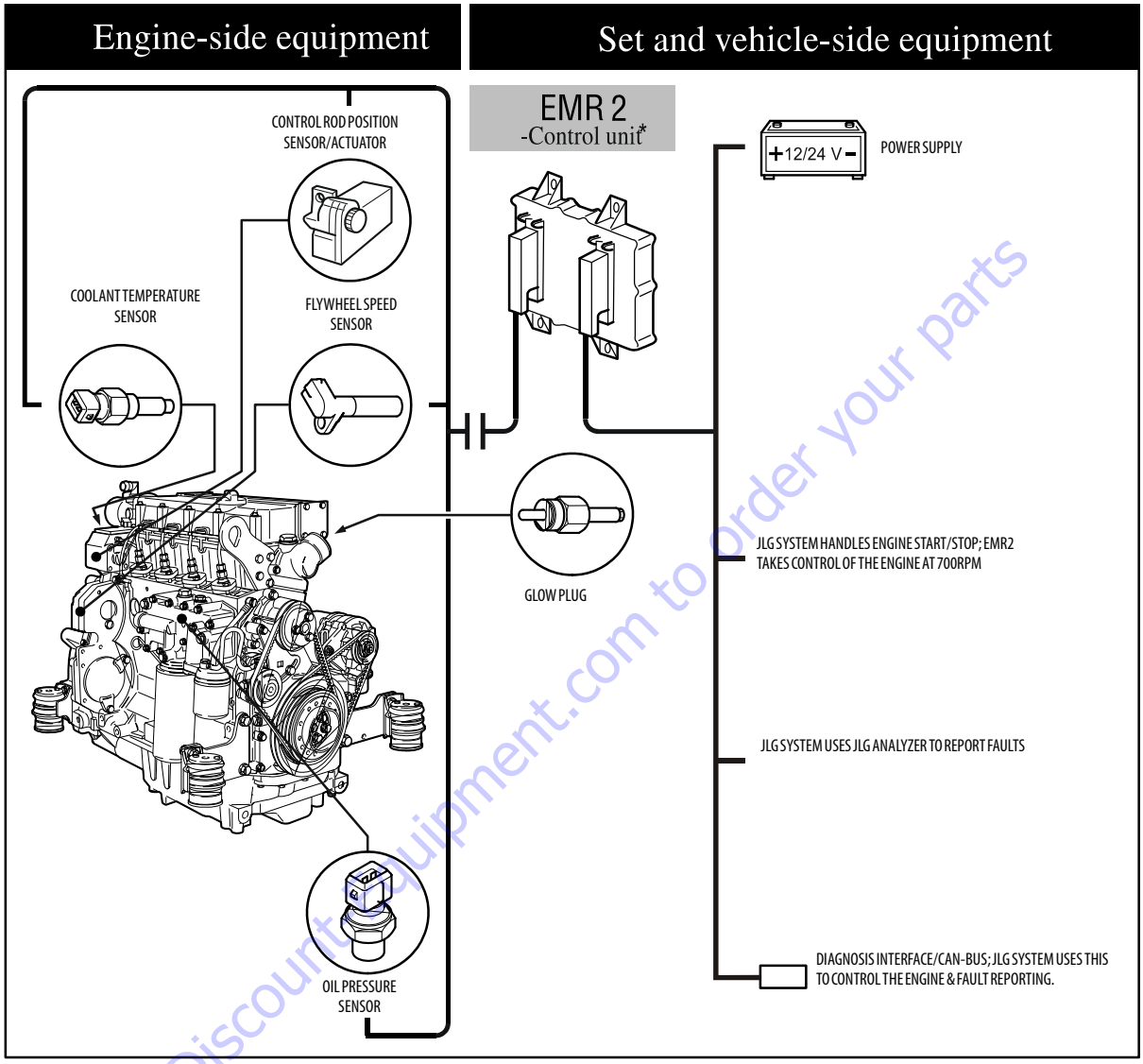

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Figure 3-81. EMR 2 Engine Side Equipment

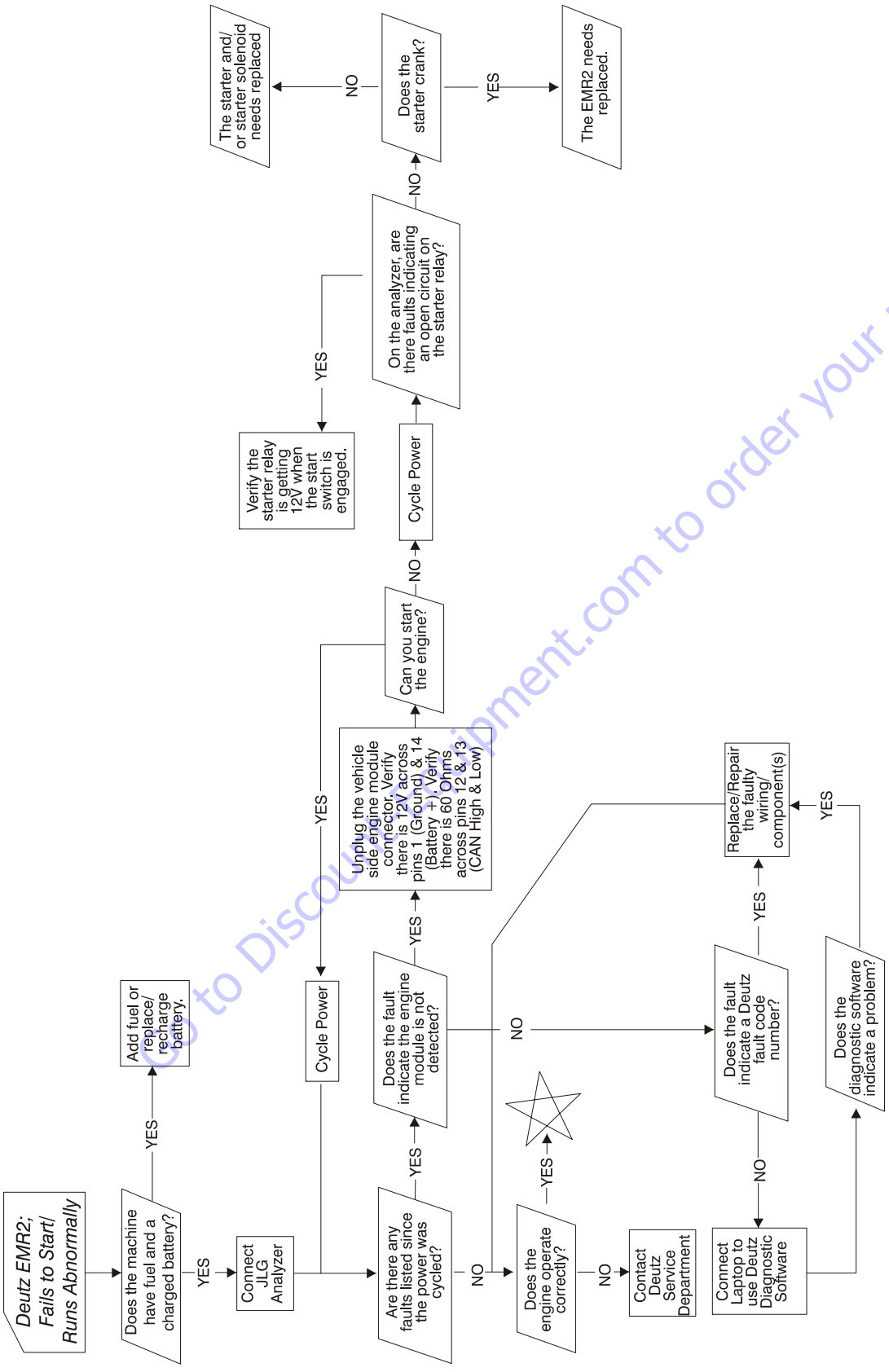

Figure 3-82. Deutz EMR 2 Troubleshooting Flow Chart

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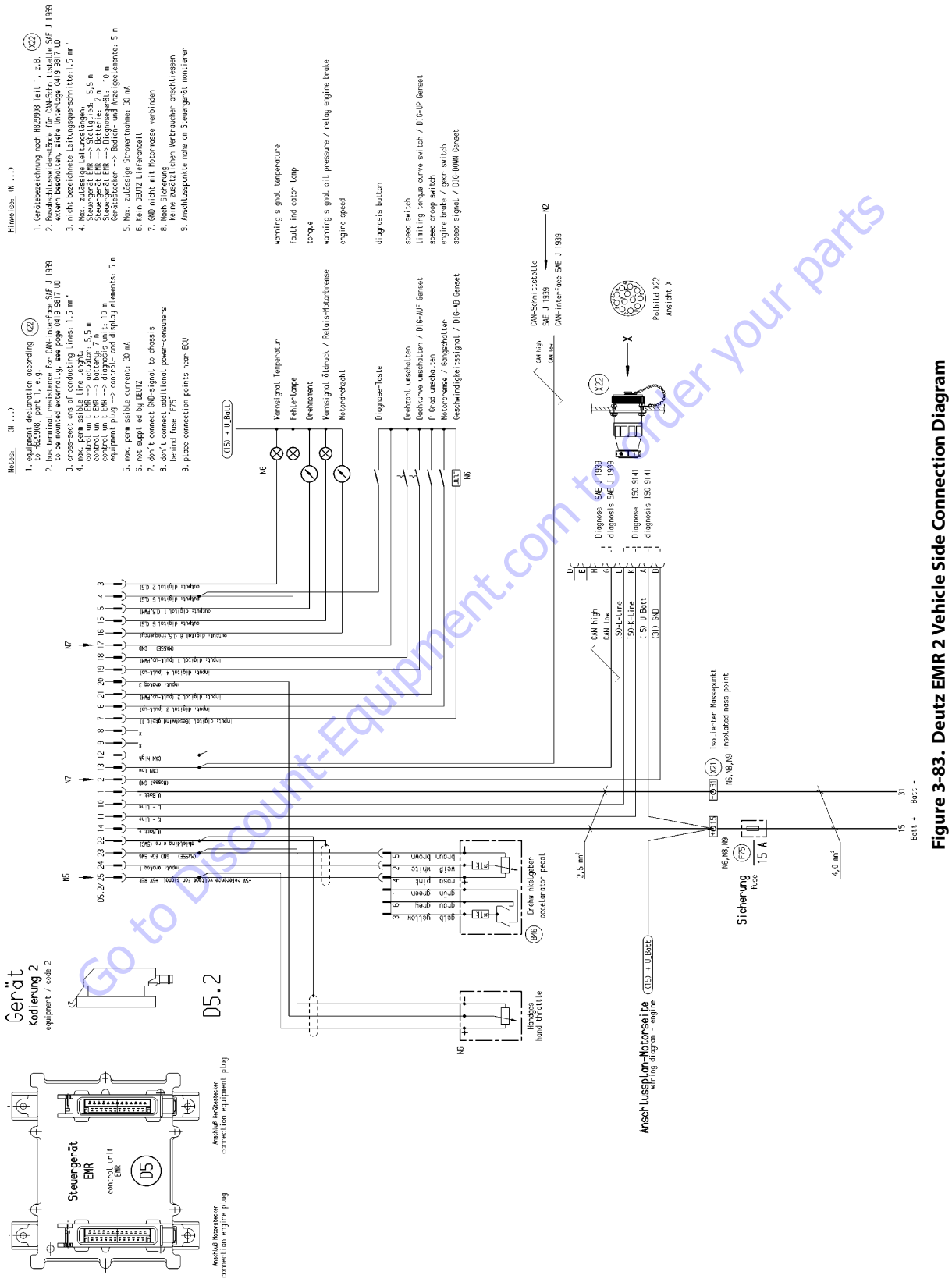

Figure 3-83. Deutz EMR 2 Vehicle Side Connection Diagram

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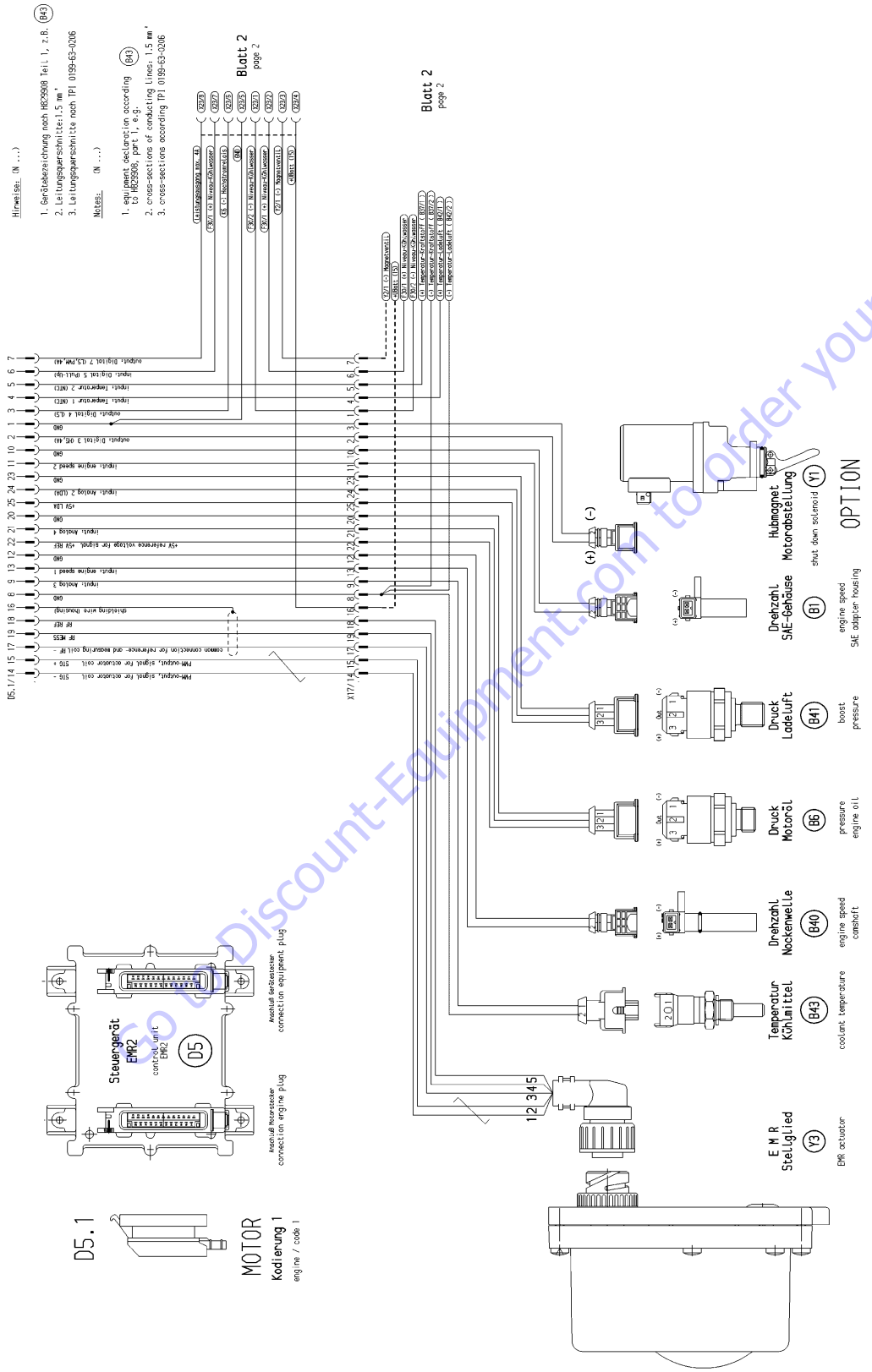

Figure 3-84. Deutz EMR 2 Engine Side Connection Diagram - Sheet 1 of 2

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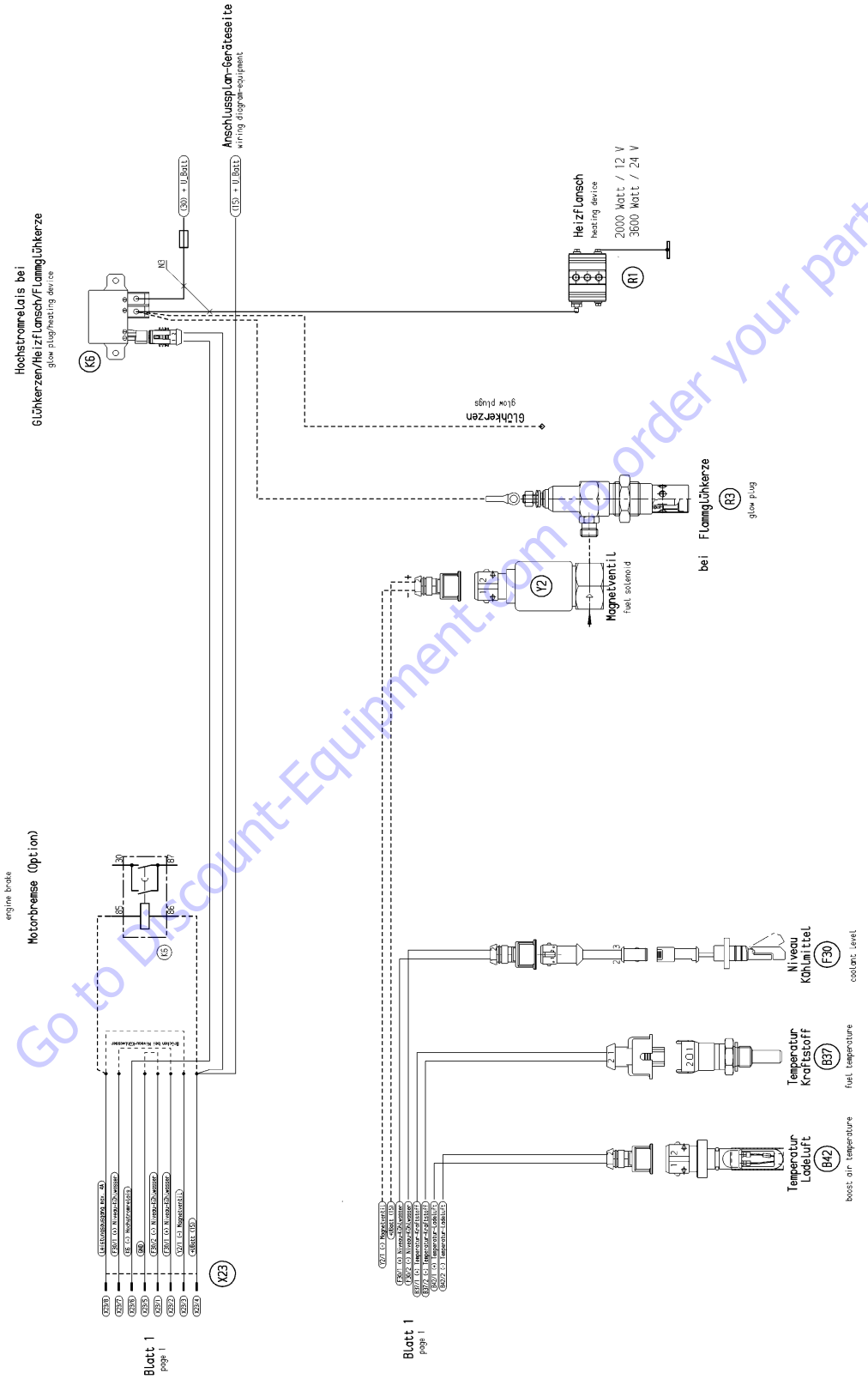

Figure 3-85. Deutz EMR 2 Engine Side Connection Diagram - Sheet 2 of 2

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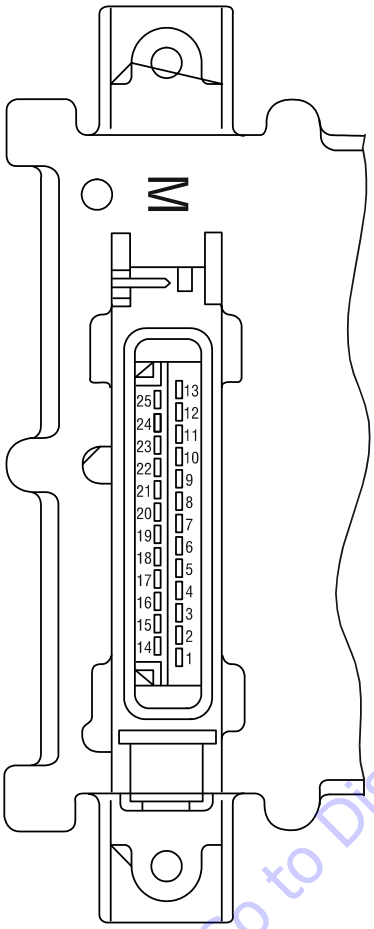

Pin No.	Designation	Description
1	Reserve	Reserve
2	Output: digital 3	Digital output for solenoid [1)]
3	Output: digital 4	For heating flange (optional)/ glow plug (optional)
4	Input (optional) Temp 1	Fuel temperature [2)]
5	Input (optional) Temp 2	Charge air temperature
6	Input (optional) DigIn 5	Coolant level / oil level
7	Output: PWM2/digital 6	
8	GND	Reference potential for analog signal at pin 9
9	Input: analog 7	Analog input for Coolant temperature sensor (NTC)
10	GND	Reference potential for analog signal at pin 11
11	Multi-function input: speed 2/DigIn 2	Digital input second engine speed (crankshaft) (optional) and speed signal (optional)
12	GND	Reference potential for analog signal at pin 13
13	Input: speed 1	Digital input first engine speed (camshaft)
14	STG -	PWM output, signal for actuator coil
15	STG +	PWM output, signal for actuator coil
16	Screen	Screening regulating rod travel sensor (for lines 17, 18, 19)
17	RF -	General connection for reference and measuring coil
18	RF REF	Analog input, reference signal of the reference coil
19	RF MESS	Analog input, measuring signal of the measuring coil
20	GND	Reference potential for signal at pin 21
21	Input: analog 4/digital 9	Analog input 4 (sensor signal oil pressure sensor) or digital input 9
22	+5 V REF	+5 V Reference voltage for signal at pin 21 (max. 15 mA)
23	GND	Reference potential for signal at pin 24
24	Input: analog 2/digital 7	Analog input 2 (sensor signal charge air) or digital input 7
25	+5 V LDA	+5 V Reference potential for signal at pin 24 (max. 15 mA)

1) For continuous power: < 4 A
2) Corresponds to special function"fuel temperature compensation at the EMR (0211 2571)

Figure 3-86. EMR 2 Engine Plug Pin Identification

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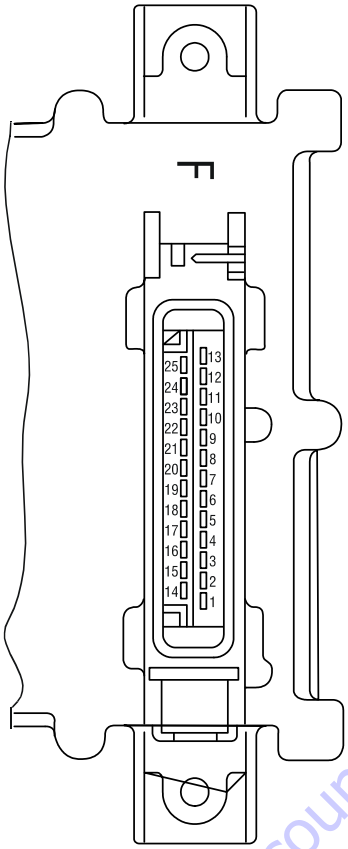

Pin-No.	Designation	Description
1	U Batt -	Negative pole at battery (clamp 31)
2	GND	Reference potential for signal
3	Output: digital 2	PWM or digital output, various functions
4	Input / output: DigInOut	Fault lamp and diagnostic button
5	Output: PWM 1/Dig 1	PWM or digital output, various functions
6	Multi-function input: DigIn 3	Genset applications/gear shift/motor brake
7	Input: digital 10/velocity	Speed signal (tacho input)
8	NC	Not occupied
9	NC	Not occupied
10	L-line	Serial ISO 9141 interface
11	K-line	Serial ISO 9141 interface
12	CAN high	Interface for CAN-Bus
13	CAN low	Interface for CAN-Bus
14	U Batt +	Positive pole for battery (clamp 15)
15	Output: digital 5	Digital output, various functions
16	Output: digital 7/Frequency	Frequency, PWM or digital output, various functions
17	Ground	Reference potential for signal at pins 18, 19 and 21
18	Input: digital 1 / PWM 1	PWM 1 or digital input 1, various functions
19	Multi-function input: DigIn 4	Performance curve switching/genset applications
20	Multi-function input: digital 8 / analog 3	Hand hand throttle/genset applications, Digital (8) or analog input (3)
21	Input: digital 2 / PWM 2	PWM 2 or digital input 2, various functions
22	Screen	Screening (e.g. for lines hand throttle or PWG)
23	GND	Reference potential for signal at pin 24
24	Input: analog 1 / digital 6	Analog input 1 (pedal value sensor, PWG) or digital input 6
25	+5 V REF	+5 V Reference voltage for signal at pin 24

Figure 3-87. EMR 2 Vehicle Plug Pin Identification

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Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Zero error display	-	No faults	524287	31	No **active** faults present		
Revolutions / speed acquisition	01	Speed sensor 1	190	8	Sensor failure. Distance from gear too far. Additional fault impulses. Cable joint interrupted.	Governor in emergency operation (if sensor 2 available). Emergency switch-off (if sensor 2 not available or failed). Governor in emergency operation (with sensor 1) Emergency switch-off (if sensor 1 not available or failed).	Check distance. Check cable connection. Check sensor and replace if required.
	03	Speed sensor	84	8	Tacho failed. Additional fault impulses. Cable connection interrupted.	Governor in emergency operation.	Check cable connection and Tacho. Replace if required.
	04	Excess speed switch-off	190	0	Speed was/is in excess of limit.e.	Engine stop.	Check parameter (21). Check speed settings.
					Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator (impulse on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.		
Sensors	07	Charge air pressure	102	2	Fault at corresponding sensor entry (e.g. short circuit or cable break).	With failure of the sensor, the associated monitoring function is de-activated.	Check sensor cable. Check sensor and replace if required. Check fault limits for sensor.
	08	Oil pressure	100	2			
	09	Coolant temperature	110	2			
	10	Charge air temperature	105	2			
	11	Fuel temperature	174	2			

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-88. EMR2 Fault Codes - Sheet 1 of 5

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Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Functional fault warning	30	Oil pressure warning	100	1	Oil pressure below speed-dependent warning line characteristic	Fault message (disappears when oil pressure is again above recovery limit). After a delay time - fill limitation.	Check engine (oil level, oil pump). Check oil pressure sensor and cable. Check oil pressure warning line characteristic.
	31	Coolant temperature warning	110	0	Coolant temperature has exceeded warning level.	Fault message (disappears when coolant temperature again drops below recovery level). After a delay time - fill limitation.	Check coolant. Check coolant temperature sensor and cable.
	32	Charge air temperature warning	105	0	Charge air temperature has exceeded warning level.	Fault message (disappears when charge air temperature gain drops below recovery level). After a delay time - fill limitation.	Check charge air. Check charge air-temperature sensor and cable.
	34	Coolant level warning	111	1	Switch input “Low coolant level” is active.	Fault message.	Check coolant level. Check coolant level sensor and cable.
	35	Speed warning (with thrust mode operation).	SID 190	14	revolutions was/is above (top) revolution speed limit. “Thrust mode” function is active.		Check parameters. Check speed settings.
					Check PID setting. Check rods. Check actuator and replace if required. Check cable to actuator. Check speed sensor (impulses on incorrect speed). Check No. of teeth. For vehicles check for possible thrust mode.		
	36	Fuel temperature warning	174	0	Fuel-temperature has exceeded warning level.	Fault message (disappears when fuel temperature again drops below recovery level).	Check fuel. Check fuel temperature sensor and cable.

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NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-89. EMR2 Fault Codes - Sheet 2 of 5

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Functional fault, switch-off	42	Charge air temperature switch-off	105	0	Charge air temperature has exceeded switch-off limit.	Emergency stop	Check charge air. Check charge air-temperature sensor and cable. Check switch-off limit.
	44	Coolant level switch-off	111	1	Switch input “Low coolant level” is active.	Emergency stop. Start lock.	Check coolant level. Check coolant level sensor and cable.
Actuator	50	Feedback	SID 24	12	Actuator not connected. Fault in actuator confirmation.	Emergency switch-off. Actuator cannot be operated.	Check actuator, replace if required. Check cable, check fault limits for “Confirmation”.
	52	Reference feedback	SID 24	13			Check actuator, replace if required. Check cable, check fault limits for “Rifeness confirmation”.
	53	Control travel difference	SID 23	7	Injection pump/actuator jammed or not connected. Difference between nominal/actual control travel is > 10 % of the overall control path.	Fault message (disappears when difference is < 10 %).	Check actuator/actuator rods / injection pump, replace if required. Check actuator cable.
	59	Auto calibration BOSCH-EDC pumps faulty operation	SID 23	13	No automatic actuator equalization possible. Incorrect input of the actuator reference values.	Engine stop / start lock. Governor cannot be taken into use. EDC actuator calibration required.	Check actuator and replaced if required. Check feedback cable. Check fault limits and reference values of the feedback. Program the fault limits for feedback, save values. Switch ignition off and on again.Check again. If faulty, inform DEUTZ-Service and carry out automatic equalization again. Set fault limits again.

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-90. EMR2 Fault Codes - Sheet 3 of 5

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Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Hardware inputs/ outputs	60	Digital output 3 (Switch-off solenoid, pin M 2)	SID 51	2	Fault (short circuit / cable break) at digital output.	Driver level is switched off.	Check cable of digital output (cable break or short circuit).
	62	Digital output 6, pin M 7	SID 60	2		Fault message.	
	63	Excess voltage switch-off solenoid	SID 51	6			
	67	Error Hand Setp1	91	11			
	68	Error CAN Setp1	898	2			
Communi-cation	70	CAN-Bus controller	SID 231	12	CAN-controller for CAN-bus is faulty. Fault removal despite re-initialising continuously not possible	Application-dependent.	Check CAN connection, terminating resistor (see Chapter 12.4), Check control unit.
	71	CAN interface SAE J 1939	SID 231	9	Overflow in input buffer or a transmission cannot be placed on the bus.		
	74	Cable break, short circuit or bus-error	SID 231	14			Check CAN connection, cable connection. Check sensor and replace if required.
Memory	76	Parameter programming (write EEPROM)	SID 253	12	Fault in parameter programming in the governor fixed value memory.	Emergency switch-off. engine cannot be started.	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service
	77	Cyclic program test	SID 240	12	Constant monitoring of program memory shows error (so-called “Flash-test”).		
	78	Cyclic RAM test	SID 254	2	Constant monitoring of working memory shows error.		Note values of parameters (3895 and 3896). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.

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NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-91. EMR2 Fault Codes - Sheet 4 of 5

Fault group	Fault no. (in SERDIA)	Fault locality/ Fault description	SPN	FMI	Cause	Remarks	Help
Control unit hardware	80	Power supply (Actuator)	SID 254	2	Power supply for actuator not in the permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	83	Reference voltage 1	SID 254	2	Reference voltage for actuator not in the permissible range.	Fault message (disappears when power again in the normal range). Auxiliary value 5 V	Check voltage supply. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	84	Reference voltage 2	SID 254	2			
	85	Reference voltage 4	SID 254	2			
	86	Internal temperature	171	12	Internal temperature for control unit not in permissible range.	Fault message (disappears when power again in the normal range).	Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	87	Atmospheric pressure	108	12	Atmospheric pressure not in permissible range.	Fault message (disappears when power again in normal range). Atmospheric pressure monitoring function de-activated.	
Program logic	90	Parameter fault (EEPROM retrieval or checksum faulty).	SID 253	2	No data found or checksum of data is faulty (note: fault only occurs during setting of parameter / saving or reset.).	Engine cannot be started.	Check data for correct settings. Save parameters. Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	93	Stack overflow	SID 240	2	Internal calculation fault (so-called “Stack overflow” fault).	Emergency switch-off. Engine cannot be started.	Note parameters (3897 and 3898). Switch ignition off and on again. Check again. If faulty inform DEUTZ Service.
	94	Internal fault	SID 254	2			

NOTE: SID is equal to 512. To get SPN #, add 512 + number. For example, SID 254 would be 512+254 or an SPN of 766.

Figure 3-92. EMR2 Fault Codes - Sheet 5 of 5

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3.30 BIO FUEL IN DEUTZ ENGINES

General

Use of bio fuels is permitted for the compact engines made by DEUTZ.

Distillate fuels with residue oil percentages or mixed fuels may not be used in DEUTZ compact engines.

The DEUTZ vehicle engines are designed for diesel fuels in accordance with EN 590 with a cetane number of at least 51. DEUTZ engines for mobile machinery are designed for a cetane number of at least 45. When using fuels of a low cetane number, disturbing white smoke and ignition misfires are to be expected under some circumstances.

A cetane number of at least 40 is permissible for the US market, therefore special engine models have been developed to avoid starting difficulties, extreme white smoke or increased hydrocarbon emissions (EPA specification - US EPA REGULATIONS FOR LARGE NONROAD COMPRESSION-IGNITION ENGINES).

If the white smoke behavior is unacceptable when using a very low cetane number, the use of ignition improvers is to be recommended as a later remedial measure.

The certification measurements for compliance with the legal emission limits are carried out with the test fuels prescribed by law. These correspond to the diesel fuels in accordance with EN 590 and ASTM D 975. No emission values are guaranteed with the other fuels described. It is the obligation of the owner to check the permission for use of the fuels in accordance with regional regulations.

Bio Fuel

PERMITTED BIO-DIESEL FUELS

Originally only rape seed oil methylester (RME) was sold as a bio-diesel fuel in Europe but fatty acid methylester (FAME) based on other oils have come onto the market increasingly in recent years. However, with the latter there is a risk that the limit values of EN 14214 are not kept in the field. Anyone who uses bio-diesel fuel in DEUTZ engines must therefore choose his supplier very carefully and have him guarantee compliance with the EN 14214 limit values. Since experience has shown that rape seed oil methylester (RME) exceeds the limit values less often that other esters, it is expressly recommended to use only rape seed oil methyester. DEUTZ customers in Germany can additionally ensure the quality by buying bio-diesel fuel with an AGQM certificate (Arbeitsgemeinschaft Qualitäts-Management Biodiesel e.V.).

The use of US bio-diesel based on soy oil methylester is only permissible in mixtures with diesel fuel with a bio-diesel part of a max. 20 weight-%. The US bio-diesel used for the mixture must comply with the ASTM D6751-07a (B100) standard.

APPROVED ENGINES

The 912, 913, 914, 1011, 2011, 1012, 2012, 1013, 2013, 413 and 513 series are approved for bio-diesel from year of manufacture 1993 under compliance with the basic conditions specified below.

BASIC CONDITIONS TO BE OBSERVED

- A power loss of 5-9% in relation to diesel fuel in accordance with EN 590 is possible due to the lower heating value. Blocking of the fuel injector is not allowed.
- The lubricating oil quality must correspond to TR 0199-99-3002. The lubricating oil change interval must be halved in relation to operation with diesel fuel in accordance with EN 590.
- Standstills of longer than 4 to 6 weeks must be avoided with bio-diesel. Otherwise the engine must be started and stopped with diesel fuel.
- Bio-diesels can be mixed with normal diesel fuel but the basic conditions described in this subsection apply for mixtures. Mixtures with up to 5% (m/m) bio-diesel (B5) which have recently been on sale at European fuel stations are excepted. These fuels must be treated like normal diesel fuels because EN 590 expressly permits adding up to 5% (m/m) bio-diesel in accordance with EN 14214.
- Approx. 30-50 hours after changing over from diesel fuel to bio-diesel, the fuel filter should be changed as a preventive measure to avoid a drop in performance due to clogged fuel filters. Deposited fuel ageing products are dissolved by bio-diesel and transported into the fuel filter. They should not be changed immediately but after approx. 30 to 50 hours because the dissolving of dirt takes a certain amount of time.

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PLANT OIL

NOTICE

PURE PLANT OILS (E.G. RAPE SEED OIL, SOY OIL, PALM OIL) ARE NOT CLASSIFIED AS BIO-DIESEL AND EXHIBIT PROBLEMATICAL PROPERTIES FOR DIESEL ENGINE OPERATION (STRONG TENDENCY TO COKE, RISK OF PISTON SEIZURE, EXTREMELY HIGH VISCOSITY, POOR EVAPORATION BEHAVIOR.

Conversion of DEUTZ engines to rape seed oil fuel operation with conversion kits and modified tanks systems of various manufacturers is not allowed and leads to loss of warranty rights.

Biological Contamination In Fuels

SYMPTOMS

The following symptoms may indicate a fuel tank is contaminated by micro-organisms:

- Internal tank corrosion,
- Filter blockage and the associated loss of power due to gel-like deposits on the fuel filter (especially after long stand-stills)

CAUSE

Micro-organisms (bacteria, yeasts, funguses) can form bio-sludge under unfavorable conditions (favored particularly by heat and water).

Penetration by water is usually caused by condensation of the water in the air. Water does not dissolve in fuel so that the penetrating water collects at the bottom of the tank. The bacteria and funguses grow in the watery phase, at the phase boundary to the fuel phase, from which they draw their nutrition. There is an increased risk especially with bio-diesel (FAME).

PREVENTIVE MEASURES

- Keep storage tank clean, regular cleaning of the tank by specialist companies
- Installation of fuel pre-filters with water traps, especially in countries with frequently fluctuating fuel qualities and high percentage of water.

If the fuel system and storage tank have already been attacked by micro-organisms. The biocide must be dosed according to the manufacturer's specifications.

- Avoid direct exposure of the storage tank to sunlight
- Use smaller storage tanks with corresponding low dwell times of the stored fuel

FUEL ADDITIVES

Use of fuel additives is not permitted. The flow improvers mentioned above are an exception. Use of unsuitable additives will result in loss of warranty.

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3.31 DEUTZ TURBOCHARGER OPERATION

Good engine operating procedures are essential to prolong turbocharger life.

Particular attention to oil system and air system will eliminate the two main causes of turbocharger failure. To prevent this Operators/Owners must ensure that :-

1. Air and oil filters are checked regularly to the manufacturer's specifications.
2. Engine maintenance intervals are adhered to.
3. Engine and equipment are operated in such a way that is not harmful to the life of the turbocharger.

Operating Practices

Operators and owners can get maximum service life from their turbochargers if a few good practices are followed:

START UP

When starting the engine use minimum throttle and run in idle mode for approximately one minute. Full working oil pressure builds up within seconds but it is useful to allow the turbocharger moving parts to warm up under good lubricating conditions. Revving the engine within the first few seconds of start up causes the turbocharger to rotate at high speeds with marginal lubrication which can lead to early failure of the turbocharger.

AFTER SERVICING

After servicing the engine or turbocharger, ensure the turbocharger is pre-lubed by adding clean engine oil into the turbocharger oil inlet until full. After pre-lubing, crank the engine without firing (engine/fuel pump stop out) to allow oil to circulate through the full system under pressure. On starting the engine, run at idle for a few minutes to ensure the oil and bearing systems are operating satisfactorily.

LOW AIR TEMPERATURES & INACTIVE OPERATION

If the engine has been inactive for some time or the air temperature is very low, crank the engine first and then run at idle. This allows the oil to circulate throughout the full system before high loads and speeds are applied to engine and turbocharger.

SHUT DOWN

Before shutting the engine down, let the turbocharger cool down. When an engine runs at maximum power/high torque, the turbocharger is operating at very high temperatures and speeds. Hot shut down can cause reduced service life which is avoidable by a minute or two of idling. Most mobile equipment applications include an adequate cooling period during parking or mooring procedures.

Allow the engine to idle for 1-5 minutes to allow the high temperatures and speed to reduce and thus prolong the life of the turbocharger.

ENGINE IDLE

Avoid running the engine for long periods in idle mode (greater than 20-30 minutes). Under idling conditions low pressures are generated in the turbocharger which can cause oil mist to leak past seals into the two end housings. Although no real harm is done to the turbocharger, as load is applied temperatures increase and the oil will start to burn off and cause blue smoke emission problems.

If the engine is allowed to Idle for a period of time, lube oil will continue to flow cooling the turbine shaft.

You can also see spots on the turbo where grooves have been "worn" in to the turbine shaft at the point where the radial bearing sits. Dirty oil/contaminates in the oil can become trapped in between the radial bearing and the surface of the shaft becoming abrasive and ultimately grinding away the material.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
978	1-2-6	29	2	Diagnostic fault check of synchronism of hand throttle and Low idle switch(LIS).	Plausibility error between sensor and idle switch	Threshold for error detection is an internal ECU threshold. The accelerator pedal must have detected full load and idle plausibility at least once.
932	1-2-6	29	3	Diagnostic fault check of short circuit to supply voltage (signal range check high) of acceleration pedal signal.	The signal exceeds the applicatable threshold; signal range violation	If the signal is below the applicatable threshold APP_uRawSRCHiHTLIS_C, the signal range violation is reset after the healing debouncing. In case when the CCP is active (CCP_stActive = 1)and the reading from the EEPROM memory is successful, the signal is below the threshold APP_uHTLISCCPHi[1], a signal range violation is reset after debouncing.
937	1-2-6	29	4	Diagnostic fault check of short circuit to ground (signal range check low) of acceleration pedal signal	The signal is below the applicatable threshold; signal range violation	If the signal exceeds the applicatable threshold APP_uRawSRCLoHTLIS_C, the signal range violation is reset after the healing debouncing. In case when the CCP is active (CCP_stActive = 1)and the reading from the EEPROM memory is successful, the signal exceeds the threshold APP_uHTLISCCPLo[1], a signal range violation is reset after debouncing.
935	2-2-6	91	3	Analog accelerator pedal sensor 1 or double accelerator pedal sensor: the voltage measured by ECU is out of the target range or the calculated pedal position is implausible compared with the position of the second pedal	Sensor defect. Short cut to battery or open loop.	Check cabling, check accelerator pedal sensor and if necessary replace it, check connection cable and if necessary repair or replace it. If the signal is below the applicatable threshold APP_uRaw1SRCHigh_C, the signal range violation is reset after the healing debouncing.
940	2-2-6	91	4	Analog accelerator pedal sensor 1 or double accelerator pedal sensor: the voltage measured by ECU is out of the target range or the calculated pedal position is implausible compared with the position of the second pedal	Short circuit to ground.	Check cabling, check accelerator pedal sensor and if necessary replace it, check connection cable and if necessary repair or replace it If the signal exceeds the applicatable threshold APP_uRaw1SRCLow_C, the signal range violation is reset after the healing
976	2-2-6	91	11	Diagnostic fault check of synchronism of single potentiometer and Low idle switch(LIS).	Measured voltage of accelerator pedal 1 is out of plausible range.	Threshold for error detection is an internal ECU threshold. Check cabling, check accelerator pedal and pedal sensor and if necessary replace it, check connection cable and if necessary repair or replace it. When the PWM period APP_tiPWMPer is in between APP_tiSRCLoPWMPer_C and APP_tiSRCHiPWMPer_C.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
474	216	94	1	Low fuel pressure: the low fuel pressure calculated by ECU is underneath the target range; the ECU activates a system reaction	Fuel pressure below warning threshold	Check low fuel pressure system (fuel feed pump, relay , fuse, wiring, sensor) and if necessary repair or replace it.
472	216	94	3	Low fuel pressure sensor: the voltage of sensor measured by ECU is out of the target range	cable break or short circuit, sensor defective, connection cable damaged Short cut to battery or open loop	Check cabling, if sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
473	216	94	4	Low fuel pressure sensor: the voltage of sensor measured by ECU is out of the target range	cable break or short circuit, sensor defective, connection cable damaged short cut to ground	Check cabling, if sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
464	228	97	3	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range	Sensor not connected or sensor defect.	Check of wiring and water in fuel sensor. Check cabling, if charge Water in Fuel sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
465	228	97	4	Fuel filter water level sensor: the voltage of sensor measured by ECU is out of the target range.	cable break or short circuit, sensor defective, connection cable damaged. Short cut to ground.	Check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
1157	228	97	12	Fuel filter water level sensor: the maximum level is exceeded	Water level in fuel pre-filter reservoir over limit (bad fuel quality)	Measure Voltage at Water in Fuel Sensor and renew harness if needed.
736	231	100	1	Oil pressure is below the target range (warning threshold)	Oilpressure too low (pressure below warning threshold)	Threshold for error detection is an internal ECU threshold. Check oil level, check engine for oil leckage, measure oil pressure external to evaluate sensor value
737	231	100	1	Oil pressure is below the target range (shut off threshold)	Oilpressure too low (pressure below shut off threshold).	Threshold for error detection is an internal ECU threshold. Check oil level, check engine for oil leckage, measure oil pressure external to evaluate sensor value.
732	224	100	3	Oil pressure sensor: the voltage of sensor measured by ECU is out of the target range	short circuit to battery or cable break	check battery and wiring Check cabling. If sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
733	224	100	4	Oil pressure sensor: the voltage of sensor measured by ECU is out of the target range	Short circuit to ground	The sensed raw voltage value Oil_uRawPSwmp is above Oil_SRCPSwmp.uMin_C Check cabling, if sensor not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it No detail informationen!
774	223	102	1	charge air pressure below lower limit	measured charge air pressure below the threshold.	Check complete air system of engine for massive leakage, especially from compressor to intake air manifold. Check air filter. Exchange charge air presure sensor.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
88	223	102	2	Charge air pressure messured by sensor is above the shut off threshold.	Charged air cooler pressure below threshold.	Check waste gate system if necessary replace TC, check CAC if all channels are clean,check charge air piping if nececery.
89	223	102	2	Charge air pressure messured by sensor is above the warning threshold	Charge air pressure above shut off threshold	Check waste gate system if necessary replace TC, check CAC if all channels are clean, check charge air piping if necessery.
772	223	102	2	Deviation between sensed intake manifold pressure is not plausible compared to environment pressure. Which sensor is not okay can not be said.	deviation between ambient pressure sensor and charge air pressure sensor at not running engine to high	1) Exchange boost pressure sensor 2) Exchange ECU
776	223	102	3	Charge air pressure sensor: the measured voltage of sensor by ECU is out of the target range	The Sensor Voltage is above the Threshold.	Check cabling, if charge air pressure/temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
777	223	102	4	Charge air pressure sensor: the measured voltage of sensor by ECU is out of the target range	The Sensor Voltage is below the Threshold.	Check cabling, if charge air pressure/temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
996	233	105	0	Charge air temperature downstream calculated by ECU is above the target range. The ECU activates a system reaction.	Charge air temperature (downstream) over warning threshold.	Check CAC system and clean it. Check fan functionality. Check cooling perfomance with temperature measurement.
997	233	105	0	Charge air temperature downstream calculated by ECU is under the shut down threshold. The ECU activates a system reaction.	Charge air temperature (downstream) over the low threshold.	Check CAC system and clean it. Check fan functionality. Check cooling perfomance with temperature measurement.
992	128	105	1	Charged Air cooler down stream temperature. Temperature below lower physical threshold.	Sensed temperature within intake air manifold < threshold.	actual temperature below -40°C? exchange sensor
994	128	105	3	Charge air temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to battery. sensor voltage > limit	The sensor raw signal Air_uRawTCACDs (voltage) > Air_SRCTCACDs.uMin_C. Check CAC-sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
995	128	105	4	Charge air temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to ground or open load. sensor voltage < limit.	The sensor raw signal Air_uRawTCACDs (voltage) is below Air_SRCTCACDs.uMin_C. Check CAC-sensor and if necessary replace it, check connection cable and if necessary repair or replace it
752	136	107	0	Air filter differential pressure: the pressure difference of the intake air between the filter inlet and outlet calculated by ECU is above the target range and the ECU activates a system reaction	Pressure loss above target range with system reaction, air filter clogged or defective, sensor not working, connection cable damaged Pressure value above warning threshold	Check airfilter and if necessary clean or renew it, check cabling, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
98	232	110	0	Coolant temperature: the coolant temperature calculated by ECU is above the target range; the ECU activates a system reaction	Cooling temperature too high. Coolant temperature above warning threshold	Clean radiator, check fan drive, check coolant level, check cooling system in general, check thermostat function, check water pump

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
99	232	110	0	Coolant temperature: the coolant temperature calculated by ECU is above the target range. The ECU activates a system reaction	Coolant temperature above shut off threshold.	Clean radiator, check fan drive, check coolant level, check cooling system in general, check thermostat function, check water pump
93	225	110	1	Coolant temperature sensor: the voltage of the sensor measured by ECU is out of the target range.	Suspected components:wiring harness, coolant temperature sensor.	Check wiring harness and connected Coolant Temp Sens.
96	225	110	3	Coolant temperature sensor: the voltage of the sensor measured by ECU is out of the target range	Short cut to battery or open load.	Check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
97	225	110	4	Coolant temperature sensor: the voltage of the sensor measured by ECU is out of the target range	Voltage Surveillance has found shortcut to Ground at Coolant Temperatur Sensor.	Check sensor and if necessary replace it, check connection cable and if necessary repair or replace it Measure Voltage at Coolant Temperature Sensor and renew harness if needed.
101	235	111	1	Coolant level: the coolant level calculated by ECU is underneath the allowed minimum.	Coolant level too low, leakage in cooling system, sensor defective, wiring damaged.	Check coolant level, inspect cooling system for leakage and if necessary repair it, check sensor and wiring
877	147	157	3	Rail pressure sensor: the voltage of sensor measured by ECU is out of the target range.	Short cut to battery. Damaged rail pressure sensor.	Check cabling, check rail pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
878	147	157	4	Rail pressure sensor: the voltage of sensor measured by ECU is out of the target range.	Check cabling, check rail pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.	Check cabling, check rail pressure sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
1381	839	164	2	Rail pressure safety function is not executed correctly	Rail pressure is still above threshold.	Threshold for error detection is an internal ECU threshold. Reset the fault and at reappearance check ECU and injection system
1180	318	168	0	Battery voltage: the voltage measured by ECU is out of the target range	Battery voltage over limit	Check alternator, regulator of alternator and if necessary replace it, check wiring and voltage of alternator
1181	318	168	1	Battery voltage: the voltage measured by ECU is out of the target range	Battery voltage below limit	Check alternator, cabling, contact resistance, safety fuses, too high load in energy system, check battery and if necessary replace it
47	318	168	2	Battery voltage: the voltage measured by ECU is out of the target range, system reaction is initiated	If Batteryvoltage (Ubatt_U) > 17V or 31V for mor than =0.5sec a warning is generated Battery voltage above warning threshold	Check wiring harness and connected alternator.
45	318	168	3	Battery voltage: the voltage measured by ECU is out of the target range, system reaction is initiated	Battery voltage above warning threshold (~38,9Volt), Short cut to battery possible.	Check wiring harness and connected alternator.
46	318	168	4	Battery voltage: the voltage measured by ECU is out of the target range, system reaction is initiated	Battery voltage below warning threshold, Short cut to ground	Check wiring harness and connected alternator.
417	312	171	3	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check high	open loop to sensor	Check cabling, if environment temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
418	312	171	4	Sensor error SCR-System environment temperature; DPF-System air inlet temperature; signal range check low	short circuit to Ground	Check cabling, if environment temperature sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it
1425	226	172	0	sensed intake air temperature at air filter > physical high limit	sensed intake air temperature at air filter > physical high limit	Check outside conditions: Temperature > Threshold within the intake air system of the engine? E.G: engine sucks in air from hot asphalt out of paver bucket Sensor positioned within black air filter housing above engine lid at hot environmental conditions and idling or similar? => if yes check with application team to adapt limits if not check sensor and wiring harness exchange sensor
1183	226	172	1	sensed air temperature within air intake path of engine below physical low limit	sensed air temperature within air intake path of engine below physical low limit	Cold start and ambient temperature < threshold Check wiring harness to AFST-sensor Exchange AFST-sensor
389	214	190	0	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Overspeed monitoring during 1 level of FOC (Failure overrun condition) if engine speed was over Limit.	check powertrain settings regarding overspeed
421	213	190	2	ECU measures a deviation between camshaft and crankshaft angle to target.	Offset error between crankshaft and camshaft.	Threshold for error detection is an internal ECU threshold, occurs by offset between crankshaft and camshaft. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Camshaft and Crankshaft senor or wiring.
419	212	190	8	Camshaft speed sensor: the ECU receives no signal and uses the signal from crankshaft speed sensor as alternative to calculate the engine speed	When disturbed camshaft signal detected. Error in sensor or wiring.	Threshold for error detection is an internal ECU threshold, occurs by disturbed camshaft signal. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Camshaft Sensor or wiring.
422	212	190	8	Sensor crankshaft speed; disturbed signal	Error in sensor or wiring. Crankshaft sensor defect.	Threshold for error detection is an internal ECU threshold, occurs by disturbed crankshaft signal. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Crankshaft Sensor or wiring.
390	214	190	11	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Overspeed monitoring during 2 level of FOC (Failure overrun condition) if engine speed was over limit.	check powertrain O settings regarding overspeed
420	212	190	12	Camshaft speed sensor: the ECU receives no signal and uses the signal from camshaft speed sensor as alternative to calculate the engine speed Threshold:	Error in sensor or wiring.	Threshold for error detection is an internal ECU threshold, occurs by disturbed or no camshaft signal. Check increment wheel position, clean and adjust if necessary, check sensor postition. Check Camshaft Sensor or wiring.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
423	212	190	12	Crankshaft speed sensor: the ECU receives no signal and uses the signal from camshaft speed sensor as alternative to calculate the engine speed.	Error in sensor or wiring.	Threshold for error detection is an internal ECU threshold, occurs by disturbed or no Crankshaft signal. Check increment wheel position, clean and adjust if necessary, check Crankshaft sensor postition or wiring.
391	214	190	14	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Overspeed monitoring during ORC (Override conditions) if engine speed was over 2900rpm	check powertrain settings regarding overspeed
1222	2-1-2	190	14	Camshaft- and Crankshaft speed sensor signal not available on CAN or defect.	Sensors for engine speed are defect.	Threshold for error detection is an internal ECU threshold. Check wiring, check cabels and repair or replace if necessary.
791	693	411	0	delta pressure across venturi in EGR line above physical high limit	sensed value of venturi difference pressure > high limit	Threshold for error detection is an internal ECU threshold. EGR-Valve blocked open EGR-Valve actuator defect EGR-cooler defect (check for coolant water) Reed Valve defect Intake throttle blocked in closed position => Check intake throttle Exhaust pressure too high => Check Exhaust pressure Check Nox-sensor upstream SCR catalyst dp venturi sensor defect
792	693	411	1	delta pressure across venturi in EGR line below physical low limit	sensed value of venturi difference pressure < low limit	Threshold for error detection is an internal ECU threshold. Check correct mounting of difference pressure sensor at venturi tube Exchange difference pressure sensor broken
795	693	411	3	The sensed raw voltage Air_uRawPEGRDeltaP is above the maximum threshold.	EGR Delta pressure Sensor defect	Check cabling, if charge EGR Delta pressure sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
381	693	411	4	Range check cannot be done or interrupted.	EGR or wiring defect	Check wiring harness and connected EGR.
796	693	411	4	The sensed raw voltage value Air_uRawPEGRDeltaP is above the minimum threshold.	EGR Delta pressure Sensor defect	Check cabling. If charge EGR Delta pressure sensor is not working, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
793	693	411	11	DFC is stored in EEPROM and status kept until check is allowed to be carried out again DFC can be reset by service routine 216	deviation between desired O2 concentration in intake air manifold and the real O2-concentration within intake air manifold > limit	Threshold for error detection is an internal ECU threshold. EGR-Valve mechanically blocked open or closed EGR-pipe blocked with metall plate instead sealing downstream EGR-Valve EGR-Valve actuator defect EGR-cooler defect (check for coolant water) Reed Valve defect Intake throttle blocked in closed position => Check intake throttle Exhaust pressure too high => Check Exhaust pressure Check Nox-sensor upstream SCR catalyst dp venturi sensor defect
1007	682	412	3	EGR downstream temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to battery. sensor voltage > limit	Check wiring harness to TEGR-sensor. Exchange TEGR-sensor.
1008	682	412	4	EGR downstream temperature sensor: the voltage of sensor measured by ECU is out of the target range.	Short circuit to ground or open load. sensor voltage < limit	Check wiring harness to TEGR-sensor. Exchange TEGR-sensor.
376	281	630	12	Internal hardware monitoring: the ECU finds an error during the access to its EEPROM memory or works with an alternative value	Section could not be erased	Threshold for error detection is an internal ECU threshold. There is no healing possible for the error. In the every new initialization phase, the debounce level is set to zero. If not programmed, EEPROM is defect --> ECU is defect, reprogramm ECU and if necessary replace it.
377	281	630	12	Internal hardware monitoring: the ECU finds an error during the access to its EEPROM memory or works with an alternative value	Minimum 3 blocks could not be readed, EEPROM has Checksum Error	There is no healing possible for the error. In the every new initialization phase, the debounce level is set to zero. If not programmed, EEPROM is defect -->ECU is defect, reprogramm ECU and if necessary replace it
378	281	630	12	Internal hardware monitoring: the ECU finds an error during the access to it's EEPROM memory or works with an alternative value	Block could not be written for minimum 3 times	Threshold for error detection is an internal ECU threshold. If not programmed, EEPROM is defect --> ECU is defect, reprogramm ECU and if necessary replace it.
84	271	639	14	CAN bus 0: the ECU is not allowed to send messages, because the status "BusOff" is detected.	CAN BusOff error; CAN 0 (Customer CAN)	Threshold for error detection is an internal ECU threshold. BusOff bit for CAN A node is set. Check wiring of CAN bus and if necessary repair it, check connection cable and if necessary repair or replace it, check resistance in CAN lines (120 Ohm)
580	154	651	3	Injector cyl. 1: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 1 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
568	154	651	5	Injector cyl. 1: interruption of electrical connection	Interruption of electronic connection Injector cyl. 1	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
581	155	652	3	Injector cyl. 2: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 2 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
569	155	652	5	Injector cyl. 2: interruption of electrical connection	Interruption of electronic connection Injector cyl. 2	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
582	156	653	3	Injector cyl. 3: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 3 wiring harness, cable break or short circuit, sensor defective, connection cable damaged	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
570	156	653	5	Injector cyl. 3: interruption of electrical connection	Interruption of electronic connection Injector cyl. 3	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
583	161	654	3	Injector cyl. 4: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 4 wiring harness, cable break or short circuit, sensor defective, connection cable	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
571	161	654	5	Injector cyl. 4: interruption of electrical connection	Interruption of electronic connection Injector cyl. 4	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
584	162	655	3	Injector cyl. 5: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 5 wiring harness, cable break or short circuit, sensor defective, connection cable	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
572	162	655	5	Injector cyl. 5: interruption of electrical connection	Interruption of electronic connection Injector cyl. 5	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
585	163	656	3	Injector cyl. 6: the current drop measured by ECU is above the target range	Suspected Components: injector cylinder 6 wiring harness, cable break or short circuit, sensor defective, connection cable	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it. Use SerDia Injector test for diagnosis.
573	163	656	5	Injector cyl. 6: interruption of electrical connection	Interruption of electronic connection Injector cyl. 6	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
543	263	676	11	Cold start aid relay error.	Relay defect or wire harness problem	Threshold for error detection is an internal ECU threshold. check wire harness, replace relay
544	263	676	11	Cold start aid relay open load	Relay or wire harness	Threshold for error detection is an internal threshold. check wire harness, replace relay
956	512	677	3	Start relay (high side power stage): the current drop measured by ECU is above the target range.	Short cut HighSide-output to battery.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
960	512	677	3	Start relay (low side power stage): the current drain measured by ECU is above the target range.	Shortcut LowSide-Output to battery.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
957	512	677	4	Start relay (high side power stage): the current drain measured by ECU is above the target range.	Shortcut HighSide-output to ground.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
961	512	677	4	Start relay (low side power stage): the current drop measured by ECU is above the target range.	Shortcut LowSide-Output to ground.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable of terminal 50 and if necessary repair or replace it.
958	512	677	5	Start relay (low side power stage): the current drop measured by ECU is above the target range	Open circuit/disconnection LowSide-Output.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
959	512	677	12	Start relay (low side power stage): the current drop measured by ECU is above the target range.	Temperature over limit.	Threshold for error detection is an internal ECU threshold. Check cabling and start relay and if necessary replace it, check connection cable and if necessary repair or replace it.
928	928	691	8	Supply module heater: PWM time periode out of valid range.	PWM signal for temperature readout from supply module to the control unit is out of range. Supply modul defect, fault in the wiring.	The Time period of the received PWM signal SCR_tiSMPerPwm is within the specified range of150ms to 250ms Supply module check and replace if necessary. Check the wiring.
549	263	729	3	wiring to the intake air heater device is faulty.	Intake Air Heater Device: overload, short-circuit	Threshold for error detection is an internal ECU threshold. Electrical error, Check wiring to the intake air heater device.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
551	263	729	4	wiring to the air intake heater is faulty	Relay (for cold start aid) cable break or short to ground:	Threshold for error detection is an internal ECU threshold. Electrical error, check wiring to the air intake heater.
545	263	729	5	The cold start aid relay is according to wiring faulty.	Relay defect or wire harness problem	Threshold for error detection is an internal ECU threshold. Electrical error, check wires
547	263	729	12	The cold start aid relay is overheated, which causes this error	High temperature around the cold start relay.	Check the functionality of relay and replace it if needed. Check the temperature around the cold start relay during worst case operation.
305	118	898	9	Timeout Error of CAN-Receive-Frame TSC1TE - active	Timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
946	282	1079	13	Internal hardware monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 1.	Suspected components EDC17cv52 Pin A19: DEF press / Exh.PressBeforeTurb (P3) / Air Pump Press /BrnFuelPressAfterDV2 Pin K19: Fan Speed Sensor Pin A21: LDF6T / OilPress / LowFuelPress Pin A17: Rail Pressure Sensor Suspected components EDC17cv54 Pin A21: CAM speed Pin K44: Delta Press Venturi / Poti EGR or Inlet Throttle Pin A24: LDF6T / OilPress / LowFuelPressPin K43: Reserve 5V Sensor Supply Pin A09: second footpedal Suspected components EDC17cv56 Pin A21: Cam speed Pin K44: DEF press / Air FilterDiffPress Pin A24: LDF6T / OilPress / LowFuelPress Pin K43: second footpedal Pin A09: Delta Press Venturi	Check cabling of external components, check working voltage and if necessary correct it, check connection cable and if necessary repair or replace it, if error is not removable, change ECU.
947	282	1080	13	Internal hardware monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 2.	Suspected components EDC17cv52 Pin K16: second footpedal Pin A20: Exh.PressAfterTurb/DPFDiffPress/ BrnDV1Press/HClPressDV1DV2 Suspected components EDC17cv54 Pin K45: DPF Diff Press / Exh. Press After Turb / Fan Speed Sensor Pin A46: first footpedal Suspected components EDC17cv56 Pin A22: Fan Speed Sensor Pin K45: Position EGR or Intake throttle flap Pin K46: First footpedal	Check cabling of external components, check working voltage and if necessary correct it, check connection cable and if necessary repair or replace it, if error is not removable, change ECU.
121	341	1109	2	Request of engine shut off: the operator ignores the engine shut off request within an allowed period.	Engine Shut Off demand has been ignored by the user	Depending on error requested a shut off.
1398	681	1136	0	ECU internal temperature; temperature measured by ECU is out of the target range	Short-Circuit in ECU, ECU heated by hot air	Close warm air circuits, replace ECU

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
85	271	1231	14	CAN bus 1: the ECU is not allowed to send messages, because the status "BusOff" is detected Warning, no diagnostic with SERDIA2010 possible	CAN BusOff error; CAN 1 (Diagnostic CAN)	Threshold for error detection is an internal ECU threshold. BusOff bit for CAN B node is set. Check wiring of CAN bus and if necessary repair it, check connection cable and if necessary repair or replace it, check resistance in CAN lines (120 Ohm)
86	271	1235	14	CAN bus 2: the ECU is not allowed to send messages, because the status "BusOff" is detected. Warning, depends on engine, EAT.	CAN BusOff error; CAN 2 (Engine CAN)	Threshold for error detection is an internal ECU threshold. BusOff bit for CAN C node is set. Check wiring of CAN bus and if necessary repair it, check connection cable and if necessary repair or replace it, check resistance in CAN lines (120 Ohm)
747	145	1237	2	Override switch switch: the ECU receives a permanent signal.	Switch is blocked, taster locked, connection cable damaged plausbility error "override switch > 250ms pressed".	If the Block Button is pressed shorter than the Maximum Plausible pressing Time. Check cabling, if sensor is not working, check switch and if necessary replace it, check connection cable and if necessary repair or replace it.
1593	129	1761	0	The urea tank level sensor detects a value higher than the maximum allowed thresh-old	Suspected components: Urea Quality Sensor defect mechanical defect at the float gauge	Check level sensor and float gauge
1594	129	1761	1	The DEF tank level sensor detects a value lower than the minimum allowed threshold	Suspected components: Urea Quality Sensor defect mechanical defect at the float gauge	Check level sensor and float gauge
1655	138	1761	14	The urea tank volume ratio is below the threshold of <5%	actual urea tank level SCRUTnk_rVol_mp [%] is below applicable threshold 5%	Check urea level => if empty, then fill in urea Check DEF level sensor. If there is urea in the tank, then move the floater of the level sensor. The floater must be free. If you lift the sensor body, then SCRUTnk_rVol_mp must change. Exchange DEF level sensor, if no change of value or it's implausible.
1656	138	1761	14	The urea tank volume ratio is below the threshold of <2.5%	actual urea tank level SCRUTnk_rVol_mp [%] is below 2.5%	Check urea level => if empty, then fill in urea Check DEF level sensor. If there is urea in the tank, then move the floater of the level sensor. The floater must be free. If you lift the sensor body, then SCRUTnk_rVol_mp must change. Exchange DEF level sensor, if no change of value or it's implausible.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1880	138	1761	14	The DEF tank level is below the threshold.	actual DEF tank level SCRUTnk_rVol_mp [%] is below the threshold	Check DEF level => if empty, refill Check DEF level sensor. If there is urea in the tank loose the sensor and move it. The floater must be free and move if you lift the sensor body. SCRUTnk_rVol_mp must change. Compare SCRUTnk_rVol_mp to: 1 = SCR_rawUTnkLvl 2 = SCR_rAdapUtnkLvl 3 = SCRUTnk_rActTnkVol *SCRUTnk_facVolPer_mp In case of malfunction, exchange DEF level sensor.
1763	415	2791	0	Internal actuator temperature is above threshold.	Overheating of EGR actuator during operation.	Let EGR actuator cool down and check heat accumulation during worst case operation.
1753	415	2791	2	corrupted CAN communication with actuator.	CAN bus error or faulty EGR actuator.	Threshold for error detection is an internal ECU threshold. Check other CAN bus components. If no message is sent, fix the wiring. If o.k. exchange EGR actuaror.
1758	415	2791	3	Overvoltage at EGR actuator.	High voltage from the battery	Check battery voltage.
1759	415	2791	4	Undervoltage at EGR actuator.	Low voltage from the battery.	Check battery voltage.
1757	415	2791	6	Overcurrent to EGR actuator.	High voltage from battery. EGR actuator is blocked or moving very hard.	Check battery voltage. Check if EGR is blocked or not running smoothly. If everything is o.k. change EGR actuator.
1752	415	2791	7	EGR actuator is mechanically blocked.	EGR actuator faulty or blocked.	Threshold for error detection is an internal ECU threshold. Check the EGR actuator and EGR valve to mechanical blockage / clean. Check for free movement of the valve. If it'S blocked, then exchange the EGR valve.
1761	415	2791	7	EGR actuator spring broken.	mechanical damage of spring due to overstress.	Threshold for error detection is an internal ECU threshold. Exchange EGR actuator.
1755	415	2791	12	Internal electrical fault of EGR actuator.	Internal damage of EGR actuator due to high temperature or electrical wiring issue.	Threshold for error detection is an internal ECU threshold. Exchange EGR actuator.
1754	415	2791	13	EGR actuator can not learn stop positions. Possibly only second failure if other EGRTV failures occure.	Error detection during the learning process.	Threshold for error detection is an internal ECU threshold. Start Serdia Usecase to reset EGR actuator. Check EGR valve and mounting situation. If o.k. change EGR actuator.
1756	415	2791	13	EGR actuator can not learn stop positions because procedure was interrupted.	Interruption of learning process due to mechanical damage.	Threshold for error detection is an internal ECU threshold. Start Serdia Usecase to reset EGR actuator.
1760	415	2791	13	Stop positions of EGR valve not o.k.	Mechanical damage of EGR actuator. EGR valve is blocked or moving very hard.	Threshold for error detection is an internal ECU threshold. Start Serdia Usecase to reset EGR actuator.
1762	415	2791	16	Internal actuator temperature above threshold.	overheating of EGR actuator	Let EGR actuator cool down, check heat accumulation during worst case operation.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1337	565	2797	4	Injector diagnosis: Timeout of Injetor detection cylinder bank 0	Short-Circuit to ground on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
1339	565	2797	4	Injector test: Short cut to ground on cylinder bank 0	Short-Circuit to ground on component wiring	Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
1338	566	2798	4	Injector diagnosis: Timeout of Injetor detection cylinder bank 1	Short-Circuit to ground on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
1340	566	2798	4	Injector test: Short cut to ground on cylinder bank 1	Short-Circuit to ground on component wiring	Check wiring, component, ECU Note: affected injector has to be evaluated according to firing order
1135	669	3031	0	The urea tank temperature sensor detects a value above the maximum allowed threshold	Sensed urea tank temperature > physical range high limit	Case "CANBUS sensor": Check urea tank temperature: really hot? Check CANBus-message of DEF sensor urea tank temperature Com_dRxSCR2Byt2 Compare it to Com_dRxSCR1Byt1 (urea temperature at quality sensor) identical? Tank heater permantly on? Check wiring of DEF-quality sensor Case "analog DEF T & Level sensor": Check urea tank temperature: really hot? Check urea tank temperature SCR_tSensUTnkT Compare urea tank temperature to EnvT_t or to SCR_tSMT (the urea temperature inside the supply module) identical? Tank heater permantly on? Check wiring of analog DEF T & Level sensor
1136	669	3031	1	The urea tank temperature sensor detects a value lower than the minimum allowed threshold.	sensed urea tank temperature < physical range low limit	Case "CANBUS sensor": Check ambient temperature EnvT_t => About -40 °C? If yes Error could be plausible Check CANBus-message of DEF sensor urea tank temperature Com_dRxSCR2Byt2 Compare it to Com_dRxSCR1Byt1 (urea temperature at quality sensor) identical? Check wiring of DEF-quality sensor Check quality sensor Case "analog DEF T & Level sensor": Check urea tank temperature: really that cold? Check ambient temperature EnvT_t => About -40 °C? If yes Error could be plausible Check urea tank temperature SCR_tSensUTnkT Check wiring of analog DEF T & Level sensor Check analog DEF T & Level sensor
129	596	3224	2	DLC Error of CAN-Receive-Frame AT1IG1Vol NOX Sensor (SCR-system upstream cat; DPF-system downstream cat); length of frame incorrect	Not Used	Threshold for error detection is an internal ECU threshold. Check Nox-Sensor and the wiring from CAN-BUS.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
130	597	3224	9	Timeout Error of CAN-Receive-Frame AT1IG1Vol; NOX sensor (SCR-system upstream cat; DPF-system downstream cat)	Failure of the CAN Bus message	NOX sensor and sensor connection check
138	114	3234	2	DLC Error of CAN-Receive-Frame AT1O1Vol NOX Sensor (SCR-system downstream cat; DPF-system downstream cat); length of frame incorrect	Failure of the CAN Bus message	NOX downstream sensor and sensor connection check
139	117	3234	9	Timeout Error of CAN-Receive-Frame AT1OG1Vol; NOX sensor (SCR-system downstream cat; DPF-system downstream cat)	Failure of the CAN Bus message	NOX downstream sensor and sensor connection check
1077	677	3361	3	Urea dosing valve (low side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Threshold for error detection is an internal ECU threshold See substitute function Check the wiring
1078	677	3361	3	Urea dosing valve (high side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Threshold for error detection is an internal ECU threshold Check the wiring
1079	677	3361	4	Urea dosing valve (low side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Check the wiring
1080	677	3361	4	Urea dosing valve (high side power stage): the current drain measured by ECU is above the target range	Fault in the wiring	Threshold for error detection is an internal ECU threshold Check the wiring
1075	677	3361	6	Urea dosing valve: the current measured value by ECU at the end of the injection is too high	Fault in the wiriing Defect urea dosing injection valve	Check wiring Check the urea dosing injection valve
1898	277	3519	3	The integrated diagnostic of the temperature sensor of the Urea Quality Sensor recognized a short circuit to battery. The UQS Sensor is an combined sensor of tank temperature, filling grade and DEF quality and it is also an CAN sensor --> no PIN	Wrong diagnostic of the short circuits logic inside the temperature sensor of the UQS CAN Communication corrupted	Check the wiring to the suction unit in the DEF tank. Check the CAN bus communication of the suction unit. In case the communication is corrupt, exchange the suction unit.
1899	277	3519	4	The integrated diagnostic of the temperature sensor of the Urea Quality Sensor recognized a short circuit to ground	DEF quality sensor in the suction unit of the DEF tank is defect CAN Communication corrupted	Check the wiring to the suction unit of the DEF tank. Check the CAN bus communication from the suction unit. In case the signal is corrupt, exchange the suction unit in the DEF tank.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1895	277	3519	12	The integrated temperature sensor of the Urea Quality Sensor measures higher temperature than threshold	Temperature sensor inside the UQS defect. CAN Communication corrupted. Overheating of the DEF tank due to malfunction of the heating valve. Flow direction is of coolant is wrong due to mixed up the hoses routed to the heating valve. Overheating of the DEF tank due to heat transfer from neighbor parts.	Check the temperature sensor signal for plausibility. In case of improper signal, exchange the suction unit in the tank. Check CAN bus communication for proper signal. In case of improper signal, exchange the suction unit in the tank. Check the function of heating valve and routing of the hoses. The coolant flow through the heating valve must be observed according to the shown arrow. In case all actions above are OK, check the real temperature in the DEF tank during worst case condition and improve the installation of the DEF tank.
1908	277	3519	13	Temperature at UQS out of range the specified thresholds; invalid quality of the temperature	Suspected Components Tank heater DEF sensor	Check temperature system and/or DEF quality sensor
1904	2-7-8	3520	2	Measured DEF Quality from UQS is too low. Quality value received from UQS is < 22 % for a certain time and a certain number or for measuring conditions not observed for a certain time.	Suspected components: Urea quality sensor defect Wrong installation (measuring air) Urea level sensor defect Non urea filled in tank CANBUS problems Evaluation conditions for new quality check not fulfilled after one previous mal detection	Check that there is liquid urea of known quality in the tank first Check urea tank level. Add urea until level is at least 10 cm above sensor. Ensure that urea is not frozen / sufficient urea is liquid Check Sensor: Are urea tank temperature and level displayed? Changes the level if you refill urea? Check electrical connection Check CANBus New quality detection is carried out if urea refill is detected or if an quality evaluation was triggered and was not finished successfully: To provoke a quality measurement: refill urea, at least 10 % of tank volume Wait until quality evaluation was carried out, can take up to 30 minutes => check value. It should be about 33 % Exchange quality sensor
1896	278	3520	3	The integrated diagnostic of the Urea Quality Sensor recognized a short circuit to battery	wiring harness of UQS corrupted CAN Communication corrupted	Threshold for error detection is an internal ECU threshold. Check the wiring harness from the ECU to the suction unit of the DEF tank Check the CAN bus communication. If the signal is corrupt, then exchange the suction unit.
1897	278	3520	4	The integrated diagnostic of the Urea Quality Sensor recognized a short circuit to ground.	wiring harness to the suction unit in the DEF tank is corrupted CAN Communication corrupted	Threshold for error detection is an internal ECU threshold. Check the wiring to the suction unit in the DEF tank. Check the CAN bus communication. In case the communication is corrupt, exchange the suction unit in the DEF tank.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1907	278	3520	13	Urea quality at UQS out of range the specified thresholds; invalid quality of the urea qualiy	Suspected components DEF quality sensor DEF	Check DEF quality and/or DEF quality sensor
1911	127	3532	3	The urea quality value from the sensor is greater than the maximum physical range threshold Comment: tank temperature is measured by the UQS sensor	Suspected Components: UQS defect	Check DEF quality and/or sensor.
1912	127	3532	4	The urea quality value from the sensor is lower than the minimum physical range threshold.	Suspected Components: UQS defect	Check DEF quality and/or Sensor.
1455	711	3711	12	Temperature Phy_tPfWgh, the weighted DPF temperature < Threshold 1 Temperature Phy_tPfWgh, the weighted DPF temperature > Threshold 2 towards the end of the stand-still main phase.	temperature Phy_tPfWgh, the weighted DPF temperature, is below or above the target temperature towards the end of the stand-still main phase.	Check temperature upstream DOC Exh_tSensOxiCatUs within Stand-still: > 450 °C? If not: => Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check temperature difference across DOC by Exh_tSensOxiCatDs - Exh_tSensOxiCatUs within Stand-still: < 100°C? If not: Check exhaust pipe downstream turbo charger for oil? check injectors: is an injector got stuck? Too many hydrocarbons in exhaust? White smoke (at hot EAT system, not at cold start)? Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check exhaust gas temperature sensors within EAT-system: T upstream DOCC, T downstream DOC & T upstream SCR catalyst all three of them can influence Phy_tPfWgh
1917	2-8-6	3936	14	Standstill escalation by time. In case the standstill request will not be released within 50 h by the driver this fault code will be set.	Stand-still request ignored by the operator. Display / stand-still request lamp broken.	Perform Stand-still. If soot load level of DPF has increased too high already call service to perform stand-still. In case the DPF soot load level remove DPF => Exchange DPF.
1122	665	4334	0	The absolute pressure value of the urea pump is greater than an applicable maximal filtered pressure threshold	Suspected Components: Urea pump defect Supply module pressure sensor defect Pump contains dirty parts	Check the urea pump Check the supply module pressur sensor Clean the urea pump (filter)
1123	665	4334	1	Urea supply module pressure sensor: The absolute pressure value of the urea pump is less than an applicable minimal filtered pressure threshold	Check the urea pump Check the supply module pressur sensor Clean the urea pump (filter)	Check the urea pump Check the supply module pressur sensor Clean the urea pump (filter)

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1866	665	4334	2	absolute difference of sensed urea pump pressure (SCR_pAbsSensUPmpP) and ambient pressure (EnvP_p) > limit abs(UPmpP_pDiffPmpEnv_mp) > UPmpP_pDiffPmpEnv_C (250 hPa)	absolute difference of sensed urea pump pressure (SCR_pAbsSensUPmpP) and ambient pressure (EnvP_p) > limit abs(UPmpP_pDiffPmpEnv_mp) > UPmpP_pDiffPmpEnv_C	Check environment pressure sensor (EnvP_p) => plausible value? Engine shut-off and immediately re-started? => Shut-off again. Wait until afterun of ECU has finished, re-Start engine Back-flow line free? Does the urea pump pressure show values < 1000 hPa in SCR state emptying (64)? Check revision valve => Does the urea pump pressure show values < 1000 hPa in SCR state emptying (64)? => exchange supply module Supply module pressure sensor defect => exchange supply module
1104	675	4341	3	Urea heater supply line: the current drain measured by ECU is above the target range	electrical error	Threshold for error detection is an internal ECU threshold Check wire harness Check supply line
1105	675	4341	4	Urea heater supply line: the current drain measured by ECU is above the target range	electrical error	Threshold for error detection is an internal ECU threshold Check wire harness Check supply line
1102	675	4341	5	Urea heater supply line: the current drain measured by ECU is above the target range	electrical error	Threshold for error detection is an internal ECU threshold Check wire harness Check supply line
1096	673	4343	3	Urea pressure line heater: the current drain measured by ECU is above the target range	shortcut to battery If this error detected during the heating phase is a result error: KWP 1089 broken heating element in pressure line	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
1097	673	4343	4	Urea pressure line heater: the current drain measured by ECU is above the target range	Shortcut to ground If this error detected during the heating phase is a result error: KWP 1089 Short cut to ground or broken wiring, broken heating element in pressure line	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
1094	673	4343	5	Urea pressure line heater: the current drain measured by ECU is above the target range	Open load If this error detected during the heating phase is a result error: KWP 1089 Broken wiring, broken heating element in pressure line	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
1092	674	4345	3	Urea backflow line heater: the current drain measured by ECU is above the target range	Shortcut to battery If this error detected during the heating phase is a result error: KWP 1089 Short cut to battery or broken wiring, broken heating element in backflow line	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
1093	674	4345	4	Urea backflow line heater: the current drain measured by ECU is above the target range	Shortcut to ground If this error detected during the heating phase is a result error: KWP 1089 Short cut to ground or broken wiring, broken heating element in backflow line	Threshold for error detection is an internal ECU threshold Check wiring Check heating element

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1090	674	4345	5	Urea backflow line heater: the current drain measured by ECU is above the target range	Open load If this error detected during the heating phase is a result error: KWP 1089 Broken wiring, broken heating element in back-flow line	Threshold for error detection is an internal ECU threshold Check wiring Check heating element
1069	668	4360	0	The filtered urea cat upstream temperature is greater than an applicable maximum temperature threshold	Sensed temperature upstream SCR > physical high limit	Check temperature difference across DOC (Exh_tOxiCatDs-Exh_TOxiCatUs) at higher engine load => high difference > 100 K? If yes, the engine emitts too many Hydrocarbons => check injectors: is an injector got stuck? => Check EGR Valve If difference normal the exhaust out of the engie itself is too hot: => Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function If that error was set while stand-still operation the error source could be exothermal soot burn off in DPF (which should not happen) => Dismount DPF and check it visually exchange temperature sensor upstream SCR
1070	668	4360	1	The filtered temperature before urea cat is less than an applicable minimum temperature threshold	Sensed temperature upstream SCR catalyst < than physical low limit	Cold start and ambient temperature < Threshold? Missdetection? Check wiring harness to UCatUsT-sensor Exchange UCatUsT-sensor
1865	668	4360	2	Error at static plausibility check: absolut temperature difference of sensed temperature upstream SCR catalyst and ambient temperature > as static plausibility limit at engine cold start (engine was off for at least 8 h), temperature upstream of SCR catalyst is expected to be identical to ambient temperature => see enable conditions for details. Error at dynamic plausibility check: temperature difference of sensed temperature upstream SCR catalyst and ambient temperature < as dynamic plausibility limit dynamic check is blocked if static plausibility check is already faulty => Temperature upstream SCR catalyst must be by 40°C higher than ambient temperature if engine runs and a certain delay time has expired.	Error at static plausibility check: absolut temperature difference of sensed temperature upstream SCR catalyst and ambient temperature > as static plausibility limit at engine cold start (engine was off for at least 8 h), temperature upstream of SCR catalyst is expected to be identical to ambient temperature => see enable conditions for details. Error at dynamic plausibility check: temperature difference of sensed temperature upstream SCR catalyst and ambient temperature < as dynamic plausibility limit dynamic check is blocked if static plausibility check is already faulty => Temperature upstream SCR catalyst must be by 40°C higher than ambient temperature if engine runs and a certain delay time has expired.	Check whether temperature sensor upstream of SCR catalyst is physically mounted within exhaust pipe If cold start condition can be made sure (engine was off for at least 8 h) compare values of EnvT_t, EngDa_tEng, Exh_TOxiCatUs, Exh_tOxiCatDs and SCR_tSensUCatUsT at ignition on, without starting the engine. All identical? Compare values of Exh_TOxiCatUs, Exh_tOxiCatDs and SCR_tSensUCatUsT after 15 min in constant operation point: show all similar values (30 K tolerance width). Are ambient temperature and (EnvT_t), cooling water temperature (EngDa_tEng) plausible? Sensor coated with urea crystalls? Dismount urea injector and inspect temperature sensor upstream SCR catalyst visually Check wiring of sensor Replace sensor
1072	668	4361	3	Urea catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	Voltage of temperature sensor upstream SCR catalyst > maximum limit Short circuit to battery	Check sensor Check wiring Replace UCatUsT-sensor
1073	668	4361	4	Urea catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	Voltage of temperature sensor upstream SCR catalyst < minimum limit Short circuit to ground	Check sensor Check wiring Replace UCatUsT-sensor

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1137	6-6-9	4365	2	Signal error in case of Urea tank temperature trnasmitted via CAN-signal Com_tUTnkT.	CAN message is not send properly.	Check sensor connector Check CANbus
1138	6-6-9	4365	3	Urea tank temperature sensor: he current drain measured by ECU is above the target range.	Shortcut or open load.	Threshold for error detection is an internal ECU threshold. The Sensed raw voltage value SCR_uRawUTnkT is below SCR_SRCUTnkT.uMax_C. Check wiring.
1914	669	4365	3	Internal error of DEF qualitysensor.	Suspected componentes: DEF qualitysensor Wiring harness	Check wiring harness and DEF qualitysensor
1139	6-6-9	4365	4	Urea tank temperature sensor: he current drain measured by ECU is above the target range.	Shortcut or open load.	Threshold for error detection is an internal ECU threshold. The sensed raw voltage value SCR_uRawUTnkT is above SCR_SRCUTnkT.uMin_C. Check wiring.
1915	6-6-9	4365	4	Internal error of DEF qualitysensor.	Suspected componentes: DEF qualitysensor Wiring harness	Check wiring harness and DEF qualitysensor
1112	671	4366	3	Urea tank heating valve: the current drain measured by ECU is above the target range	Shortcut to battery If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Urea tank heating valve defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea tank heating valve
1113	671	4366	4	Urea tank heating valve: the current drain measured by ECU is above the target range	Shortcut to ground If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Urea tank heating valve defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea tank heating valve
1110	671	4366	5	Urea tank heating valve: the current drain measured by ECU is above the target range	Open load If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Urea tank heating valve defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea tank heating valve
1120	666	4375	3	Urea supply module pump: the current drain measured by ECU is above the target range	Shortcut to battery If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Pump in urea supply module defect	Threshold for error detection is an internal ECU threshold The hardware detects absence of any short circuit to battery on the PWM output power stage for the urea pump module actuator Check wiring Check pump in the urea supply module
1121	666	4375	4	Urea supply module pump: the current drain measured by ECU is above the target range	Shortcut to ground If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Pump in urea supply module defect	Threshold for error detection is an internal ECU threshold The hardware detects a short circuit to ground error on the PWM output power stage for the UreaPump Module Motor Actuator. The error is updated by setting bit 1 of measuring point UPmp-Mot_stPrevTstRslt_mp Check wiring Check pump in the urea supply module

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1118	666	4375	5	Urea supply module pump: the ECU can not measure any reaction during pump control	Open load Broken wiring Pump in urea supply module defect	Threshold for error detection is an internal ECU threshold The hardware detects the presence of load on the PWM output power stage for the urea pump module actuator. Check wiring Check pump in the urea supply module
1131	667	4376	3	Urea supply module reversal valve: the current drain measured by ECU is above the target range	Shortcut to battery Fault in the wiring Reversal valve in the urea supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea supply modul
1132	667	4376	4	Urea supply module reversal valve: the current drain measured by ECU is above the target range	Shortcut to ground Fault in the wiring Reversal valve in the urea supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea supply modul
1129	667	4376	5	Urea supply module reversal valve: the current drain measured by ECU is above the target range	Open load Fault in the wiring Reversal valve in the urea supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check urea supply modul
1039	683	4765	0	The exhaust temperature value from the sensor befor DOC is above an applicable upper shutoff threshold TOxiCatUs_tShOffThresHiAds_C = Threshold 1 in Normal and Heatmodes (TOxiCatUs_tShOffThresHiRgn_C = Threshold 2 in stand-still)	sensed temperature upstream DOC > shut-off limit	Check air path of engine: EGR-Valve, Intake-Throttle, Check Turbocharger and Piping each for leakage and correct function Check injectors: is an injector got stuck? Exchange temperature sensor upstream DOC
1040	683	4765	0	The exhaust temperature value from the sensor befor DOC is above an applicable upper warning threshold TOxiCatUs_tWarnThresHi_C = Threshold	Sensed temperature upstream DOC > warning limit	Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injectors: is an injector got stuck? Exchange temperature sensor upstream DOC

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1036	683	4768	2	Static plausibility check: The exhaust temperature value from the sensor before DOC, the exhaust temperature value from the sensor after DOC, the temperature value from the sensor before SCR-Cat, the environment temperature and the coolant engine temperature their ratios to each other exceed their related thresholds. Dynamic plausibility check with environment temperature sensor value: The exhaust temperature value from the sensor before DOC is lower than an applicable environment temperature threshold	Static plausibility check: The exhaust temperature value from the sensor before DOC, the exhaust temperature value from the sensor after DOC, the temperature value from the sensor before SCR-Cat, the environment temperature and the coolant engine temperature their ratios to each other exceed their related thresholds. (difference between temperature after DOC and temperature before DOC > Threshold 1 difference between temperature befor DOC and before SCR > Threshold 2 difference between temperature after DOC and before SCR < Threshold 3 difference between temperature after DOC and ambinet temperature < Threshold 4 differnece between temperatur ambient temperature and engine temperature < Threshold 5) Dynamic plausibility check with environment temperature sensor value: The exhaust temperature value from the sensor before DOC is lower than an applicable environment temperature threshold (< environmental temperature + Threshold 6)	Check ambient temperature => value plausible? upstream DOC sensor mounted within exhaust line? T upstream DOC sensor physically mounted in correct position upstream DOC? (not upstream SCR or downstream DOC?) Check T upstream DOC sensor Check other T-sensors within EAT-system (Exh_tOxiCatDs & UCatUsT_tFlt_mp show plausible values? No errors on them?
1881	683	4768	2	At engine cold start conditions the sensed exhaust gas temperature downstream DOC (Exh_tSensTOxiCatDs) has exceeded the sum of ambient temperature (EnvT_t) + offset (40°C) earlier than the sensed exhaust gas temperature upstream of DOC (Exh_tSensTOxiCatUs). The check is only performed once each ignition cycle and only if the start is judged a cold start. Error status is frozen for that ignition cycle. No healing possible.	Difference temperature of exhaust gas temperature downstream DOC and fixed ambient temperature at ignition on exceeds a certain limit earlier than the difference temperature of exhaust gas temperature upstream DOC and fixed ambient temperature at ignition on.	Check whether all exhaust gas temperature sensors within the EAT system are mounted properly: Within the exhaust line and at correct positions. Check the position of the sensor upstream SCR which might be physically mounted in the wrong position. If cold start condition can be made sure (engine was off for at least 8 h) compare values of EnvT_t, EngDa_tEng, Exh_TOxiCatUs, Exh_tOxiCatDs and SCR_tSensUCatUsT at ignition on, without starting the engine. All identical? Then the sensors itself are okay. Check exhaust piping for leakage. Check wiring of sensors Replace sensors Check DOC => physicallly intact?
1044	683	4768	3	Oxidation catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	The sensed raw voltage value Exh_uRawTOxiCatUs is above Exh_SRCTOxiCatUs.uMax_C Shortcut to battery	Check wiring harness to temperature sensor upstream DOC Exchange temperature sensor upstream DOC
1045	683	4768	4	Oxidation catalyst upstream temperature sensor: the voltage of sensor measured by ECU is out of the target range	The sensed raw voltage value Exh_uRawTOxiCatUs is below Exh_SRCTOxiCatUs.uMin_C Shortcut to ground	Check wiring harness to temperature sensor upstream DOC Exchange temperature sensor upstream DOC

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1024	594	5763	3	Actuator of the external EGR valve: the ECU detects a short circuit to battery or open load.	Short cut to battery or open loop.	Check cabling, actuator defect, check actuator and if necessary replace it, check connection cable and if necessary repair or replace it.
1226	594	5763	3	Actuator EGR-valve: short cut to battery is detected	Short-Circuit to battery on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case
1227	594	5763	3	Actuator EGR-valve: short cut to battery on ECU pin is detected	Short-Circuit to battery on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case
1025	594	5763	4	Actuator of the external EGR valve: the ECU detects a short circuit to ground.	Short cut to ground	Check cabling, actuator defect, check actuator and if necessary replace it, check connection cable and if necessary repair or replace it.
1228	594	5763	4	Actuator EGR-valve: short cut to ground on ECU pin is detected	Short-Circuit to ground on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case
1229	594	5763	4	Actuator EGR-valve: short cut to battery on ECU pin is detected	Short-Circuit to ground on component	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case
1232	5-9-4	5763	4	Actuator error EGR-Valve (2.9;3.6) or Throt-tle-Valve (4.1;6.1;7.8); Voltage below threshold 3.6) Drosselklappe (4.1;6.1;7.8); Voltage below threshold;	Monitoring for CY146 Under Voltage.	Threshold for error detection is an internal ECU threshold. Check wiring, component
1023	5-9-4	5763	5	Actuator error EGR-Valve; signal range check low, measured current is below target	Short circuit to ground.	Check wiring, check cabels and repair or replace if necessary, check actuator with SERDIA 2010 test for EGR and if necessary replace it.
1014	594	5763	6	Actuator error EGR-Valve. Signal range check high.	Short cut to batterie.	Check wiring and repair or replace if necessary, check actuator with SERDIA test for EGR and if necessary replace it.
1022	5-9-4	5763	6	Actuator error EGR-Valve; signal range check high, measured current by ECU is over target	Short circuit to battery or open circuit.	Check cabling, actuator defect, check actuator and if necessary replace it, check connection cable and if necessary repair or replace it.
1223	594	5763	6	Actuator EGR-Valve: Open load on ECU out-put is detected	Open circuit on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case
1224	594	5763	6	Actuator EGR-valve: too high curent is going into the actuator. Output is switched off	Overload on component wiring	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU Check repair with SerDia 2010 use case

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1230	5-9-4	5763	6	Actuator error EGR-valve; Overload by short-circuit	Short Circuit over Load	Threshold for error detection is an internal ECU threshold. Check wiring, component
1016	594	5763	7	Actuator position for EGR valve is not plausible, internal error, angular misalignement of the flap.	Position error of throttle flap (deviation > 7%).	Threshold for error detection is an internal ECU threshold. Threshold for error detection, deviation from setpoint > 7%. Troubleshooting with SERDIA 2010 Use Case "EGR Diagnostic".
1231	5-9-4	5763	11	Power stage overtemperature due to high current.	Temperature dependent Over Current	Threshold for error detection is an internal ECU threshold. Check wiring, component
1015	594	520521	5	Actuator error EGR-Valve. Signal range check low.	Short cut to ground.	Check wiring and repair or replace if necessary, check actuator with SERDIA test for EGR and if necessary replace it.
825	253	523009	9	The pressure relief valve (PRV) has reached the number of allowed activations.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Replace pressure relief valve (PRV) and reset fault with Serdia.
833	2-5-3	523009	10	The pressure relief valve (PRV) has reached the allowed opening time.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Replace pressure relief valve (PRV) and reset fault with Serdia.
171	3-3-3	523212	9	Timeout Error of CAN-Receive-Frame ComEngPrt; Engine Protection	Timeout Error (Missing CAN Bus message)	Check wiring harness and customer devices
179	527	523240	9	Timeout CAN-message FunModCtl; Function Mode Control	Timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
565	151	523350	4	Injector cylinder bank 1: the current drop measured by ECU is above the target range	Short circuit injection bank 1 (all injectors of this bank can be affected)	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
566	152	523352	4	Injector cylinder bank 2: the current drop measured by ECU is above the target range	Short circuit injection bank 2 (all injectors of this bank can be affected)	Threshold for error detection is an internal ECU threshold. Check wiring harness, injectors and if necessary repair/replace it.
567	153	523354	12	Internal hardware monitoring: the ECU detects an error of its injector high current output. Chip of CY33x defect power stage components	Defective powerstage in ECU	Threshold for error detection is an internal ECU threshold. If error is not removable, change ECU.
839	1-4-3	523450	4	Diagnostic fault check for min error of COM message.	The sensed raw value is less than the threshold.	Check cabling, check sensor and if necessary replace it, check connection cable and if necessary repair or replace it.
826	146	523470	2	The pressure relief valve (PRV) has been opened due to excessive pressure.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Threshold for error detection is an internal ECU threshold. Reset the fault and at reappearance check injection system.
827	146	523470	2	The pressure relief valve (PRV) has been opened due to excessive pressure.	Rail pressure has exceeded the trigger threshold of the pressure limiting valve.	Threshold for error detection is an internal ECU threshold. Reset the fault and at reappearance check injection system.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
876	146	523470	7	Rail pressure is out of the expected average range.	Rail pressure is out of the expected average range. PRV can not be opened.	(A) Check railpressure relief valve and replace if necessary. (B) Check high pressure pumps, pressure relief valve and metering unit. (C) Change components if necessary
831	146	523470	11	Rail pressure relief valve can not be opened due to the railpressure.	Railpressure out of tolerance range (PRV can not be opened by a pressure peak in this operating point)	Threshold for error detection is an internal ECU threshold. Check railpressure, check rail pressure sensor for plausibility, check FCU.
832	146	523470	11	Rail pressure is out of the expected average range. The PRV can not be opened at this operating point with a pressure shock.	Averaged rail pressure is outside the expected tolerance range.	Threshold for error detection is an internal ECU threshold. Check PRV and replace if necessary.
828	146	523470	12	Rail pressure relief valve: is open. Shutoff conditions.	Shut Off after PRV Open	Threshold for error detection is an internal ECU threshold. Check PRV opening counter and if necessary replace PRV, check rail-pressure sensor for plausibility and if necessary replace it, check FCU and if necessary replace it.
829	146	523470	12	Rail pressure relief valve is open. Warning conditions.	Warning PRV open	Threshold for error detection is an internal ECU threshold. Check PRV opening counter and if necessary replace PRV, check rail-pressure sensor for plausibility and if necessary replace it, check FCU and if necessary replace it.
830	146	523470	14	Rail pressure relief valve is open. (PRV)	Open PRV	Threshold for error detection is an internal ECU threshold. Only after ECU reset. Check PRV opening counter and if necessary replace it, check rail-pressure sensor for plausibility and if necessary replace it, check FCU and if necessary replace it.
980	515	523550	12	Terminal 50 was operated for more than 2 minutes. This may happen due to short to battery or wrong usage of Terminal 50. Starter control is disabled until this error is healed.	Startinformation to Starter (T50-switch) erratic/defect.	Threshold for error detection is an internal ECU threshold. Check cabling, if sensor not working, check start switch and if necessary replace it, check connection cable and if necessary repair or replace it.
948	282	523601	13	Internal hardware monitoring: the ECU detects a deviation of the target range of the power supply voltage of sensor output 3.	Suspected components EDC17cv52 Pin A18: DeltaPressVenturi / Position intake throttle flap Pin K20: First footpedal Pin K21: Air FilterDiffPress Suspected components EDC17cv54 and cv56 Pin A07: Rail pressure	Check cabling of external components, check working voltage and if necessary correct it, check connection cable and if necessary repair or replace it, if error is not removable, change ECU.
644	555	523612	3	supply voltage too high	not used	Threshold for error detection is an internal ECU threshold.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
646	555	523612	4	supply voltage too low	not used	Threshold for error detection is an internal ECU threshold.
387	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Injector shut off demand for the ICO coordinator System responses: not	Threshold for error detection is an internal ECU threshold. Caution ! Sequence error, check error memory for other errors.
612	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory.	Plausibility check failed (MoCADC_uNTP_mp is higher than MoCADC_uNTPMax_C).	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
613	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Analysis of test voltage (Value is out of the target -> ECU internal error)	Threshold for error detection is an internal ECU threshold. Check wiring, check connected sensors actuators. If error is still present, exchange ECU.
614	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Analysis of the ratiometric correction (Value is out of the target -> ECU internal error)	Threshold for error detection is an internal ECU threshold. Check wiring, check connected sensors actuators. If error is still present, exchange ECU.
615	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error report due to an error in the plausbility of Function Coordination(FC) and Monitoring Modul(MM)(ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
616	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error report due to an interrupted SPI communication (ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
617	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	multiple error in complete ROM-test during postdrive detected (ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
618	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Too less bytes received by monitoring memory from CPU as response (ECU internal error). Loss of synchronization sending bytes to the monitoring memory from CPU	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
619	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Suspected components: Injector ECU wiring harness/connector	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
620	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error trying to set MM Response time (ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
621	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error detected in the internal ECU communication, Too many SPI errors during MoCSOP execution	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
623	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error in the check of the shut-off path test of the under voltage detection (ECU internal error). Diagnostic fault check to report the error in undervoltage monitoring	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
624	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error in the check of the shut-off path of the monitoring module (ECU internal error).	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
625	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Time out error trying to set or cancelling the alarm task (ECU internal error). Failure setting the alarm task period	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
627	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error in time monitoring of the shut-off path test (ECU internal error). Diagnostic fault check to report the timeout in the shut off path test	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
628	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error in the check of the shut-off path test of the over voltage detection (ECU internal error). Diagnostic fault check to report the error in overvoltage monitoring	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
629	555	523612	12	The two voltage values (ADC_VAL1, ADC_VAL2), detected by the accelerator pedal, are not plausible to each other.	Defect pedal or wiring	Threshold for error detection is an internal ECU threshold. Check Pedal, repair or exchange the Pedal. Check wiring. If error is still present, exchange ECU.
630	555	523612	12	Impermissible offset between the engine speed of level 2 and level 1	Calculated engine speed in level 1/2 implausible (-> ECU internal error).	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
631	555	523612	12	Diagnostic fault check to report the plausibility error between level 1 energizing time and level 2 information	Implausible injection energizing time for either PiIx or MI1 or PoIx.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
632	555	523612	12	Error in the plausibility of the start of energising angles	Implausible start of energising of either PiIx or MI1 or PoIx.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
633	555	523612	12	Error in the plausibility of the energising times of the zero fuel quantity calibration	The energising times of the zero fuel quantity calibration ZFC is out of the target. (-> ECU internal error)	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
634	555	523612	12	Error in the plausibility of PoI2 efficiency.	Error in the plausibility of PoI2 efficiency.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
635	555	523612	12	Error in the PoI2 shut-off.	Error in the PoI2 shut-off.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
636	555	523612	12	Error in the plausibility of PoI3 efficiency.	Error in the plausibility of PoI3 efficiency.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
637	555	523612	12	Engine speed: the engine speed calculated by ECU is above the target range; the ECU activates a system reaction	Error in the plausibility of current energising time with maximum permitted energising time. Diagnostic fault check to report the error due to Over Run	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
638	555	523612	12	Error in the plausibility of the wave correction parts	Error in the plausibility of the wave correction parts	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
639	555	523612	12	Plausibility error of the Rail pressure sensor	In case the gradient of rail pressure is larger than the max threshold or lesser than the min threshold. Rail metering unit defect. Leakge in the Rail System.	Threshold for error detection is an internal ECU threshold. Check metering unit or cable. Check Rail pressure. Check the Rail System of leakage.
640	555	523612	12	Error in the torque comparison between permissible engine torque and current actual torque	Error in the torque comparison between the permissible inner engine torque and the current plausible actual torque.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
641	555	523612	12	Diagnosis of curr path limitation forced by ECU monitoring level 2	The torque comparison is not plausible with the torque monitoring.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
642	555	523612	12	Diagnosis of lead path limitation forced by ECU monitoring level 2	The setpoint path of the air system is limited by the limitation torque of the functional control unit monitoring.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
643	555	523612	12	Diagnosis of set path limitation forced by ECU monitoring level 2.	If the quantity setpoint is exceeds the limit of the torque function.	Threshold for error detection is an internal ECU threshold. If error is still present, exchange ECU.
714	555	523612	12	Error report "WDA wire is active" due to a defect query/response communication	Error detection by monitoring module	Threshold for error detection is an internal ECU threshold. Software reset.
715	555	523612	12	Error report "ABE wire is active" due to undervoltage detection	The reason is that a slow dropping of the vehicle electrical system voltage (defective autobattery) should not lead the ECU OCWDA's diagnose to enter an error in the fault memory due to an undervoltage recognition.	Threshold for error detection is an internal ECU threshold. Software reset.
716	555	523612	12	Error report "ABE wire is active" due to overvoltage detection	If the ABE/WDA powerstage shut-off is active due to an overvoltage detection.	Threshold for error detection is an internal ECU threshold. software reset.
717	555	523612	12	Error report "ABE/WDA active" due to an unknown reason	The reason is that a slow dropping of the vehicle electrical system voltage (defective autobattery) should not lead the ECU OCWDA's diagnose to enter an error in the fault memory due to an undervoltage recognition.	Threshold for error detection is an internal ECU threshold. Software reset.
1170	555	523612	12	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Error during positive test (ECU internal error). Diagnostic fault check to report that the positive test failed	Threshold for error detection is an internal ECU threshold. Reflash ECU. If error is still activ replace ECU.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1857	555	523612	12	Fault in the monitoring during the engine start. Start requested in level 1, but not released in level 2 which leads to no fuel injection.	wiring is not according DEUTZ requirements engine start conditions are not observed low battery voltage during start malfunction of starter	Threshold for error detection is an internal ECU threshold. check other active errors and fix them. check all needed engine start conditions, e.g. neutral switch. check the engine speed during starting of the engine. If it's too low, then check the battery voltage and then check the starter for malfunction.
973	555	523612	14	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory.	Visibility of Softwareresets in DSM	Threshold for error detection is an internal ECU threshold.
974	555	523612	14	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory.	Visibility of Softwareresets in DSM	Threshold for error detection is an internal ECU threshold.
975	555	523612	14	Internal hardware monitoring: the CPU of the ECU is reset and the cause is logged internally; no item will be created in error memory	Visibility of SoftwareResets in DSM	Threshold for error detection is an internal ECU threshold. If possible the software update has to be done. Replace the ECU.
856	134	523613	0	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	Pressure governor deviation exceeds the limiting value based on the engine speed.	Threshold for error detection is an internal ECU threshold. (A) Check for leakage (B) Check fuel-primary pressure (C) Change components, check sensor and if necessary replace it, check fuel system and if necessary repair it
857	134	523613	0	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	maximum positive deviation of rail pressure exceeded concerning set flow of fuel.	Threshold for error detection is an internal ECU threshold. (A) Check for leakage (B) Check fuel-primary pressure (C) Change components, check sensor and if necessary replace it, check fuel system and if necessary repair it
858	134	523613	0	Rail pressure: the fuel pressure in rail calculated by ECU is above the target range which is dependant on the engine speed.	leakage is detected based on fuel quantity balance.	Threshold for error detection is an internal ECU threshold. (A) Check backflow pressure (B) Check Injector function with SerDia (C) Change components (metering unit, injector) if necessary
859	134	523613	0	Rail pressure: the fuel pressure in rail calculated by ECU is above the target range which is dependant on the engine speed.	Maximum negative rail pressure deviation with metering unit on lower limit is exceeded.	Threshold for error detection is an internal ECU threshold. (A) Check backflow pressure (B) Check Injector function with SerDia (C) Change components (metering unit, injector) if necessary
862	134	523613	0	Rail pressure: the fuel pressure in rail calculated by ECU is above the target range.	Rail pressure exceeds the limiting value.	(A) Check backflow pressure (B) Check pressure relief valve and metering unit. (C) Change components if necessary

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
861	134	523613	1	Rail pressure: the fuel pressure in rail calculated by ECU is below the target range which is dependant on the engine speed.	Rail pressure falls below the limiting value based on the engine speed.	Threshold for error detection is an internal ECU threshold. (A) Check backflow pressure (B) Check Injector function with SerDia (C) Change components (metering unit, injector) if necessary
864	134	523613	2	Rail pressure metering unit, Setpoint of metering unit in overrun mode not plausible.	Pressure pump delivery quantity in overrun exceeds the threshold based on the pressure.	Threshold for detection is an internal ECU threshold. (A) Check backflow pressure (B) Check pressure relief valve and metering unit. (C) Change components if necessary
594	135	523615	3	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to battery high side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
596	135	523615	3	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to battery low side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
595	135	523615	4	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to ground high side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
597	135	523615	4	Fuel metering unit: the current drain measured by ECU is above the target range	short circuit to ground low side	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
592	135	523615	5	Detecting an open load fault in the metering unit	wiring harness defective, cable break	Threshold for error detection is an internal ECU threshold. Check wiring harness and metering unit if necessary repair/replace it.
593	135	523615	12	powerstage of metering unit is overheated	over temperature	Threshold for error detection is an internal ECU threshold. Check functionality of metering unit and replace it if needed. Check temperature of metering unit and improve the installation in case of overheating.
1127	665	523632	3	Urea supply module pressure sensor: the current drain measured by ECU is above the target range	Shortcut to battery Broken wiring Pressure sensor in urea supply module defect	Check wiring Check pressure sensor in urea supply module
1128	665	523632	4	Urea supply module pressure sensor: the current drain measured by ECU is above the target range The sensed raw voltage value SCR_uRawUPmpP is above SCR_SRCUPmpP.uMin_C	Shortcut to ground Broken wiring Pressure sensor in urea supply module defect	Check wiring Check pressure sensor in urea supply module
1117	666	523632	11	Urea supply module pump: the current drain measured by ECU is above the target range	When the pump motor does not switch to pump actuation mode after temperature measurement has been carried out.	Threshold for error is an internal ECU threshold

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
122	591	523698	11	Shut off request from supervisory monitoring function	Engine Shut Off due to supervisory function	Threshold for error detection is an internal ECU threshold. Check error memory for additional errorcode to find root cause. Depending on additional error follow the documented "Take action for repair".
1100	676	523718	3	Urea heater relay: the current drain measured by ECU is above the target range	Shortcut to battery If this error detected during the heating phase it is a result error: KWP 1089 Broken wiring, broken relay	Threshold for error detection is an internal ECU threshold Check wiring Check SCR main relay
1101	676	523718	4	Urea heater relay: the current drain measured by ECU is above the target range	Shortcut to ground If this error detected during the heating phase it is a result error: KWP 1089 Broken wiring, broken relay	Threshold for error detection is an internal ECU threshold Check wiring Check SCR main relay
1098	676	523718	5	Urea heater relay: the current drain measured by ECU is above the target range	Open load If this error detected during the heating phase it is a result error: KWP 1089 Broken wiring broken relay	Threshold for error detection is an internal ECU threshold Test SCR main relay Check cabling, if necessary replace relay.
1109	672	523719	4	Urea supply module heater: the current drain measured by ECU is above the target range	Shortcut to ground If this error detected during the heating phase it is a result error: KWP 1089 Broken wiring Heating element in supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check cabling, if necessary replace supply module
1106	672	523719	5	Urea supply module heater: the current drain measured by ECU is above the target range	Open load If this error detected during the heating phase is a result error: KWP 1089 Broken wiring Heating element in supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check cabling, if necessary replace supply module
925	148	523720	8	Supply module heater: Duration of switch on is too long.	uty cycle for temperature readout from supply module heater to the control unit is out of range; Supply modul defect, fault in the wiring.	When the received supply module heater temperature duty cycle SCR_rSMT is out of the failurerange (SCR_rSMFailMax_C < SCR_rSMHtrT < SCR_rSMFailMin_C) Supply module check and replace if necessary. Check the wiring.
926	148	523720	8	Supply module heater: Dutycycle timing over error threshold.	Duty cycle for temperature readout from supply module heater to the control unit is not valid. Supply modul defect, fault in the wiring.	When the received supply module heater duty cycle SCR_rSMHtrT is in the valid range (SCR_r- Supply module check and replace if necessary. Check the wiring.
930	689	523721	8	Supply module heater: Dutycycle timing over error threshold.	Duty cycle for temperature readout from supply module to the control unit is out of range. Supply modul defect, fault in the wiring.	Supply module check and replace if necessary. Check the wiring.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
931	689	523721	8	Supply module heater: Dutycycle timing out of valid range.	Duty cycle for temperature readout from supply module to the control unit is not valid. Supply modul defect, fault in the wiring.	When the received supply module duty cycle SCR_rSMT is in the valid range (SCR_rSMTVld-Min_C <= SCR_rSMT <= SCR_rSMTVldMax_C), OR in the failure range (SCR_rSMFailMin_C <=SCR_rSMT <= SCR_rSMFailMax_C) Supply module check and replace if necessary. Check wiring.
927	689	523721	11	Supply module heater: temperature measurement not available.	Duty cycle for temperature readout from supply module heater to the control unit is not available. Supply modul defect, fault in the wiring.	Threshold for detection is an internal ECU threshold. No erasing in the current driving cycle. Supply module check and replace if necessary. Check the wiring.
929	691	523722	8	Supply module heater: Faulty PWM signal from supply module.	PWM Signal for temperature readout from supply module to the control unit is not valid. Supply modul defect, fault in the wiring.	Threshold for error detection is an internal ECU threshold. When valid Sync followed by temperature information signal is received AND valid sync and temperaturesignal for both information is received one after the other. Supply module check and replace if necessary. Check the wiring.
291	119	523776	9	Timeout Error of CAN-Receive-Frame TSC1TE - active	Timeout Error (Missing CAN Bus message)	Threshold for error detection is an internal ECU threshold. Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
292	119	523777	9	Message TSC1-TE has been missing (passive)	Passive timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus scheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range, check actuator
559	1-5-8	523895	13	Missing or wrong injector adjustment value programming (IMA) injector 1 (in firing order).	Missing or wrong injector adjustment value for cyl. 1.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA). Use SERDIA UseCase to check it.
560	1-5-8	523896	13	Missing or wrong injector adjustment value programming (IMA) injector 2 (in firing order).	Missing or wrong injector adjustment value for cyl. 2	Threshold for error detection is an internal ECU threshold. check dataset and flash correct injector adjustement value (IMA). Use SERDIA UseCase to check it.
561	1-5-8	523897	13	Missing or wrong injector adjustment value programming (IMA) injector 3 (in firing order).	Missing or wrong parametrisation of injector adjustment cyl. 3.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA).
562	1-5-8	523898	13	Missing or wrong injector adjustment value programming (IMA) injector 4 (in firing order).	Missing or wrong injector adjustment value for cyl. 4.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA).
563	1-5-8	523899	13	Missing or wrong injector adjustment value programming (IMA) injector 5 (in firing order).	Missing or wrong injector adjustment value for cyl. 5.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA).

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
564	1-5-8	523900	13	Missing or wrong injector adjustment value programming (IMA) injector 6 (in firing order).	Missing or wrong injector adjustment value for cyl. 6.	Threshold for error detection is an internal ECU threshold. Check correct injector adjustment value (IMA).
73	7-2-2	523912	4	@ engines < 4l: Throttle valve error, Open Load or Short cut to Battery, blocked valve or wrong control signal for valve. @ engines with Burner T4i: Pressure Sensor error after valve (DV2), lower limit reached	The sensed raw voltage value is below the minimum threshold.	The sensed raw voltage value DPM_uRawBrnDVDsP is above the minimum threshold DPM_SRCBrnDVDsP.uMin_C @ CRT < 4l: check throttle valve @ engines with Burner T4i: check back-pressure valve
42	167	523924	4	Overload at Pins O_V_RH2x: A01, K74, K91. Components on A01, K74, K91 cannot be activated. Internal ECU power stage switched off.	Suspected components: 1- Pin K91: Clutch switch, Brake switch, Engine brake demand, Regeneration activation, Parking brake, Gearbox N, Fan control 1 2- Pin K74: Boost air cooler bypass or electrical fuel pump relay, Fan control 2/fuel valve for flame star	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pins A01, K74, K91 and/or reflash ECU. If error is still present, exchange ECU.
38	731	523925	3	Short circuit to battery error of actuator relay 2. Components on Pin A88, K57 cannot be activated. Internal ECU power stage switched off.	Suspected Components: 1- Lamps K57: Warn Ash Charge, Diagnostic, Warn Coolant Temp/Level, Warn Oil, Warn Boost Air, Warn Air Filter, Warn Water in Fuel, SCR, Regeneration, Engine Running. 2- Relay Preheat A88 3- Exhaust Flap A88	Check wiring harness and connected loads on pins A88, K57.
43	731	523925	4	Short circuit to ground actuator relais 3 Overload at Pins O_V_RH3x: A88, K57	Suspected components: 1- Pin A88: Preheat relay, Exhaust flap 2- Pin K 57: - control lamps: - OBD, preheat lamp, warning temp., warning oil, maintenance lamp, regeneration indicator, alternator management, engine running, diagnostic	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pinsA88, K57. If error is still present, exchange ECU.
44	732	523926	4	Short circuit to ground aktuator relais 4. Overload at Pins O_V_PCV: A90	Suspected components:Fan, Wiring harness	Threshold for error detection is an internal ECU threshold. Check wiring harness and connected loads on pin A90. If error is still present, exchange ECU.
40	733	523927	3	Short circuit to battery error of actuator relay 2. Components on Pin A04, A05 cannot be activated. Internal ECU power stage switched off.	Suspected Components: 1- Urea Pump A04 2- SCR Heater A05	Check wiring harness and connected loads on pins A04, A05.
168	763	523935	12	Timeout Error of CAN-Transmit-Frame EEC3VOL1; Engine send messages	Fault is detected if a TimeOut of the EEC3VOL1 frame has occured.	Check wiring harness and customer nodes
169	764	523936	12	Timeout Error of CAN-Transmit-Frame EEC3VOL2; Engine send messages	Timeout Error (Missing CAN Bus message)	Check wiring harness and customer nodes

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
133	766	523938	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1IGCVol1 information; factors & Sensorcalibration for NOX Sensor (SCR-system upstream cat; DPF-system downstream cat)	Failure of the CAN Bus message	NOX sensor and sensor connection check
134	766	523939	9	Broadcast Announce Message of the calibration message of the upstream catalytic NOx sensor has failed. Timeout Error (BAM to BAM) for CAN-Receive-Frame AT1IGCVol1 information. factors & Sensorcalibration for NOX Sensor (SCR-system upstream cat, DPF-system downstream cat).	Defective Nox sensor, faulty parameterization	NOX sensor and sensor connection check
135	766	523940	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1IGCVol1 information; factors & Sensorcalibration for NOX Sensor (SCR-system upstream cat; DPF-system downstream cat)	Failure of the CAN Bus message	NOX sensor and sensor connection check
140	767	523941	9	Timeout Error (BAM to packet) for CAN-Receive-Frame AT1OGCVol2 information; factors & Sensorcalibration for NOX Sensor (SCR-system downstream cat; DPF-system downstream cat)	Timeout Error (Missing CAN Bus message)	NOX downstream sensor and sensor connection check
141	767	523942	9	Timeout Error (BAM to BAM) for CAN-Receive-Frame AT1OGCVol2 information, Calibration message 1 of the after catalyst NOx sensor has failed. Factors & Sensorcalibration for NOX Sensor (SCR-system downstream cat, DPF-system downstream cat)	Defective Nox sensor, faulty parameterization.	NOX downstream sensor and sensor connection check.
142	767	523943	9	Timeout Error (PCK2PCK) for CAN-Receive-Frame AT1OGCVol2 information; factors & Sensorcalibration for NOX Sensor (SCR-system downstream cat; DPF-system downstream cat)	The fault is detected when a timeout error in packet 2 of NOxSenVol2Rx frame occurs.	NOX downstream sensor and sensor connection check
1011	771	523960	0	Physical range check high for EGR cooler downstream temperature.	Sensed temperature downstream EGR-cooler > limit.	EGR-Valve blocked open EGR-Valve actuator defect EGR-cooler defect (check for coolant water) Reed Valve defect Intake throttle blocked in closed position Exhaust pressure too high Check Nox-sensor upstream SCR catalyst dp venturi sensor defect
1012	771	523960	1	Physical range check low for EGR cooler downstream temperature.	sensor voltage > lower limit	EGR-Valve blocked open EGR-Valve actuator defect EGR-cooler defect (check for coolant water) Reed Valve defect Intake throttle blocked in closed position Exhaust pressure too high Check Nox-sensor upstream SCR catalyst dp venturi sensor defect

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
360	737	523982	0	Powerstage diagnosis disabled; Indicating that battery voltage is not high.	Powerstage diagnostic can be deactivated due to too high battery voltage.	Check wiring, check alternator, check cables and repair or replace if necessary.
361	737	523982	1	Powerstage diagnosis disabled; Indicating that battery voltage is not low.	Powerstage diagnostic can be deactivated due to too low battery voltage.	Check wiring, check alternator, check cables and repair or replace if necessary.
1239	788	523984	3	Actuator relay 5: the voltage measured by ECU is out of the target range	Short-Circuit to battery to component	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU
1241	176	523986	4	Actuator relay 4: the voltage measured by ECU is out of the target range	Short-Circuit to ground to component	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU
1242	791	523987	4	Actuator relay 5: the voltage measured by ECU is out of the target range	Short-Circuit to ground to component	Threshold for error detection is an internal ECU threshold. Check wiring, component, ECU
1434	8-3-6	524050	11	CAN; not used	not used	not used
1435	8-3-7	524051	11	CAN; not used	not used	not used
1505	8-4-3	524057	2	Low fuel pressure: the low fuel pressure calculated by ECU is underneath the target range; the ECU activates a system reaction	Fuel pressure below warning threshold	Threshold for error detection is an internal ECU threshold. Check low fuel pressure system (fuel feed pump, relay , fuse, wiring, sensor) and if necessary repair or replace it.
1558	869	524063	3	SCR heater mainrelay; short circuit to battery Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Short-Circuit to battery on wiring to component	Check wiring, component
1559	869	524063	4	Connection between heating valve (Y31) on the control unit Pin A:92 and Load side SCR heater main relay (K31) is a short cut to ground. Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Faulty wiring, faulty heater relay (K27-K31), defective heating valve (Y31), broken element in heating.	Disconnect plug from heating valve (Y31) and reset fault. If fault is still present you have to look in the wiring of Y31 to the control unit Pin A:92. If error is no longer present, you have to check the wiring of Y31 via relay K31 and possibly the heating cables and relay (K27-K30).
1555	869	524063	5	Urea backflow line heater: broken wiring detected Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Open Load on wiring to component	Check wiring, component
1556	869	524063	5	Urea main relay: broken wiring detected Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	relay defect relay not connected wiring harness broken problems with supply voltage	Check wiring, component
1557	869	524063	5	Urea pressure line heater: broken wiring detected Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Open load on wiring to component	Check wiring, component
1560	869	524063	5	SCR relay for suction line not connected Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	relay defect relay not connected wiring harness broken problems with supply voltage	Check wiring, component

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1561	869	524063	5	Open load on wiring to component Threshold 1 < SCRHtr_rUHtrMeasRatio_mp < Threshold 2	Open load on wiring to component	Check wiring, component
1562	869	524063	5	SCR heater tank; open load	Open load on wiring to component	Check wiring, component
1646	869	524063	12	SCR supply module temperature is not reaching a threshold before a calibratable time is exceeded. Corresponding to the environmental Temperature a specific defrosting time is given. After starting the defrosting a clock counter is starting. Does the counter reach the given defrosting time limit, an error will be detected. Is the temperature reached in time the clock counter will be reset Example: by using the calibrated temperature/time curve --> environmental temperature 0°C --> defrosting time limit 6000s --> if the clock counter reaches 6000s the error will be detected	Suspected components: Enviroment temperature sensor defect SCR supply module temperature sensor defect SCR supply module electrical heater defect	Check Environment temperature sensor SCR supply module temperature sensor SCR supply module electrical heater
1565	892	524065	0	The relativ pressure value of the exhaust gas from the urea cat upstream sensor is greater than an applicable maximum pressure threshold	sensed presure upstream SCR catalyst > physical high range limit f(exhaust volume flow) UCatUsP_pRelFlt_mp > UCatUsP_pMax_mp	Check for crystallisation in exhaust line upstream SCR and dwnstream of urea injector Check correct connection from exhaust line to pressure sensor upstream SCR catalyst: syphons?, water in tube?, water in sensor? Check that exhaust pipe outlet is free (downstream SCR catalyst) Check wiring of pressure sensor upstream SCR catalyst Check pressure sensor upstream SCR catalyst: sensor has no connection to vehicle body? => Ensure that sensor is free Does sensor oscillate heavely at engine low idle / high idle? => try to supress the oscillating Exchange pressure sensor upstream SCR catalyst Check calculated exhaust volume flow of engine within EDC: SCR_dvolSCRUs pausible? If not: Check T sensor upstream SCR catalyst, check complete engine air path: EGR-Valve, Intake throttle, turbocharger, piping for leakage and function Check SCR catalyst: Broken? Exchange SCR-Catalyst

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1566	892	524065	1	The relativ pressure value of the exhaust gas from the urea cat upstream sensor is less than an applicable minimum pressure threshold	sensed presure upstream SCR catalyst > physical high range limit f(exhaust volume flow) UCatUsP_pRelFlt_mp < UCatUsP_pMin_mp	Check correct connection from exhaust line to pressure sensor upstream SCR catalyst: leakage? Check electric connector: 4h pin open / new connector type used? pressure exchange from inside electrical connector with the environemt possible Check exhaust line: any leakages upstream of SCR catalyst? Check wiring of pressure sensor upstream SCR catalyst Exchange pressure sensor upstream SCR catalyst Check calculated exhaust volume flow of engine within EDC: SCR_dvolSCRUs pausible? If not: Check T sensor upstream SCR catalyst, check complete engine air path: EGR-Valve, Intake throttle, turbocharger, piping for leakage and function Check SCR catalyst: Broken? Exchange SCR-Catalyst
1598	892	524065	2	Comparison of urea cat upstream exhaust gas- and environment pressure, the difference should not exceed a certain limit abs(UCatUsP_pDiffEnvCat_mp) > Threshold	absolut value of difference between sensed pressure upstream SCR catalyst and environmental pressure > limit abs(UCatUsP_pDiffEnvCat_mp) > Threshold	Check electric connector: 4h pin open / new connector type used? pressure exchange from inside electrical connector with the environemt possible? water in sensor? sensor frozen? Check wiring of pressure sensor upstream SCR catalyst Exchange pressure sensor upstream SCR catalyst Check intake manifold pressure sensor (Air_pCACDs) Check ambient pressure sensor (EnvP_p)
1569	892	524065	3	voltage of pressure sensor upstream SCR > voltage high limit	voltage of pressure sensor upstream SCR > voltage high limit	Check wiring of pressure sensor upstream SCR catalyst Check pressure sensor upstream SCR catalyst Exchange pressure sensor upstream SCR catalyst
1570	892	524065	4	voltage of pressure sensor upstream SCR < voltage low limit	voltage of pressure sensor upstream SCR < voltage low limit	Check wiring of pressure sensor upstream SCR catalyst. Check pressure sensor upstream SCR catalyst. Exchange pressure sensor upstream SCR catalyst

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1581	894	524067	0	Filtered urea supply module heater temperature value is above an applicable maximum heater temperature threshold of the supply module The temperature is read out via the PWM signal of the urea pump. That is only possible in status init of the SCR-system short after ignition was switched on. When that state is left the sensed temperature value is frozen.	sensed temperature of supply module heater > physical high range limit	Compare SCR_tSMT with SCR_tSMHtrT. Both show the same value? Check urea tank temperature (SCR_tAdapUTnkT). Very hot (> 70°C), urea tank heater permanet on? Does the pump never stop working? Check wiring to supply module Compare SCR_tSMT with SCR_tSMHtrT. Both show different values or urea tank temperature (SCR_tAdapUTnkT) is cold: exchange urea pump unit Supply module heater temperature sensor defect Supply module heater defect Supply module defect
1585	894	524067	0	Filtered urea supply module temperature value (SCR_tSMT) is above an applicable maximum temperature threshold of the supply module The temperature is read out via the PWM signal of the urea pump. That is only possible in status init of the SCR-system short after ignition was switched on. When that state is left the sensed temperature value is frozen.	sensed temperature of urea within supply module > physical high range limit	Compare SCR_tSMT with SCR_tSMHtrT. Both show the same value? Check urea tank temperature (SCR_tAdapUTnkT). Very hot (> 70°C), ure tank heater permanet on? Does the pump never stop working? Check wiring to supply module Compare SCR_tSMT with SCR_tSMHtrT. Both show different values or urea tank temperature (SCR_tAdapUTnkT) is cold: exchange urea pump unit Supply module temperature sensor defect Supply module heater defect Supply module defect
1582	894	524067	1	Filtered urea supply module heater temperature value is below an applicable minimum heater temperature threshold of the supply module The temperature is read out via the PWM signal of the urea pump. That is only possible in status init of the SCR-system short after ignition was switched on. When that state is left the sensed temperature value is frozen.	sensed temperature of supply module heater < threshold	Check ambient temperature EnvT_t < Threshold? Compare SCR_tSMT with SCR_tSMHtrT Check wiring with regard to supply modul heater exchange urea pump unit Supply module heater temperature sensor defect Supply module defect
1586	894	524067	1	Filtered urea supply module temperature (SCR_tSMT) value is below an applicable minimum temperature threshold of the supply module The temperature is read out via the PWM signal of the urea pump. That is only possible in status init of the SCR-system short after ignition was switched on. When that state is left the sensed temperature value is frozen.	sensed temperature of urea within supply module < physical low range limit	Check ambient temperature EnvT_t < threshold? Compare SCR_tSMT with SCR_tSMHtrT Check wiring with regard to supply modul heater exchange urea pump unit Supply module temperature sensor defect Supply module defect

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1867	894	524067	2	absolute diference of sensed temperature of supply module heater temperature and ambient temperature UPmpT_tDiffPmpHtrAmb_mp > threshold	absolute diference of sensed temperature of supply module heater temperature and ambient temperature UPmpT_tDiffPmpHtrAmb_mp > threshold	Compare SCR_tSMT with SCR_tSMHtrT, EnvT_t and CEngTds_t and SCR_tAdapUTnkT => All identical? If not: Has the machine been brought from cold environment into a warm one or vice versa without engine running, e.g. at workshop? Environment temperature sensor defect Coolant temperature sensor defect Supply module temperature sensor defect Problem at Supply module unit (broken?) => exchange supply module
1868	894	524067	2	absolute diference of sensed temperature of supply module temperature and ambient temperature > threshold	absolute diference of sensed temperature of supply module temperature and ambient temperature UPmpT_tDiffPmpAmb_mp > threshold	Compare SCR_tSMT with SCR_tSMHtrT, EnvT_t and CEngTds_t and SCR_tAdapUTnkT => All identical? If not: Has the machine been brought from cold environment into a warm one or vice versa without engine running, e.g. at workshop? Environment temperature sensor defect Coolant temperature sensor defect Supply module temperature sensor defect Problem at Supply module unit (broken?) => exchange supply module
1533	246	524074	9	Open load sensor internally at NOx-sensor downstream SCR	Open load sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor downstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration. Check wiring harness Exchange sensor
1534	247	524075	11	Short circuit sensor internally at NOx-sensor downstream SCR	Short circuit sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor downstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration? Rearrange if critical and possible Check wiring harness Exchange sensor

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1535	248	524076	9	Open line sensor internally at NOx-sensor downstream SCR NOx Sensors are CAN Sensors --> no HW Pin on the ECU	Open line sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor upstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration. Check wiring harness Exchange sensor
1536	249	524077	11	Short circuit sensor internally at NOx-sensor downstream SCR NOx Sensors are CAN Sensors --> no HW Pin on the ECU	Short circuit sensor internally at NOx-sensor downstream SCR	Threshold for error detection is an internal ECU threshold. Check NOx-Sensor upstream SCR catalyst: water inside? Shake out sensor after dismounting. => If water inside, replace sensor. Check mounting position of sensor and judge it regarding condense water formation / agglomeration. Check wiring harness Exchange sensor
1537	255	524078	9	Lambda value of NOx-Sensor downstream SCR is out of range. When the filtered Lambda concentration value at the sensor (ComRxSCR_rFltLamDs_mp) is greater than the physical range check max. lambda threshold	sensed lambda value of Nox-sensor downstream SCR catalyst is > physical high limit ComRxSCR_rCanLamDs_mp > threshold	Check whether NOx-sensor downstream SCR catalyst is physically mounted within the exhaust line Check Lambda values of NOx-sensor downstream SCR catalystat at idle conditions, ComRxSCR_rCanLamDs_mp > threshold? Compare to ComRxSCR_rCanLamUs_mp. Values must be almost identical Check CANBus of NOx-sensor downstream SCR catalyst Check NOx-sensor downstream SCR catalyst wiring Check NOx-sensor downstream SCR catalyst itself Replace NOx-sensor downstream SCR catalyst

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1538	256	524079	9	sensed lambda value of NOx-sensor downstream SCR catalyst is < physical low limit ComRxSCR_rCanLamDs_mp < threshold	sensed lambda value of NOx-sensor downstream SCR catalyst is < physical low limit ComRxSCR_rCanLamDs_mp < threshold	Compare to ComRxSCR_rCanLamUs_mp. ComRxSCR_rCanLamDs_mp must be almost identical! If almost identical, Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injection system of engine. Injector stuck? if sensed lambda upstream SCR higher (ComRxSCR_rCanLamUs_mp) : Diesel in Urea-tank? Check CANBus of NOx-sensor downstream SCR catalyst Check NOx-sensor downstream SCR catalyst wiring Check NOx-sensor downstream SCR catalyst itself Replace NOx-sensor downstream SCR catalyst
1539	257	524080	9	sensed lambda value of Nox-sensor upstream SCR catalyst is > physical high limit ComRxSCR_rCanLamUs_mp > Threshold	sensed lambda value of Nox-sensor upstream SCR catalyst is > physical high limit ComRxSCR_rCanLamUs_mp > Threshold	Check whether NOx-sensor upstream SCR catalyst is physically mounted within the exhaust line Check Lambda values of NOx-sensor upstream SCR catalystat at idle conditions, ComRxSCR_rCanLamUs_mp < Threshold? Compare to ComRxSCR_rCanLamDs_mp. Must be almost identical Check CANBus of NOx-sensor upstream SCR catalyst Check NOx-sensor upstream SCR catalyst wiring Check NOx-sensor upstream SCR catalyst itself Replace NOx-sensor upstream SCR catalyst
1540	258	524081	9	sensed lambda value of Nox-sensor upstream SCR catalyst is < physical low limit ComRxSCR_rCanLamUs_mp < Threshold	sensed lambda value of Nox-sensor upstream SCR catalyst is < physical low limit ComRxSCR_rCanLamUs_mp < Threshold	Check air path of engine: EGR-Valve, Intake-Throttle, Turbocharger and Piping each for leakage and correct function Check injection system of engine. Injector stuck? Check CANBus of NOx-sensor upstream SCR catalyst Check NOx-sensor upstream SCR catalyst wiring Check NOx-sensor upstream SCR catalyst itself Replace NOx-sensor upstream SCR catalyst
1542	261	524083	9	sensed NOx-value of NOx-sensor downstream SCR catalyst < Threshold	sensed Nox-value of Nox-sensor downstream SCR catalyst < physical low limit	Check CANBus of NOx-sensor downstream SCR catalyst Check NOx-sensor downstream SCR catalyst wiring Check NOx-sensor downstream SCR catalyst itself Replace NOx-sensor downstream SCR catalyst

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1544	912	524085	9	sensed Nox-value of Nox-sensor upstream SCR catalyst < Threshold	sensed Nox-value of Nox-sensor upstream SCR catalyst < physical low limit	Check CANBus of NOx-sensor upstream SCR catalyst Check NOx-sensor upstream SCR catalyst wiring Check NOx-sensor upstream SCR catalyst itself Replace NOx-sensor upstream SCR catalyst
1666	924	524100	9	Timeout error of CAN-Transmit-Frame Com-DPFHisDat.	Open load on CANBUS wiring.	Check wiring, component.
1676	928	524104	9	Timeout error of CAN-Receive-Frame Com-RxDPFCtl. CM1 Module Customer Recieve Message.	Time out of Check CANBUS EAT Control Receive Message, PGN65348. The message is not received.	Threshold for error detection is an internal ECU threshold. Check CANBUS EAT Control Receive Message, PGN65348. CM1 Module Customer Recieve Message.
1672	9-4-2	524118	9	Timeout error of CAN-Receive-Frame ComRxCM1	If the frame CM1 message is not transmitted successfully	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
1683	9-4-5	524121	9	Timeout error of CAN-Receive-Frame Com-RxTrbChActr	Timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
1687	9-4-9	524125	9	Timeout error of CAN-Receive-Frame Com-TxTrbChActr	Timeout Error (Missing CAN Bus message)	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range.
1827	192	524141	7	DEF dosing valve is blocked with crystalized urea or other deposits.	While SCR system is starting up and fter urea pressure reaches 10000 hPa, the DEF dosing module is tested. Expectation is that urea pressure drops below 1500 hPa if injector works properly. The test is repeated up to 3 times before an error is set. SCRSysPresMon_stPresDropDet_mp = 0 while SCRCo_stStatus_mp = 16. Suspected component: wiring harness DEF dosing valve The error is stored into the EEPROM of the ECU and status at ECU shut down is regained at ignition on.	Check electrical connection of urea injector: - wiring harness - connector Conduct SERDIA use-case "injection test". If it is faulty: - remove urea injector from exhaust line: - check for crystallisation direct on injector nozzle / plate - rinse it thoroughly in water - remount urea injector and conduct SERDIA use-case "injection test" If the error is still active, then exchange urea injector.
1858	192	524141	7	DEF dosing valve is blocked with crystalized urea or other deposits.	While SCR system is starting up and fter urea pressure reaches 10000 hPa, the DEF dosing module is tested. Expectation is that urea pressure drops below 1500 hPa if injector works properly. The test is repeated up to 3 times before an error is set. SCRSysPresMon_stPresDropDet_mp = 0 while SCRCo_stStatus_mp = 16. Suspected component: wiring harness DEF dosing valve The error is stored into the EEPROM of the ECU and status at ECU shut down is regained at ignition on.	Check electrical connection of urea injector: - wiring harness - connector Conduct SERDIA use-case "injection test". If it is faulty: - remove urea injector from exhaust line: - check for crystallisation direct on injector nozzle / plate - rinse it thoroughly in water - remount urea injector and conduct SERDIA use-case "injection test" If the error is still active, then exchange urea injector.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1639	966	524147	13	No proper urea pressure level could be build up within the SCR system state "Fill Lines" => SCRCo_stStatus_mp = 1 within some miuntes	This error shows up, if no proper urea pressure level could be build up within the SCR system state "Fill Lines" => SCRCo_stStatus_mp = 1 within some minutes Once the urea pump pressure has exceeded the threshold the error is declared as okay. Suspected components: Suction line blocked PWM Powerstage has a defect and a default value which leads not to a rising pressure Pump Pressure sensor defect pump filter contains dirty parts reverting valve continously open	Make sure that frozen lines, pump or tank can be excluded! Check whether there is urea in the urea tank Check urea lines: All lines connected? The right lines connected to the correct places? Suction line blocked? No leakage? Not also urea to the outside but also air into the lines, especially in the suction line! Perform service routine "pressure test": Does the urea pump work? => check wiring harness & PWM signal for pump Does the urea pressure rise? DFC already healed? If all unsuccessful so far: Check urea pressure sensor: At ignition on and SCR system state = 0 ("Init check"), SCR_pAbsAdapUPmpP shall be identical to EnvP_p. Fulfilled: Sensor okay! Check reverting valve => see DFC_SCRCoRevVlvBlk Check pump filter: dirt inside? Suspected components: Urea pump broken Reverting valve continously open Urea suction line, backflow line broken or connection swapped PWM Powerstage has a defect Pump Pressure sensor broken
1874	971	524152	2	CAN message is not received fora definite time => error is set. As soon as the message is received the error heals.	CAN message is not received for a definite time => error is set. As soon as the message is received the error heals.	Check eletrical connection oif urea quality sensor Check engine CAN bus Check urea quality sensor itself Exchange urea quality sensor
1875	997	524153	2	CAN message is not reseived for a definite time => error is set. As soon as the message is received the error heals.	CAN message is not reseived for a definite time => error is set. As soon as the message is received the error heals.	Check eletrical connection of suction unit sensor (combined sensor with tank level and tank temperature) Check engine CAN bus Check level sensor itself Exchange suction unit
1705	972	524156	9	Timeout error of CAN-Receive-Frame ComRxEBC2 from wheel speed sensor.	Timeout Error (Missing CAN Bus message) Defect on wheel speed sensor.	Check CAN Bus cabling (Bus sheduling, polarity, short circuit, power interrupt), test protocol of receiver, check CAN functional range. Replace the wheel speed sensor.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1863	995	524177	7	The error shows up, if no proper urea presure could be build up within the SCR system state "Fill Lines" => SCRCo_stStatus_mp = 1.	This error shows up, if no proper urea presure could be build up within the SCR system state "Fill Lines" => SCRCo_stStatus_mp = 1. 3 cases can lead to the error: Case A: increasing pressure is detected within 15s the check has passed => no error Case B: The pressure threshold was not reached within the 60s but case A was not positiv. Case C: The minimum pressure of 3000 hPa was not reached within the 60s.	Make sure that DEF lines, pump and tank are not frozen. Check for DEF level in the tank. Check DEF lines: Are all DEF lines connected? Is the suction line blocked? Is ther any leakage? Not only urea to the outside but also air into the lines, especially in the suction line! Perform SERDIA usecase "pressure test": Does the DEF pump work? => check wiring harness & PWM signal for pump. Does the urea pressure increase? All errors are already healed? If still unsuccessful so far: Check urea pressure sensor: At ignition on and SCR system state = 0 ("Init check"), SCR_pAbsAdapUPmpP shall be identical to EnvP_p. Fulfilled: Sensor okay! Check DEF pump filter: Is any dirt inside? Suspected components: Suction line PWM Powerstage has a defect and a default value which leads not to a rising pressure DEF pump pressure sensor defect DEF pump filter contains dirty parts

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1864	996	524178	7	The urea pump is not able to control the urea pressure between 9bar and 11 bar.	The urea pump controller is not able to control the urea pressure between 9bar and 11 bar due to malfunction in the SCR system. Suspected components: - DEF pump broken - Reverting valve continously open - Urea suction line, backflow line broken or connection swapped - PWM Powerstage has a defect - Pump Pressure sensor broken	Make sure that DEF lines, pump and tank are not frozen. Check for DEF level in the tank Check DEF lines: All lines connected? The right lines connected to the correct places? Suction line blocked? Is there any leakage? Not also urea to the outside but also air into the lines, especially in the suction line! Perform SERDIA usecase "pressure test": Does the DEF pump work properly? => check wiring harness & PWM signal for pump Does the DEF pressure rise? Is the error healed? If still unsuccessful so far: - Check DEF pressure sensor: At ignition on and SCR system state = 0 ("Init check"), SCR_pAbsAdapUPmpP shall be identical to EnvP_p. Fulfilled: Sensor okay! - Check reverting valve - Check DEF pump filter: dirt inside? Suspected components: DEF pump broken Reverting valve continously open DEF suction line, backflow line broken or connection swapped PWM Powerstage has a defect DEF pump pressure sensor broken
1891	272	524190	14	Not enough urea in tank or low urea quality or hardware tampering failure is detected or hardware failure is detected	Low DEF tank level Low DEF quality Hardware Tampering is active Hardware Failure is active	Check DEF level in tank. If there is no DEF, refill up to volume above the warning threshold. Check the DEF quality in the tank. If wrong fluid is filled, refill with proper DEF. Check other errors based on hardware malfunctions.
1892	273	524191	14	A low DEF tank level or a low DEF quality is detected or hardware tampering(system components are pinched off) or hardware failures as shortcut to battery, shortcut to ground etc. are detected.	Low DEF tank level Low DEF quality Hardware Tampering is active Hardware Failure is active	Threshold for error detection is an internal ECU threshold. Check the DEF level in tank. If there is no DEF, refill up above the warning level. Check DEF quality filled in the tank. Check other errors based on hardware tampering or failure.

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1893	275	524193	8	The total time in standstill-regeneration mode exceeds the long-limit threshold within last 500h total engine run time. The error is activated if the engine runs to many times in Standstill regeneartion.	Stand-still mode is very often aborted by the operator. Stand-still mode does not reach required temperature level and regeneration level is therefore reached after a short time again	Read out stand-still statistics => see service manual: Stand-still operation finished or often interrupted by driver / engine shut-off? => Run stand-still and instruct operator Stand-still operation required often by soot load => Check dp DPF pressure sensor Stand-still mode does not reach required temperature level: Check engine air path: Intake Trottle, EGR-Valve and turbocharger okay? Any leakage in engine air intake sytem or exhaust gas system? Check temperature sensors within exhaust system: upstream DOC, downstream DOC If soot load level of DPF allow it: Perform Stand-still and check reached temperature level upstream and downstream DOC: T upstream DOC in the range of 480-550°C? Downstream DOC after 25 min stand-still main phase 590°C are reached? Temerature traces are steady and even? Temperature downstream DOC higher than upstream DOC but difference does not exceed 100 K? Very small difference (< 10 K after 25 min stand-still main phase, 590 °C downstream DOC are not reached) => exchange DOC Very big difference (>100 K after 25 min stand-still main phase, 590 °C downstream DOC exceeded) => check injection system of engine & engine air path

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1894	276	524194	8	The total time in standstill-regeneration mode exceeds the long-limit threshold: 2,5h stand-still operation within 50h total motor run time. The error is activated if the engine runs to much time in short Standstill regeneartion.	Stand-still mode is aborted / interrupted too often by the operator Stand-still is required too often due to miscalculation in the soot model Stand-still mode does not reache temperature level and regeneration level is therefore reached after a short time again.	Read out stand-still statistics => see service manual: Stand-still operation finished or often interrupted by driver / engine shut-off? => Run stand-still and instruct operator Stand-still operation required often by soot load => Check dp DPF pressure sensor Stand-still mode does not reach required temperature level: Check engine air path: Intake Trottle, EGR-Valve and turbocharger okay? Any leakage in engine air intake sytem or exhaust gas system? Check temperature sensors within exhaust system: upstream DOC, downstream DOC If soot load level of DPF allows it: Perform Stand-still and check reached temperature level upstream and downstream DOC: T upstream DOC in the range of 480-550°C? Downstream DOC after 25 min stand-still main phase 590°C are reached? Temerature traces are steady and even? Temperature downstream DOC higher than upstream DOC but difference does not exceed 100 K? Very small difference (< 10 K after 25 min stand-still main phase, 590 °C downstream DOC are not reached) => exchange DOC Very big difference (>100 K after 25 min stand-still main phase, 590 °C downstream DOC exceeded) => check injection system of engine & engine air path

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Table 3-9. Engine Fault Codes

Deutz Code	Blink Code	SPN	FMI	Description	Possible Cause	Action
1900	279	524195	14	The standstill request of detected crystallization is ignored for more than 5h(>300min) This will be activated if there is a standstill request activated by Crystalisation Monitoring.	Back pressure upstream SCR catalyst has reached a level which indicates crystallisation inside of exhaust line. The error detection depends on the sensed pressure upstream of the SCR catalyst and the calculated exhaust volume flow through the mixer pipe. In case of error is set, but no crystallisation can be found in the mixing pipe, a possible reason can be the defect sensors: - exhaust pressure & temperature upstream of the SCR catalyst, - the ambient pressure - the exhaust mass flow => Check air path system at the engine.	Dismount urea injector from exhaust line and inspect visually the injector and the exhaust line for urea crystallisation upstream of SCR catalyst: If crystallisation can be clearly seen, then stand-still must be processed. Has the engine been operated in low load for longer time? If yes, then it could be the reaoson for crystallisation. Does the NOx-Sensors work properly? Compare ComRxSCR_rNOxUs to ComRxSCR_rNOxDs, when ComRxSCR_stNOxRdyUs = 1 & ComRxSCR_stNOxRdyDs = 1 (Warm engine and EAT-system, SCRT_tCatAvrgExhGs_mp > 250°C, SCR_stStatus = "Dosing" = 8): sensed NOx upstream of SCR catalyst must be higher than downstream of SCR catalyst. Go to idle and wait until SCR system enters status "stand-by" (no dosing), SCRT_tCatAvrgExhGs_mp < 225°C: ComRxSCR_rNOxUs = ComRxSCR_rNOxDs Clean urea injector: rinse it thourougly under water Check EGR-Path: difference pressure sensor at venturi tube, EGR cooler, EGR-Valve, Reed-Valve, Intake throttle regarding function and leakage. Does the EGR-cooler leak water in the exhaust? Check air path for leakage Check turbocharger No crystallisation can be seen in the mixing pipe: Check exhaust pressure sensor upstream of SCR catalyst (SCR_pSensUCatUsP): tube, water in sensor? Check environmental pressure sensor (EnvP_p): plausible? Check exhaust temperature sensor upstream of SCR-catalyst (SCR_tSensUCatUsT): plausible compared to Exh_tOxiCatUs & Exh_tOxiCatDs e.g. when engine has idled for 20 minutes? => Run stand-still to remove crystallisation and to reset the DFC
1108	672	5232719	3	Urea supply module heater: the current drain measured by ECU is above the target range	Short circuit to battery If this error detected during the heating phase it is a result error:KWP 1089 Broken wiring Heating element in supply module defect	Threshold for error detection is an internal ECU threshold Check wiring Check cabling, if necessary replace supply module

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3.32 CAT DGC DIAGNOSTIC SUPPORT AND TROUBLE CODE DEFINITIONS

This section defines the diagnostics and recommended troubleshooting procedures associated with the engine control module (ECM) on the CAT 3.4 engine.

This section is organized in the following manner:

1st page of Diagnostic Information for a Given Fault (See Figure 3-93.) then:

2nd Page of Diagnostic Information for a Given Fault (See Figure 3-94.)

DTC XXXX- Diagnostic Condition

Block Diagram of Circuit

- *External Hardware Input/Output*- This identifies the hardware that either sends an input to the ECM or is driven by and ECM output.
- *Check Condition*- This defines what condition to troubleshoot the fault condition.
- *Fault Condition(s)*- This identifies the condition(s) that set the fault.
- *Corrective Action(s)*- This identifies the *RECOMMENED* corrective action(s) that the ECM is generally programmed to perform. In some instances, the calibration engineer(s) may choose to perform a different action.
- Emissions or Non-emissions related fault

Text to identify the circuit of interest and its use for control.

Text to describe the conditions that cause the fault to set.

Figure 3-93. 1st page of Diagnostic Information for a Given Fault

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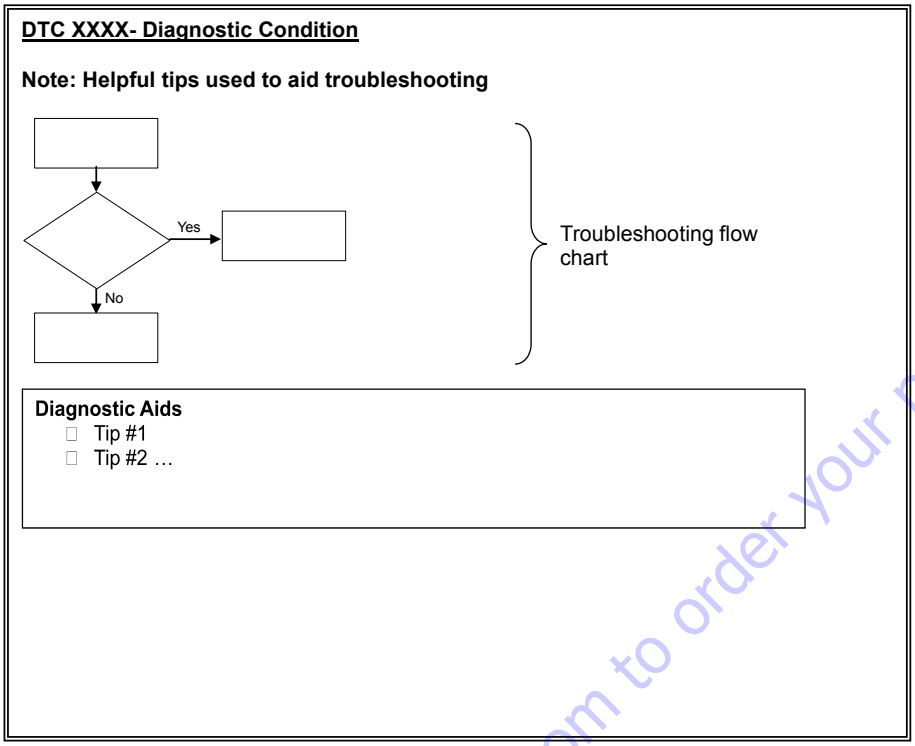

Figure 3-94. 2nd Page of Diagnostic Information for a Given Fault

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List of Abbreviations in this Section

ABBREVIATION	MEANING
AL	Adaptive Learn
BP	Barometric Pressure
CAN	Controller Area Network
CCP	CAN Calibration Protocol
CHT	Cylinder Head Temperature
CL	Closed Loop
CNG	Compressed Natural Gas
DBW	Drive-By-Wire
DGC	Diesel Governor Control
DM	Diagnostic Message
DMM	Digital Multi-Meter (high impedance)
DST	Diagnostic Scan Tool
DTC	Diagnostic Trouble Code
DVOM	Digital Voltage and Ohm Meter (high impedance)
ECI	EControls Inc.
ECIPP	EControls Inc. Proprietary Protocol
ECM	Engine Control Module
ECT	Engine Coolant Temperature
ECU	Engine Control Unit
EDIS	EControls Display and Interface Software
EGO	Exhaust Gas Oxygen Sensor, typically heated
EMWT	Exhaust Manifold Water Temperature
EPR	Electronic Pressure Regulator
ERWT	Exhaust Manifold Riser Temperature
ETB	Electronic Throttle Body
ETC	Electronic Throttle Control
FDR	Flight Data Recorder
FMI	Failure Mode Indicator
FO	Firing Order
LED	Light Emitting Diode
LPG	Liquefied Propane Gas
MAP	Manifold Absolute Pressure
MGCP	Marine Global Control Platform
µP	Microprocessor
Mfg	Manufacture
MIL	Malfunction Indicator Lamp
NG	Natural Gas
OBD	On-Board Diagnostics
OEM	Original Equipment Manufacture
PC	Personal Computer
PCU	Powertrain Control Unit
PFI	Port Fuel Injection
PGN	Parameter Group Number

ABBREVIATION	MEANING
PWM	Pulse Width Modulated
RAM	Random Access Memory
RPM	Revolutions Per Minute
Rx	Receive
SAE	Society of Automotive Engineering
SA	Source Address
SPFI	Sequential Port Fuel Injection
SPN	Suspect Parameter Number
Tach	Tachometer
TBI	Throttle Body Injection
TDC	Top Dead Center
TIP	Throttle Inlet Pressure
TPS	Throttle Position Sensor
TSC	Torque/Speed Control
Tx	Transmit
FP	Fuel Pressure
FPP	Foot Pedal Position
FRP	Fuel Rail Pressure
FRT	Fuel Rail Temperature
FSS	Fault Snapshot
FT	Fuel Temperature
GCP	Global Control Platform
HDGCP	Heavy-Duty Global Control Platform (On-Road Heavy-Duty)
HEGO	Heated Exhaust Gas Oxygen Sensor (same as HO2S)
HO2S	Heated Oxygen Sensor (same as HEGO)
IAC	Idle Air Control
IAT	Intake Air Temperature
ICAV	Instant Crank Angle Velocity
IVS	Idle Validation Switch
LDGCP	Light-Duty Global Control Platform (Industrial, Smart/ Logic Coil)
UEGO	Universal Exhaust Gas Oxygen Sensor (also called wide-range EGO)
VDC	Voltage, Direct Current
VR	Variable Reluctance
Vsw	Switched, Ignition Voltage
WGP	Waste-Gate Pressure

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Diagnostic Trouble Codes

The numeric diagnostic trouble codes assigned to the faults in this section are cross-referenced to SAE's "Recommended Practice for Diagnostic Trouble Code Definitions" (SAE J2012). While these codes are recommended, the manufacturer may define their own codes by assigning a new number to the flash code in the diagnostic calibration. This will assign both the DTC as displayed in EDIS as well as the flash code output on the MIL output pin. EDIS may be used to connect to the DGC ECM via CAN.

CAN

The DGC supports SAE J1939 CAN based diagnostic support. This includes:

- DM1: Active Diagnostic Trouble Codes
- DM2: Previously Active Diagnostic Trouble Codes
- DM3: Diagnostic Data Clear/Reset of Previously Active DTCs
- DM4: Freeze Frame Parameters
- DM5: Diagnostic Readiness (bytes 1, 2, and 3 are supported)
- DM11: Diagnostic Data Clear/Reset For Active DTCs
- DM12: Emissions-Related Active Diagnostic Trouble Codes
- DM19: Calibration Information

All diagnostic trouble codes broadcast over CAN will be SAE J1939 DM1 and DM2 formatted messages. DGC ECMs are compliant with J1939 OBD-M, supporting the Diagnostic Messages above as well as user indicators and CAN data defined in the OBD-M protocol. Faults available for broadcast and their respective SPN/FMI numbers are dependent on the application and engine calibration. There are 4 CAN SPN/FMI lists available in the DGC software set, contact EControls Inc. for a list of CAN SPN/FMIs.

The data capture at the occurrence of a fault, known in the ECM as fault snapshot (FSS), is available upon DM4 request. The following bytes are supported for DM4 if configured in the ECM software:

- Byte 1: Freeze Frame Length
- Byte 2-6: SPN, FMI, SPN Conversion Method, and Occurrence
- Byte 7: Manifold Absolute Pressure
- Byte 8-9: Engine Speed
- Byte 10: Engine Load (MAP based estimate)
- Byte 11: Engine Coolant Temperature
- Byte 14: # of starts since fault was last active
- Byte 15: Index into FSS_storage table for Fault Snap Shot retrieval

Resetting active and previously active DTCs is handled through DM11 and DM3, respectively DM1 and DM2 lamp indicators are assigned to each fault based on the fault.s diagnostic action as defined in the calibration. The lamps are assigned based on the configuration outlined in Table 3-10.

Table 3-10. J1939 Diagnostic Lamp Configuration

ECI DIAGNOSTIC ACTION	J1939 LAMP
MIL	MIL
Soft Warning	Amber
Hard Warning, Low Rev Limit, Shutdown	Red Stop
Power Derate 1 & 2	Protect
Forced Idle	None (use in combination with other action)

MIL Output

The MIL output is used to convey fault information to the equipment operator. The MIL is always on (grounded) when the system is in a key-on (Vsw), engine-off state. This provides assurance that the output is functional. If a DTC is logged as previously-active (historic), the MIL will send a single flash for the "Blink on-time" every "Blink off-time."

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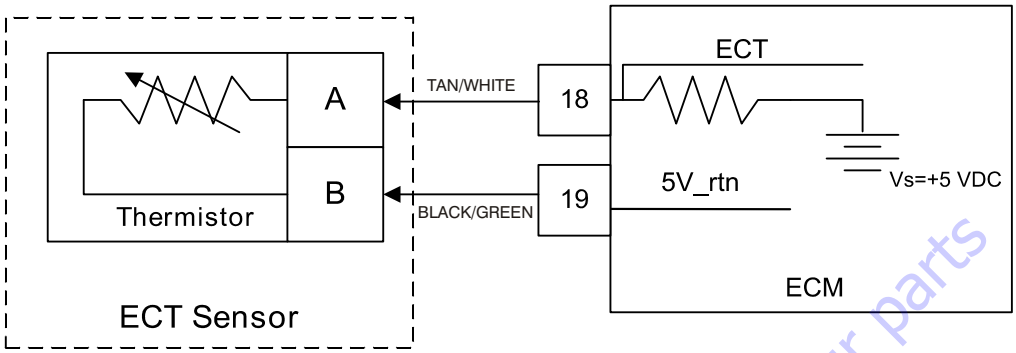
DTC 116- ECT Higher Than Expected Stage 1



- Engine Coolant Temperature Sensor
- Check Condition-Engine Running
- Fault Condition-Engine Coolant Temperature reading or estimate greater than the stage 1 limit when operating at a speed greater than defined in the diagnostic calibration
- Corrective Action(s): Sound audible warning or illuminate secondary warning lamp, disable adaptive learn fueling correction during active fault. Recommend a power derate 1/2 and/or a low rev limit to protect engine from possible damage.
- Non-emissions related fault

The Engine Coolant Temperature sensor is a thermistor (temperature sensitive resistor) located in the engine coolant. Some engines use a CHT sensor that is located in the coolant in the cylinder head. Some engines use an ECT (Engine Coolant Temperature) sensor that is located in the coolant near the thermostat. If the engine is equipped with a CHT sensor then the ECT value is estimated. If equipped with an ECT sensor then the CHT value is estimated. They are used for engine airflow calculation, ignition timing control, to enable certain features, and for engine protection. The ECM provides a voltage divider circuit so when the sensor reading is cool the sensor reads higher voltage, and lower when warm.

This fault will help protect the engine in the event of over temperature. When the coolant exceeds x deg. F and engine RPM exceeds y RPM for the latch time this fault will set.

Diagnostic Aids

If the "ECT High Voltage" fault is also present, follow the troubleshooting procedures for that fault as it may have caused "ECT Higher Than Expected 1."

If the cooling system utilizes an air-to-water heat exchanger (radiator) and fan:

- Check that the radiator has a proper amount of ethylene glycol/water and that the radiator is not leaking
- Ensure that there is no trapped air in the cooling path
- Inspect the cooling system (radiator and hoses) for cracks and ensure connections are leak free
- Check that the fan is operating properly
- Check that the thermostat is not stuck closed

If the cooling system utilizes a water-to-water heat exchanger:

- Check that the heat exchanger has a proper amount of ethylene glycol/water and that the heat exchanger is not leaking
- Ensure that there is no trapped air in the cooling path
- Inspect the cooling system (radiator and hoses) for cracks and ensure connections are leak free
- Check that the raw water pickup is not blocked/restricted by debris and that the hose is tightly connected
- Check that the thermostat is not stuck closed
- Check that the raw water pump/impeller is tact and that it is not restricted

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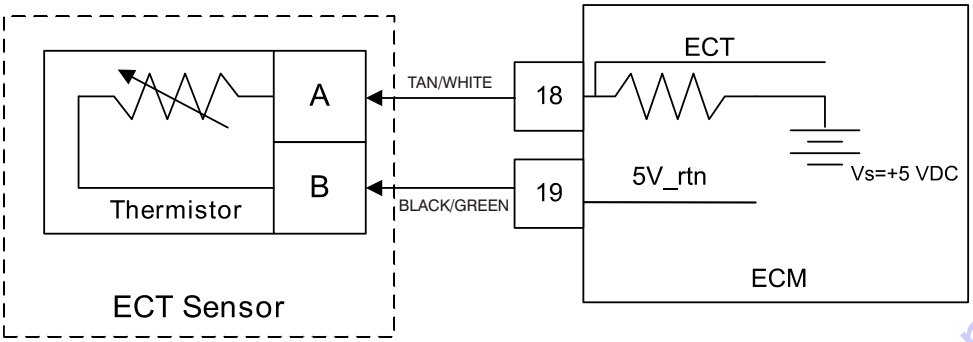
DTC 117- ECT/CHT Low Voltage



- Engine Coolant Temperature Sensor
- Check Condition-Engine Running
- Fault Condition-CHT/ECT sensor voltage less than the limit defined in the diagnostic calibration
- Corrective Action(s)- Sound audible warning or illuminate secondary warning lamp, disable adaptive learn fueling correction during active fault, or any combination thereof as defined in calibration. Recommend a power derate 1/2 to reduce the possibility of engine damage due to the inability to sense temperature.
- Non-emissions related fault

The Engine Coolant Temperature sensor is a thermistor (temperature sensitive resistor) located in the engine coolant. Some engines use an ECT sensor that is located in the coolant near the thermostat. Some engines use a CHT (Cylinder Head Temperature) sensor that is located in the coolant in the cylinder head. If the engine is equipped with an ECT sensor then the CHT value is estimated. If equipped with a CHT sensor then the ECT value is estimated. The ECM provides a voltage divider circuit so that when the coolant is cool, the signal reads higher voltage, and lower when warm.

This fault will set if the signal voltage is less than the limit defined in the diagnostic calibration anytime the engine is running. The limit is generally set to 0.10 VDC. The ECM will use a default value for the CHT/ECT sensor in the event of this fault.

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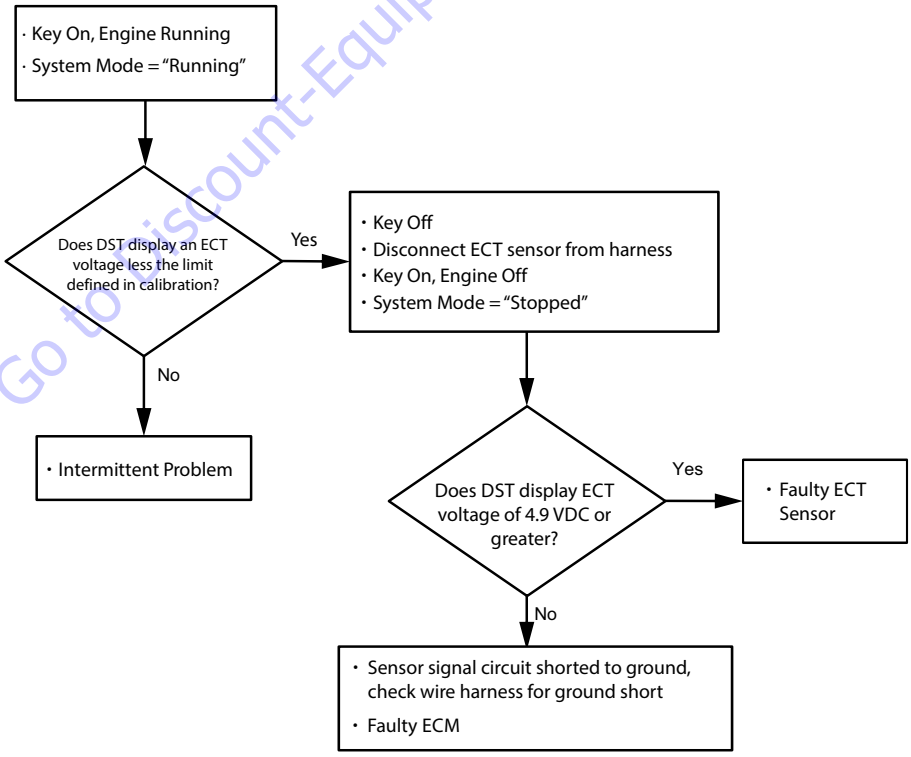
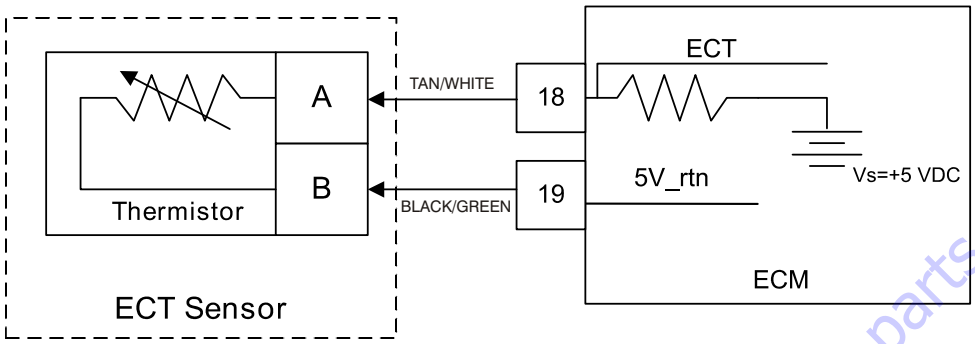


DTC 118- ECT/CHT High Voltage



- Engine Coolant Temperature Sensor
- Check Condition-Engine Running
- Fault Condition-CHT/ECT sensor voltage higher than the limit defined in the diagnostic calibration
- Corrective Action(s)- Sound audible warning or illuminate secondary warning lamp, disable adaptive learn fueling correction during active fault, or any combination thereof as defined in calibration. Recommend a power derate 1/2 to reduce the possibility of engine damage due to the inability to sense temperature.
- Non-emissions related fault

The Engine Coolant Temperature sensor is a thermistor (temperature sensitive resistor) located in the engine coolant. Some engines use an ECT sensor that is located in the coolant near the thermostat. Some engines use a CHT (Cylinder Head Temperature) sensor that is located in the coolant in the cylinder head. If the engine is equipped with an ECT sensor then the CHT value is estimated. If equipped with a CHT sensor then the ECT value is estimated. The ECM provides a voltage divider circuit so that when the coolant is cool, the signal reads higher voltage, and lower when warm.

This fault will set if the signal voltage is higher than the high voltage limit as defined in the diagnostic calibration anytime the engine is running. The limit is generally set to 4.90 VDC. In many cases, this condition is caused by the CHT/ECT sensor being disconnected from the engine harness, an open-circuit or short-to-power of the CHT/ECT circuit in the wire harness, or a failure of the sensor. The ECM will use a default value for the CHT/ECT sensor in the event of this fault.

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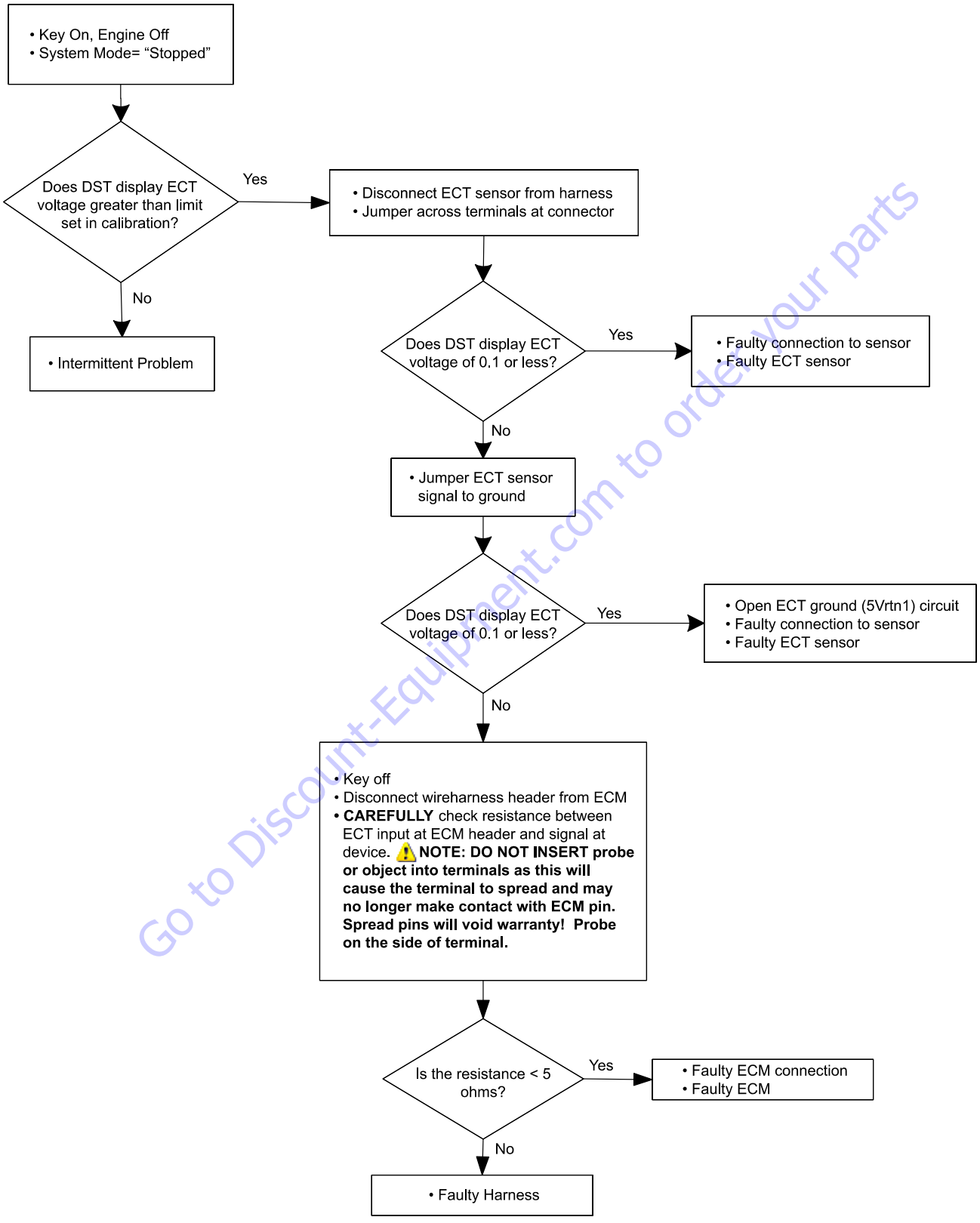

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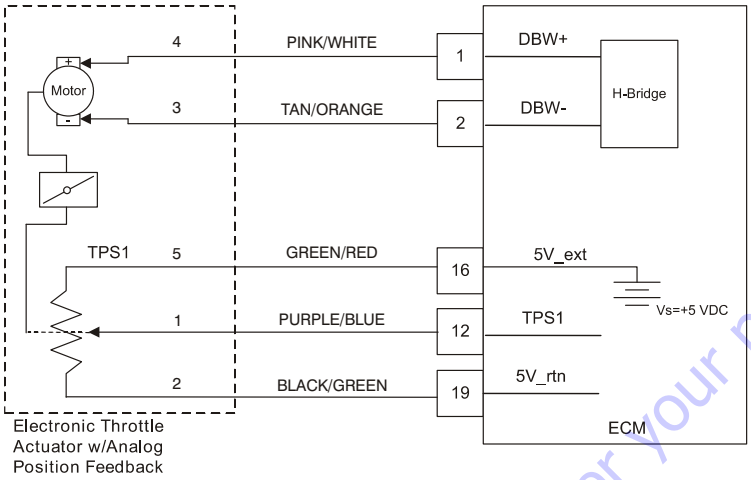
DTC 122- TPS1 Signal Voltage Low



- Throttle Position Sensor 1
- Check Condition-Key On, Engine Off
- Fault Condition-TPS1 sensor voltage lower than the limit defined in the diagnostic calibration
- Corrective Action(s): Sound audible warning or illuminate secondary warning lamp, shutdown engine
- Non-emissions related fault

In the case of a diesel engine, an actuator controls a fuel injection pump, directly affecting the fueling level into the cylinders. This may be by direct manipulation of the fuel injection pump rack or by manipulation of the mechanical governor control level or "throttle arm." In the DGC ECM and EDIS, references to the throttle and throttle position sensor refer to these fuel injection pump control actuators and their position feedback sensors. When the fuel injection pump is electronically controlled it can be used to control the idle stability and limit engine speed based on operating conditions.

The Throttle Position Sensor uses either;

1) a variable resistor and voltage divider circuit or

2) a non-contact hall-effect sensor to determine throttle actuator position, and is located within the throttle actuator.

There are two types of throttle actuators;

1) actuator with analog position feedback and

2) actuator with digital position feedback

The first type, with analog position feedback, provides an analog return signal between 0 and 5 volts that is proportional to the throttle actuator position. The second type, with digital position feedback, provides a serial data signal to the ECM with the throttle actuator position voltage level encoded in the data stream.

This fault will set if TPS1 voltage is lower than the low voltage limit as defined in the diagnostic calibration at any operating condition while the engine is cranking or running. The limit is generally set to 4.90 VDC. In many cases, this condition is caused by the TPS sensor being disconnected from the engine harness, an open-circuit or short-to-ground of the TPS circuit in the wire harness, or a failure of the sensor. This fault should be configured to trigger an engine shutdown and the engine will not start with this fault active.

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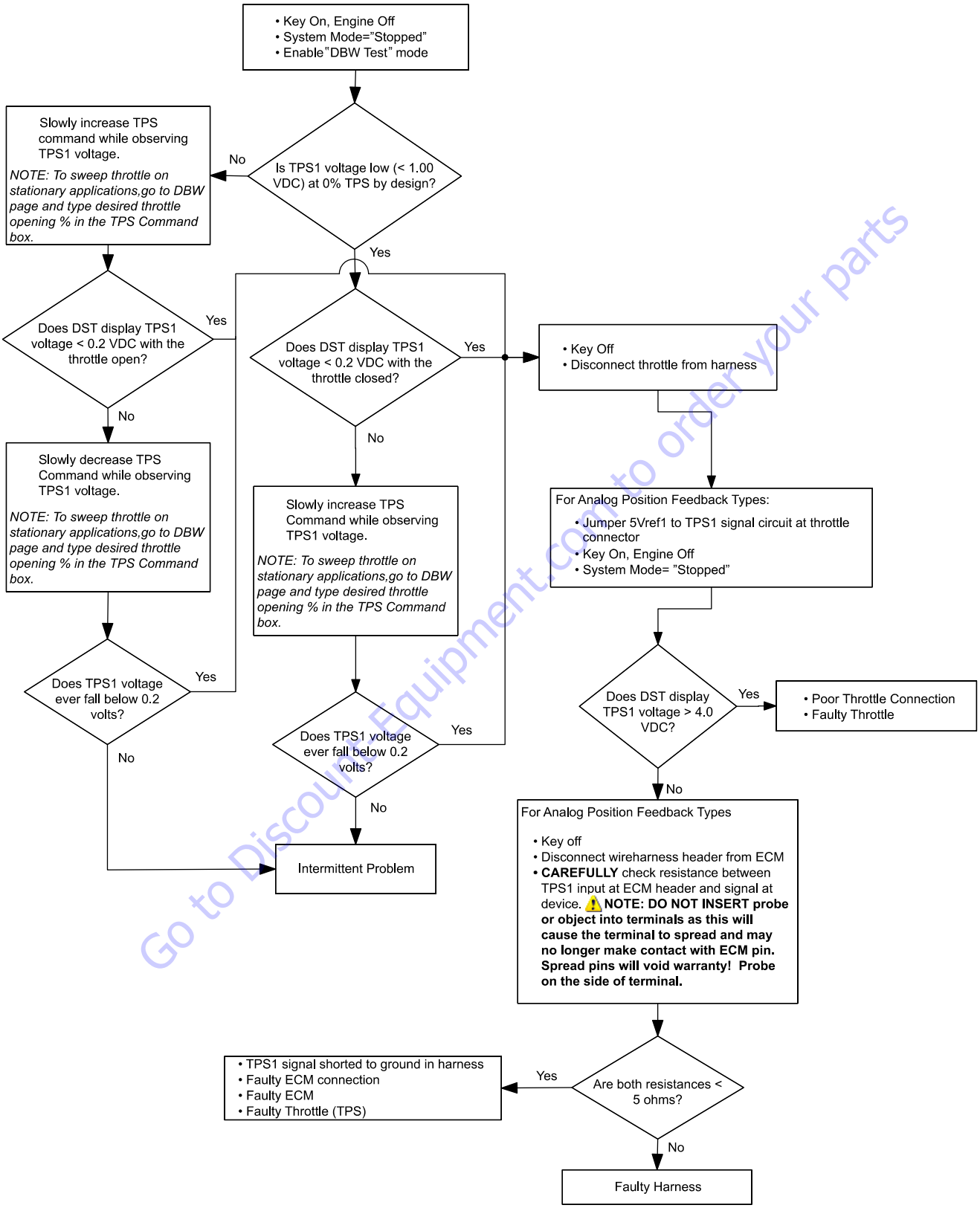

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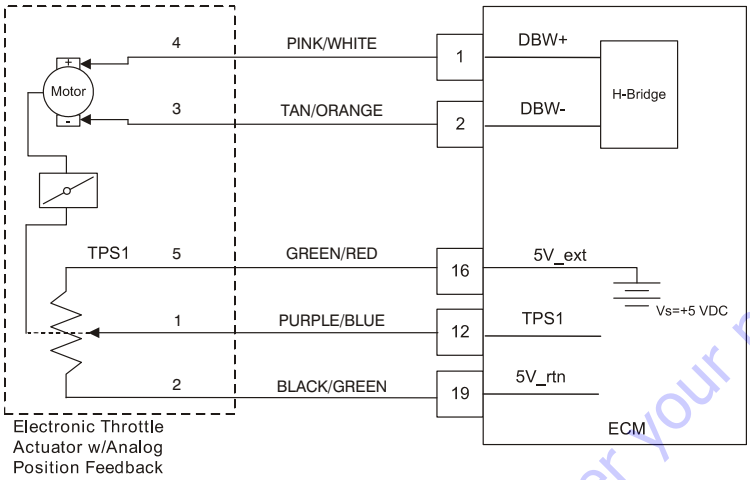
DTC 123- TPS1 Signal Voltage High



- Throttle Position Sensor 1
- Check Condition-Key On, Engine Off
- Fault Condition-TPS1 sensor voltage higher than the limit defined in the diagnostic calibration
- Corrective Action(s): Sound audible warning or illuminate secondary warning lamp, shutdown engine
- Non-emissions related fault

In the case of a diesel engine, an actuator controls a fuel injection pump, directly affecting the fueling level into the cylinders. This may be by direct manipulation of the fuel injection pump rack or by manipulation of the mechanical governor control level or "throttle arm." In the DGC ECM and EDIS, references to the throttle and throttle position sensor refer to these fuel injection pump control actuators and their position feedback sensors. When the fuel injection pump is electronically controlled it can be used to control the idle stability and limit engine speed based on operating conditions.

The Throttle Position Sensor uses either;

1) a variable resistor and voltage divider circuit or

2) a non-contact hall-effect sensor to determine throttle actuator position, and is located within the throttle actuator.

There are two types of throttle actuators, 1) actuator with analog position feedback and 2) actuator with digital position feedback. The first type, with analog position feedback, provides an analog return signal between 0 and 5 volts that is proportional to the throttle actuator position. The second type, with digital position feedback, provides a serial data signal to the ECM with the throttle actuator position voltage level encoded in the data stream.

This fault will set if TPS1 voltage is higher than the limit set in the diagnostic calibration at any operating condition while the engine is cranking or running. The limit is generally set to 4.90 VDC. In many cases, this condition is caused by a short-to-power of the TPS circuit in the wire harness or a failure of the sensor. This fault should be configured to trigger an engine shutdown and the engine will not start with this fault active.

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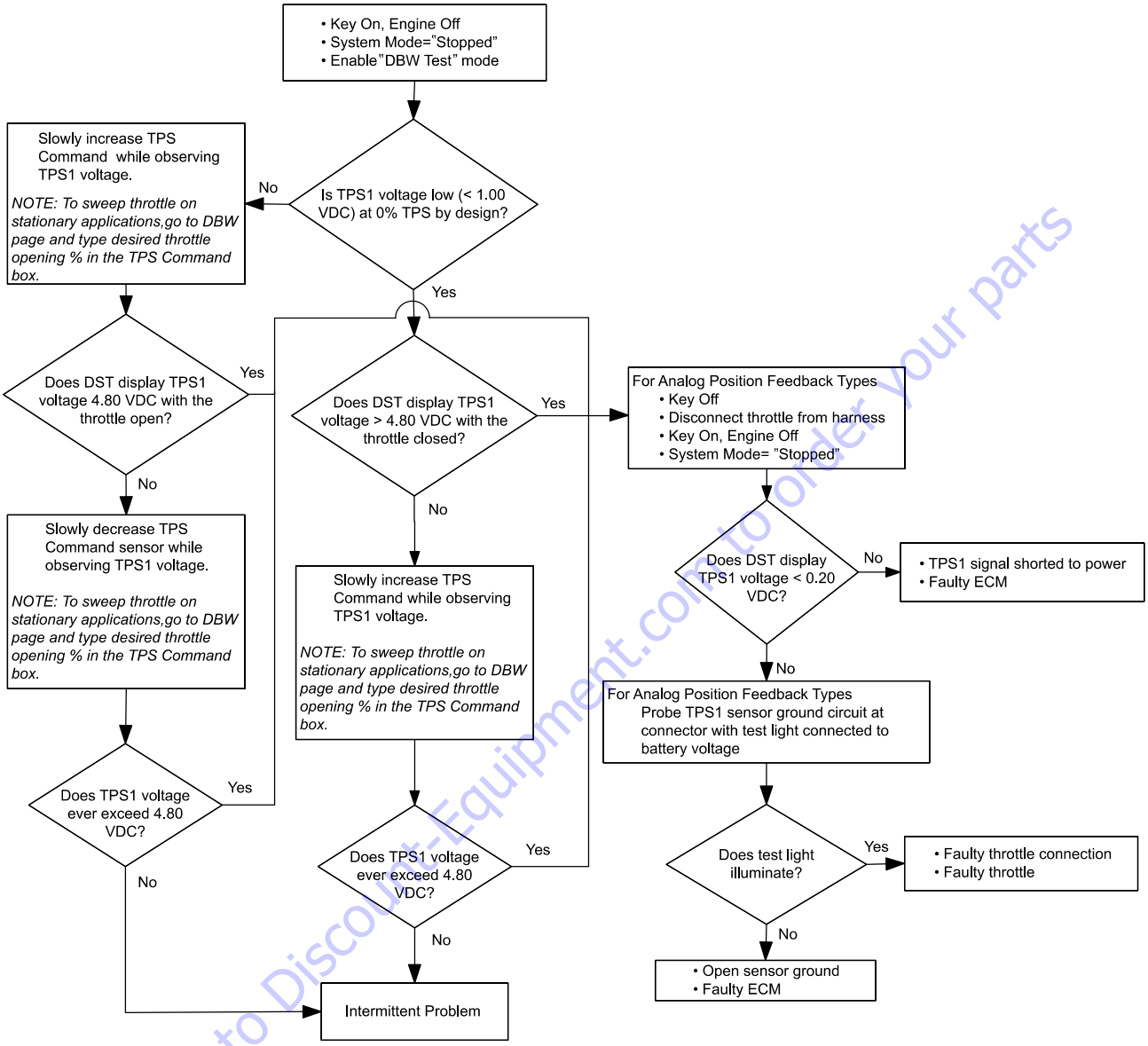

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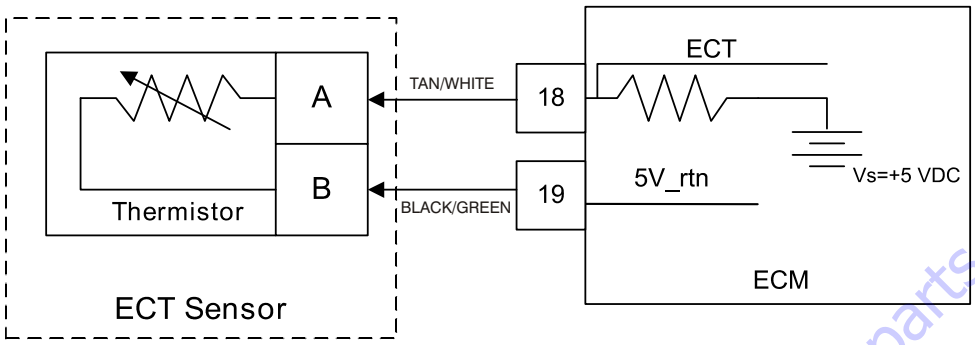
DTC 217- ECT Higher Than Expected 2



- Engine Coolant Temperature Sensor
- Check Condition-Engine Running
- Fault Condition-Engine Coolant Temperature reading or estimate greater than the stage 2 limit when operating at a speed greater than defined in the diagnostic calibration
- Corrective Action(s)- Sound audible warning or illuminate secondary warning lamp, disable adaptive learn fueling correction during active fault. Recommend a power derate 2 and/or a forced idle or engine shutdown to protect engine from possible damage.
- Non-emissions related fault

The Engine Coolant Temperature sensor is a thermistor (temperature sensitive resistor) located in the engine coolant. Some engines use a CHT sensor that is located in the coolant in the cylinder head. Some engines use an ECT (Engine Coolant Temperature) sensor that is located in the coolant near the thermostat. If the engine is equipped with a CHT sensor then the ECT value is estimated. If equipped with an ECT sensor then the CHT value is estimated. The ECM provides a voltage divider circuit so when the sensor reading is cool the sensor reads higher voltage, and lower when warm.

This fault will help protect the engine in the event of over temperature. When the coolant exceeds x deg. F and engine RPM exceeds y RPM for the latch time this fault will set.

Diagnostic Aids

If the "ECT High Voltage" fault is also present, follow the troubleshooting procedures for that fault as it may have caused "ECT Higher Than Expected 2."

If the cooling system utilizes an air-to-water heat exchanger (radiator) and fan:

- Check that the radiator has a proper amount of ethylene glycol/water and that the radiator is not leaking
- Ensure that there is no trapped air in the cooling path
- Inspect the cooling system (radiator and hoses) for cracks and ensure connections are leak free
- Check that the fan is operating properly
- Check that the thermostat is not stuck closed

If the cooling system utilizes a water-to-water heat exchanger:

- Check that the heat exchanger has a proper amount of ethylene glycol/water and that the heat exchanger is not leaking
- Ensure that there is no trapped air in the cooling path
- Inspect the cooling system (radiator and hoses) for cracks and ensure connections are leak free
- Check that the raw water pickup is not blocked/restricted by debris and that the hose is tightly connected
- Check that the thermostat is not stuck closed
- Check that the raw water pump/impeller is tact and that it is not restricted

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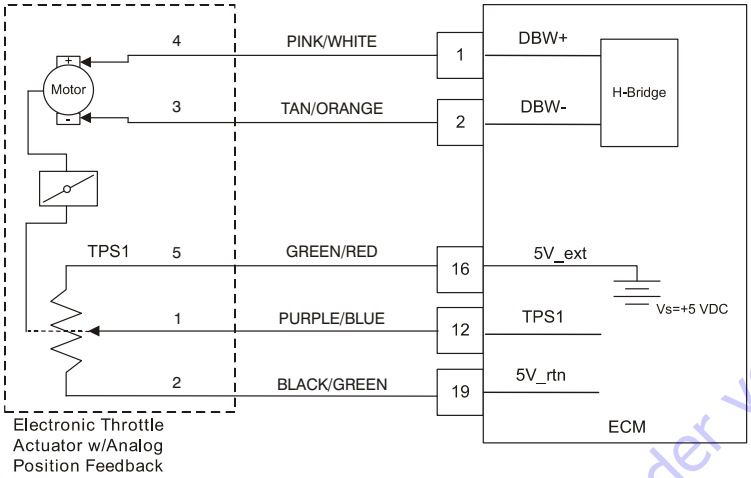
DTC 219- RPM Higher Than Max Allowed Governed Speed



- Max Govern Speed Override- Crankshaft Position Sensor
- Check Condition-Engine Running
- Fault Condition-Engine speed greater than the max governor override speed as defined in the diagnostic calibration
- Corrective Action(s): Sound audible warning or illuminate secondary warning lamp, reduce throttle to limit speed. Recommend closed loop and adaptive learn fueling correction remains active during fault.
- Non-emissions related fault

This fault will set anytime the engine RPM exceeds the limit set in the diagnostic calibration for the latch time or more. This speed overrides any higher max governor speeds programmed by the user. This fault is designed to help prevent engine or equipment damage.

The throttle will be lowered in order to govern the engine to the speed set in the diagnostic calibration.

DTC 219- RPM Higher Than Max Allowed Governed Speed (continued)

Diagnostic Aids

NOTE: If any other DTCs are present, diagnose those first.

- Ensure that no programmed governor speeds exceed the limit set in the diagnostic calibration for Max Gov Override Speed
- Check mechanical operation of the throttle actuator

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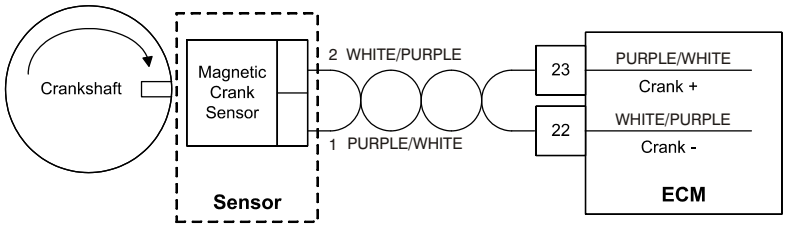
DTC 336- Crank Signal Input Noise



- Crankshaft Position sensor
- Check Condition- Key On, Engine On
- Fault Condition- Electrical noise or irregular crank pattern detected causing x number of crank resynchronization events as defined in the diagnostic calibration
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp and disable adaptive fueling correction for remainder of key-cycle.
- Emissions related fault

The crankshaft position sensor is a magnetic sensor (variable reluctant/magnetic pick-up or hall effect) installed in the engine block adjacent to a "coded" trigger wheel located on the crankshaft. The sensor-trigger wheel combination is used to determine crankshaft position (with respect to TDC cylinder #1 compression) and the rotational engine speed. Determination of the crankshaft position and speed is necessary to properly activate the ignition, fuel injection, and throttle governing systems for precise engine control.

The ECM must see a valid crankshaft position signal while running. If no signal is present, the signal amplitude is too high (due to improper air gap with respect to trigger wheel), or an irregular crank pattern is detected causing the ECM to resynchronize x times for y ms or longer as defined in the diagnostic calibration, this fault will set. Irregular crank patterns can be detected by the ECM due to electrical noise, poor machining of trigger wheel, or trigger wheel runout and/or gear lash.

Ensure crank circuit used with VR/magnetic pick-up sensors are properly twisted.

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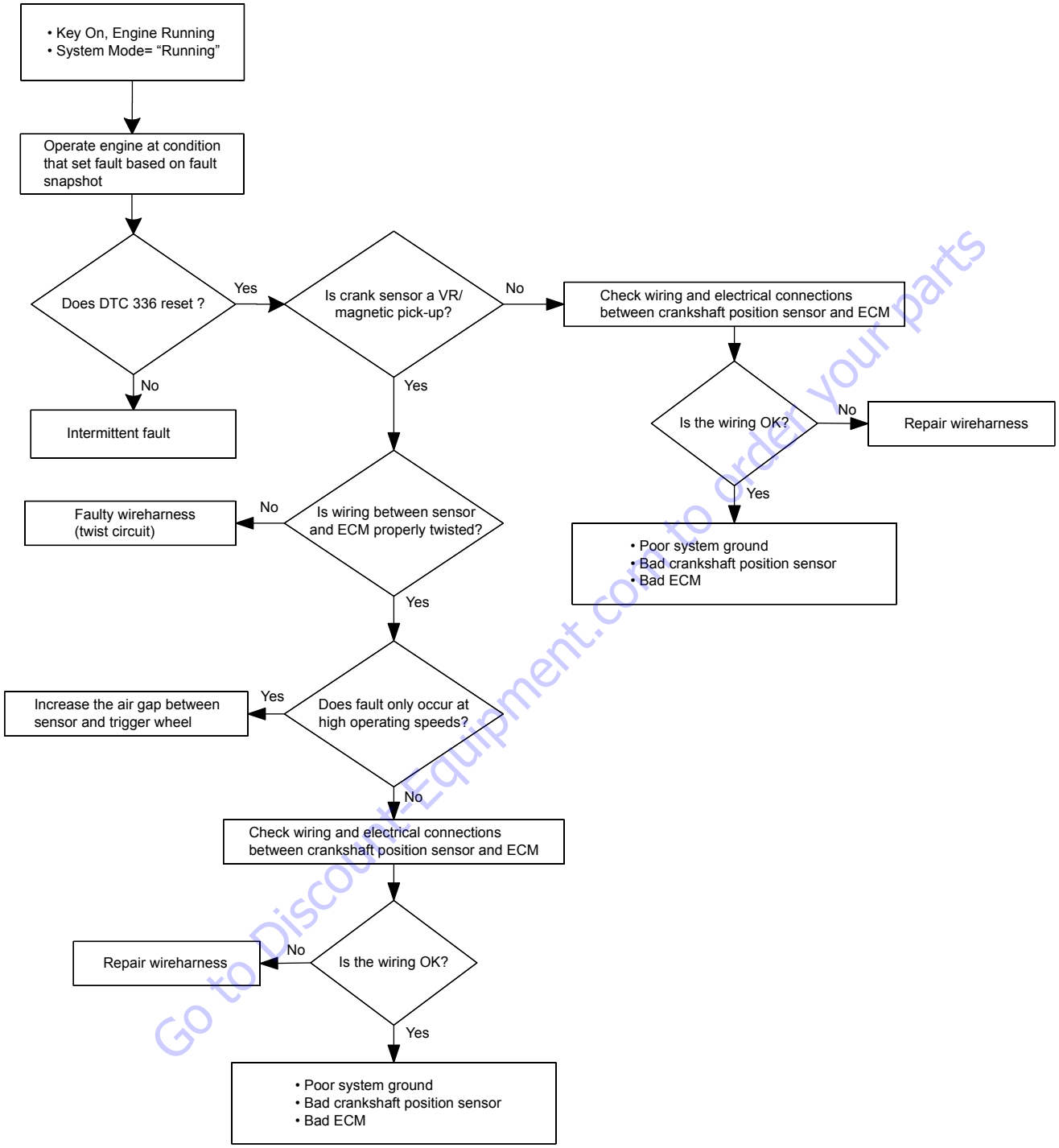

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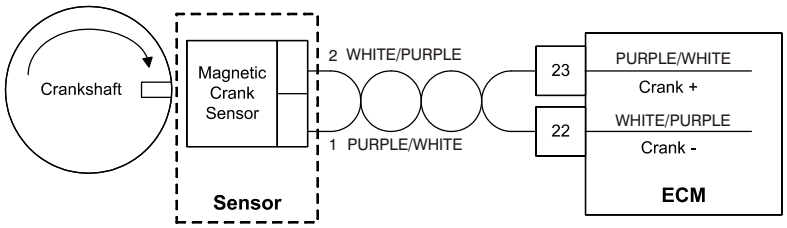
DTC 337- Loss of Crank Input Signal



- Crankshaft Position sensor
- Check Condition- Key On, Engine On
- Fault Condition- Loss of crankshaft position signal while valid camshaft position signals continue for x number of cam pulses as defined in the diagnostic calibration
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp
- Emissions related fault

The crankshaft position sensor is a magnetic sensor (variable reluctant/magnetic pick-up or hall effect) installed in the engine block adjacent to a "coded trigger wheel located on the crankshaft. The sensor-trigger wheel combination is used to determine crankshaft position (with respect to TDC cylinder #1 compression) and the rotational engine speed. Determination of the crankshaft position and speed is necessary to properly activate the ignition, fuel injection, and throttle governing systems for precise engine control.

The ECM must see a valid crankshaft position signal while running. If no signal is present while x cam pulses continue the fault will set. The engine typically stalls or dies as a result of this fault condition due to the lack of crankshaft speed input resulting in the inability to control ignition timing.

DTC 337- Loss of Crank Input Signal (continued)

Diagnostic Aids

- Check that crankshaft position sensor is securely connected to harness
- Check that crankshaft position sensor is securely installed into engine block
- Check crankshaft position sensor circuit wiring for open circuit

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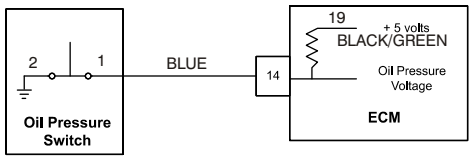
DTC 521- Oil Pressure Sender/Switch High Pressure



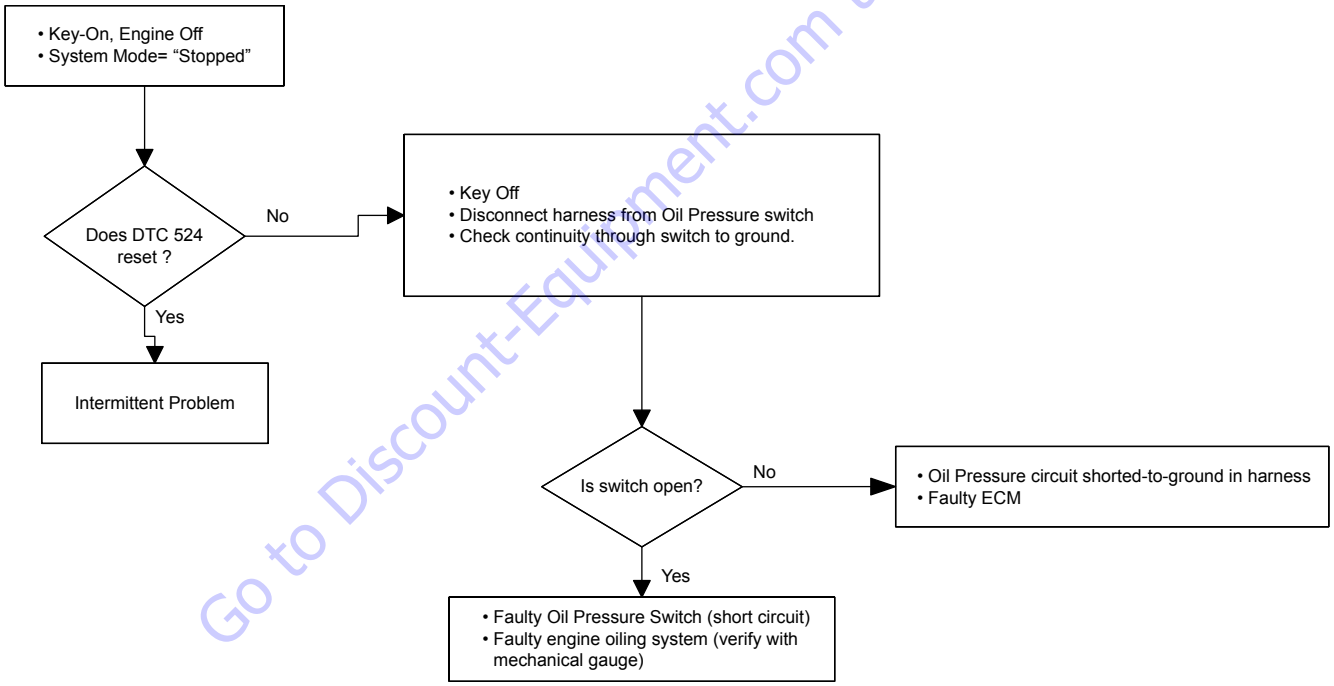
Normally-Closed Switch-Type

- Engine Oil Pressure
- Check Condition- Key on, Engine on (or Engine off)
- Fault Condition- For sender types, oil pressure higher than x psia while engine speed is greater that y RPM. For switch types, oil pressure is indicating high when the engine has been stopped for more than n seconds.
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, possibly configure for power derate 1 or low rev limit
- Non-emissions related fault

The ECM can be configured to monitor oil pressure through a proportional transducer or through a switch. Oil pressure monitoring is important to prevent engine damage due to low oil pressure resulting in higher friction and lack of lubrication. In addition, high oil pressure can be undesirable because it can cause oil to leak past seals and rings, can be a result of a restriction in the oil flow path, or can be a sign of a malfunctioning oiling system.

Additionally for normally-open type oil pressure switches, a high pressure indication while the engine is off is a symptom of a failed oil pressure switch. The ECM can monitor oil pressure indication when the engine is stopped for this failure mode.

For sender types, this fault sets if the engine oil pressure is higher than x psia and engine speed greater than y RPM as defined in the diagnostic calibration. For switch types, this fault sets if the engine oil pressure is indicating high when the engine is stopped for more than n seconds. Recommend a power derate and/or low rev limit to help prevent possible engine damage and reduce oil pressure.



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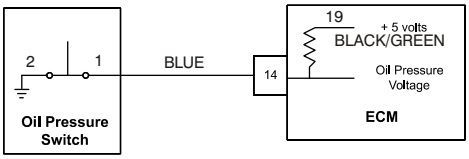
DTC 524- Oil Pressure Low



Normally-Closed
Switch-Type

- Engine Oil Pressure
- Check Condition- Key on, Engine on
- Fault Condition- Engine oil pressure lower than expected while engine has been running for a minimum amount of time while engine speed is above some limit as defined in the diagnostic calibration
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, generally configured to derate the engine and trigger an engine shutdown
- Non-emissions related fault

The ECM can be configured to monitor oil pressure through a proportional transducer or through a switch. Oil pressure monitoring is important to prevent engine damage due to low oil pressure resulting in higher friction and lack of lubrication. In addition, high oil pressure can be undesirable because it can cause oil to leak past seals and rings, can be a result of a restriction in the oil flow path, or can be a sign of a malfunctioning oiling system.

For systems that use a transducer, this fault sets if the engine oil pressure is less than x psia and engine speed is greater than y RPM after the engine has been running for z seconds as defined in the diagnostic calibration. For systems that use a switch this fault can be configured two different ways. It may use a normally closed switch or a normally open switch. If the switch is normally open, the fault will set if the circuit becomes grounded. If the switch is normally closed, the fault will set if the circuit becomes open. Go to the Faults page in EDIS to determine how the input is configured. ("Open=OK" is normally open and "Ground=OK" is normally closed). The engine will should be configured to derate or force idle and/or shut down in the event of this fault to help prevent possible damage.

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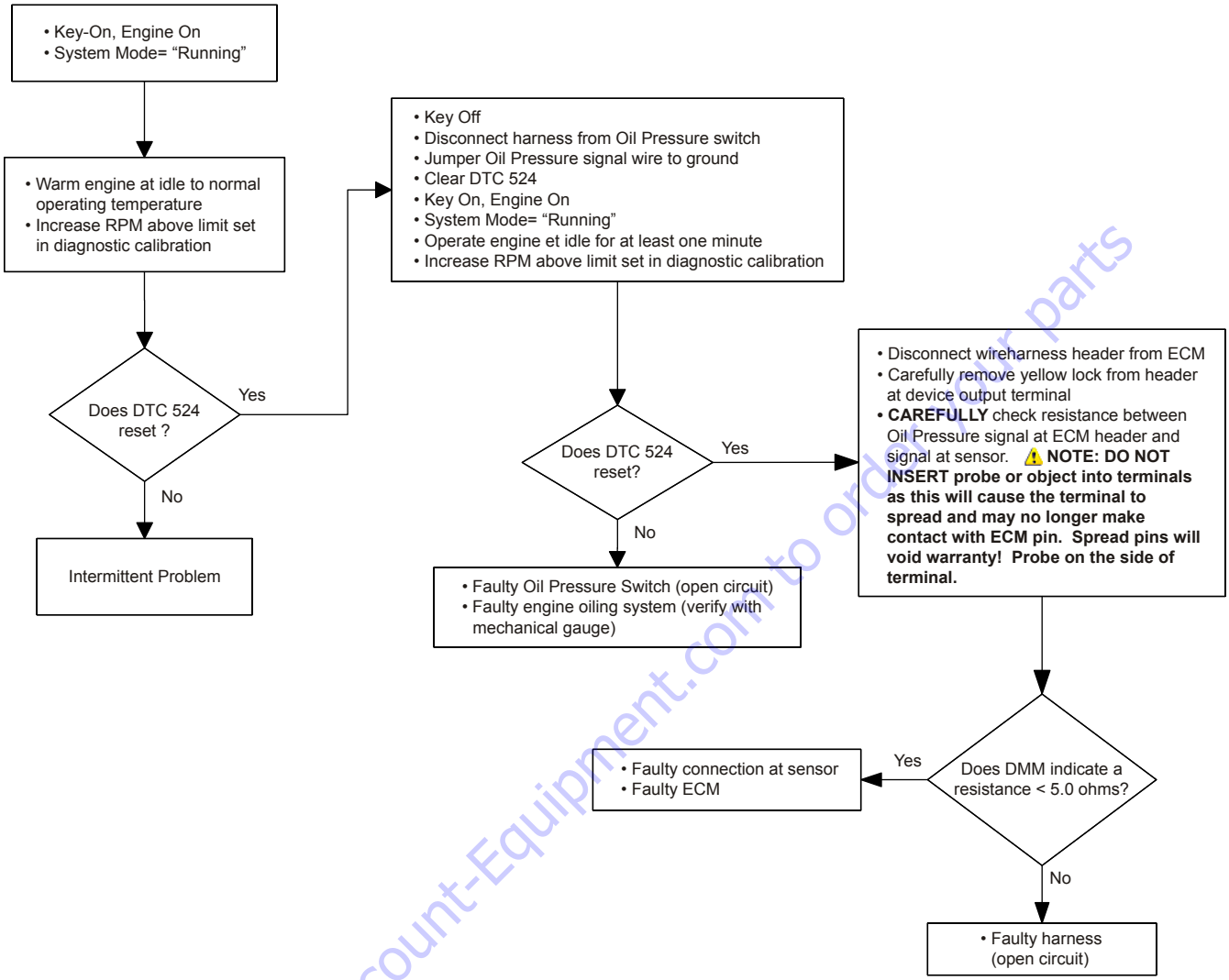
Normally Closed Switch



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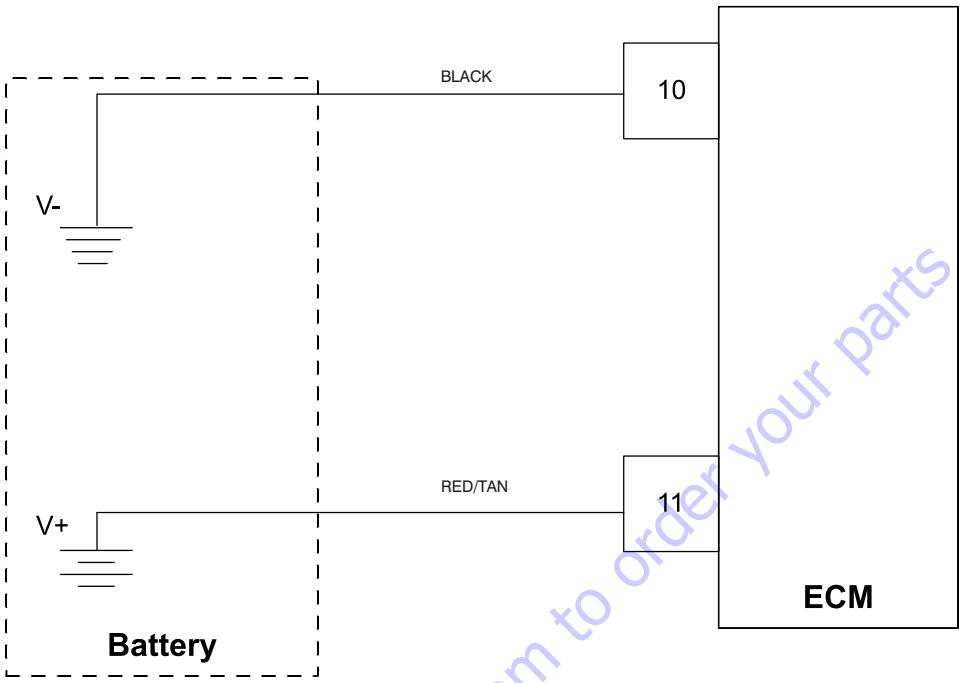
DTC 562- Battery Voltage (VBat) Low



- System voltage to ECM
- Check Condition- Key on, Engine on
- Fault Condition- Battery voltage to ECM less than x volts while the engine is operating at y RPM or greater as defined in the diagnostic calibration
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, disable adaptive fueling correction for remainder of key cycle
- Non-emissions related fault.

The battery voltage powers the ECM and must be within limits to correctly operate throttle actuator, power supplies, and other powered devices that the ECM controls.

This fault will set if the ECM detects system voltage less than x volts while the engine is operating at y RPM as defined in the diagnostic calibration as the alternator should be charging the system.

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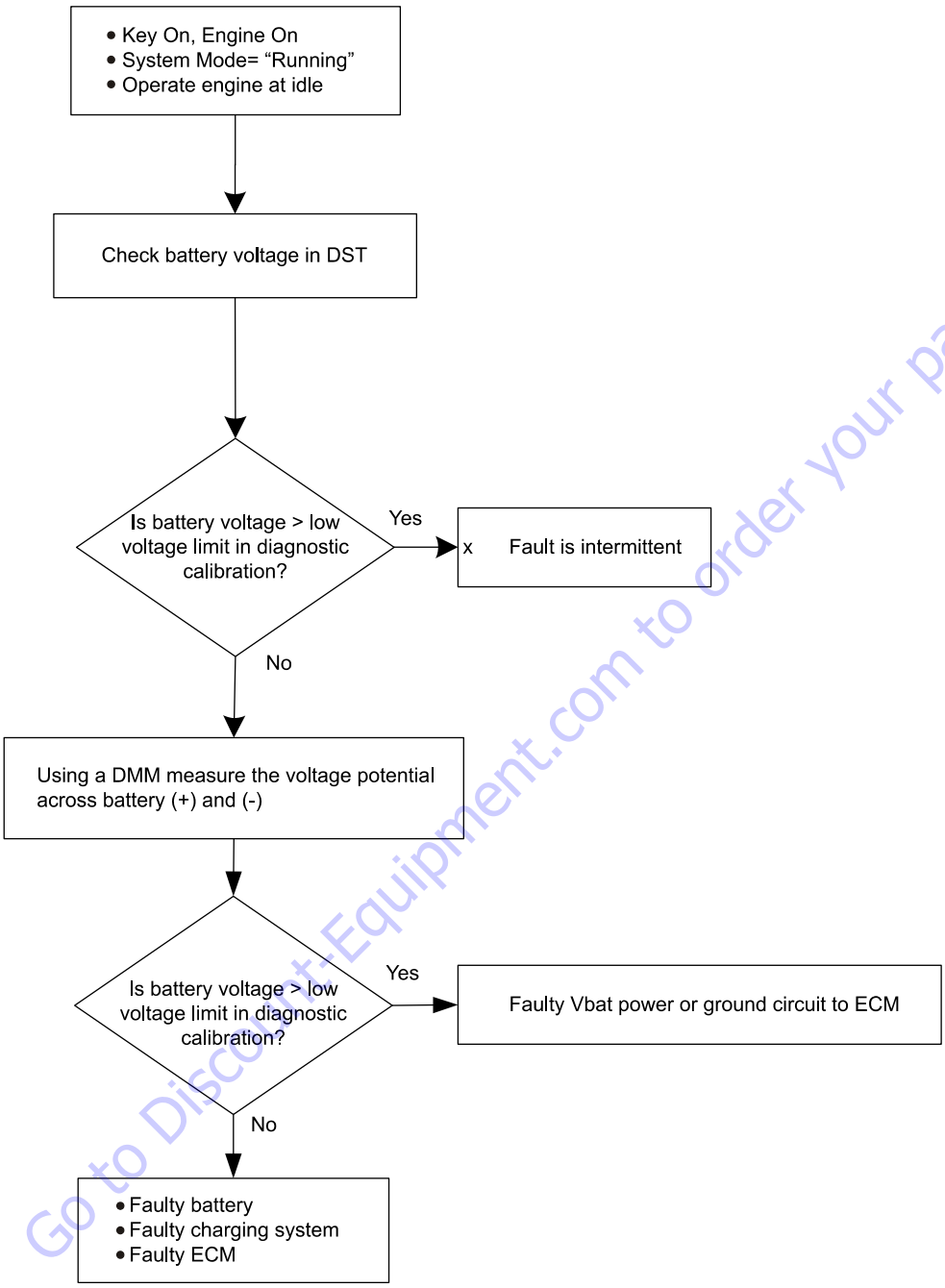

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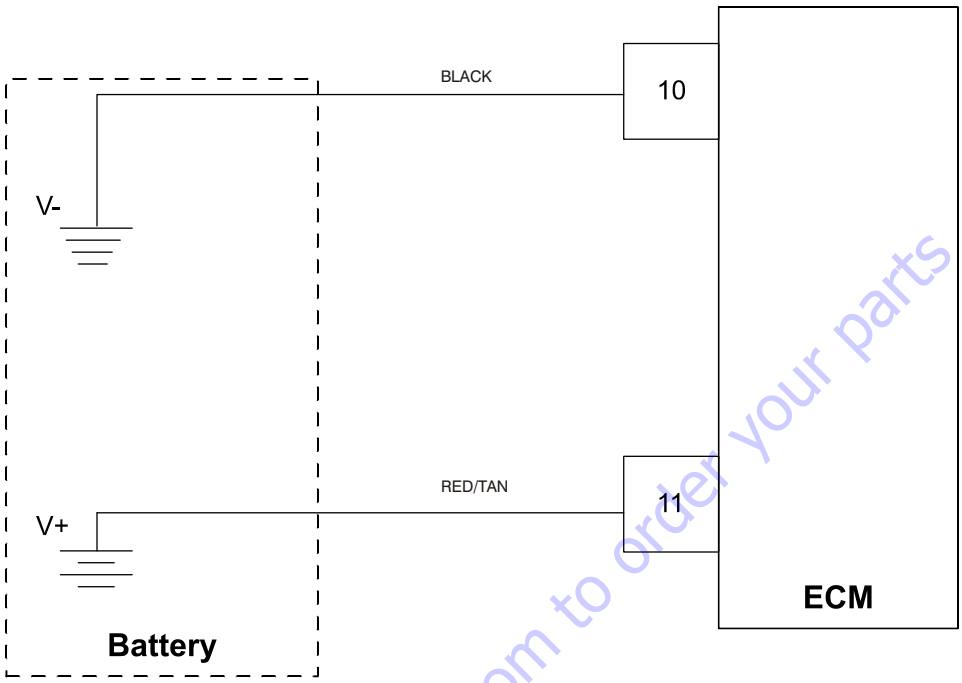
DTC 563- Battery Voltage (VBat) High



- System voltage to ECM
- Check Condition- Key on, Engine Cranking or Running
- Fault Condition- Battery voltage to ECM greater than x volts while the engine is running as defined in the diagnostic calibration
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, disable adaptive fueling correction for remainder of key cycle
- Non-emissions related fault.

The battery voltage powers the ECM and must be within limits to correctly operate throttle actuator, power supplies, and other powered devices that the ECM controls.

This fault will set if the ECM detects system voltage greater than x volts while the engine is running or cranking as defined in the diagnostic calibration.

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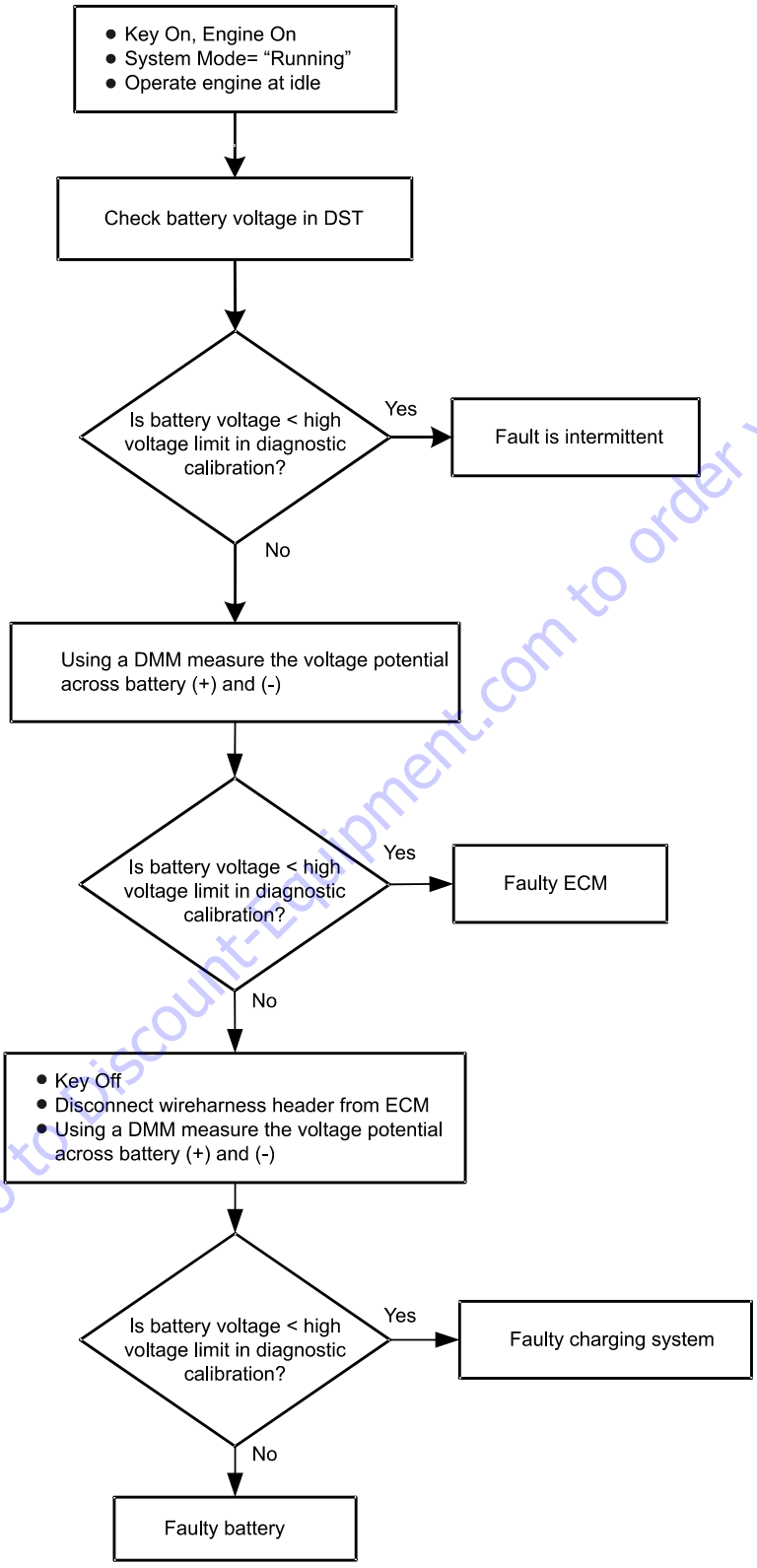

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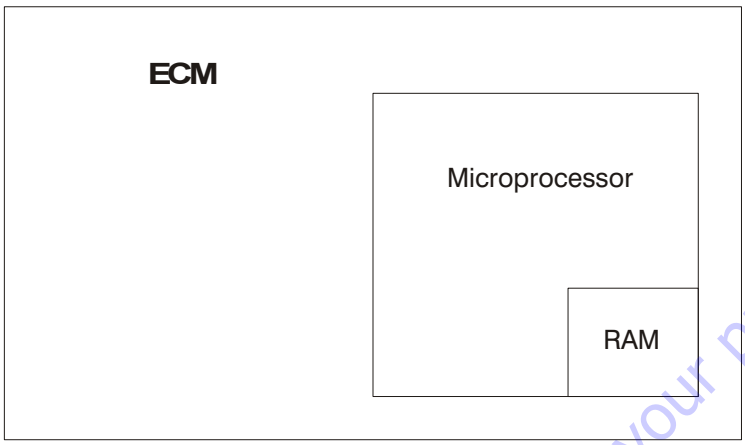
DTC 601- Microprocessor Failure - FLASH



- Engine Control Module- Flash Memory
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, disable adaptive fueling correction for remainder of key cycle, recommend power derate 2 and low rev limit to reduce possible engine damage and/or overspeed condition
- Non-emissions related fault

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault.

If this fault sets, the ECM will reset itself and log the code. The fault should be configured to never forget and will not self-erase and will not clear until a technician performs diagnostics and manually clears the code. This fault should be configured to set a power derate 2 and low rev limit to reduce possible engine damage and reduce possibility of an overspeed condition. A fault of flash memory can occur for any calibration variable set and thus could cause undesirable operation.

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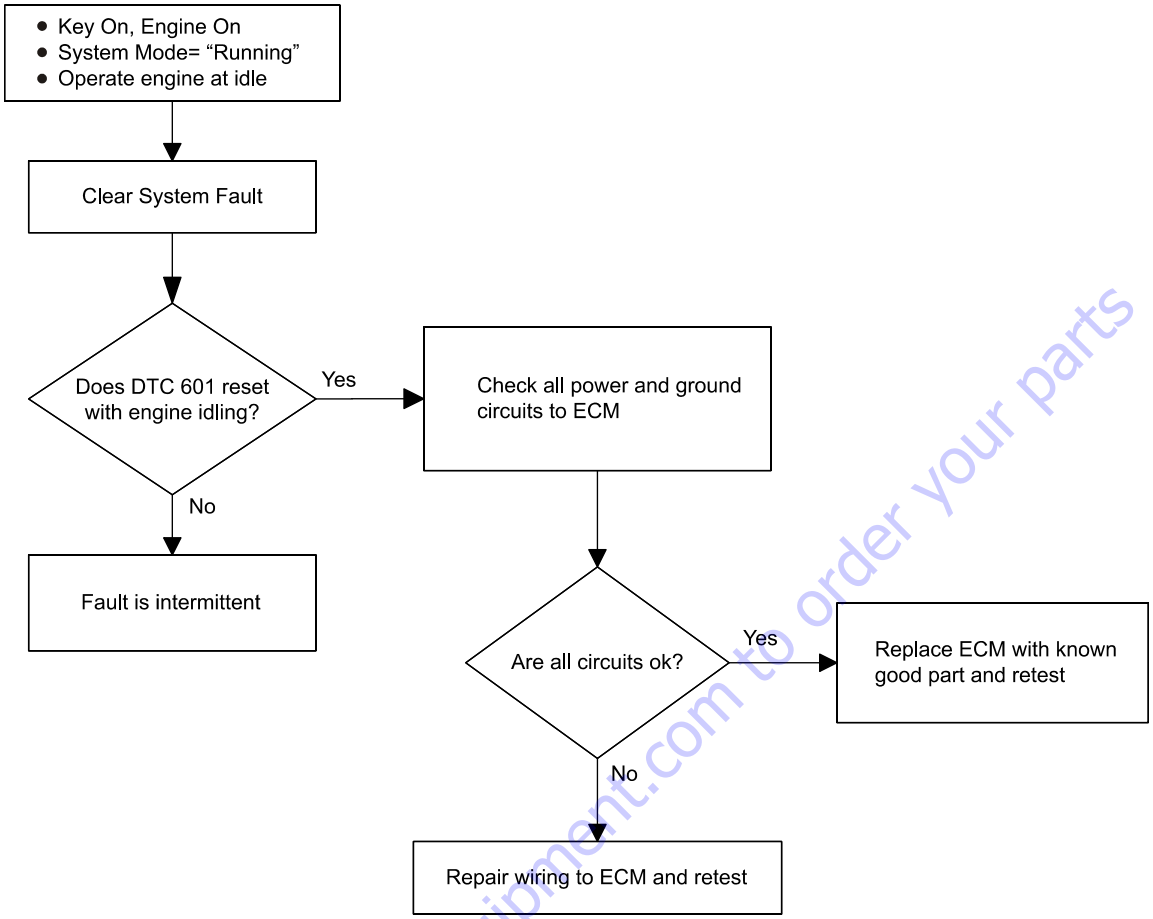

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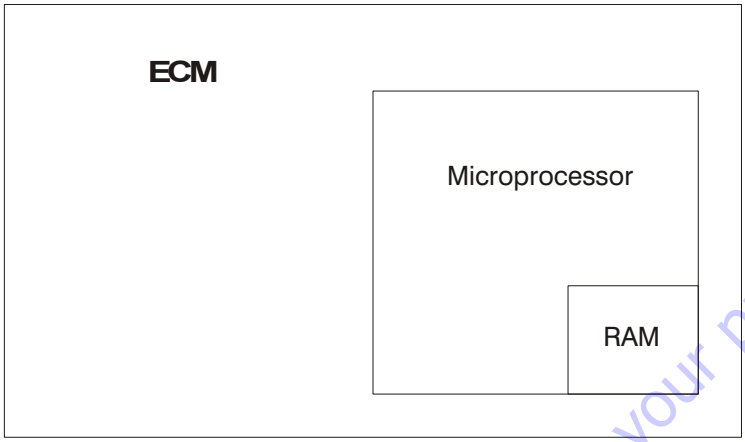
DTC 604- Microprocessor Failure - RAM



- Engine Control Module- Random Access Memory
- Check Condition- Key on
- Fault Condition- Internal ECM microprocessor memory access failure
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, disable adaptive fueling correction for remainder of key cycle, recommend power derate 2 and low rev limit to reduce possible engine damage and/or overspeed condition
- Non-emissions related fault

Random Access Memory is located within the microprocessor and can be read from or written to at any time. Data stored in RAM include DTCs (when fault configuration is set to "Battery Power Retained"), adaptive fuel learn tables, octane adaptation table, misfire adaption tables, and closed loop fuel multipliers. The ECM has checks that must be satisfied each time an instruction is executed.

This fault will set if the ECM detects a problem accessing or writing information to RAM and should be configured to set a power derate 2 and low rev limit to reduce possible engine damage and reduce possibility of an overspeed condition. If this fault sets, the ECM will reset itself and log the code. This fault should be erased by a technician after diagnostics are performed. The fault should be configured to never forget and will not self-erase.

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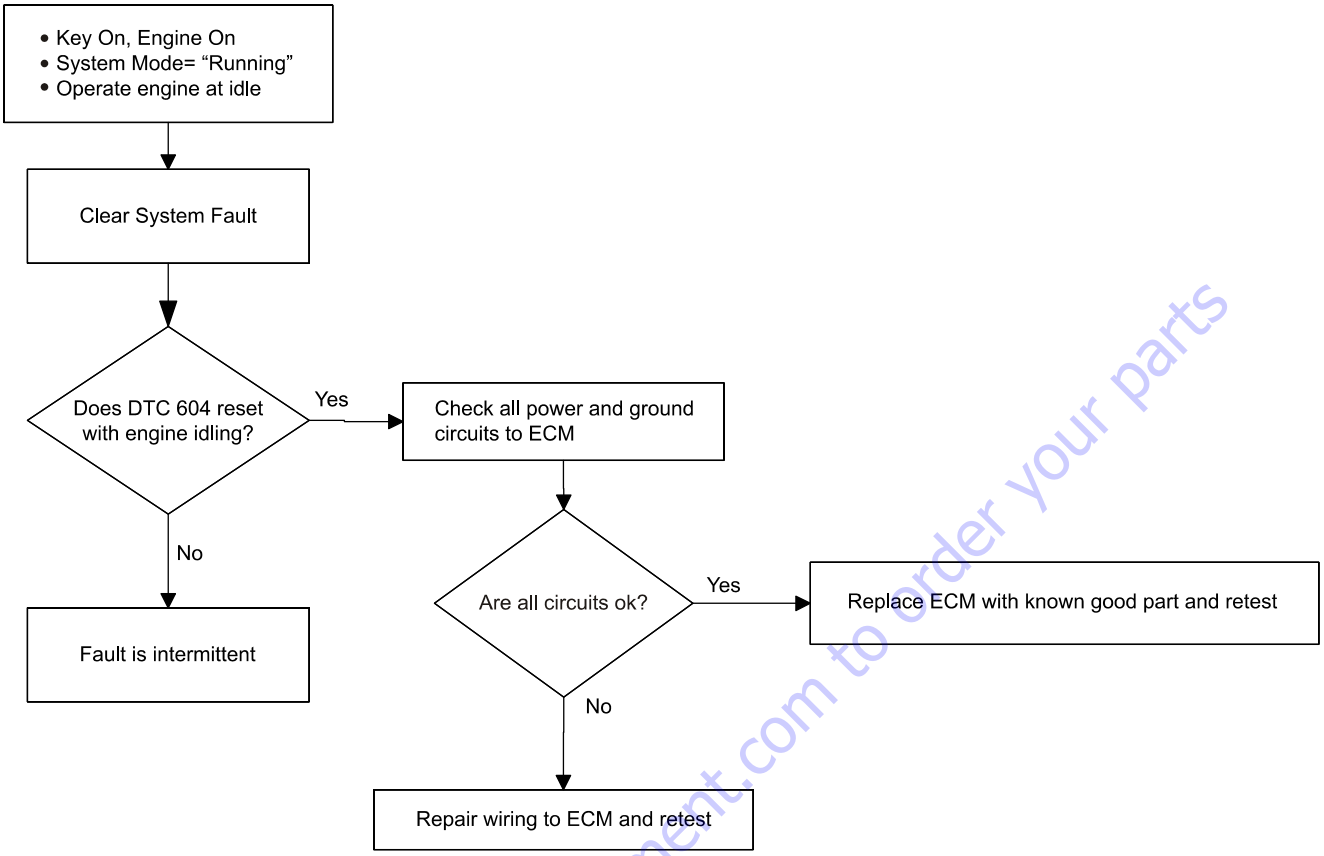

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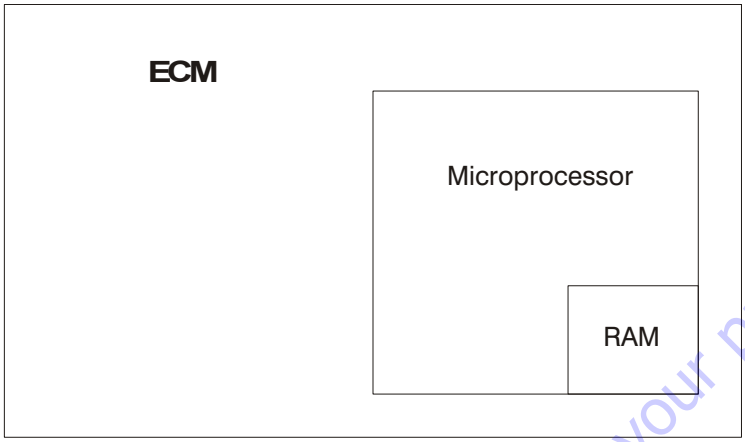
DTC 606- Microprocessor Failure - COP



- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- Corrective Action(s) - Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp, disable adaptive fueling correction for remainder of key cycle, recommend power derate 2 and low rev limit to reduce possible engine damage and/or overspeed condition
- Non-emissions related fault

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault.

If this fault sets, the ECM will reset itself and log the code. The fault should be configured to never forget and will not self-erase and will not clear until a technician performs diagnostics and manually clears the code. This fault should be configured to set a power derate 2 and low rev limit to reduce possible engine damage and reduce possibility of an overspeed condition.

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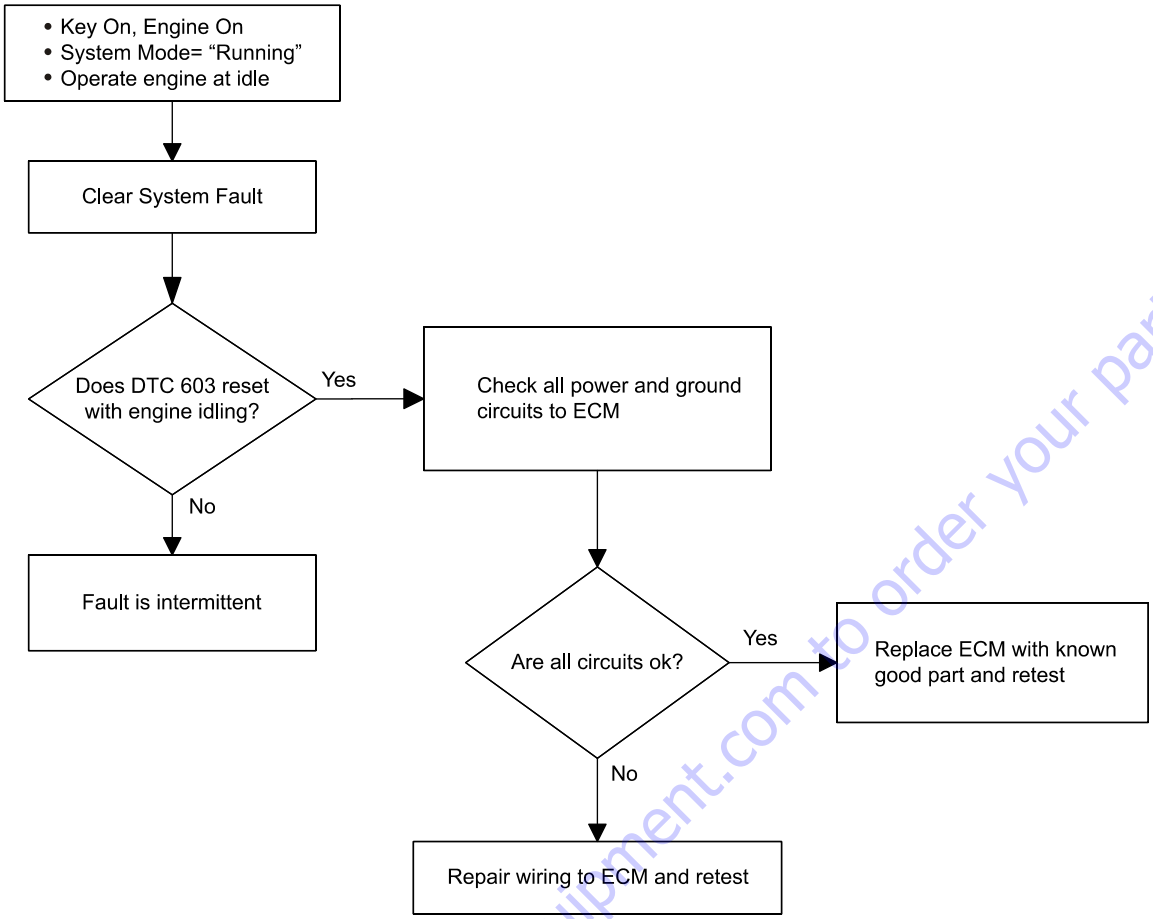

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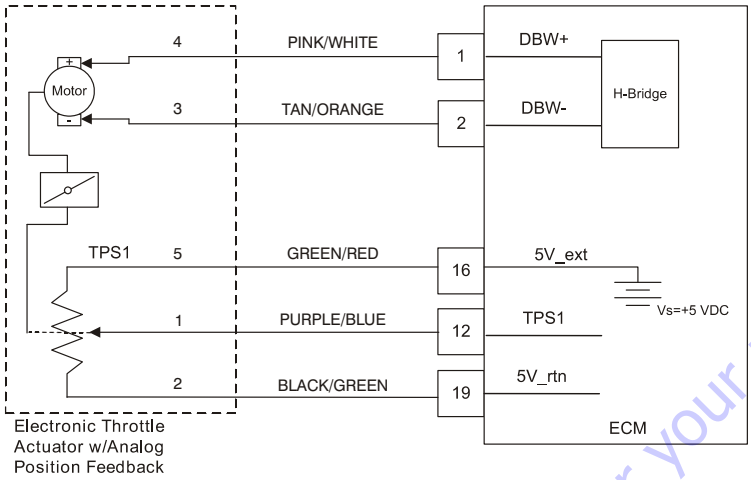
DTC 642- 5 Volt External Low Voltage



- Engine Control Module
- Check Condition- Key on
- Fault Condition- ECM 5-volt output is below the acceptable limit
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

The ECM supplies 5-volt power to sensors, switches, and actuators external to the ECM. By supplying the power to these devices, the ECM can accurately measure their output relative to its own ground reference. The ECM can also control when the devices are active and put the devices in a low or no power state based on the current operating condition of the engine or vehicle.

If this fault sets, something other than the ECM is drawing the 5-volt power output of the ECM below an acceptable threshold. This may be due to a short in the wire harness, malfunctioning device, or failure of the ECM power output circuitry.

Diagnostic Aids

- Measure the 5-volt output of the ECM while cycling the key on and the engine stopped. Verify that the output is lower than the fault thresholds configured in the diagnostic calibration.
- Inspect the 5-Volt output circuit in the wire harness and look for shorts to ground or other harness circuits.
- Disconnect each device powered by the 5-volt output of the ECM one-at-a-time. Powered devices may include the throttle actuator, smart sensors, smart actuators, etc. After disconnecting device, observe the system fault and determine if the fault has cleared. If the fault clears, troubleshoot the disconnected device for failures.
- With all 5-volt powered devices disconnected, look for a change in the fault state and measure the 5-volt output of the ECM and verify it is within acceptable limits.

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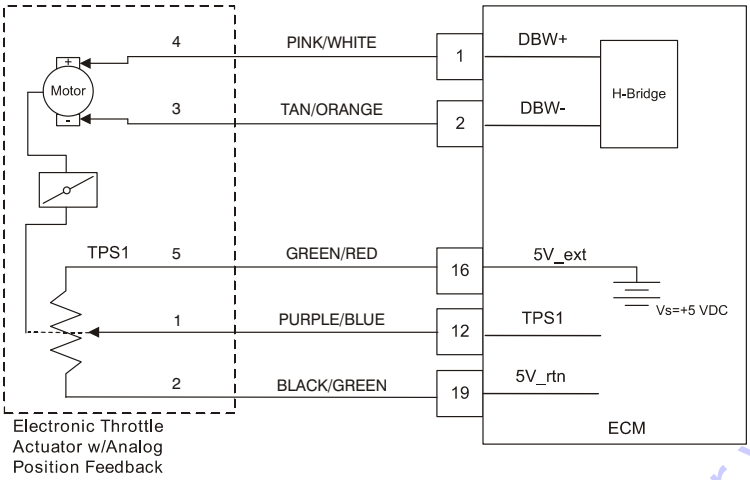
DTC 643- 5 Volt External High Voltage



- Engine Control Module
- Check Condition- Key on
- Fault Condition- ECM 5-volt output is above the acceptable limit
- Corrective Action(s)- Illuminate MIL and/or sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

The ECM supplies 5-volt power to sensors, switches, and actuators external to the ECM. By supplying the power to these devices, the ECM can accurately measure their output relative to its own ground reference. The ECM can also control when the devices are active and put the devices in a low or no power state based on the current operating condition of the engine or vehicle.

If this fault sets, something other than the ECM is drawing the 5-volt power output of the ECM above an acceptable threshold. This may be due to a short in the wire harness, malfunctioning device, or failure of the ECM power output circuitry.

Diagnostic Aids

- Measure the 5-volt output of the ECM while cycling the key on and the engine stopped. Verify that the output is lower than the fault thresholds configured in the diagnostic calibration.
- Inspect the 5-Volt output circuit in the wire harness and look for shorts to ground or other harness circuits.
- Disconnect each device powered by the 5-volt output of the ECM one-at-a-time. Powered devices may include the throttle actuator, smart sensors, smart actuators, etc. After disconnecting device, observe the system fault and determine if the fault has cleared. If the fault clears, troubleshoot the disconnected device for failures.
- With all 5-volt powered devices disconnected, look for a change in the fault state and measure the 5-volt output of the ECM and verify it is within acceptable limits.

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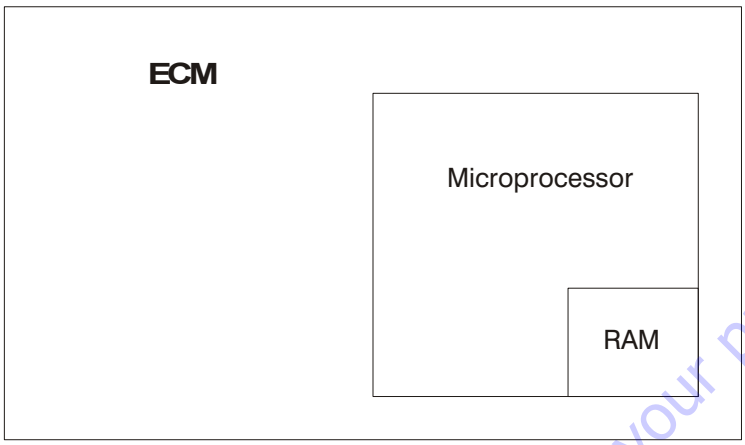
DTC 1612- Microprocessor Failure - RTI 1



- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- MIL- On until code is cleared by technician
- Adaptive- Disabled for the remainder of the key-on cycle
- Closed Loop- Enabled
- Power Derate (level 2 until fault is cleared manually)

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault. The ECM will reset itself in the event this fault is set, and the MIL will be on until the code is cleared. This fault should be erased after diagnosis by removing battery power. It will not self-erase.

During this active fault, Power Derate (level 2) will be enforced. When this is enforced, maximum throttle position will be 20%. This is enforced until the fault is manually cleared.

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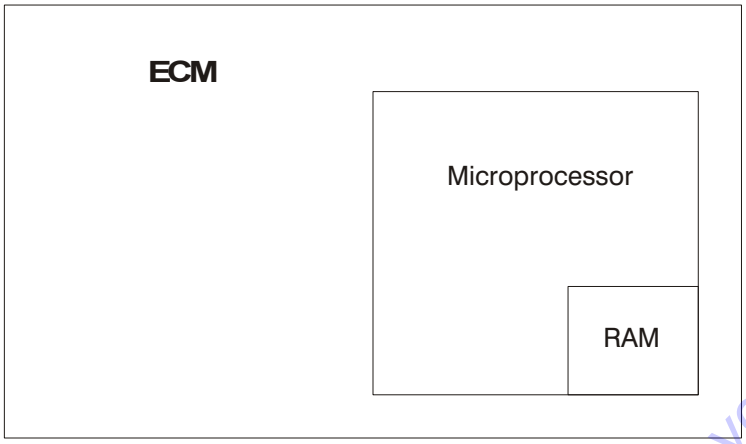
DTC 1613- Microprocessor Failure - RTI 2



- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- MIL- On until code is cleared by technician
- Adaptive- Disabled for the remainder of the key-on cycle
- Closed Loop- Enabled
- Power Derate (level 2 until fault is cleared manually)

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault. The ECM will reset itself in the event this fault is set, and the MIL will be on until the code is cleared. This fault should be erased after diagnosis by removing battery power. It will not self-erase.

During this active fault, Power Derate (level 2) will be enforced. When this is enforced, maximum throttle position will be 20%. This is enforced until the fault is manually cleared.

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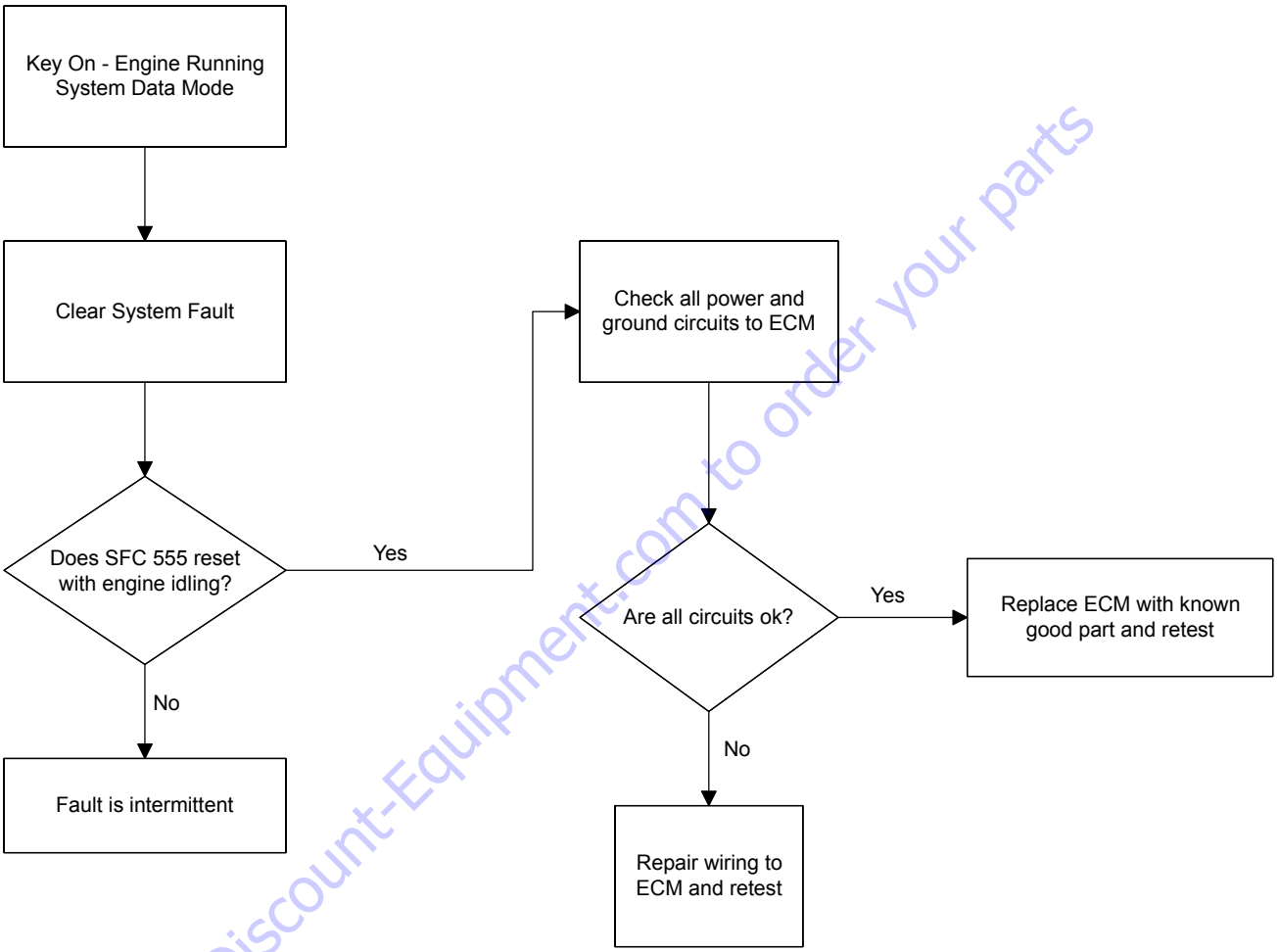
SFC 555- RTI 2 Loss



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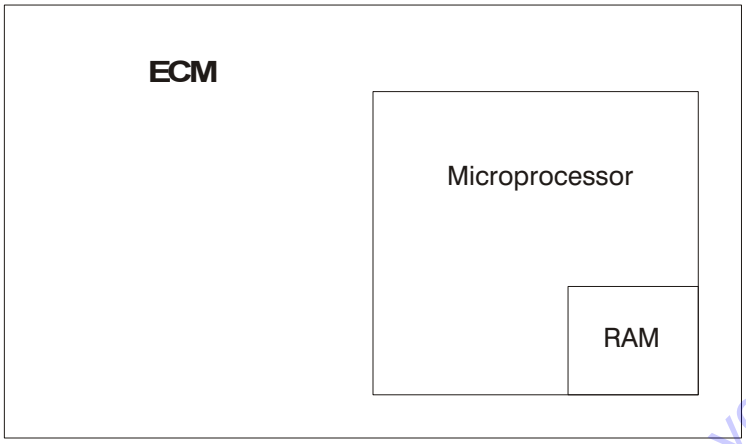
DTC 1614- Microprocessor Failure - RTI 3



- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- MIL- On until code is cleared by technician
- Adaptive- Disabled for the remainder of the key-on cycle
- Closed Loop- Enabled
- Power Derate (level 2 until fault is cleared manually)

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault. The ECM will reset itself in the event this fault is set, and the MIL will be on until the code is cleared. This fault should be erased after diagnosis by removing battery power. It will not self-erase.

During this active fault, Power Derate (level 2) will be enforced. When this is enforced, maximum throttle position will be 20%. This is enforced until the fault is manually cleared.

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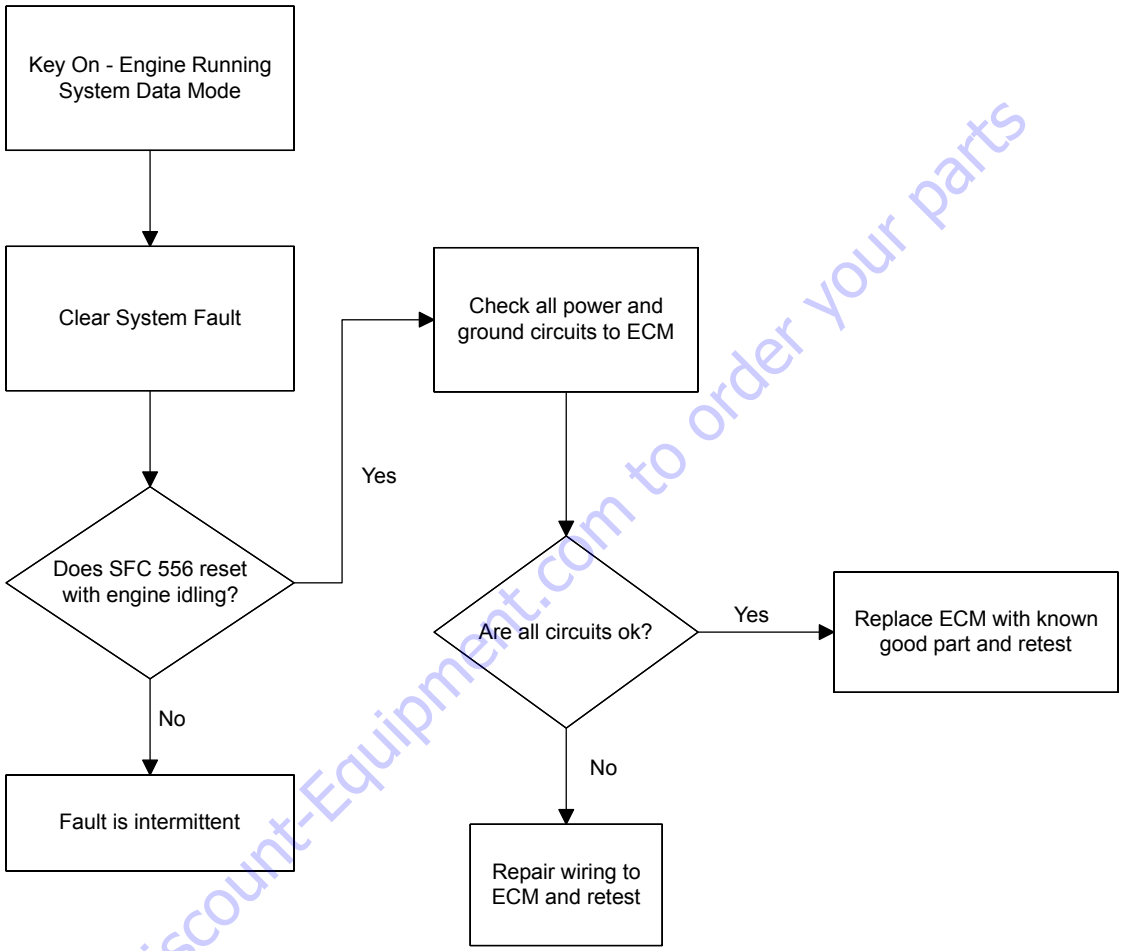
SFC 556- RTI 3 Loss



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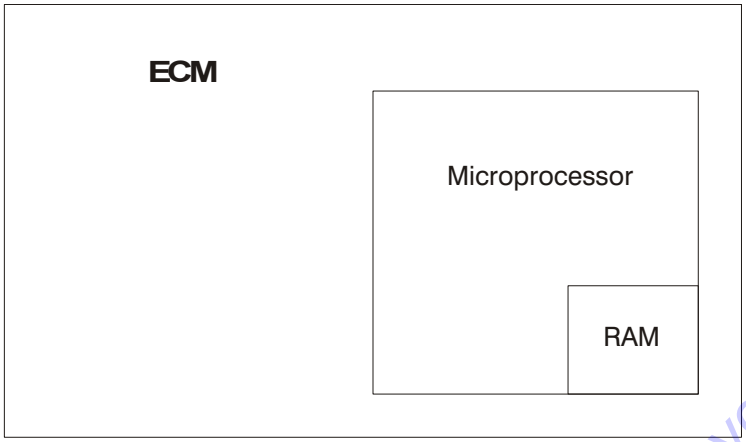
DTC 1615- Microprocessor Failure - A/D



- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- MIL- On until code is cleared by technician
- Adaptive- Disabled for the remainder of the key-on cycle
- Closed Loop- Enabled
- Power Derate (level 2 until fault is cleared manually)

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault. The ECM will reset itself in the event this fault is set, and the MIL will be on until the code is cleared. This fault should be erased after diagnosis by removing battery power. It will not self-erase.

During this active fault, Power Derate (level 2) will be enforced. When this is enforced, maximum throttle position will be 20%. This is enforced until the fault is manually cleared.

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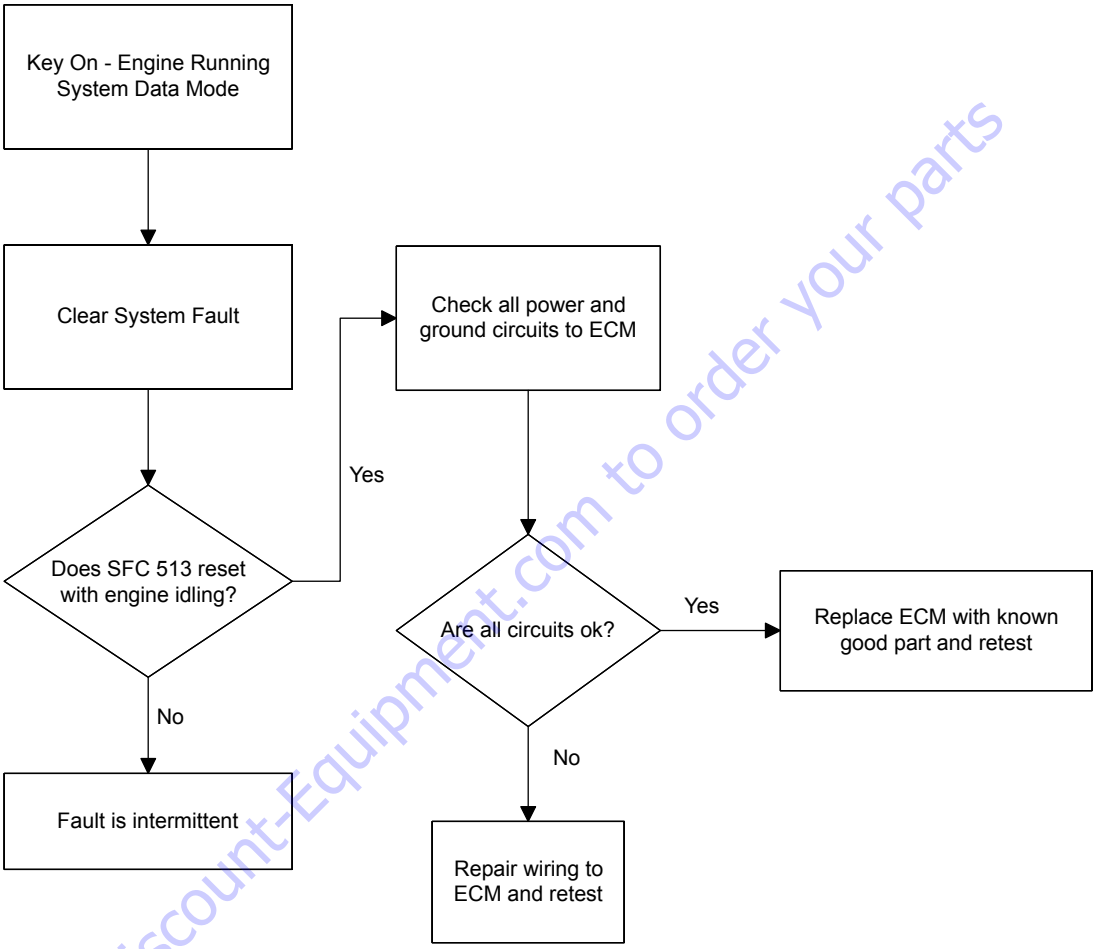
SFC 513- A/D Loss



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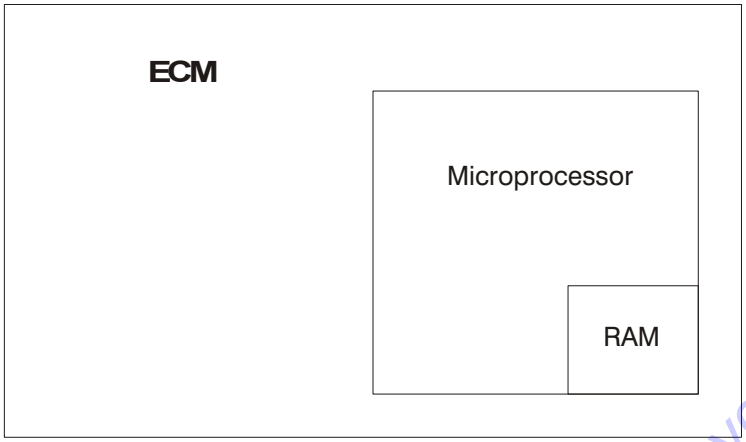
DTC 1616- Microprocessor Failure - interrupt



- Engine Control Module
- Check Condition- Key on
- Fault Condition- Internal microprocessor error
- MIL- On until code is cleared by technician
- Adaptive- Disabled for the remainder of the key-on cycle
- Closed Loop- Enabled
- Power Derate (level 2 until fault is cleared manually)

The ECM has checks that must be satisfied each time an instruction is executed. Several different things can happen within the microprocessor that will cause this fault. The ECM will reset itself in the event this fault is set, and the MIL will be on until the code is cleared. This fault should be erased after diagnosis by removing battery power. It will not self-erase.

During this active fault, Power Derate (level 2) will be enforced. When this is enforced, maximum throttle position will be 20%. This is enforced until the fault is manually cleared.

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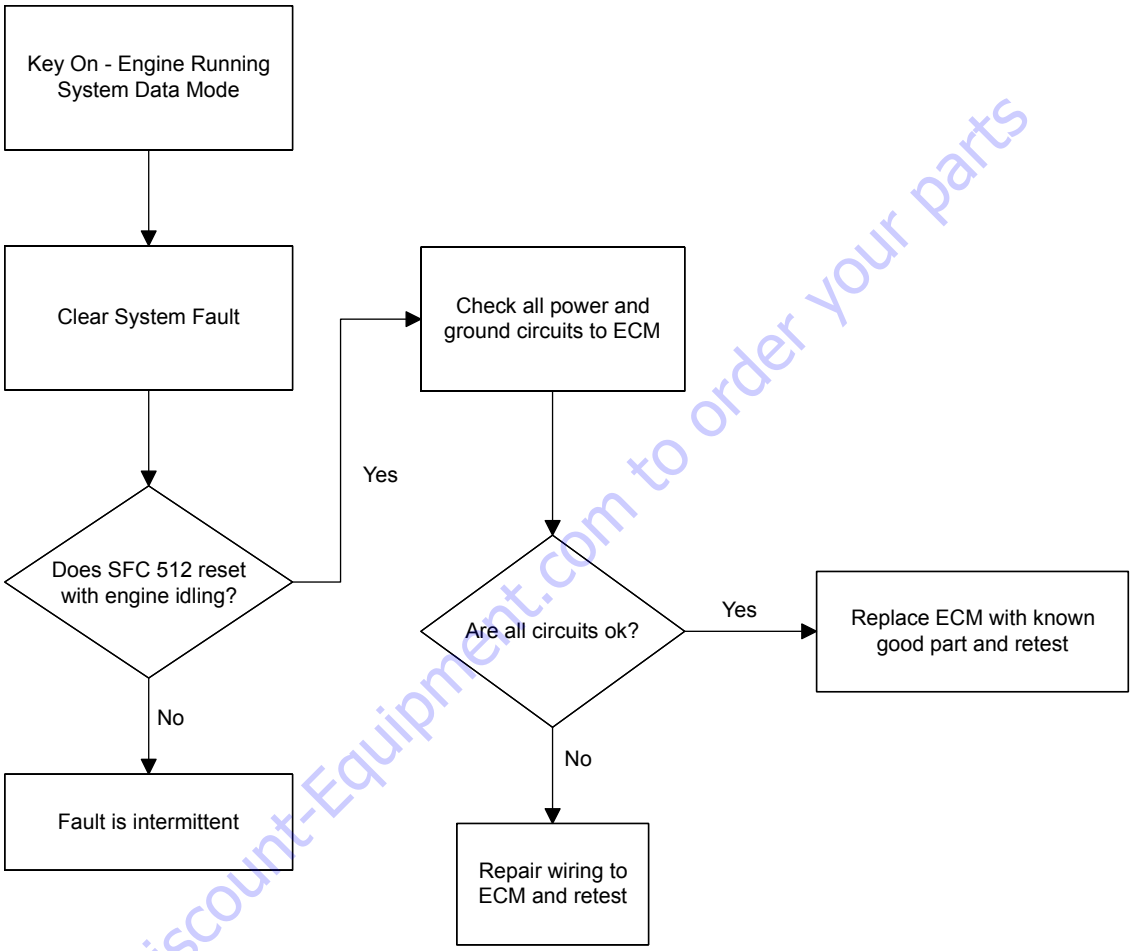
SFC 512- Invalid Interrupt



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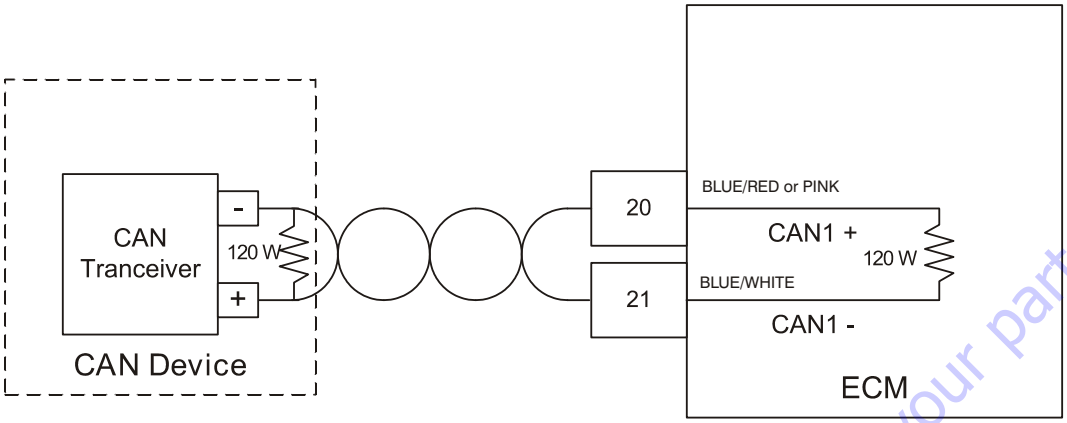
DTC 1625- CAN J1939 Shutdown Request



- Controller Area Network
- Check Condition- Key On, Engine Off and/or Running
- Fault Condition- ECM has received shutdown message from another CAN device and is shutdown on request.
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

In some situations, external controllers may send a request to the ECM to shutdown engine operation and stop the engine. This request may be sent in response to a safety related condition in the vehicle.

This fault will set if the ECM receives the J1939 shutdown request via the CAN interface. This is the expected behavior.

Diagnostic Aids

- The ECM has shutdown the engine upon command by a external controller. This is the requested and expected behavior.

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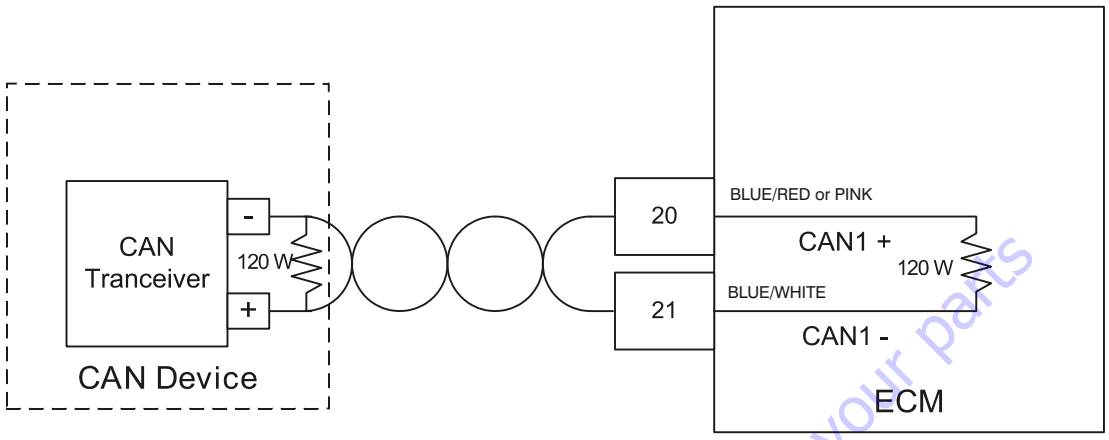
DTC 1626- CAN J1939 Transmit (Tx) Fault



- Controller Area Network
- Check Condition- Key On, Engine Off and/or Running
- Fault Condition- ECM CAN transceiver transmit error counts greater than the limit defined in the diagnostic calibration (must be < 125 failures)
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

The Controller Area Network (CAN) is a serial communication network used to transmit and receive data between intelligent devices. Systems that utilize CAN communication include smart actuators, smart sensors, dash panels and gauges, and other microcomputers. Each smart sensor, actuator, or controller incorporates a CAN transceiver that interprets logic level signals on the network and translates the information into digital data.

This fault will set if CAN communication is enabled and the ECM transceiver broadcasts a number of packets (as defined in the diagnostic calibration, must be set to less than 125 failures) to the network that are not received.

Diagnostic Aids

- Verify that all CAN devices are powered and are properly grounded
- Verify that the CAN network is properly terminated
- Check CAN wire routing with respect to noise sources (ignition coils, spark plug coil wires, etc.) and shield if necessary
- Check CAN (+) and (-) wires for short circuits

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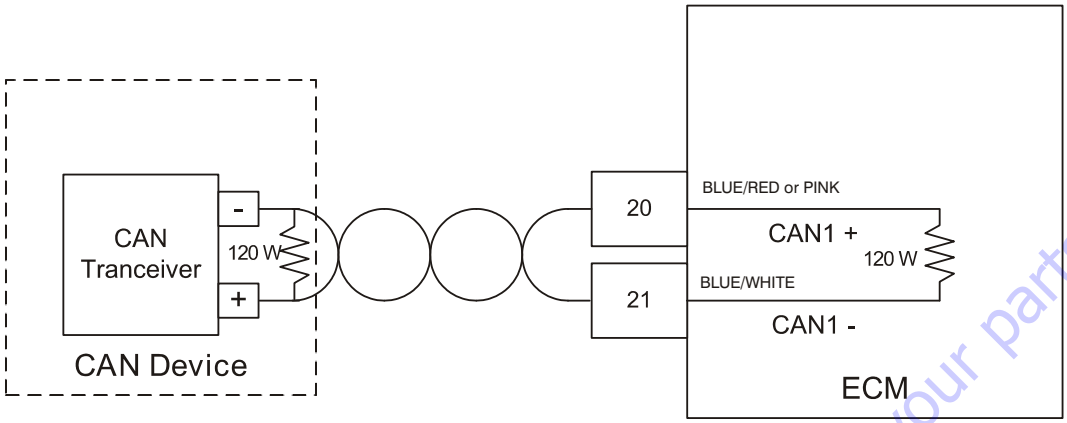
DTC 1627- CAN J1939 Receive (Rx) Fault



- Controller Area Network
- Check Condition- Key On, Engine Off and/or Running
- Fault Condition- ECM CAN transceiver receive error counts greater than the limit defined in the diagnostic calibration (must be < 125 failures)
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

The Controller Area Network (CAN) is a serial communication network used to transmit and receive data between intelligent devices. Systems that utilize CAN communication include smart actuators, smart sensors, dash panels and gauges, and other microcomputers. Each smart sensor, actuator, or controller incorporates a CAN transceiver that interprets logic level signals on the network and translates the information into digital data.

This fault will set if CAN communication is enabled and the ECM transceiver is expecting to see network traffic and either does not see traffic (as defined in the diagnostic calibration, must be set to less than 125 failures).

Diagnostic Aids

- Verify that all CAN devices are powered and are properly grounded
- Verify that the CAN network is properly terminated
- Check CAN wire routing with respect to noise sources (ignition coils, spark plug coil wires, etc.) and shield if necessary
- Check CAN (+) and (-) wires for short circuits

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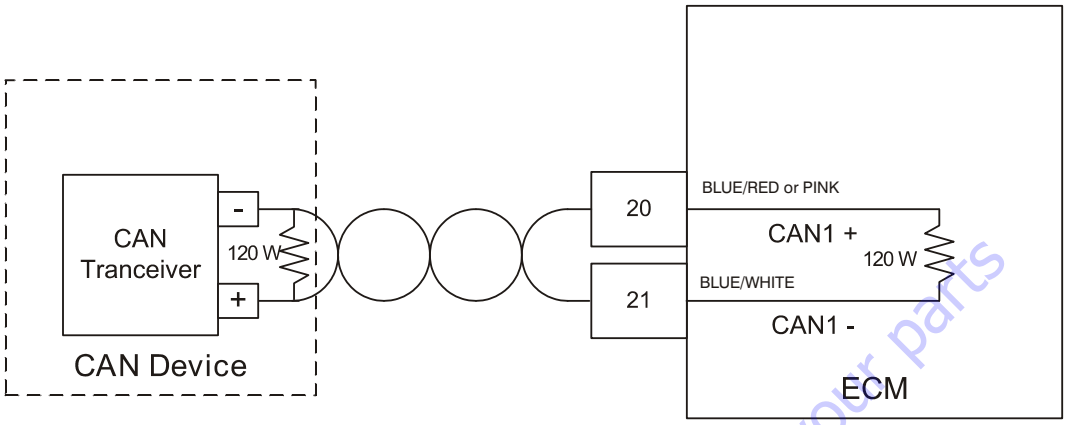
DTC 1628- CAN Address Conflict Failure



- CAN device(s)
- Check Condition- Key On, Engine on
- Fault Condition- two or more devices on the network that contain the same SA
- Corrective Action(s)- Sound audible warning or illuminate secondary warning lamp
- Non-emissions related fault

The Controller Area Network serves as a communication portal between intelligent devices. These devices may be but are not limited to other engine ECMs (slave), diagnostic tools, "smart" gauges, "smart" sensors, powertrain control units, vehicle controllers, actuators, etc. The network permits several devices to communicate with each other receiving and broadcasting commands as programmed. This type of network allows devices to be added to an entire system through only two conductors and permits all other devices to broadcast and receive commands to and from the device when properly commanded.

This fault indicates that there are two (2) or more devices on the network that use the same source address.

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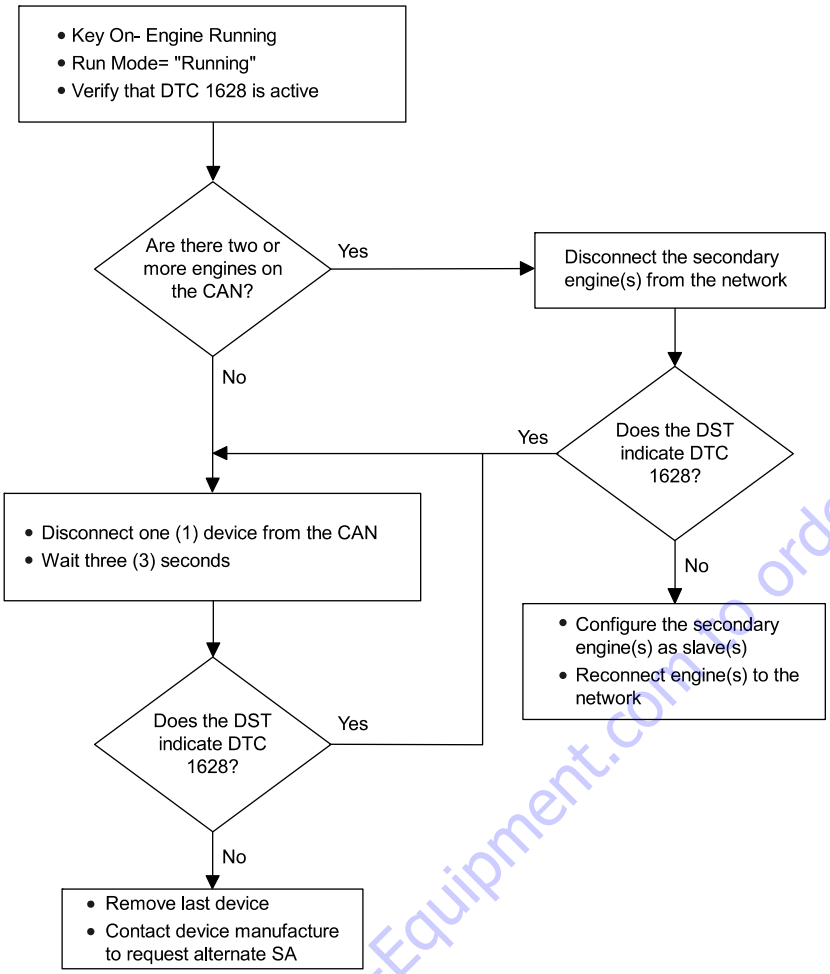

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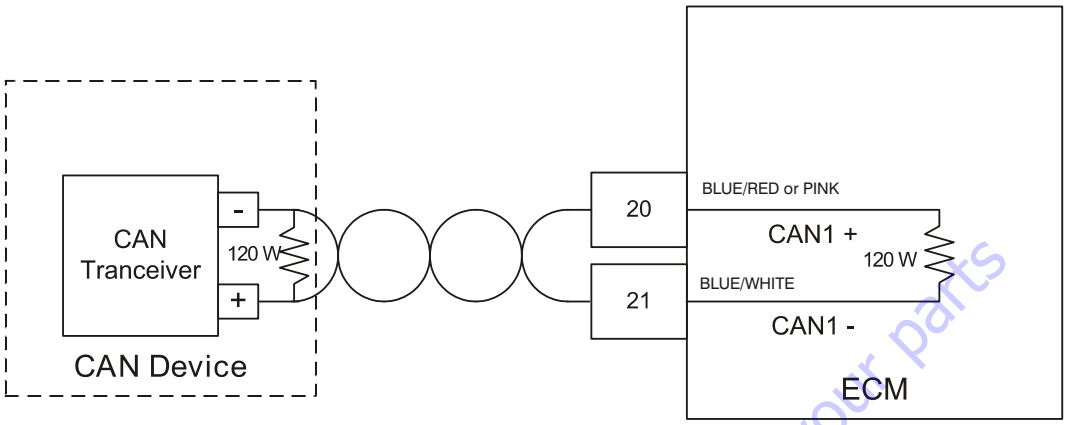
DTC 1629- J1939 TSC1 Message Receipt Loss



- Controller Area Network
- Check Condition- Key On, Engine Running
- Fault Condition- ECM is expecting to receive J1939 TSC1 messages and has not received a message for more than n seconds (as defined in the diagnostic calibration).
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp. Govern engine speed at a forced idle.
- Non-emissions related fault

J1939 TSC1 may be used to send a commanded (or desired) engine speed to the ECM. If configured, the ECM will govern the engine speed to this commanded speed if possible. When operating in this mode, the ECM expects to receive TSC1 messages on a regular interval. When this message is not received, the ECM must operate the engine at a default idle speed until commanded to do otherwise.

This fault will set if CAN communication is enabled, the engine is running, and no TSC1 messages are received over the CAN bus for more than n seconds (as determined by the diagnostic calibration).

Diagnostic Aids

- Verify that the CAN device generating the TSC1 message is powered and properly grounded
- Verify that the CAN network is properly terminated
- Check CAN wire routing with respect to noise sources (ignition coils, spark plug coil wires, etc.) and shield if necessary
- Check CAN (+) and (-) wires for short circuits

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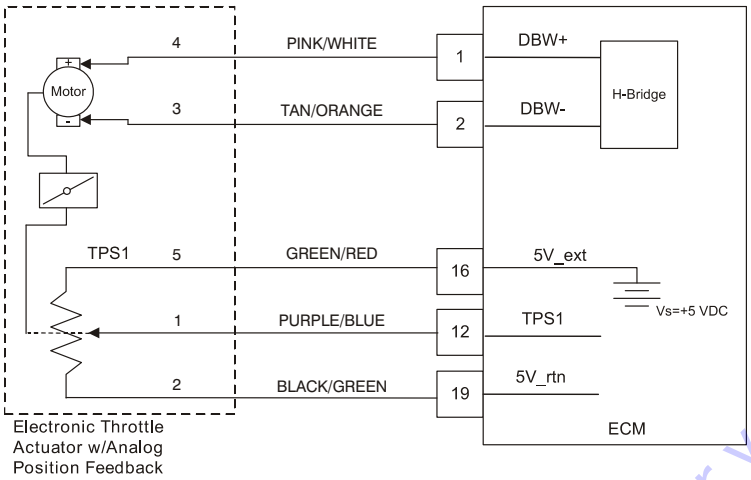
DTC 1652- TPS1 Loss of Communications



- Throttle Actuator (with serial/digital position feedback)
- Check Condition- Key On, Engine Running and/or Stopped
- Fault Condition- ECM is expecting to receive throttle position information from the throttle actuator and is not.
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp. Shutdown engine.
- Non-emissions related fault

In the case of a throttle actuator with serial/digital position feedback, the ECM receives a constant data stream from the throttle actuator. If the communication is absent or interrupted, the ECM can no longer control the position of the throttle.

This fault will set if the key is on, the throttle actuator is receiving power, and the ECM is not receiving digital information from the actuator.

Diagnostic Aids

- Verify that the throttle actuator 5V supply voltage is present at the actuator.
- Check for a all four TPS feedback wires for short circuits.
- Check TPS SER+ and TPS SER- wire routing with respect to noise sources (ignition coils, spark plug coil wires, etc.) and shield if necessary.

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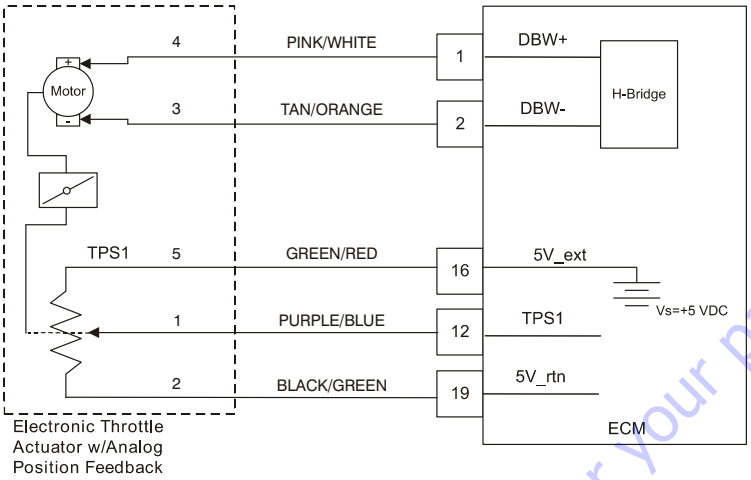
DTC 2111- Unable to Reach Lower TPS



- Throttle Position Sensor
- Check Condition-Cranking or Running
- Fault Condition-Throttle command is 20% less than throttle position for 200ms or longer
- MIL-On during active fault
- Engine Shut Down

In the case of a diesel engine, an actuator controls a fuel injection pump, directly affecting the fueling level into the cylinders. This may be by direct manipulation of the fuel injection pump rack or by manipulation of the mechanical governor control level or "throttle arm." In the DGC ECM and EDIS, references to the throttle and throttle position sensor refer to these fuel injection pump control actuators and their position feedback sensors. When the fuel injection pump is electronically controlled it can be used to control the idle stability and limit engine speed based on operating conditions.

The Throttle Position Sensor uses either 1) a variable resistor and voltage divider circuit or 2) a non-contact hall-effect sensor to determine throttle actuator position, and is located within the throttle actuator.

There are two types of throttle actuators, 1) actuator with analog position feedback and 2) actuator with digital position feedback. The first type, with analog position feedback, provides an analog return signal between 0 and 5 volts that is proportional to the throttle actuator position. The second type, with digital position feedback, provides a serial data signal to the ECM with the throttle actuator position voltage level encoded in the data stream.

This fault will set if the throttle command is 20% less than the actual throttle position. During this active fault the MIL light will be on and the engine will shut down.

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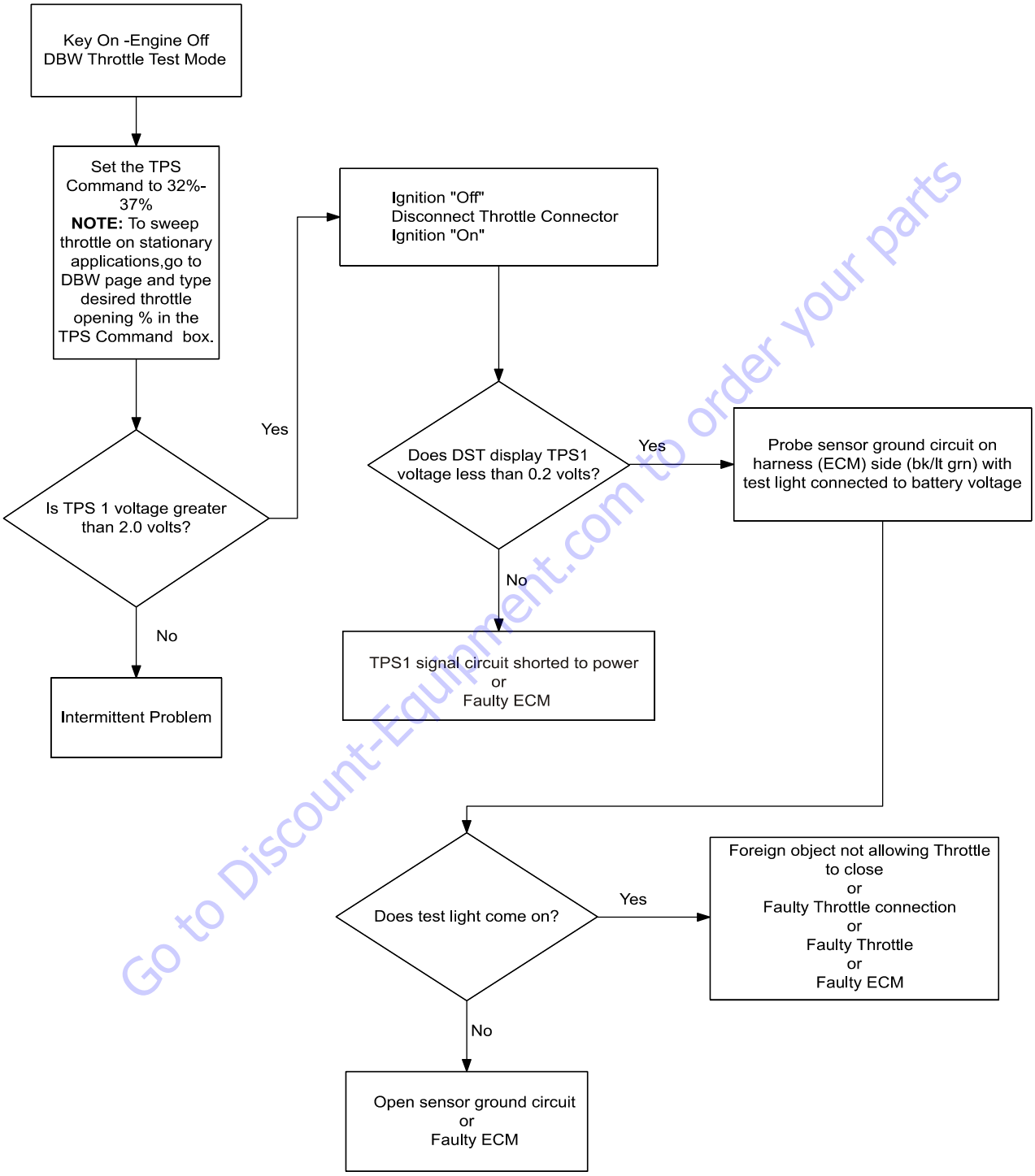
SFC 638-Throttle Unable To Close



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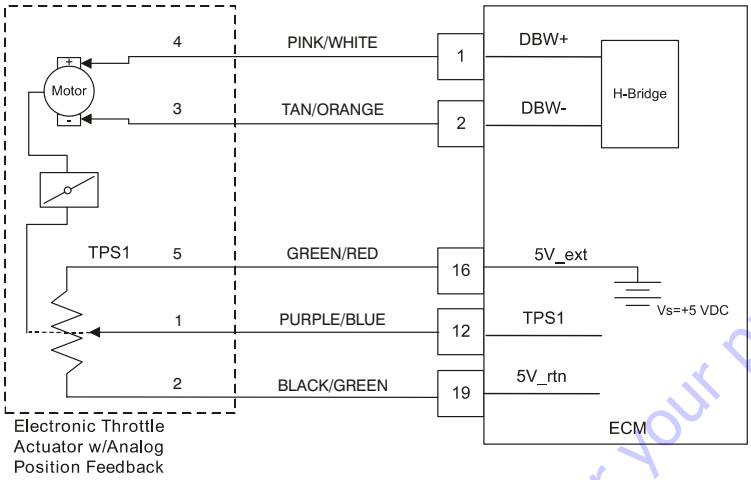
DTC 2112- Unable to Reach Higher TPS



- Throttle Position Sensor
- Check Condition-Cranking or Running
- Fault Condition-Throttle command is 20% more than actual throttle position
- MIL-On during active fault
- Engine Shut Down

In the case of a diesel engine, an actuator controls a fuel injection pump, directly affecting the fueling level into the cylinders. This may be by direct manipulation of the fuel injection pump rack or by manipulation of the mechanical governor control level or "throttle arm." In the DGC ECM and EDIS, references to the throttle and throttle position sensor refer to these fuel injection pump control actuators and their position feedback sensors. When the fuel injection pump is electronically controlled it can be used to control the idle stability and limit engine speed based on operating conditions.

The Throttle Position Sensor uses either 1) a variable resistor and voltage divider circuit or 2) a non-contact hall-effect sensor to determine throttle actuator position, and is located within the throttle actuator.

There are two types of throttle actuators, 1) actuator with analog position feedback and 2) actuator with digital position feedback. The first type, with analog position feedback, provides an analog return signal between 0 and 5 volts that is proportional to the throttle actuator position. The second type, with digital position feedback, provides a serial data signal to the ECM with the throttle actuator position voltage level encoded in the data stream.

This fault will set if the throttle command is 20% or more than the actual throttle position. During this active fault the MIL light will be on and the engine will shut down.

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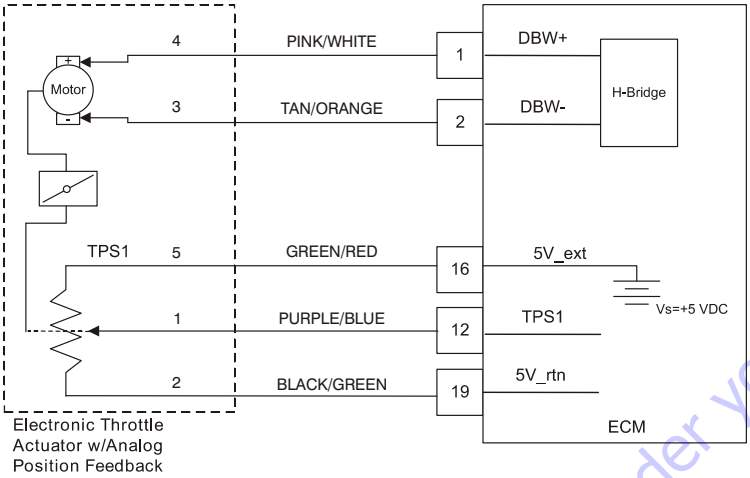
DTC 9999- Throttle Actuator Failsafe Spring Failure



- Throttle Actuator
- Check Condition- Key Off, Engine Stopped
- Fault Condition- When the key is off (or the actuator is unpowered), the ECM is expecting the failsafe spring in the actuator to return the throttle position to near 0%. If the throttle does not reach this position when the actuator is powered, a fault is generated.
- Corrective Action(s)- Illuminate MIL, sound audible warning or illuminate secondary warning lamp. Govern the engine speed to a forced idle speed.
- Non-emissions related fault

The throttle actuator has a return spring that causes the throttle to move to a near 0% position when powered off. This causes the engine to shutdown following a key off. If the ECM detects the throttle position to be above x volts when the key is off (as determined by the diagnostic calibration), it will power up the actuator and attempt to drive it to a zero position. This should ensure that the engine is stopped.

This fault will set if the throttle does not return to a near 0% position with the key is off.

Diagnostic Aids

- Disconnect the throttle actuator from the wire harness. Remove the throttle actuator from the engine and manually move it. Verify that the internal spring forces the throttle back to near 0% position.
- Inspect the throttle arm or fuel rack on the fuel pump. Verify that it is not stuck.

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DTC to SPN/FMI Table

FAULT INDEX	DESCRIPTION	DTC SET	
		SPN	FMI
2	DTC 118: ECT voltage high	110	3
3	DTC 117: ECT voltage low	110	4
4	DTC 116: ECT higher than expected stage 1	110	15
9	DTC 563: Vbat voltage high	168	15
10	DTC 562: Vbat voltage low	168	17
11	DTC 643: Sensor supply voltage 1 high	1079	3
12	DTC 642: Sensor supply voltage 1 low	1079	4
13	DTC 123: TPS1 voltage high	51	3
14	DTC 122: TPS1 voltage low	51	4
29	DTC 524: Oil pressure low	100	1
86	DTC 217: ECT higher than expected stage 2	110	0
89	DTC 2112: Unable to reach higher TPS	51	7
90	DTC 2111: Unable to reach lower TPS	51	7
96	DTC 336: CRANK input signal noise	636	2
98	DTC 606: Microprocessor failure - COP	629	31
99	DTC 1612: Microprocessor failure - RTI 1	629	31
100	DTC 1613: Microprocessor failure - RTI 2	629	31
101	DTC 1614: Microprocessor failure - RTI 3	629	31
102	DTC 1615: Microprocessor failure - A/D	629	31
103	DTC 1616: Microprocessor failure - Interrupt	629	31
104	DTC 601: Microprocessor failure - FLASH	628	13
105	DTC 604: Microprocessor failure - RAM	630	12
106	DTC 219: RPM higher than max allowed govern speed	515	15
144	DTC 337: Crank signal loss	636	4
145	DTC 1625: J1939 shutdown request	1384	31
146	DTC 1626: CAN-J1939 Tx fault	639	12
147	DTC 1627: CAN-J1939 Rx fault	639	12
175	DTC 1628: J1939 CAN address / engine-number conflict	639	13
188	DTC 521: Oil pressure high	100	0
189	DTC 1652: TPS1 loss of communications	51	9
190	DTC 1629: CAN-J1939 TSC1 Parameter Rx Fault	695	9
191	DTC 1113: Unable to achieve lower RPM	515	31
192	DTC 9999: TPS1 failsafe spring failure	51	7

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3.33 AUXILIARY POWER SYSTEM

The Auxiliary Power System is intended as a secondary means of moving the boom in the event of primary power loss. This system uses an electric motor/pump unit powered by a 12V battery capable of operating all functions except drive and controlled boom angle (see Section 4.11, Controlled Boom Angle System). To reduce the demand on the battery and therefore extend the run time of the system, the auxiliary power functionality differs from the primary power functionality. When commanded, the control system will attempt to use the force of gravity to operate main lift down, tower lift down, and tower telescope in by supplying pilot pressure to the respective cylinders. If appropriate movement is not detected by the boom sensors, the auxiliary power system will supply the hydraulic flow to power the movement conventionally.

The envelope control system (see Section 4.6, Envelope Control System) remains active during auxiliary power operation, however, functionality of tower lift or main lift only approximates the normal tower path control (see Section 4.7, Tower Path Control System) or main boom control (see Section 4.8, Automatic Main Boom Control System) functionality. Rather than the normal combined movements of tower lift, tower telescope, and main lift, these movements will automatically alternate during commands for tower lift or main lift to approximate the movements made under normal engine power.

3.34 COUNTERWEIGHT

If counterweight has been removed, ensure retaining bolts are torqued to the proper value as shown in Figure 3-95., Counterweight Bolt Torque.

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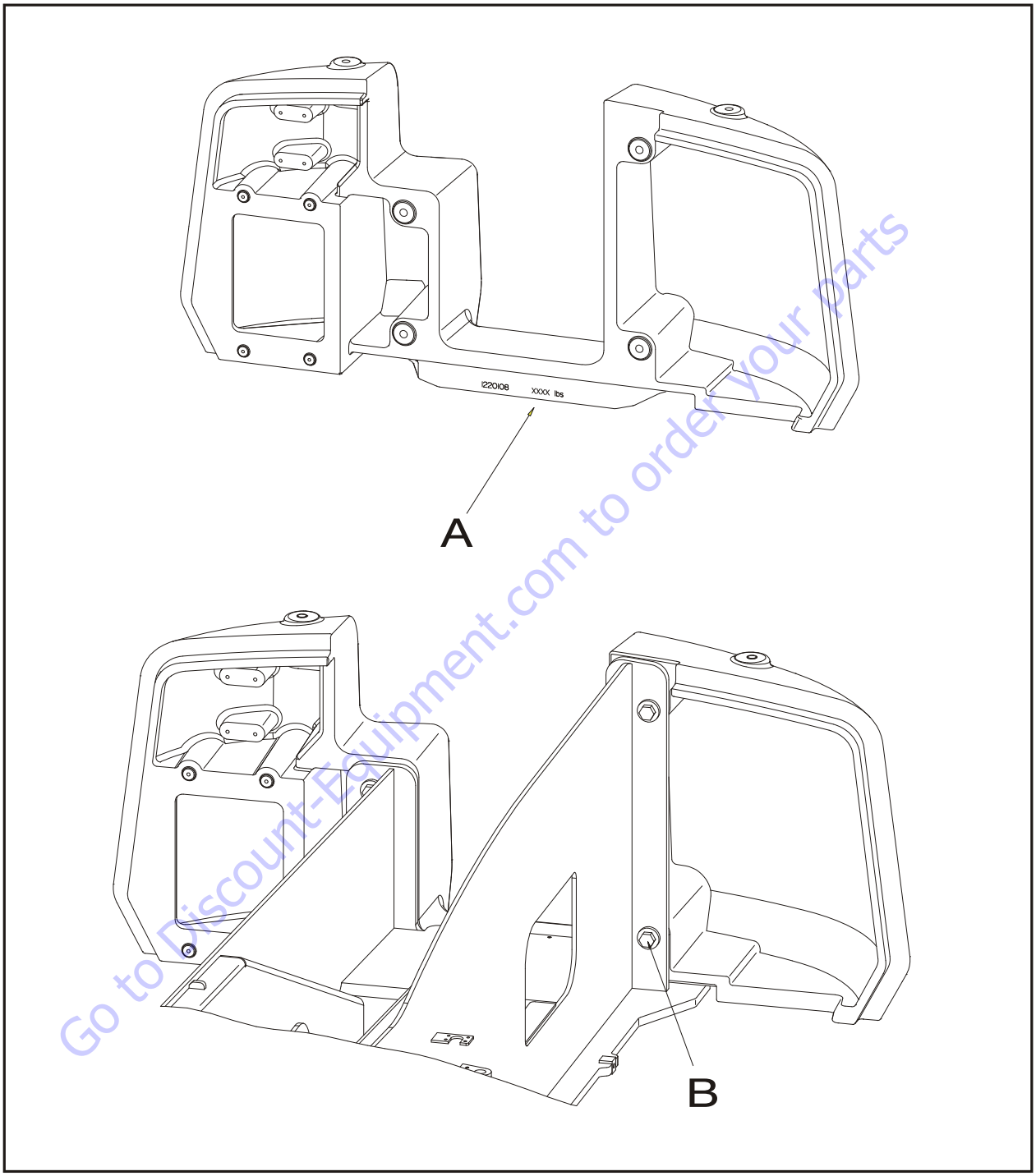

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A. Part Number\Actual Weight Stamping

B. Apply JLG Threadlocker PN 0100019 to Bolt Threads and to Threads in Counterweight. Torque to 400 ft. lbs. (542 Nm). Typical Four Places.

Figure 3-95. Counterweight Bolt Torque

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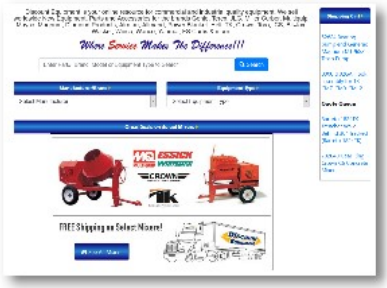

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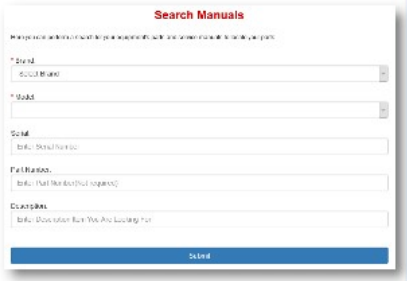

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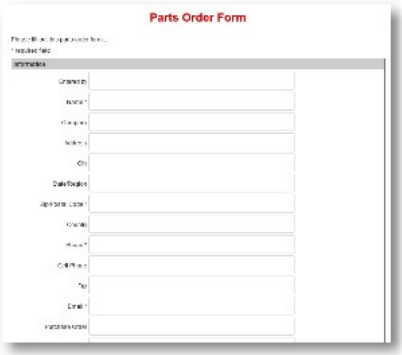

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SECTION 4. BOOM & PLATFORM

4.1 PLATFORM CONTROL ENABLE SYSTEM

Platform controls use a time dependent enable circuit to limit the time availability of “live” or enabled controls. To operate any directional function, the footswitch must be depressed before activation of the function. When the footswitch is depressed, the controls are enabled and the operator has 7 seconds to operate any function. The controls will remain enabled as long as the operator continues to use any function and will remain enabled 7 seconds after the last function has been used. While the controls are “live”, the enable light will be illuminated in the platform display panel. When the time limit has been reached, the enable light will turn off and the controls will be “dead” or disabled. To continue use of the machine the controls must be re-enabled to start the timer system over again. This is done by releasing all functions, then releasing and re-depressing the footswitch.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.2 TRANSPORT POSITION SENSING SYSTEM

The Transport Position Sensing System uses the following sensors to sense when the boom is in the position associated with high speed travel.

- Main boom angle sensors (mounted at the tower to main boom pivot pin).
- The main boom angle limit switch will be used in the event of a main boom angle sensor fault.
- Four main boom length limit switches (mounted on the main base boom).
- Tower lift cylinder angle sensor (mounted at the tower lift cylinder pivot to the turntable).
- The tower angle sensors in conjunction with the chassis tilt sensor will be used in the event of a tower lift cylinder angle sensor fault.
- Tower boom length sensors (mounted in the pivot end of the tower base boom).
- The tower length switch will be used in the event of a tower length sensor fault.
- The position of the articulated jib is not considered.

This system is used in the control of the following systems:

- Beyond Transport - Drive Speed Cutback System.
- Drive/Steer - Boom Function Interlock System - CE Only
- Jib Stow System
- Electrical Retrieval System
- Swing Speed Proportioning System
- Axle Extension System
- Oscillating Axle System

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.3 BEYOND TRANSPORT - DRIVE SPEED CUTBACK SYSTEM

When boom is positioned beyond the transport position as described in Section 4.2, Transport Position Sensing System, the drive motors are automatically restricted to their maximum displacement position (slow speed). See Section 3.24, Chassis Tilt Indicator System for interaction with the tilt sensor.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.4 DRIVE/STEER – BOOM FUNCTION INTERLOCK SYSTEM (CE ONLY)

The Drive/Steer – Boom Function Interlock System uses the Transport Position Sensing System to sense when the boom is out of the transport position. All controls are simultaneously functional when the booms are within the transport position as on the standard machine. When the boom is beyond the transport position, the control functions are interlocked to prevent simultaneous operation of any boom function with drive/steer. The first function set to be operated while in this mode, becomes the master function set. In other words, while operating drive/steer functions the boom functions are inoperable. Likewise, while operating boom functions drive/steer functions are inoperable.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

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4.5 JIB STOW SYSTEM

This machine is equipped with a full function side swing rotator that is mechanically limited to 55 degree rotation to the left and electrically limited to 70 degrees to the right through the use of a positive action limit switch mounted on the rotator assembly. The machines stowed length can be reduced to facilitate transportation on standard trailers by swinging the jib further to the right using the hydraulic power of the side swing rotator. The control system will prevent swinging the jib past the 70 degree position unless the axles are retracted, the boom is in the transport position (see Section 4.2, Transport Position Sensing System), and the jib stow override button on the platform control panel is held in combination with the jib swing function switch. When the jib is stowed, automatic platform leveling is disabled, the boom is restricted to the transport position, and axle extension is disabled. This system is functional only in the 500# (230 kg) mode of the Dual Capacity System (see Section 4.13, Dual Capacity System).

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.6 ENVELOPE CONTROL SYSTEM

The Envelope Control System is the primary means of controlling the working positions of the tower and main boom within the stability and structural requirements of the machine. Although the machine includes a load pin capable of measuring the changing forces on the boom, it is used exclusively for boom retrieval as described in the electrical retrieval system (see Section 4.9, Electrical Retrieval System) and is not used for controlling the stability of the machine until a fault is detected within the primary envelope control system. The control system is therefore not considering the load on the machine but rather the measured position of the boom within the envelope.

The main boom must be controlled in maximum angle and minimum angle to avoid entering a position that could compromise backward stability and avoid main boom to tower boom interference. The tower boom must be controlled by permitting only specific combinations of tower length and tower angle to avoid entering a position that could compromise forward and backward stability (see Section 4.7, Tower Path Control System).

This system uses two gravitationally based angle sensors and two length sensors to continuously measure the position of the tower boom in addition to two rotary angle sensors to continuously measure the position of the main boom. Each pair of sensors are continuously monitored for mutual agreement, proper response to command, and for correlation to a main boom angle limit switch, a tower boom length limit switch, and a tower rotary angle sensor. Recognized faults within this system will result in control by the Electrical Retrieval System (Section 4.9, Electrical Retrieval System), reduced function speeds, and BCS warning light illumination. After retrieval the boom will be restricted from leaving the transport position (see Section 4.2, Transport Position Sensing System) until the fault is resolved.

Boom position violations outside of the allowable envelope will result in reduced function speeds, BCS warning light illumination, restriction of functions, and sounding of the platform alarm and the flashing of the BCS light with attempts to operate restricted functions.

Normally, the tower lift function switch on the ground and platform control panels automatically activates both tower lift and tower telescope as described in the tower path control system (see Section 4.7, Tower Path Control System). Violations of the tower envelope will result in the suspension of this automatic feature. In an otherwise healthy control system, violations of the tower envelope can be corrected by actuating either of the tower lift up or tower lift down directions of the tower lift switch regardless of the direction of the violation. The control system will telescope or lift the tower in a singular manner to correct the tower position.

The restricted functions due to backward tower envelope violations are disallowing automatic tower lift down with tower lift down commands, automatic tower telescope out with tower lift up commands, main lift up and down, main telescope in, jib, swing, drive and steer.

The restricted functions due to forward tower envelope violations are disallowing automatic tower lift up with tower lift up commands, automatic tower telescope in with tower lift down commands, main lift up and down, main telescope out, jib, swing, drive and steer.

The restricted functions due to maximum main boom envelope violations are disallowing tower lift up and down, main lift up, main telescope in, jib, swing and drive.

The restricted functions due to minimum main boom envelope violations are disallowing main lift down, swing and drive.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

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4.7 TOWER PATH CONTROL SYSTEM

(see Figure 4-1., Tower Path vs. Main Boom Angle)

The Tower Path Control System uses the envelope control sensors to enhance the control of the tower boom for increased user efficiency and is used as an integral part of the envelope control system (see Section 4.6, Envelope Control System). Both the ground and platform control panels use one function switch to control the tower. User commands for tower lift up or tower lift down causes the control system to automatically introduce the correct combination of tower telescope and tower lift for the tower boom to follow a pre-described path or trajectory of the tower nose.

The tower path is a fixed relationship of tower length and tower angle (relative to gravity) and is variable only by the angle of the main boom. With main boom angles below +15°, the tower boom will reach maximum angles of 68° (at full tower boom extension) and with main boom angles above +65° the tower boom will reach maximum angles of 72° (at full tower boom extension).

Movement of the main boom will cause the control system to adjust the tower path accordingly. A fully raised tower boom will automatically vary in angle from 72° to 68° as the main boom is lowered from its maximum angle to the ground and conversely be raised from 68° to 72° as the main boom is raised from the ground to maximum angle. The amount of tower angle variation during main boom movements diminishes as the tower is lowered.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.8 AUTOMATIC MAIN BOOM CONTROL SYSTEM

The Automatic Main Boom Control System uses the envelope control sensors to enhance the control of the main boom during tower lift functions. Due to the mechanical joining of the main and tower booms, changes in tower boom angle would normally have an opposite effect on the main boom angle. To compensate for this, when the tower is raised the control system automatically introduces main lift up. Similarly, when the tower is lowered the control system automatically introduces main lift down. This is done to keep the platform moving in the same direction as the user command and to increase user efficiency during tower lift functions.

The interaction of the main boom and the tower boom is slightly different when the main boom is above or below 60° relative to gravity.

During tower lift up or tower lift down movements with the main boom below 60°, the control system will maintain the angle of the main boom (relative to gravity) read at the start of the tower lift command or as read at the conclusion of main lift during combined tower and main lift commands.

During tower lift down movements with the main boom initially above 60°, the control system will lower the main boom to approximately 60° before initiating tower movement. The control system will then control the main boom to 60° for the remainder of the tower lift down command.

During tower lift up movements with the main boom initially above 60°, the control system will delay automatic compensation of the main boom angle during the tower lift movement until the main boom reaches approximately 60°. The control system will then control the main boom to 60° until the tower boom has reached its maximum height. Continuing to operate the tower lift up function when the tower reaches its maximum height, will cause the control system to automatically raise the main boom to its original angle.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

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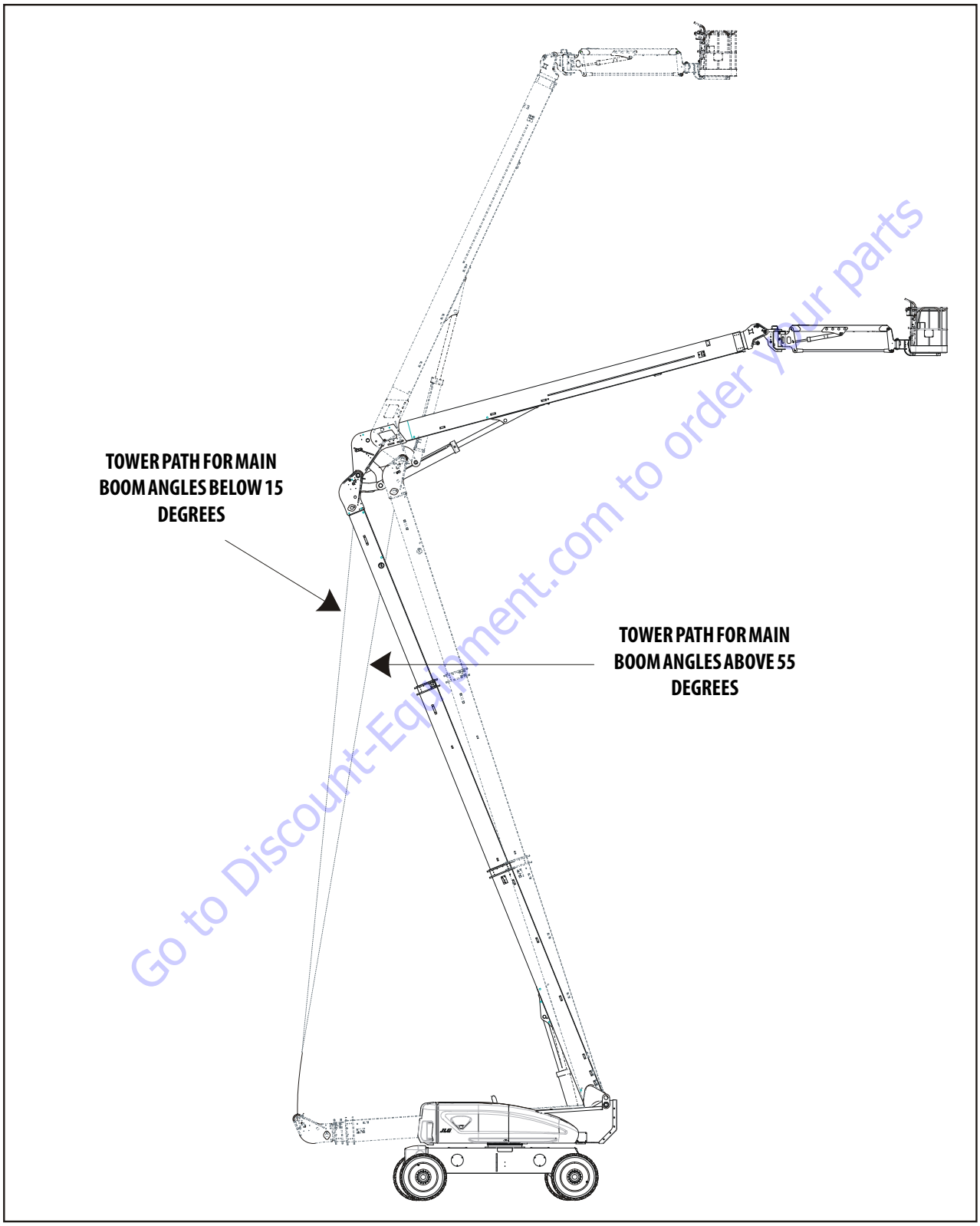

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Figure 4-1. Tower Path vs. Main Boom Angle

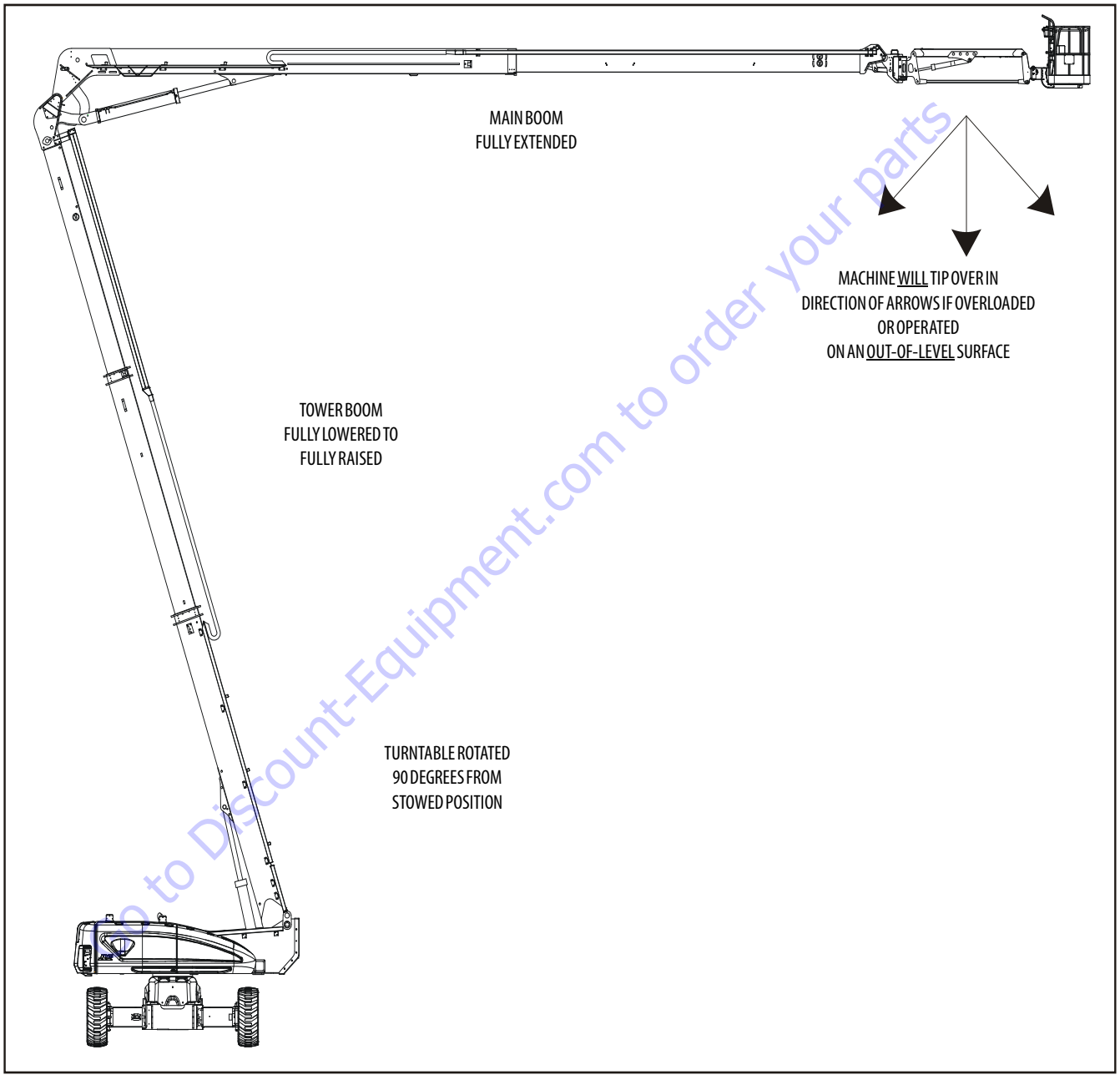

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Figure 4-2. Position of Least Forward Stability

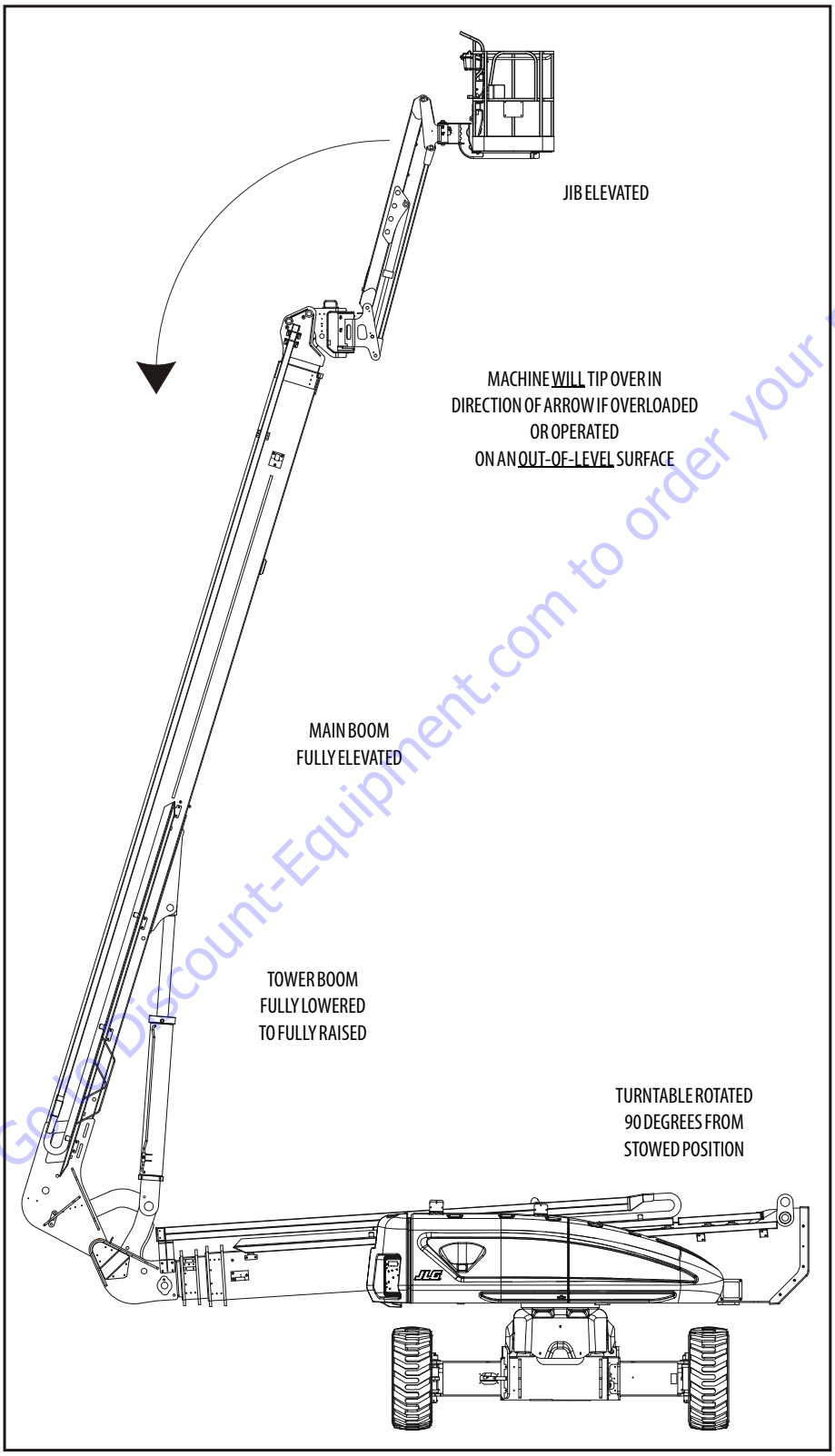

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Figure 4-3. Position of Least Backward Stability - Sheet 1 of 2

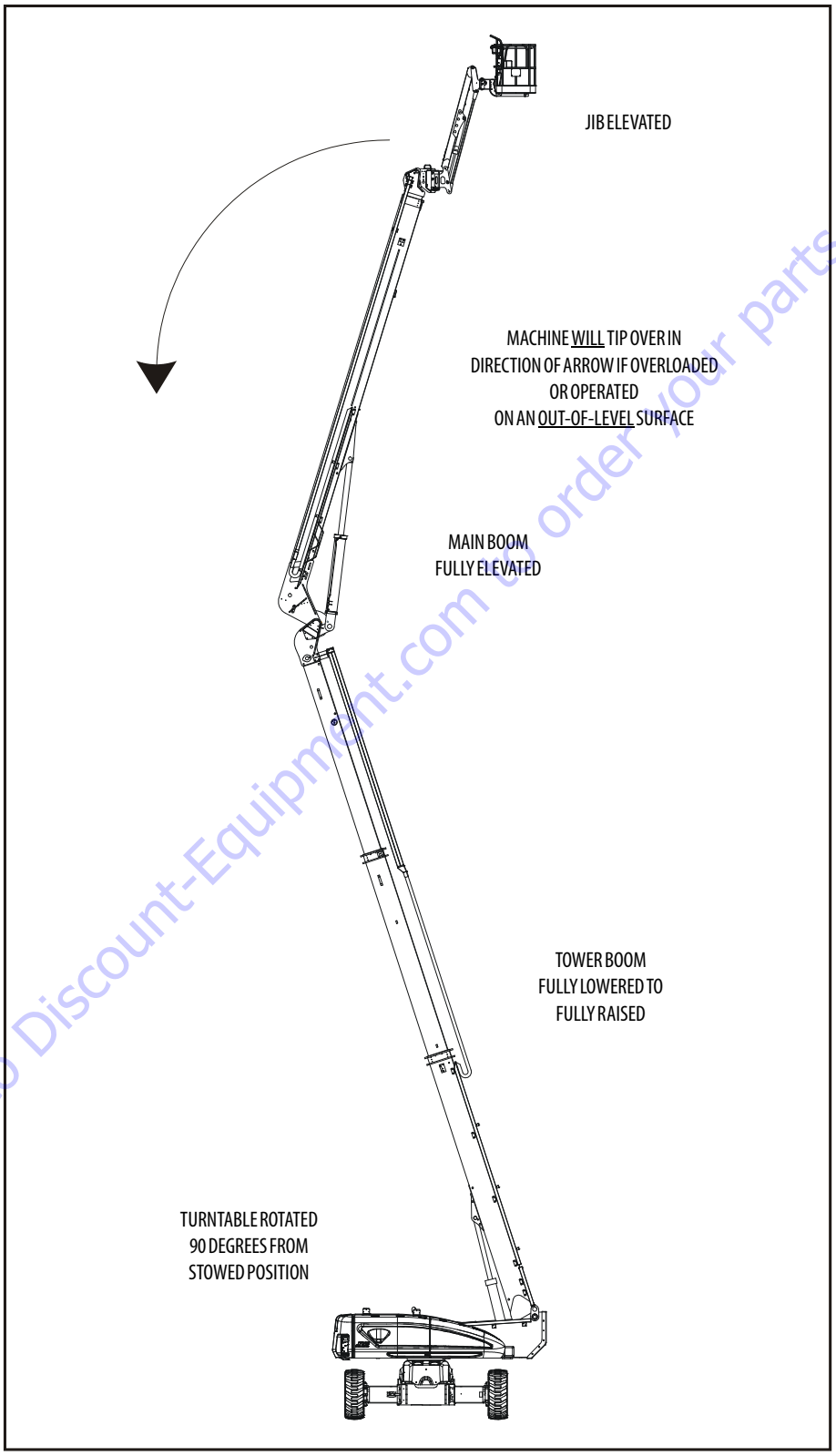

Figure 4-4. Position of Least Backward Stability - Sheet 2 of 2

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4.9 ELECTRICAL RETRIEVAL SYSTEM

The Electrical Retrieval System provides a backup means of retrieving an elevated boom in the event of a failure of any sensor used in the envelope control system (see Section 4.6, Envelope Control System). Although the system is continuously monitored for its viability, it is not active until a failure of the envelope control system is detected.

The system uses a load cell pin to attach the tower lift cylinder to the turntable. This pin is instrumented with gauges allowing the forces in the pin to be monitored. The control system uses these force readings to select one of two sequences of retrieving the boom in a manner necessary to maintain the stability and structural integrity of the machine.

The two sequences of boom retrieval are determined based on the boom being closest to a position of forward stability concern or closest to a position of backward stability concern (See Figure 4-2., Figure 4-3., and Figure 4-4.). Regardless of the sequence selected by the control system, the control system must recognize successive positions of the main and tower booms before continuing with the sequence.

While operating in this mode, the positions of the booms are determined by sensors not used by the primary envelope control system. These include the tower length switch, tower cylinder angle sensor, main boom angle switch, and main boom length switches.

Operating in this mode will result in reduced function speeds, BCS warning light illumination, and restriction of functions. Attempts to operate restricted functions will flash the BCS light and sound the platform alarm.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.10 HYDRAULIC RETRIEVAL SYSTEM

The Hydraulic Retrieval System provides a backup means of retrieving an elevated boom in the event of a recognized failure within the primary hydraulic control system related to the main lift, tower lift, and tower telescope functions. The control system monitors the primary hydraulic control system for short and open circuits, unexpected boom sensor response to command, control valve spool position faults, internal valve control module faults, and CAN BUS communication faults.

When a fault is detected, the control system automatically bypasses the appropriate hydraulic components and using alternative valves and control logic allows the operator to return the boom to the ground. In some cases the boom will be allowed to move only to the extent gravity is capable of assisting and in other cases the boom will be powered to allow complete retrieval to the transport position.

Although the envelope control system (see Section 4.6, Envelope Control System) remains active during the hydraulic retrieval, the tower lift functionality will follow the tower path (see Section 4.7, Tower Path Control System) in an approximated fashion. Rather than the normal combined movements of tower lift, tower telescope, and main lift, the tower lift movements will move in an alternating sequence between tower lift and tower telescope with the automatic main lift system (see Section 4.8, Automatic Main Boom Control System) disabled.

Operating in this mode will result in reduced function speeds, and restriction of functions. Attempts to operate restricted functions will flash the BCS light and sound the platform alarm.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.11 CONTROLLED BOOM ANGLE SYSTEM

The Controlled Boom Angle System uses the envelope control sensors to enhance the control of the boom by minimizing the interaction of swing and drive functions with the envelope edges. This interaction is due to two factors. First, the envelope is controlled relative to gravity regardless of ground slope and second, the turntable/boom mounting is effected by swing and drive functions when the ground slope varies. This can cause the boom position to vary within the envelope or even violate the envelope edges when swinging or driving without intentionally moving the boom. The controlled boom angle system minimizes this effect by automatically introducing either the tower or main boom lift up or down during swing and drive commands to maintain a constant boom angle relative to gravity.

When the tower is below the tower transport angle and the main boom is 25 degrees above the tower boom, the angle of the main boom is controlled. When the tower is above the tower transport angle, the angle of the tower is controlled regardless of main boom position.

Just as the booms are controlled during swing and drive functions, the tower angle is also controlled during main boom lift and main boom telescope functions.

Controlled boom angle is disabled with any envelope violation or failure.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

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4.12 SLOW DOWN SYSTEM

To reduce the machine dynamics and improve operator control, the control system uses the envelope control sensors to automatically slow down the tower lift up, main lift up, and main lift down function speeds as the minimum and maximum angles of the working envelope are approached. The control system indicates to the operator this automatic introduction of slow down by flashing the creep light on the platform display panel. This feature applies to both platform and ground controls, however, no indication is made on the ground control panel.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.13 DUAL CAPACITY SYSTEM

The Dual Capacity System is a multiple envelope control system as opposed to a capacity indication system. The control system changes the allowable working envelope to match the capacity select mode to either the 500# (230 kg) mode or the 1000# (450 kg) mode. It then displays the capacity mode on the platform and ground display panel and controls the positions of the main boom within the allowable envelope for that mode. This mode is selectable by the operator with the dual capacity select switch on the platform control panel.

The 500# (230 kg) mode has the largest envelope and allows the use of the side swing jib. The 1000# (450 kg) mode has a smaller envelope and requires the jib to be fixed in the centered position.

The control system uses the envelope control sensors (item16) in addition to the 4 limit switches and cams mounted on the main base and fly booms to restrict the main boom length between the main boom angles of +55° and –45° for the 1000# envelope.

To select the 1000# (450 kg) mode the boom must already be in the smaller 1000# (450 kg) envelope and the jib must be centered (+/-10 degrees) verified to the control system by the jib centered limit switch mounted on the side swing rotator.

When the operator selects the 1000# (450 kg) mode and these conditions are met, the capacity light changes from 500# (230 kg) to 1000# (450 kg), jib swing is disallowed, and the envelope is changed accordingly.

When the operator selects the 1000# mode and these conditions are not met, both capacity lights will flash, the platform alarm will sound, and all functions except jib swing will be disabled until the capacity select switch is put back into the 500# (230 kg) position. Operation of jib swing in this condition can be used to find the center position of the jib as the jib swing function will stop when the center position is reached.

When in the 1000# (450 kg) mode, attempts to telescope, lift or lower the main boom into the restricted area will cause that function to be prevented.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.14 HYDRAULIC SYSTEM WARM UP

For optimal life and performance of the hydraulic system in extremely cold temperatures, the control system monitors the hydraulic system temperature and automatically limits the function speeds of the high demand functions.

While the system is cold and in the warm up mode, the tower lift, main lift, and main telescope functions are limited to creep speeds and is indicated to the operator by flashing the creep light on the platform control panel.

Operating the machine while in the warm up mode will generate sufficient heat to bring the hydraulic temperature up to allowable temperatures and the warm up mode will be automatically turned off. Although operating any function will generate heat, the tower lift function will warm the hydraulic system temperature the fastest as this function will operate tower lift, tower telescope, and main lift function automatically.

Functions being operated when the warm up mode turns off will remain in the creep speed until the function is re-initiated.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.15 REDUCED PLATFORM HEIGHTS

The control system allows the maximum platform height of the machine to be restricted to a selectable reduced height to allow increased versatility in the rental market. The selection of 125, 100, and 80 ft maximum platform heights are available in the dealer mode - machine set up menu on the analyzer. The reduced platform heights are implemented by restricting the travel of the tower boom up the tower path (see Section 4.7, Tower Path Control System) while maintaining all other aspects of the envelope control system (see Section 4.6, Envelope Control System). The limits and functionality of the main boom are unaffected by the selection.

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4.16 ELECTRONIC PLATFORM LEVELING

The Electronic Platform Leveling System uses two tilt sensors (mounted on either side of the pivot weldment), a control valve (mounted to the platform support), a level cylinder, and the platform control module (mounted in the platform control box) to automatically measure and control the incline of the platform with respect to gravity. This system is active while operating drive, telescope, lift or swing. It is not active while operating any other function (e.g. rotate, jib, or steer). The system controls the platform angle relative to gravity using a set point established during power-up (cycling of the EMS) or at the conclusion of a manual platform level override by the operator using the platform level override switch from either the platform or the ground control. In other words the operator can chose a platform incline other than level with gravity and the system will maintain that incline automatically.

If a fault occurs in the platform leveling system the following will occur:

- Automatic platform leveling will stop (except when there is a fault in only one sensor)
- The platform level fault indicator will flash
- The platform alarm will sound
- All functions will default to creep speed if in platform mode and the boom is out of the transport position (see Section 4.2, Transport Position Sensing System)

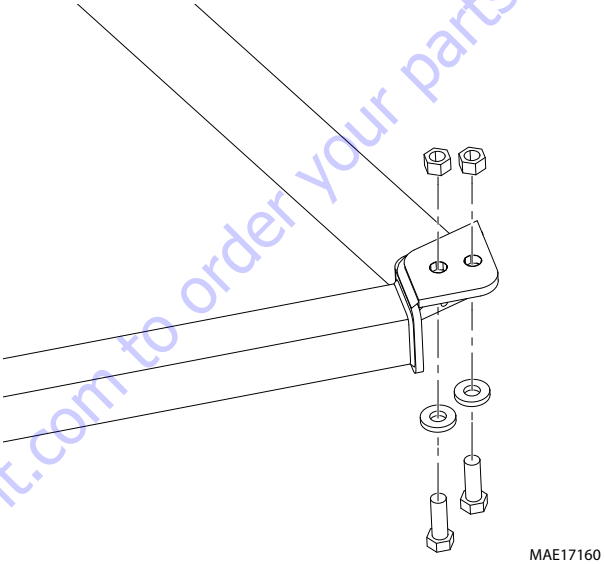
To reset a platform leveling fault, the emergency stop switch should be recycled.

NOTE: *For more detailed information concerning system adjustment and operation, refer to Section 6 - JLG Control System.*

4.17 PLATFORM

Support Removal

1. Disconnect electrical cables from control console.
2. Tag and disconnect the hydraulic lines from the rotator. Use suitable container to retain any residual hydraulic fluid. Cap hydraulic lines and ports.
3. Remove the bolts securing the platform to the platform support, then remove the platform.



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4. Using a suitable lifting device, support the platform support.

NOTE: *The platform support weighs approximately 125 lbs. (56.8 kg).*

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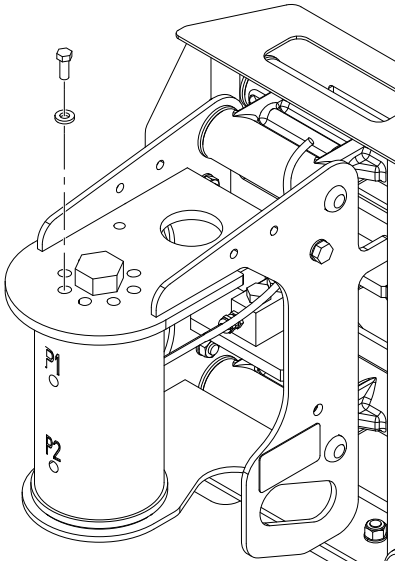
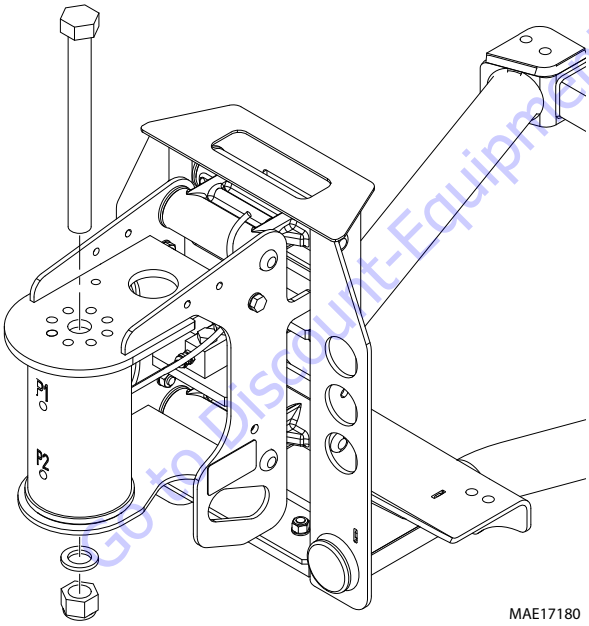
5. Remove the bolts and washers securing the support to the rotator.



6. Using a suitable brass drift and hammer, remove the rotator center bolt, then remove the support from the rotator.

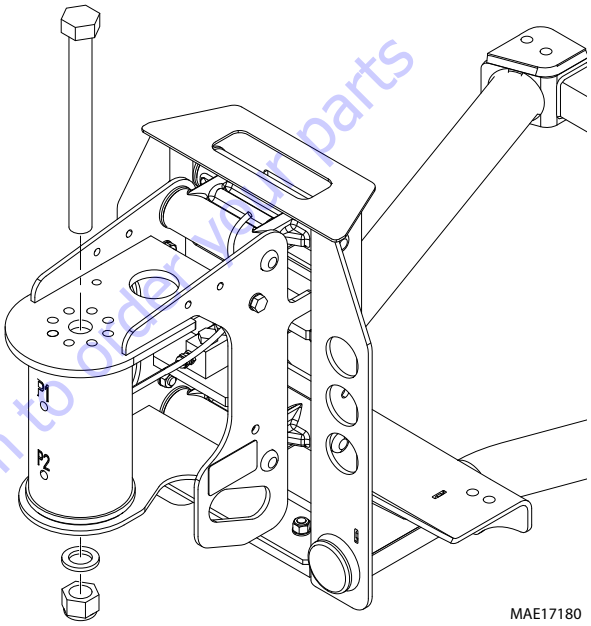


Support Installation

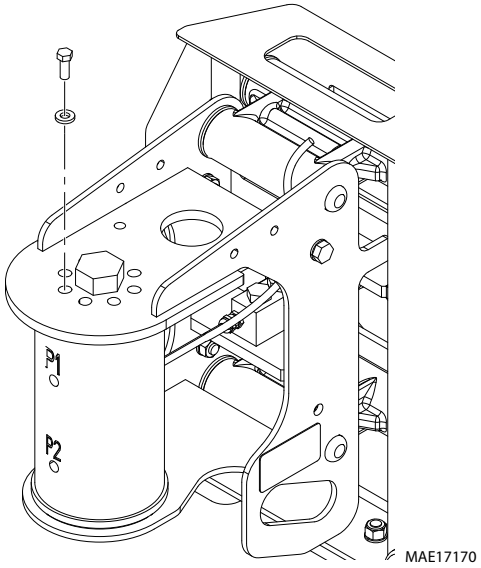
1. Using a suitable lifting device, support the platform support and position it on the rotator.

NOTE: *The platform support weighs approximately 125 lbs. (56.7 kg).*

2. Install the rotator center bolt.



3. Apply JLG Threadlocker PN 0100011 to the bolts and washers securing the support to the rotator and install the bolts and washers.



4. Torque the nut on the rotator center bolt to 586 ft. lbs. (795 Nm). Torque the retaining bolts to 40 ft. lbs. (55 Nm).

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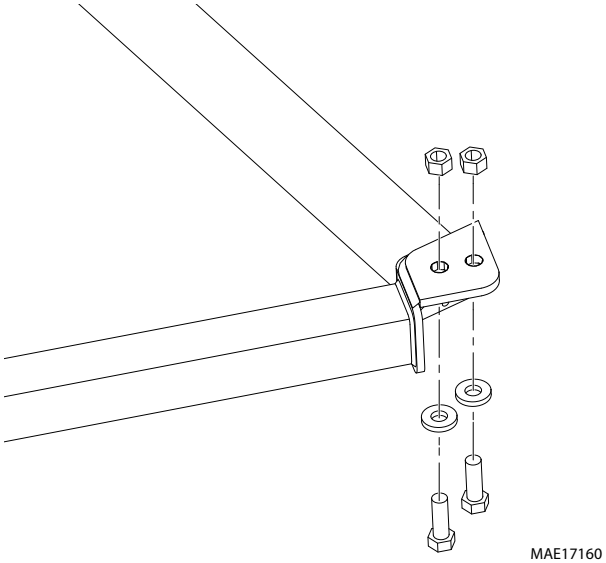
5. Position the platform on the platform support and install the bolts securing the platform to the platform support.



6. Remove tag and reconnect the hydraulic lines to the rotator.
7. Connect the electrical cables to the platform control console.

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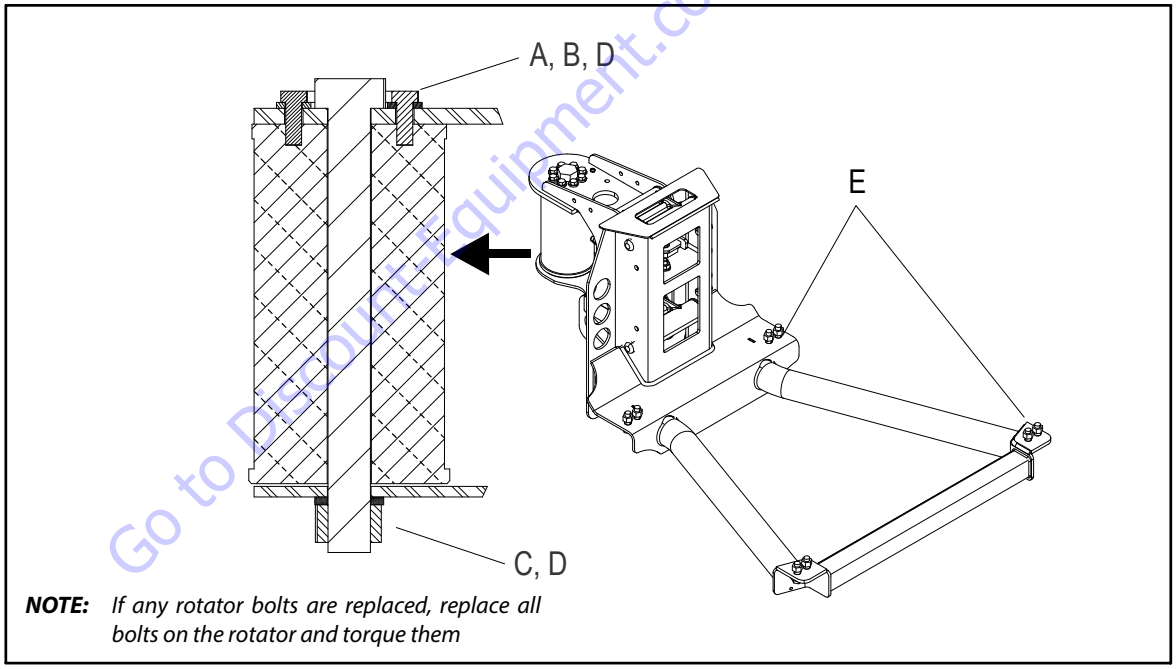
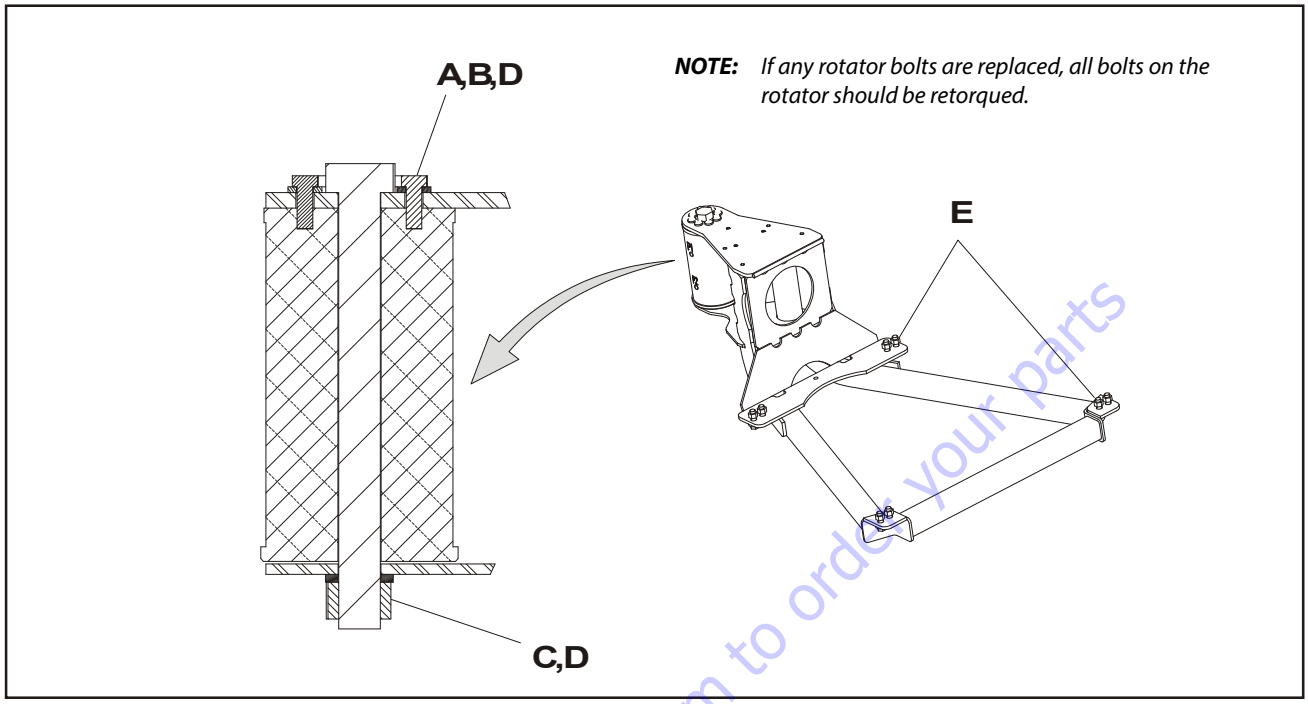


NOTE: *If any rotator bolts are replaced, replace all bolts on the rotator and torque them*

A	Torque to 40 ft.lbs. (55 Nm)
B	JLG Threadlocker PN 0100011
C	Torque 586ft. lbs. (795 Nm)
D	Check torque every 150 hours of operation
E	Torque 105 ft. lbs. (145 Nm)

Figure 4-5. Platform Support Torque Values



A Torque to 50 ft.lbs. (68 Nm)
B JLG Threadlocker PN 0100011
C Torque to 586ft. lbs. (795 Nm)
D Check torque every 150 hours of operation
E Torque to 75 ft. lbs. (102 Nm)

Figure 4-6. Platform Support Torque Values

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4.18 ROTATOR

Removal

1. Remove the Platform and Platform Support. Refer to Section 4.17, Platform.
2. Tag and disconnect hydraulic lines to rotator. Use suitable container to retain any residual hydraulic fluid. Cap or plug all openings of hydraulic lines and ports.

NOTE: *The rotator approximately weighs 60 lbs. (27 kg).*

3. Supporting the rotator and jib assembly, remove hardware from pin #1. Using a suitable brass drift and hammer remove pin #1.
4. Remove the hardware from pin #2. Using a suitable brass drift and hammer, remove pin #2 and remove the rotator.

Installation

NOTE: *The rotator approximately weighs 60 lbs. (27 kg).*

1. Supporting the rotator and jib assembly, align rotator with jib assembly mounting point and jib. Using a soft head mallet, install pin #1 to the jib assembly. Install hardware securing pin #1.
2. Using a soft head mallet install pin #2 to jib assembly and install the rotator. Install hardware securing pin #2.

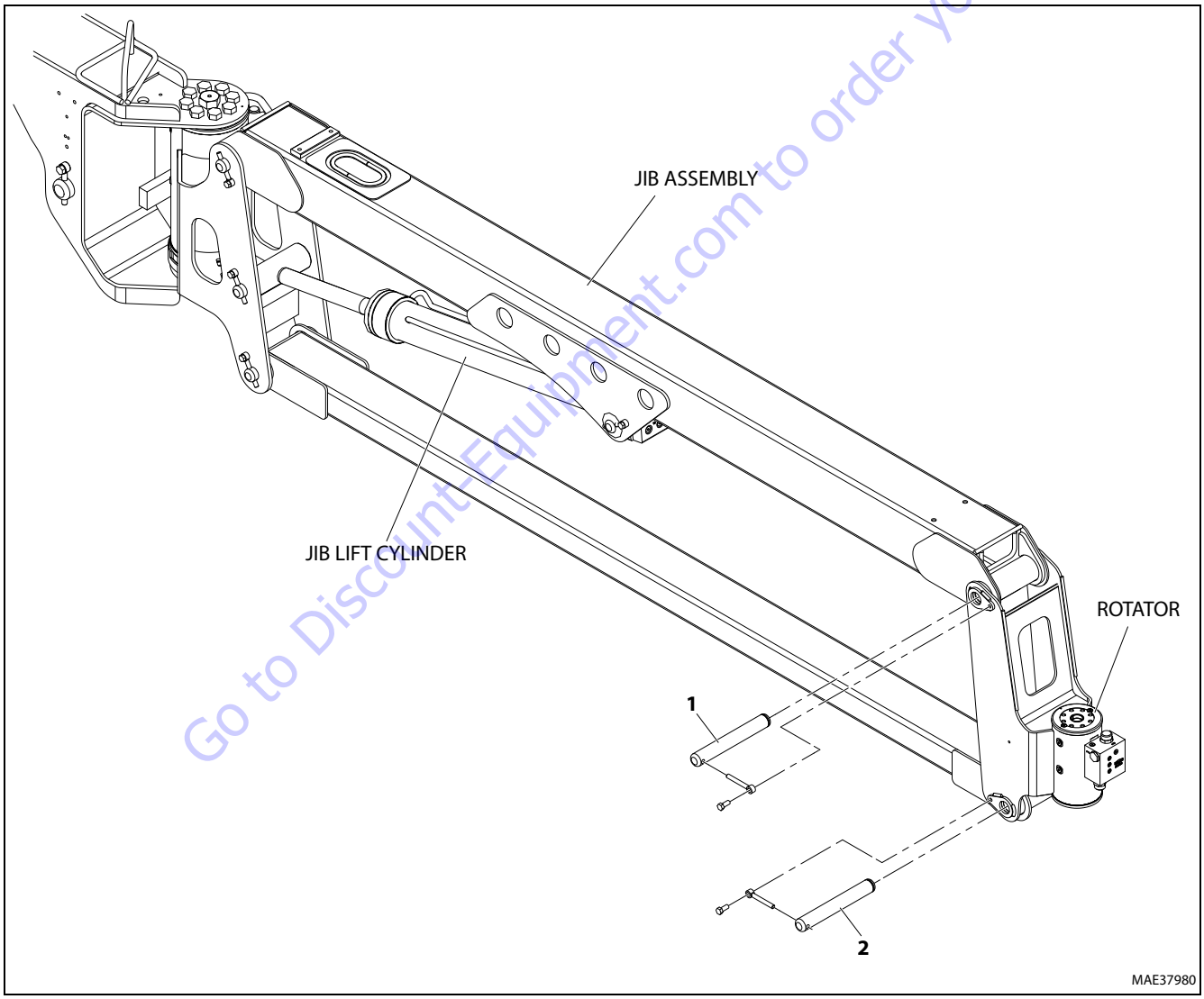

Figure 4-7. Rotator Removal/Installation

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4.19 MAIN BOOM

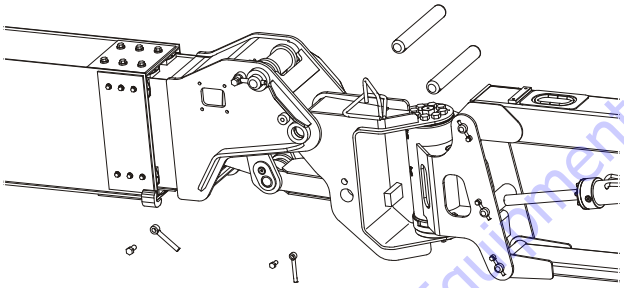
Disassembly

NOTE: *The following procedure allows the boom base section to remain attached to the machine.*

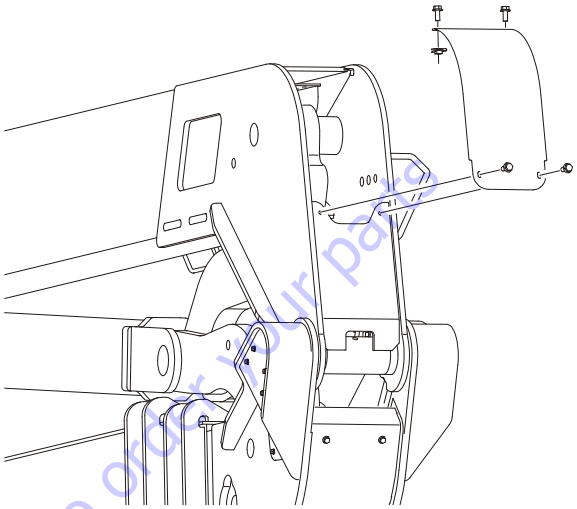
1. Make sure the machine is on a firm, level surface.

NOTE: *The jib and platform assembly weighs approximately 1000 lbs. (454 kg).*

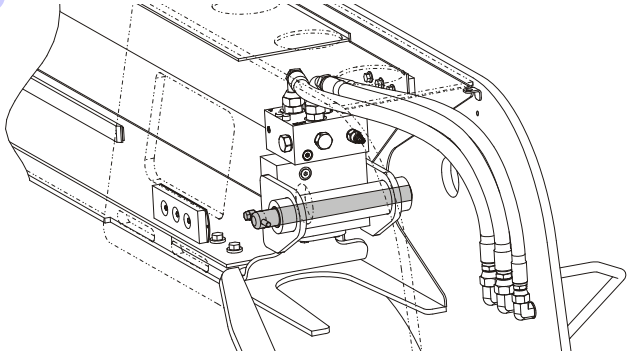
2. Support the jib sand platform assembly.
3. Tag and disconnect all electrical lines running to the jib and platform.
4. Tag and disconnect all hydraulic lines running to the jib and platform.
5. Remove the bolts, keeper pins, and pivot pins that secure the jib rotator support to the nose of the fly section.



6. Remove the jib/platform assembly from the boom.
7. Extend the fly section enough to attach an adequate lifting device for removing the fly section.
8. Remove the cover from the top of the main boom to gain access to the telescope cylinder attaching hardware.



9. Remove the bolt, keeper pin, and retaining pin securing the barrel end of the telescope cylinder to the main boom base section.



10. Using an adequate lifting device, pull the main fly section and telescope cylinder out of the main boom base section.

NOTE: *The main boom fly section including telescope cylinder and level cylinder weighs approximately 2000 lbs. (907 kg).*

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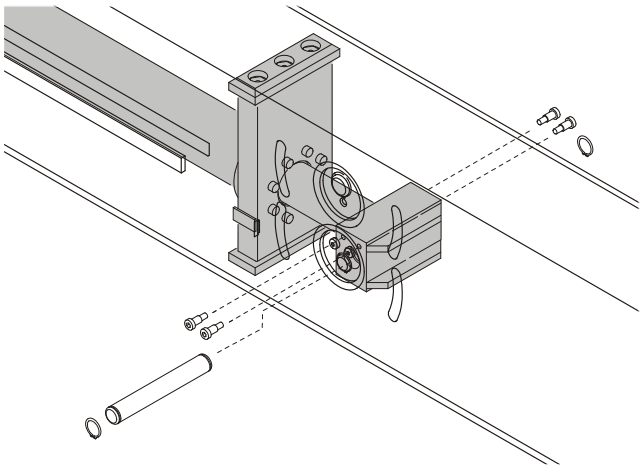
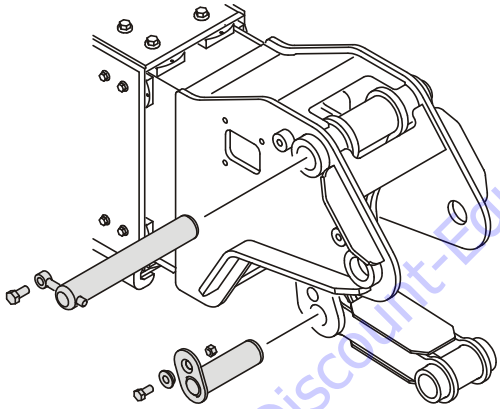
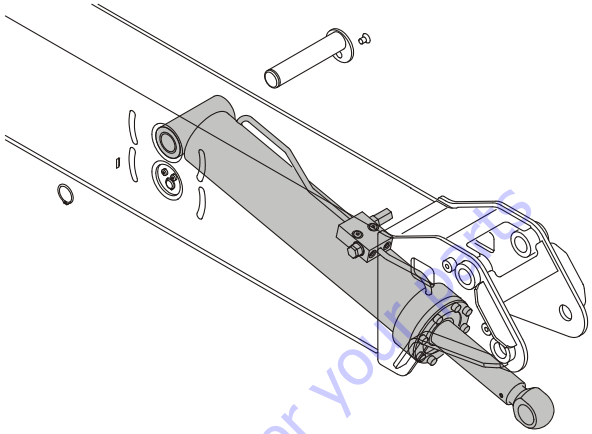
11. If necessary, remove the shoulder screws, retaining rings, and pin that secures the rod end of the telescope cylinder to the main boom fly section and remove the telescope cylinder from the fly section.



12. If necessary, remove the bolt, keeper pin, and pivot pin securing the upper link to the boom nose and remove the upper and lower links as an assembly. If necessary, remove the bolt (screw prior to S/N 80869), pin retainer sleeve, and nut securing the lower link to the upper link.

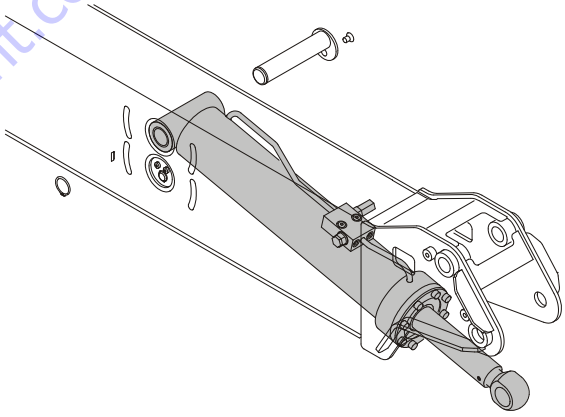


13. If necessary, remove the shoulder screws, retaining ring, and pin that secures the barrel end of the level cylinder to the main boom fly section and remove the level cylinder from the fly section.



Assembly

1. If removed during assembly, install the level cylinder into the fly section. Install the shoulder screws, retaining ring, and pin that secures the barrel end of the level cylinder to the main boom fly section.



2. If removed during assembly, install the pin retainer sleeve, bolt (screw prior to S/N 80869), and nut securing the lower link to the upper link. On machines using the bolt and nut, torque to 190 ft. lbs. (260 Nm). Position the

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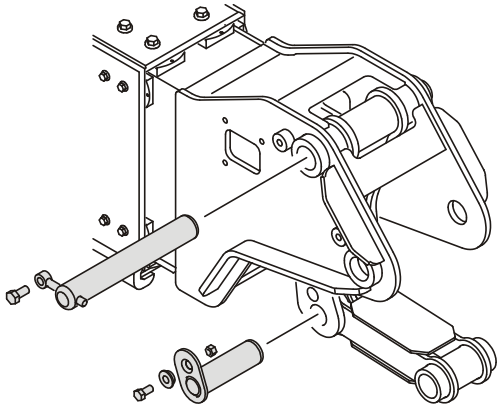
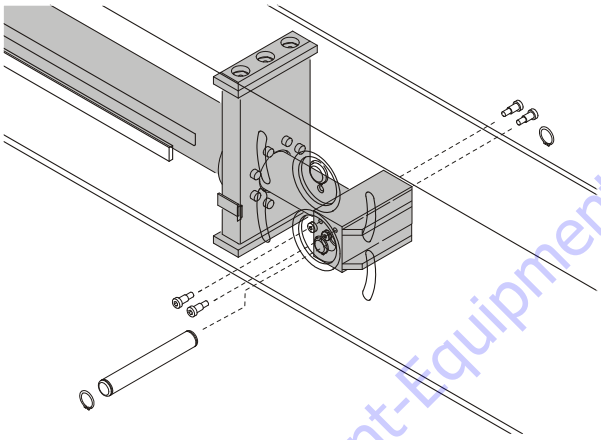
upper link to the boom nose and secure in place with the pivot pin, keeper pin, and bolt.



3. If removed during assembly, install the telescope cylinder into the fly section. Install the shoulder screws, retaining rings, and pin that secures the rod end of the telescope cylinder to the main boom fly section.

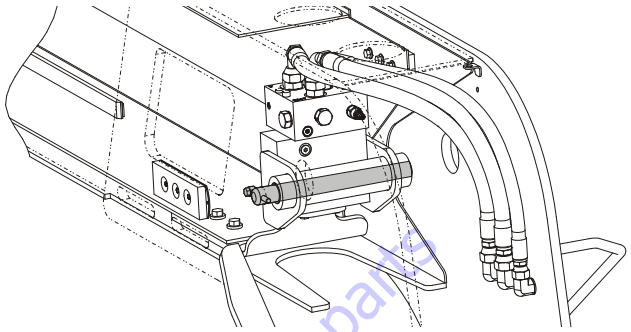


4. Using an adequate lifting device, slide the main fly section and telescope cylinder into the main boom base section.

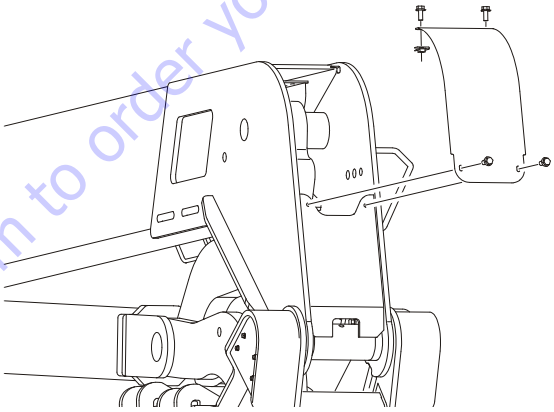
NOTE: *The main boom fly section including telescope cylinder and level cylinder weighs approximately 2000 lbs. (907 kg)*

.

4. Install the bolt, keeper pin, and retaining pin that secures the barrel end of the telescope cylinder to the main boom base section.



5. Install the cover to the top of the main boom.



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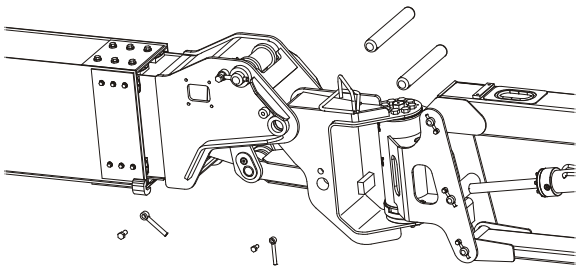
6. Install the jib/platform assembly onto the boom.
7. Extend the fly section enough to attach an adequate lifting device for removing the fly section.
8. Install the bolts, keeper pins, and pivot pins that secure the jib rotator support to the nose of the fly section.



9. Connect all hydraulic lines running to the jib and platform as tagged during disassembly.
10. Connect all electrical lines running to the jib and platform as tagged during removal.

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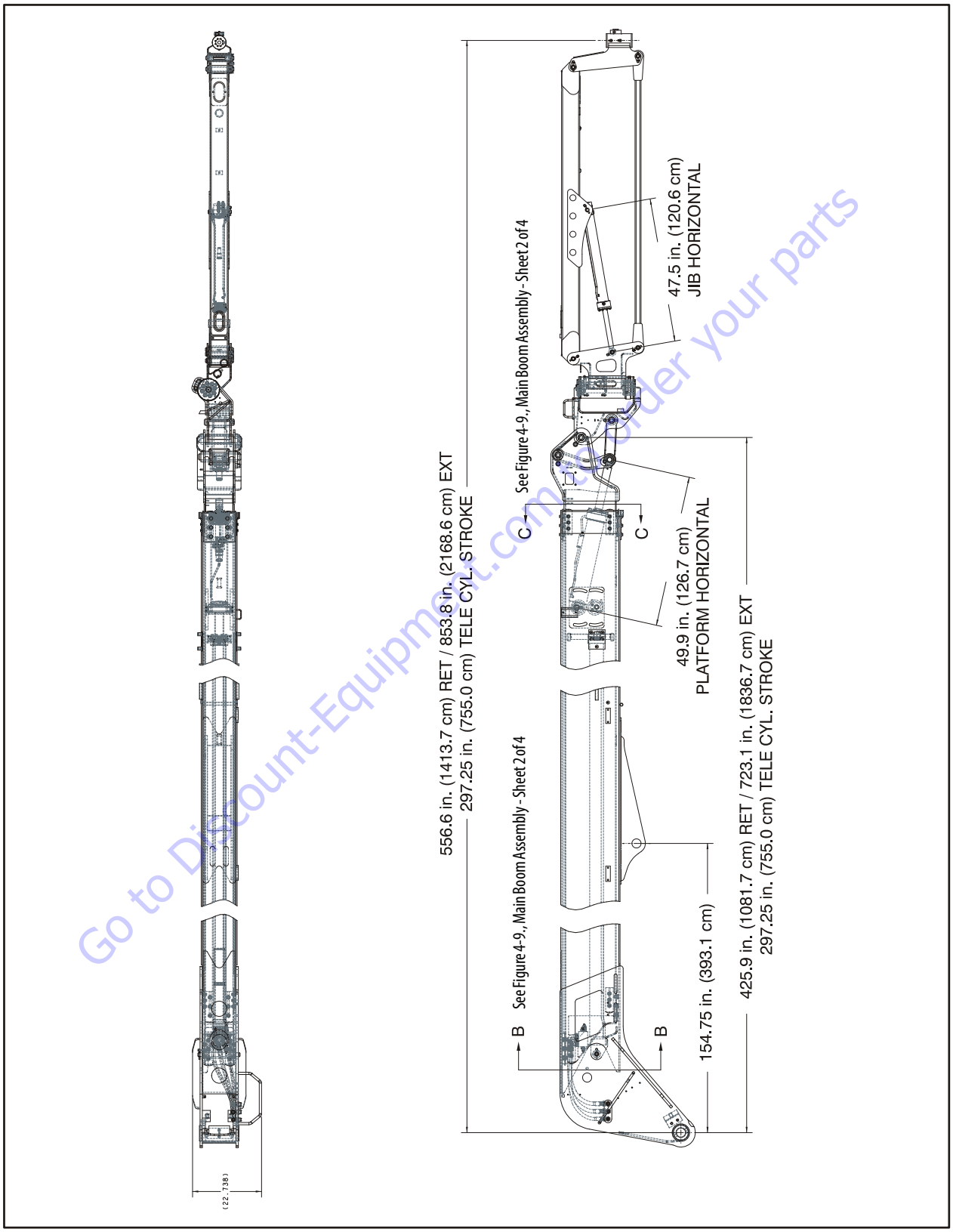

Figure 4-8. Main Boom Assembly - Sheet 1 of 4

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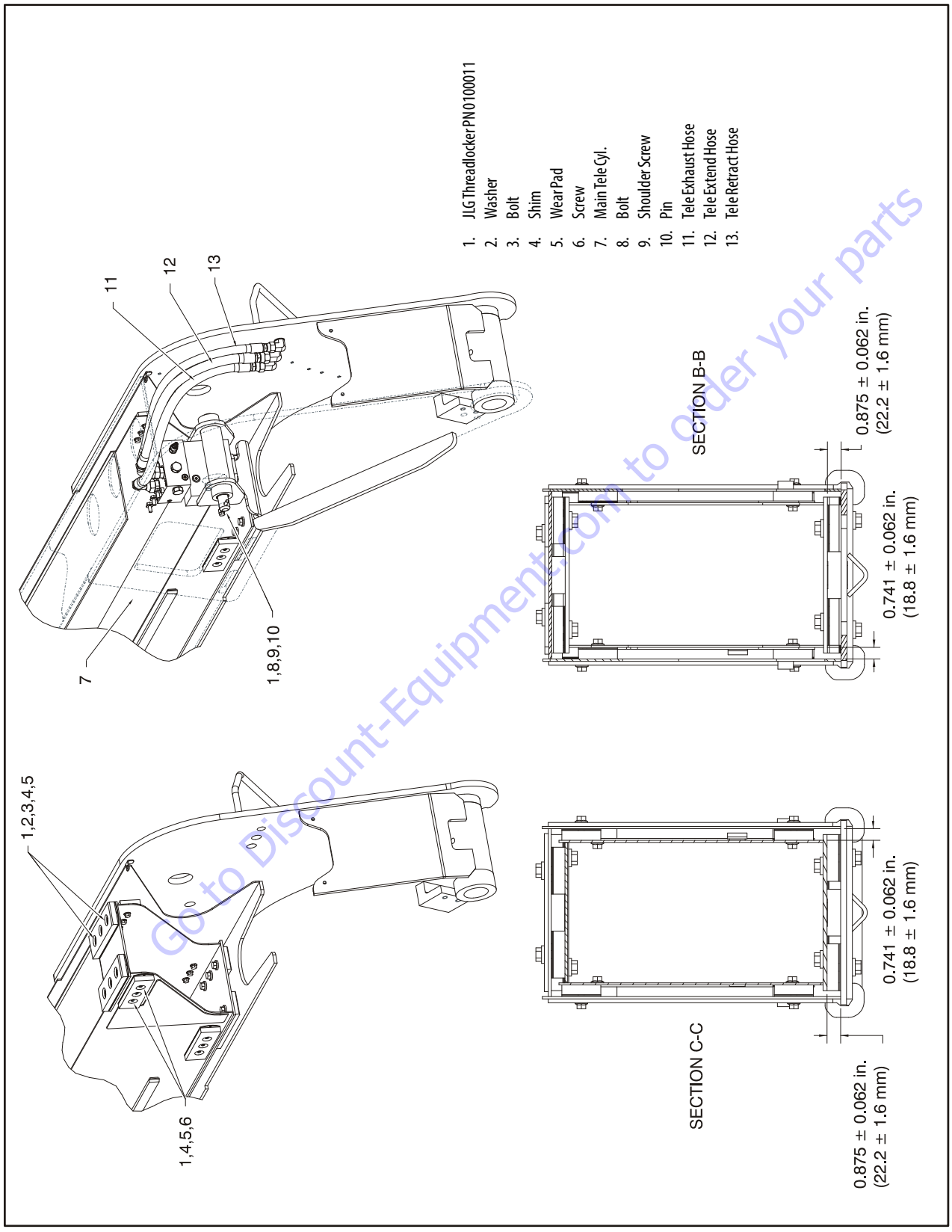

Figure 4-9. Main Boom Assembly - Sheet 2 of 4

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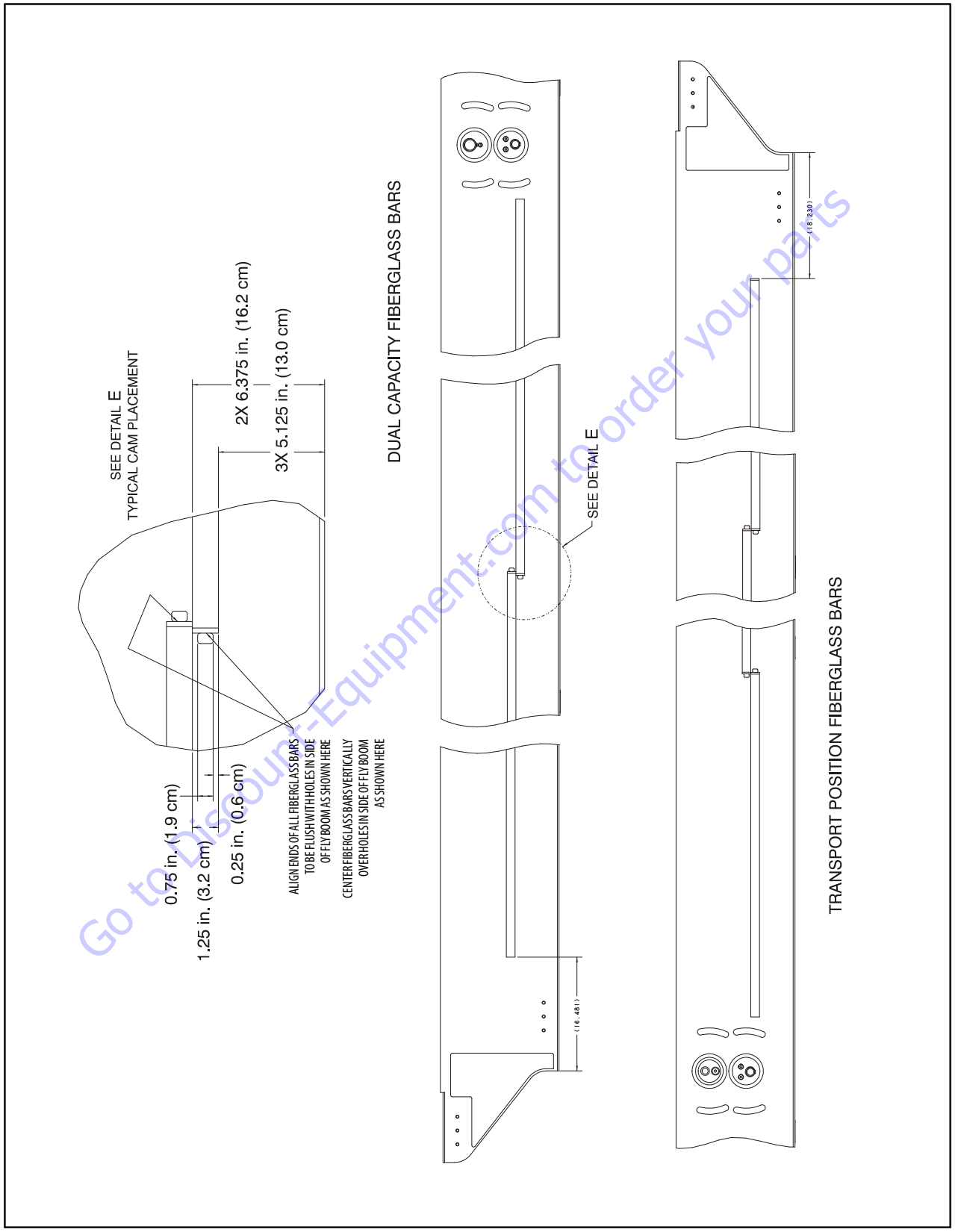

Figure 4-10. Main Boom Assembly - Sheet 3 of 4

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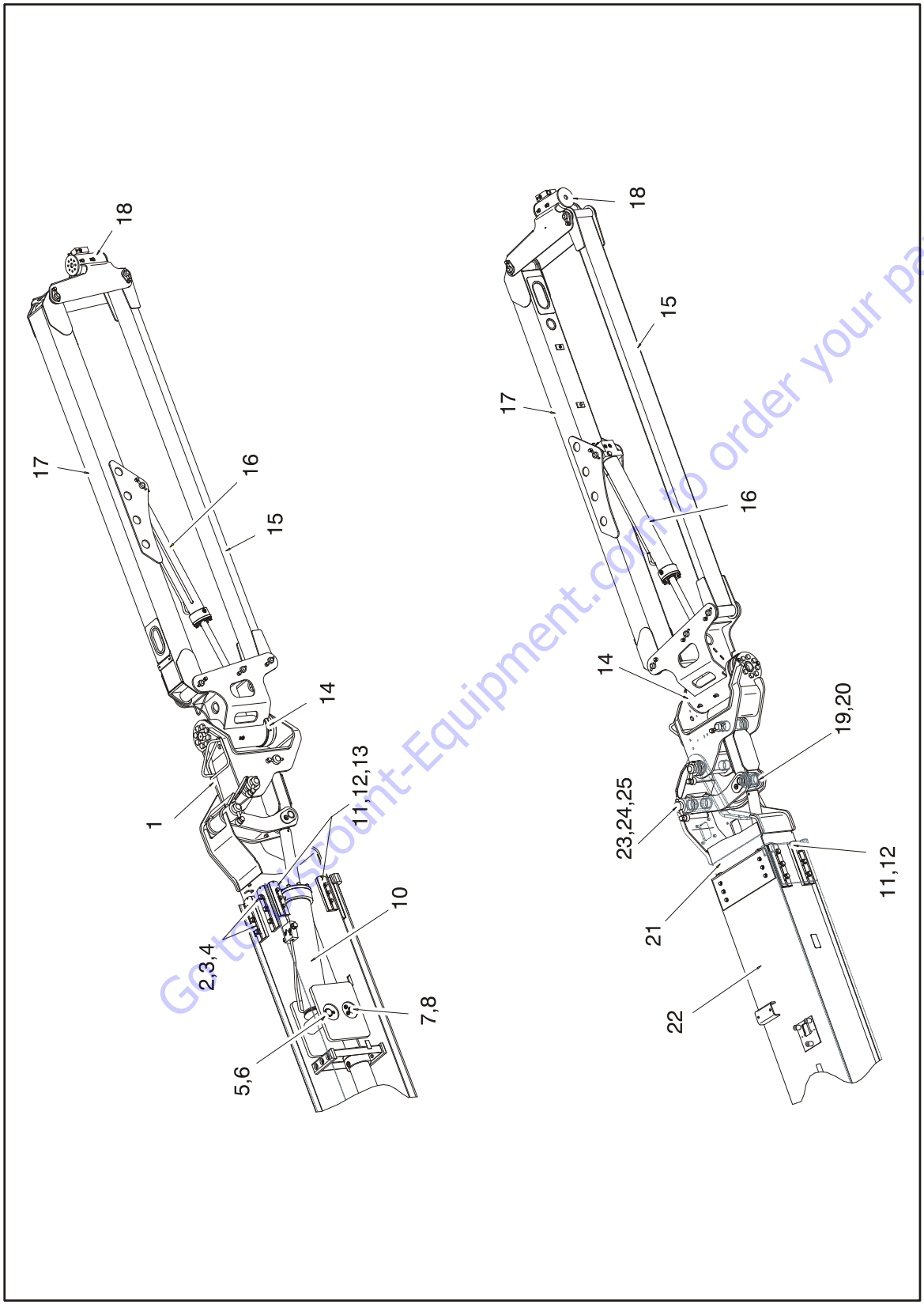

1. Pivot Assembly
2. Upper Front Wear Pad
3. Shim
4. Bolt
5. Bolt
6. Level Cylinder Pin
7. Tele Cylinder Pin
8. Retaining Ring
9. Shoulder Screw
10. Level Cylinder
11. Side Wear Pad
12. Shim
13. Bolt
14. Jib Rotator
15. Lower Jib Link
16. Jib Cylinder
17. Upper Jib Link
18. Platform Rotator
19. Level Link Pin
20. Retaining Ring
21. Fly Boom Section
22. Base Boom Section
23. Bolt
24. Keeper
25. Pin

Figure 4-11. Main Boom Assembly - Sheet 4 of 4

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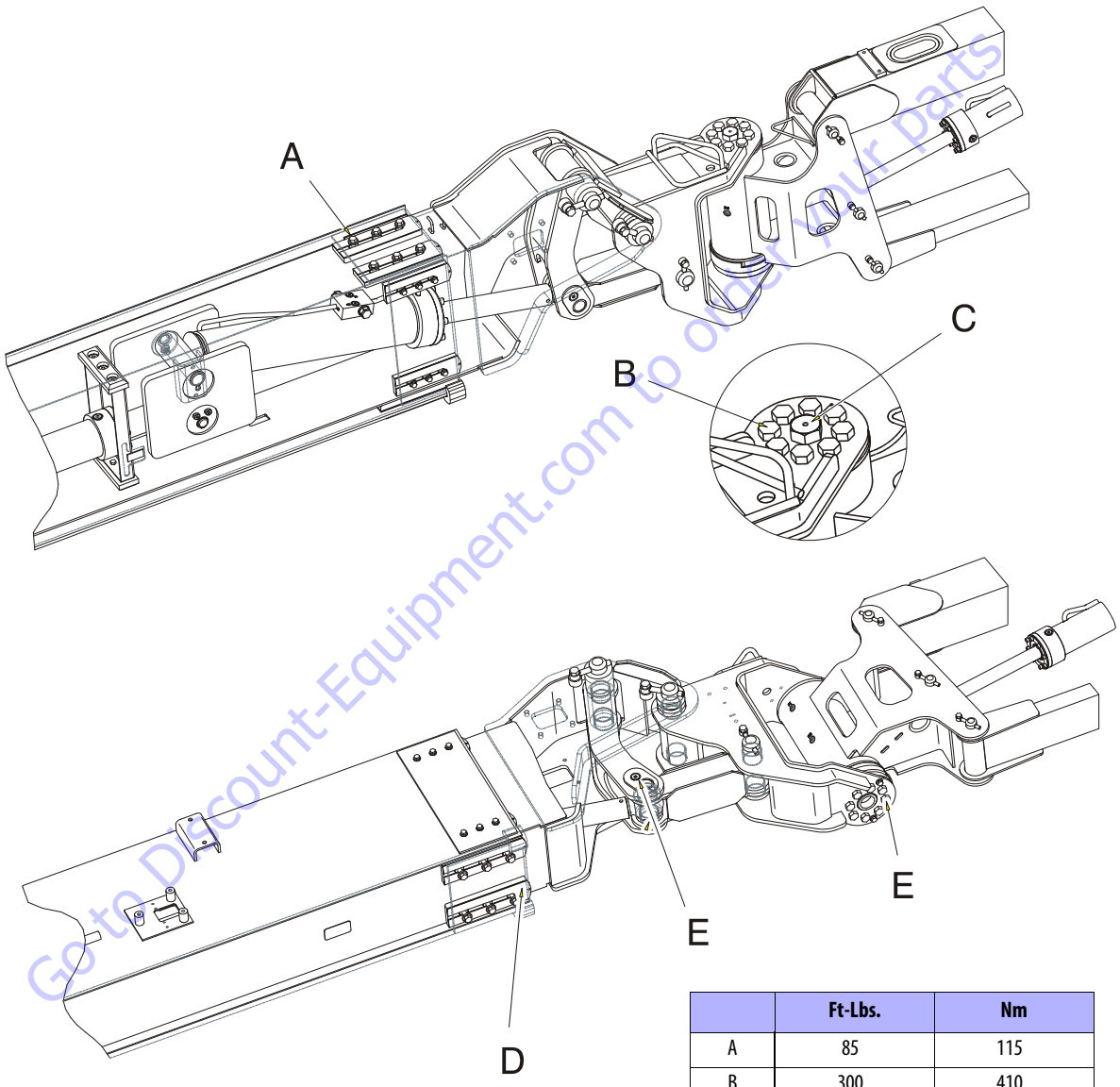
NOTE: *If any rotator bolts are replaced, all bolts on the rotator should be retorqued. Check torque on the bolts every 150 hours of operation.*



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	Ft-Lbs.	Nm
A	85	115
B	300	410
C	480	650
D	85	115
E	190	260

Figure 4-12. Main Boom Assembly Torque Values

4.20 TOWER BOOM

Installation and Assembly

NOTE: *To ease assembly of the tower base boom to the machine, have the base section slightly tilted downward towards the pivot pin bushings.*

1. Use an overhead crane or other suitable lifting device, and maneuver the tower boom base section in place. Install the pivot pin. Install the keeper pin and apply JLG Threadlocker PN 0100019 to the retaining bolt. Torque the bolt to 285 ft. lbs. (386 Nm).

NOTE: *The tower lift cylinder weighs approximately 643 pounds (292 kg).*

2. Use a ratchet strap to carefully raise the lift cylinder up into position under the boom.

3. Place blocking under the front of the tower base and move the lifting strap out to the end of the tower base section.

4. Lift the tower base section up and extend the lift cylinder to align it with the attachment lugs. Refer to the Service Mode procedure in Section 4.26, Tower Lift Cylinder.

5. When the lift cylinder and tower base pivot holes are aligned, install the pivot pin. Install the keeper pin and apply JLG Threadlocker PN 0100019 to the retaining bolt. Torque the bolt to 285 ft. lbs. (386 Nm).

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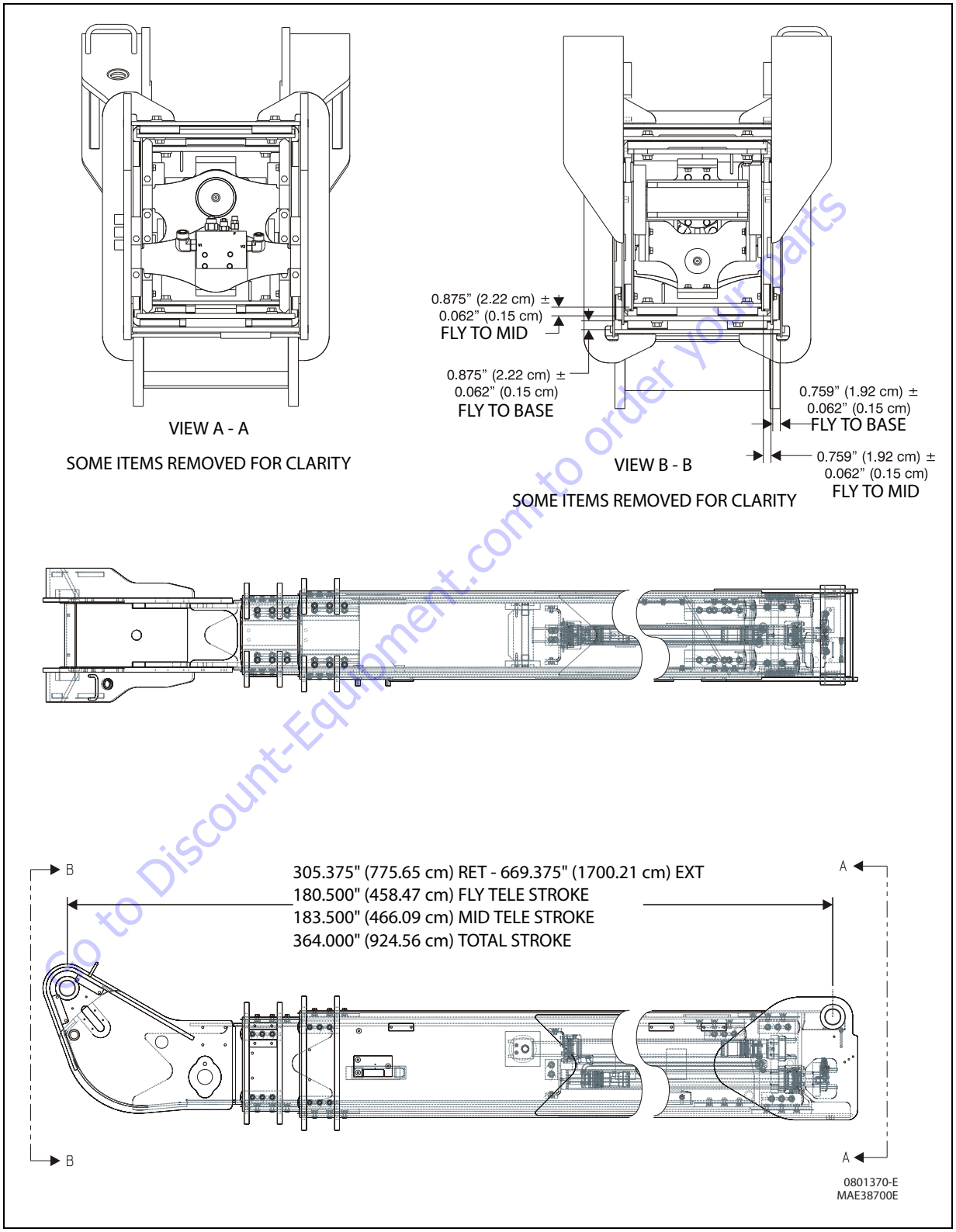

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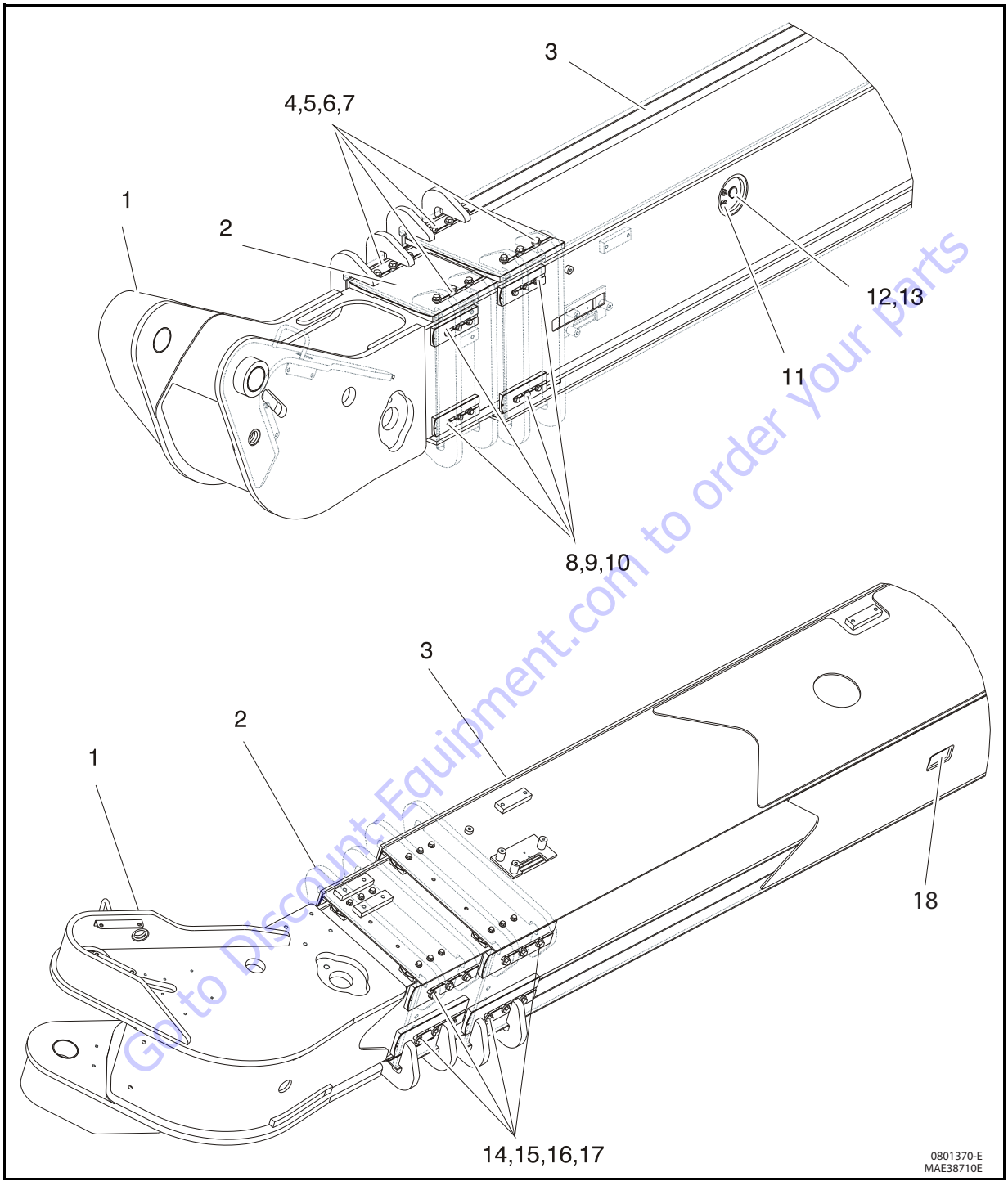
Figure 4-13. Tower Boom Assembly - Sheet 1 of 3



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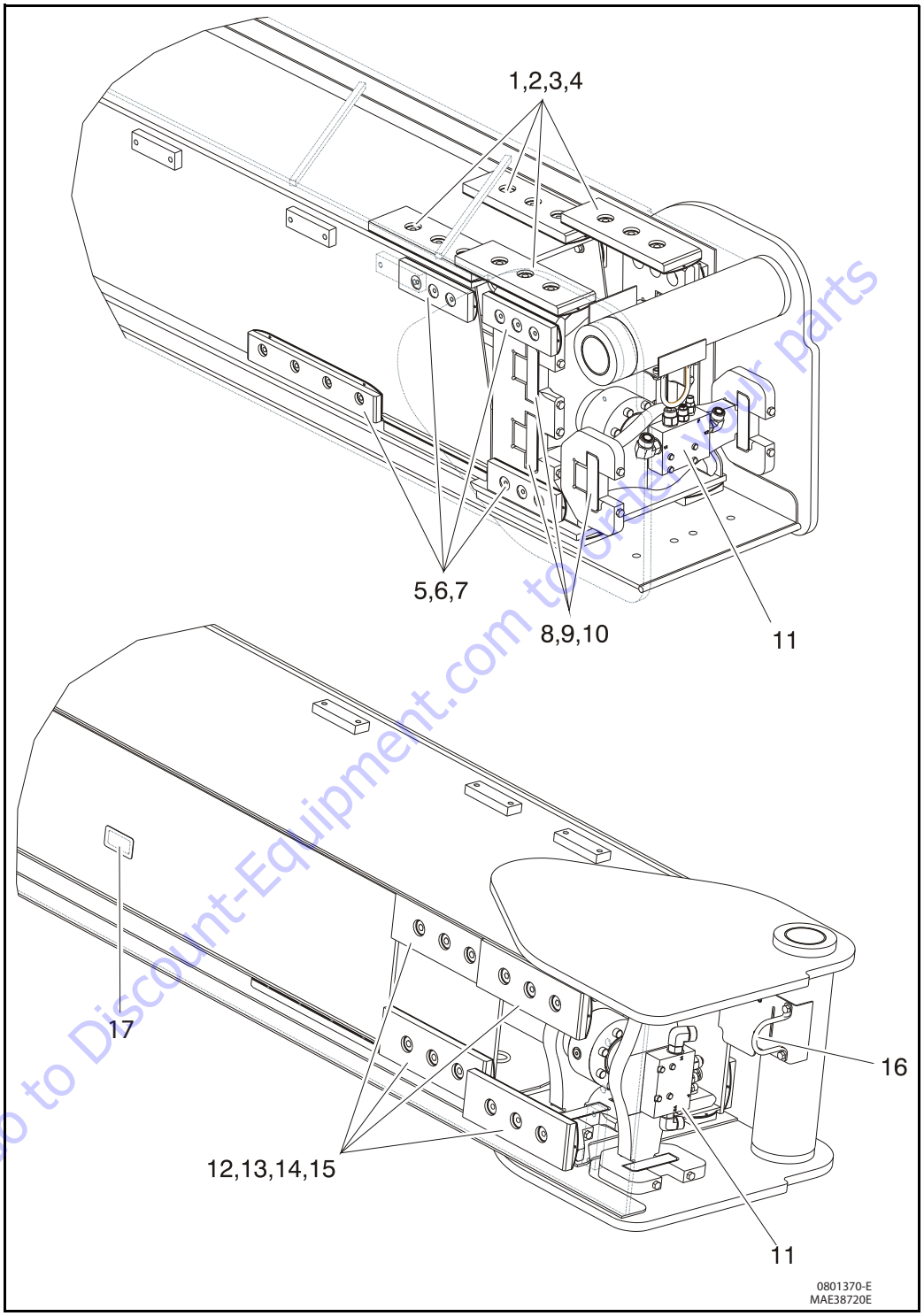
1. Tower Fly
2. Tower Mid
3. Tower Base
4. Front Upper Wear Pad
5. Wear Pad Shim
6. Bolt
7. Washer
8. Front Side Wear Pad
9. Wear Pad Shim
10. Screw
11. Shoulder Bolt
12. Snap Ring
13. Retaining Pin
14. Front Lower Wear Pad
15. Wear Pad Shim
16. Bolt
17. Washer
18. Cover (Prior to SN 0300120859)

Figure 4-13. Tower Boom Assembly - Sheet 2 of 3



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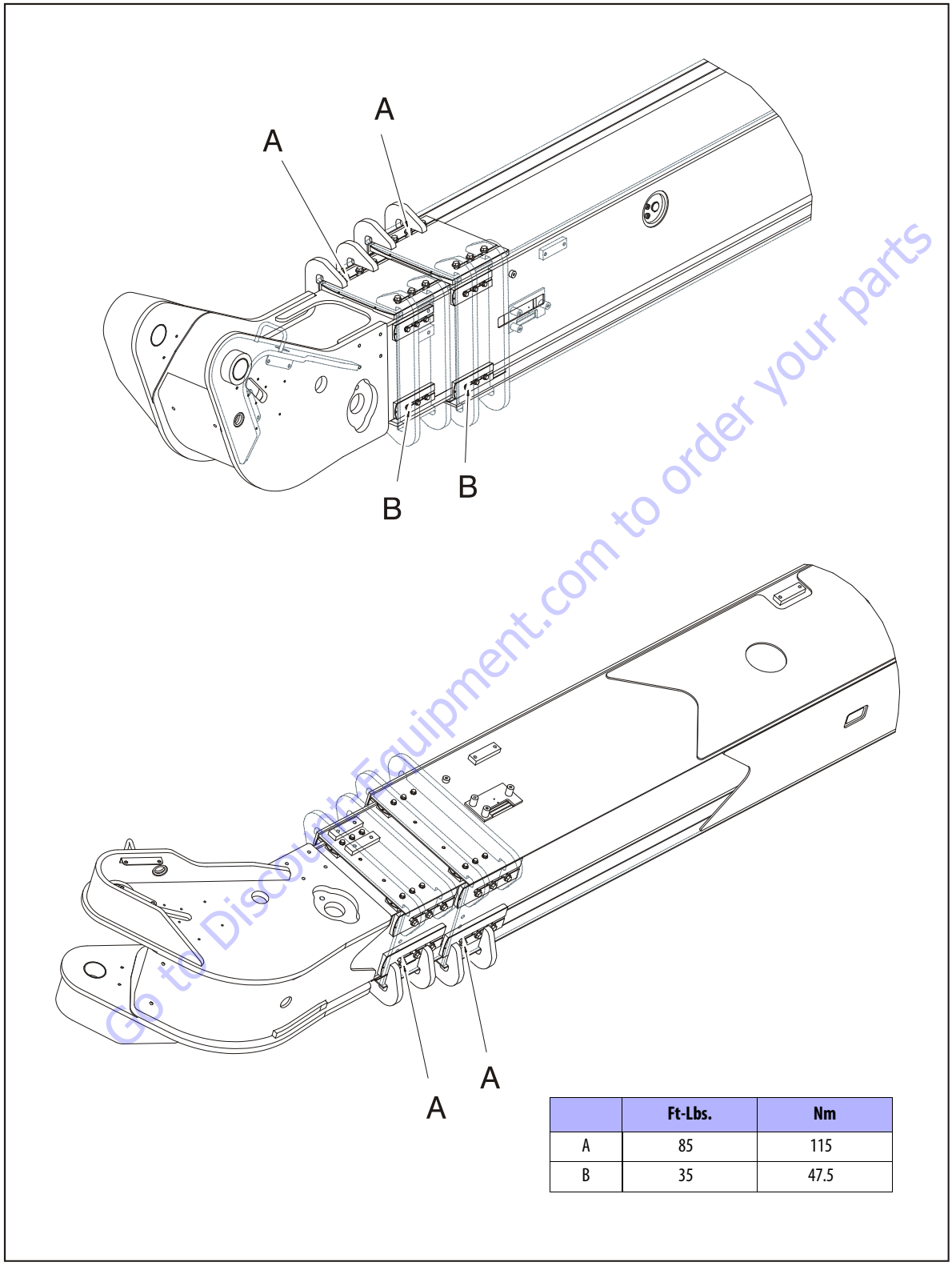
1. Upper Rear Wear Pad
2. Wear Pad Shim
3. Bolt
4. Washer
5. Rear Side Wear Pad
6. Wear Pad Shim
7. Screw
8. Trunnion Keeper Block
9. Keeper Shim
10. Bolt
11. Tower Tele Cylinder
12. Bottom Rear Wear Pad
13. Wear Pad Shim
14. Bolt
15. Washer
16. Hose Loop
17. Cover (Prior to SN 0300120859)

Figure 4-14. Tower Boom Assembly - Sheet 3 of 3



	Ft-Lbs.	Nm
A	85	115
B	35	47.5

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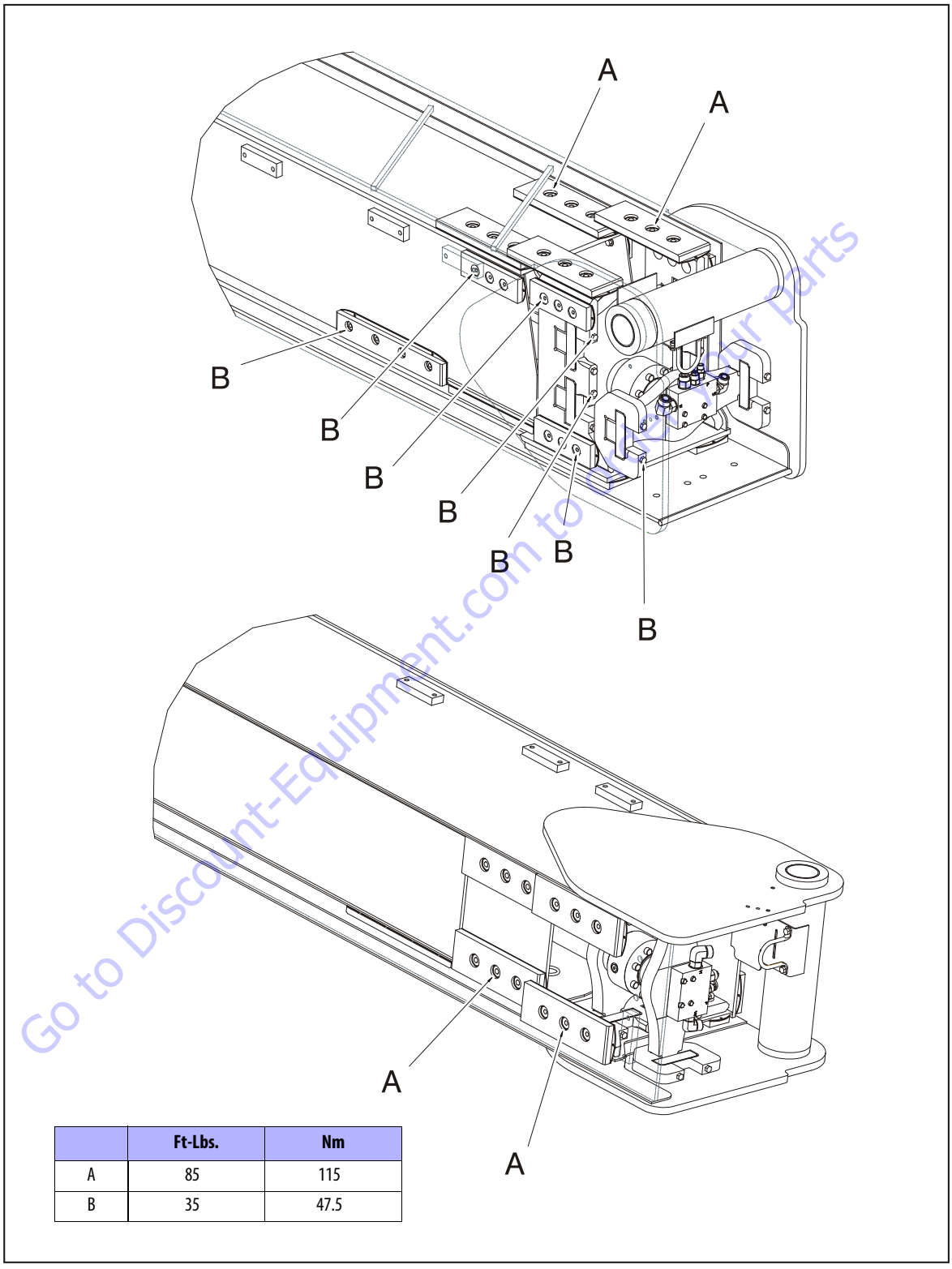
Figure 4-15. Tower Boom Assembly Torque Values - Sheet 1 of 2



	Ft-Lbs.	Nm
A	85	115
B	35	47.5

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Figure 4-16. Tower Boom Assembly Torque Values - Sheet 2 of 2

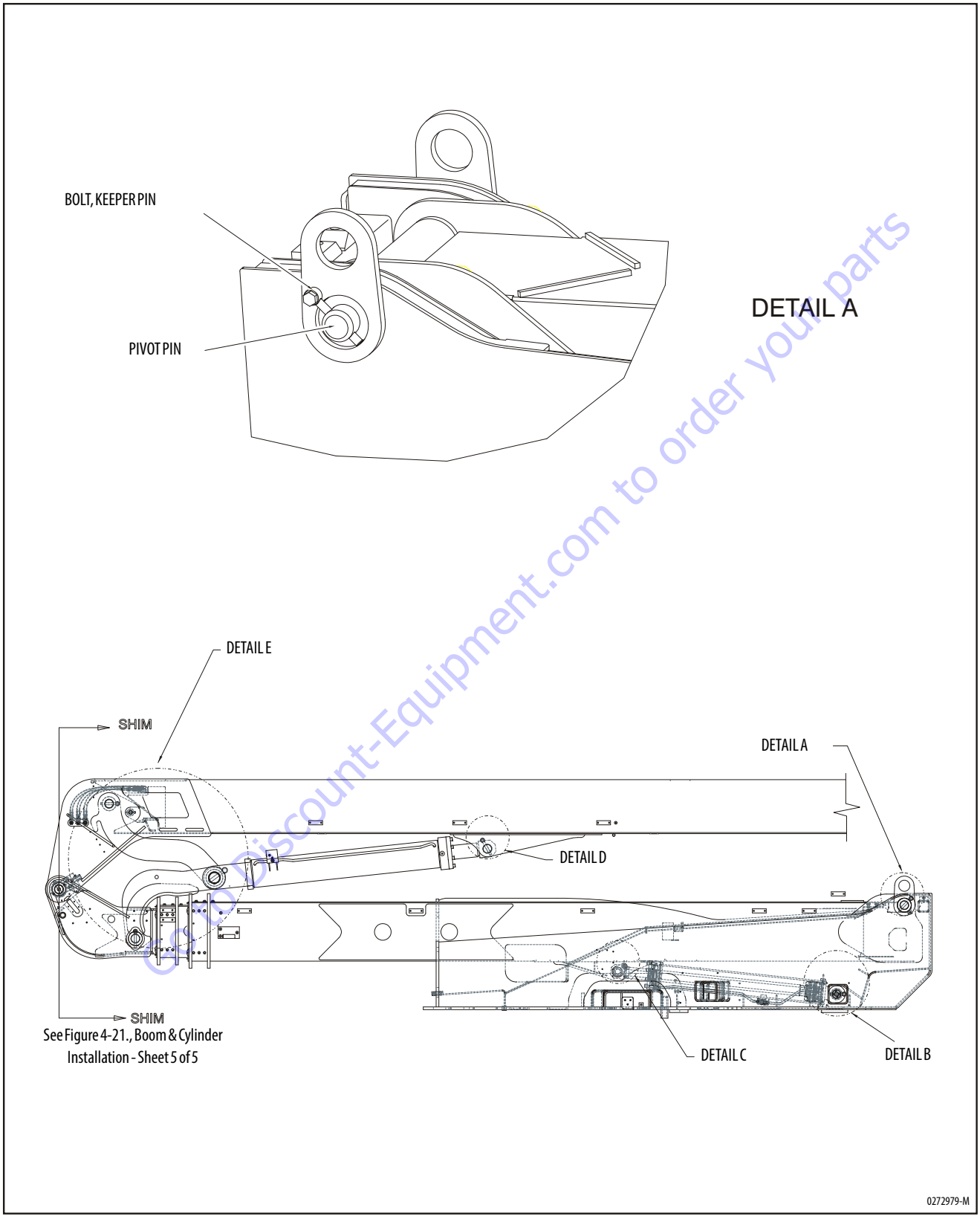

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Figure 4-17. Boom & Cylinder Installation (Prior to SN 0300144623) - Sheet 1 of 5

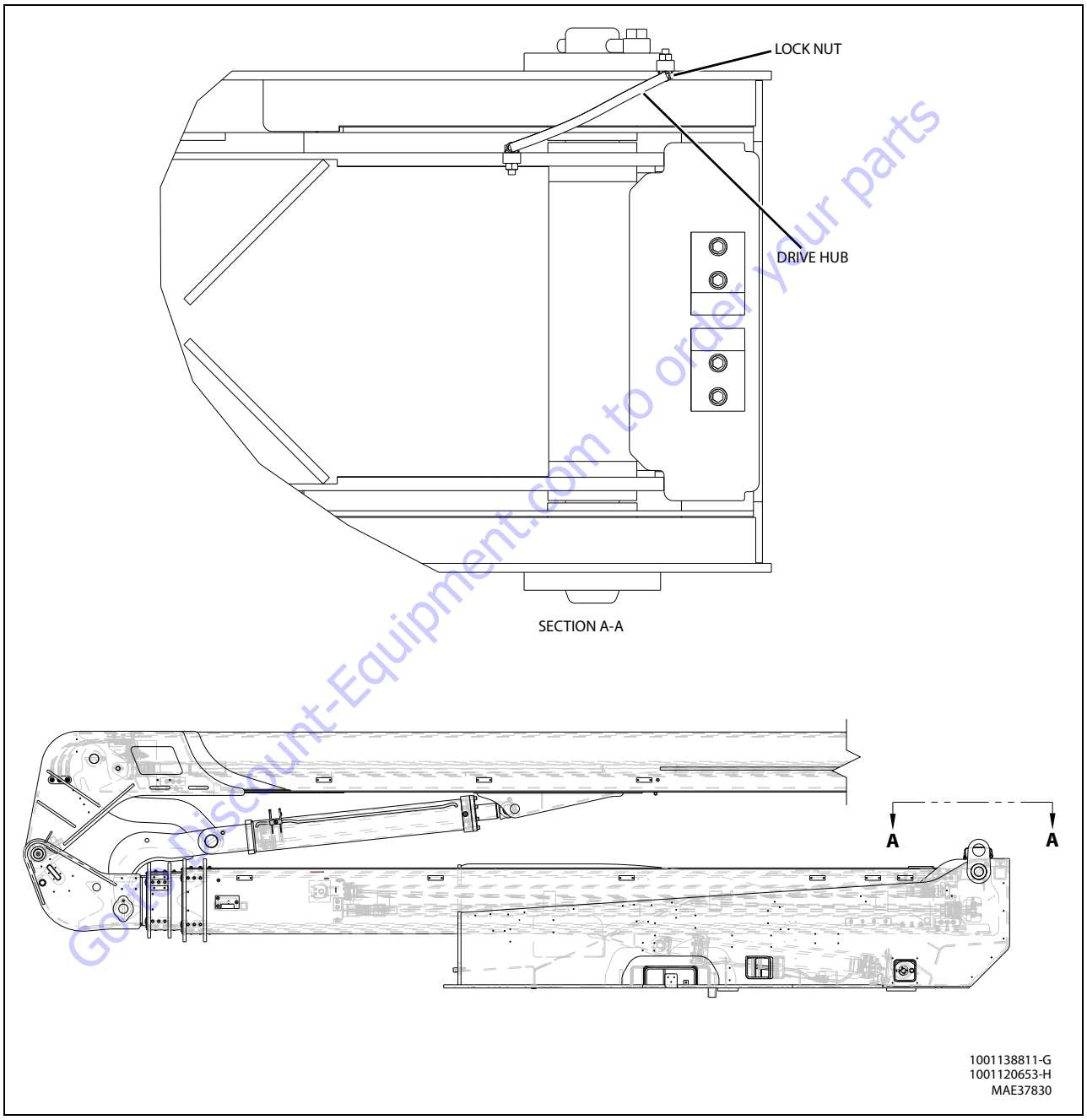

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Figure 4-18. Boom & Cylinder Installation (SN 0300144623 to Present) - Sheet 2 of 5

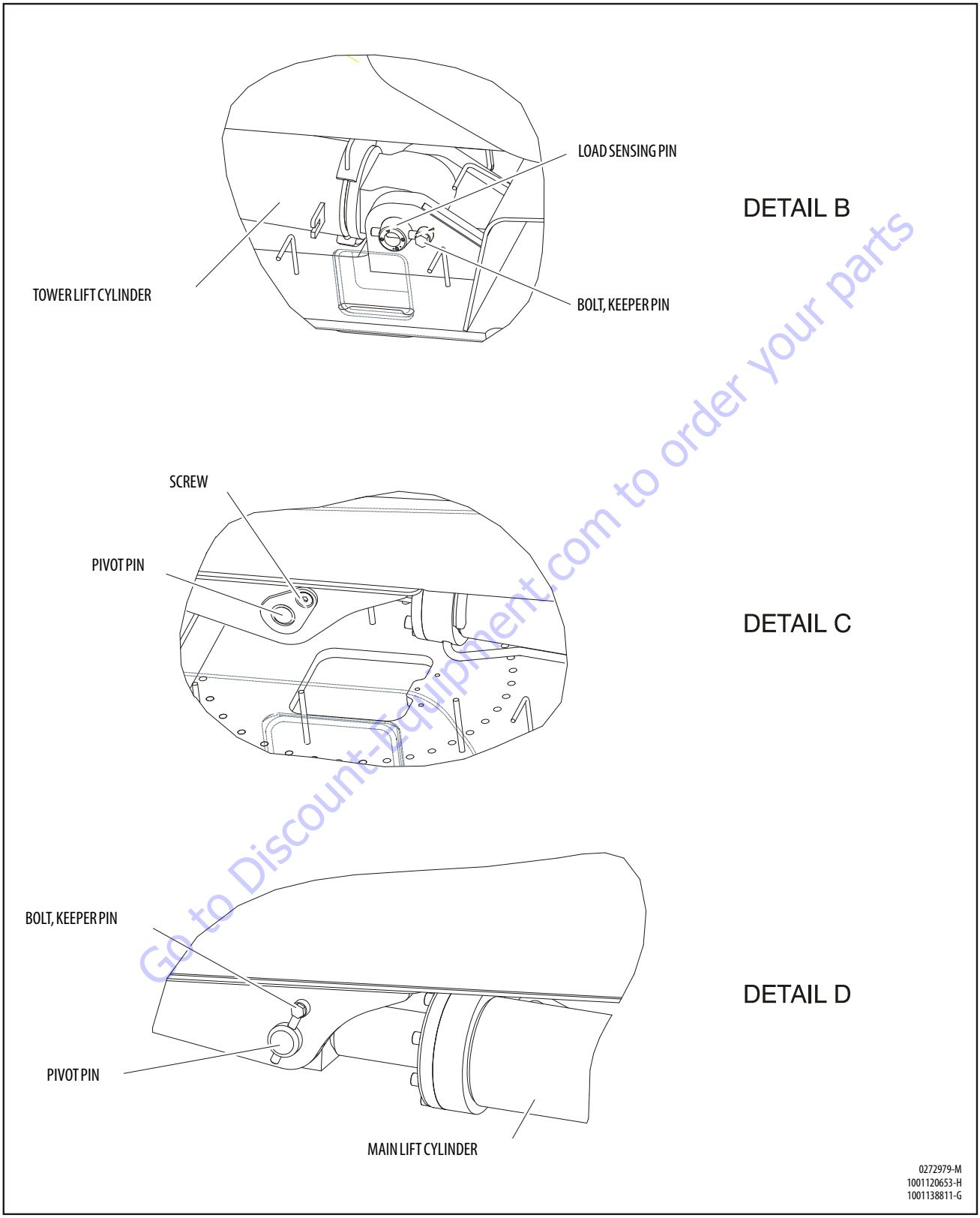

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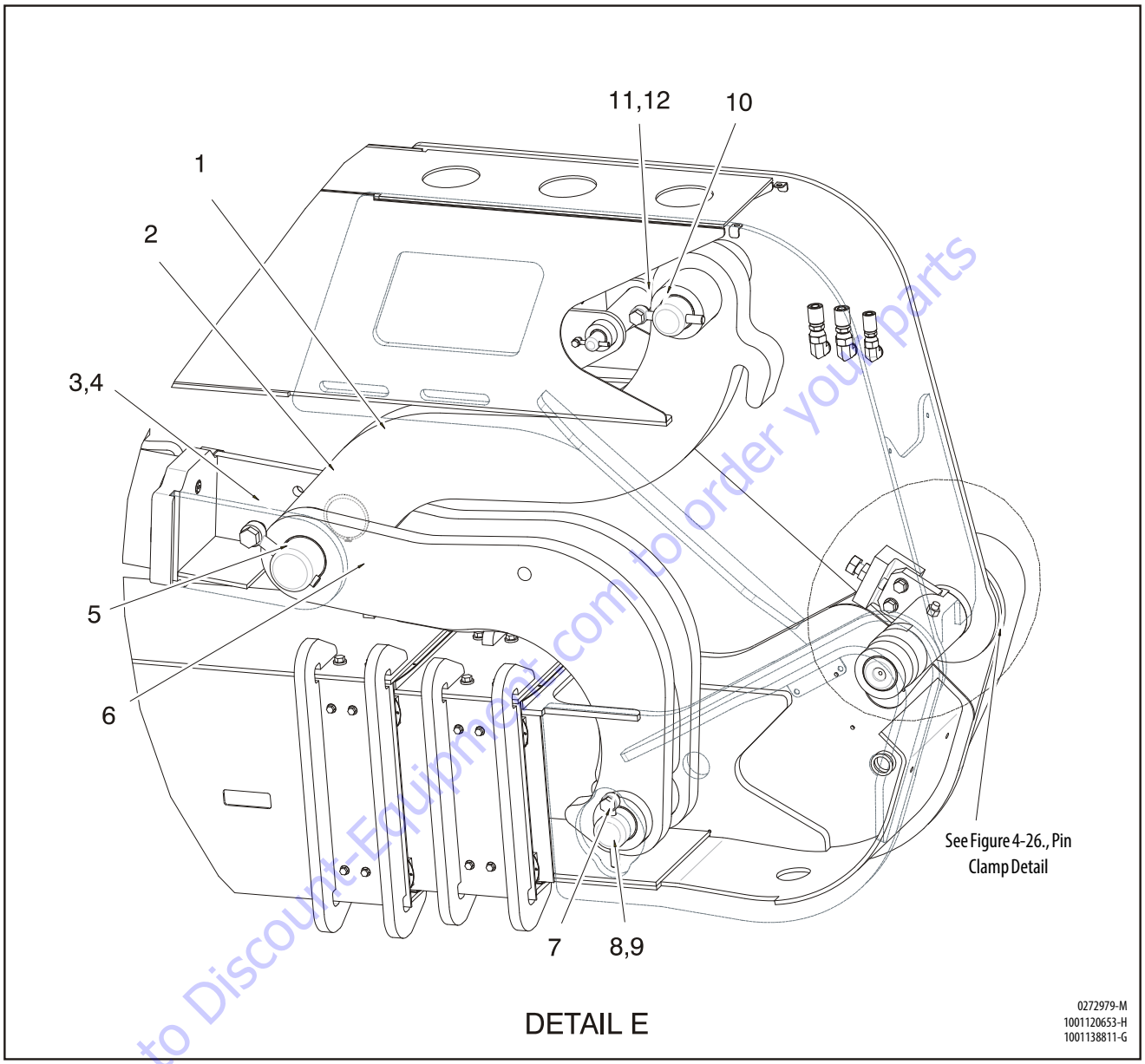
Figure 4-19. Boom & Cylinder Installation - Sheet 3 of 5



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1. Upper Link
2. Retaining Ring
3. Bolt
4. Keeper
5. Pin
6. Lower Link
7. Pin
8. Keeper
9. Bolt
10. Pin
11. Bolt
12. Keeper

Figure 4-20. Boom & Cylinder Installation - Sheet 4 of 5

NOTE: *If space is available install one thrust washer on each side of the boom assembly between the tower fly boom section and the main base boom section. If space only allows for the use of one thrust washer, install it on the same side as the proximity sensor. (Same as the left side or powertrack side of the machine.)*

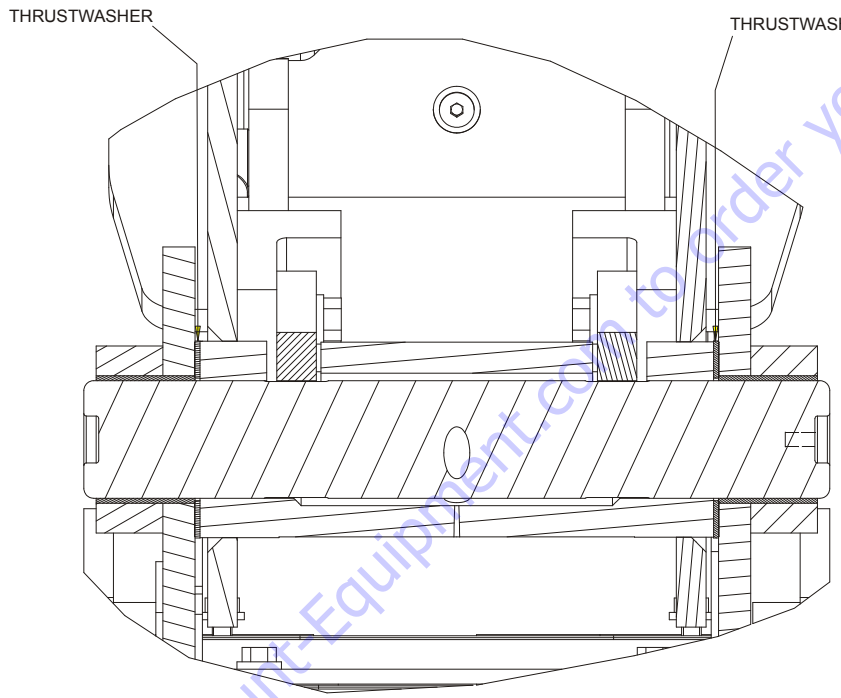

Figure 4-21. Boom & Cylinder Installation - Sheet 5 of 5

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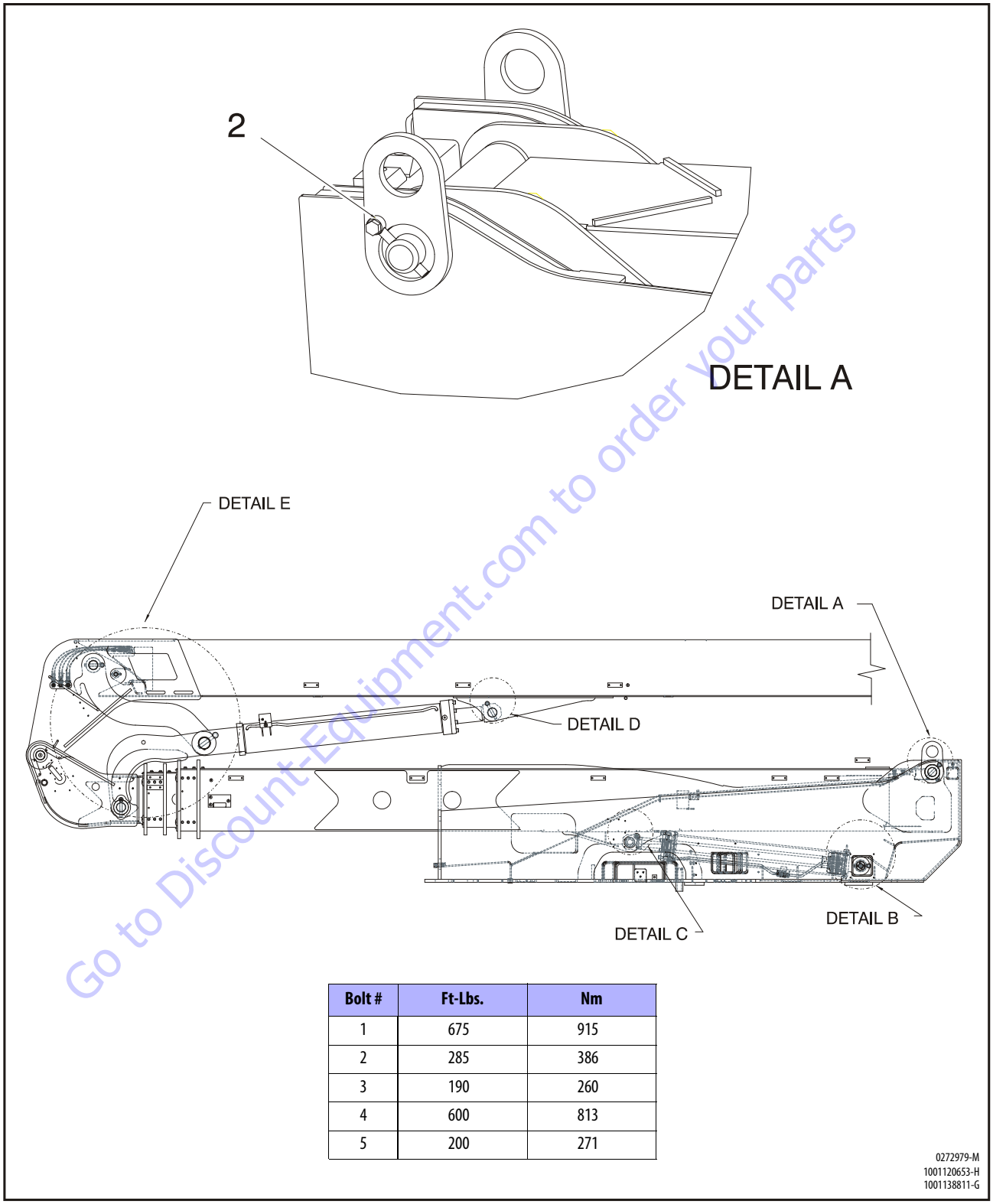

Bolt #	Ft-Lbs.	Nm
1	675	915
2	285	386
3	190	260
4	600	813
5	200	271

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Figure 4-22. Boom and Cylinder Installation Torque Values - Sheet 1 of 3

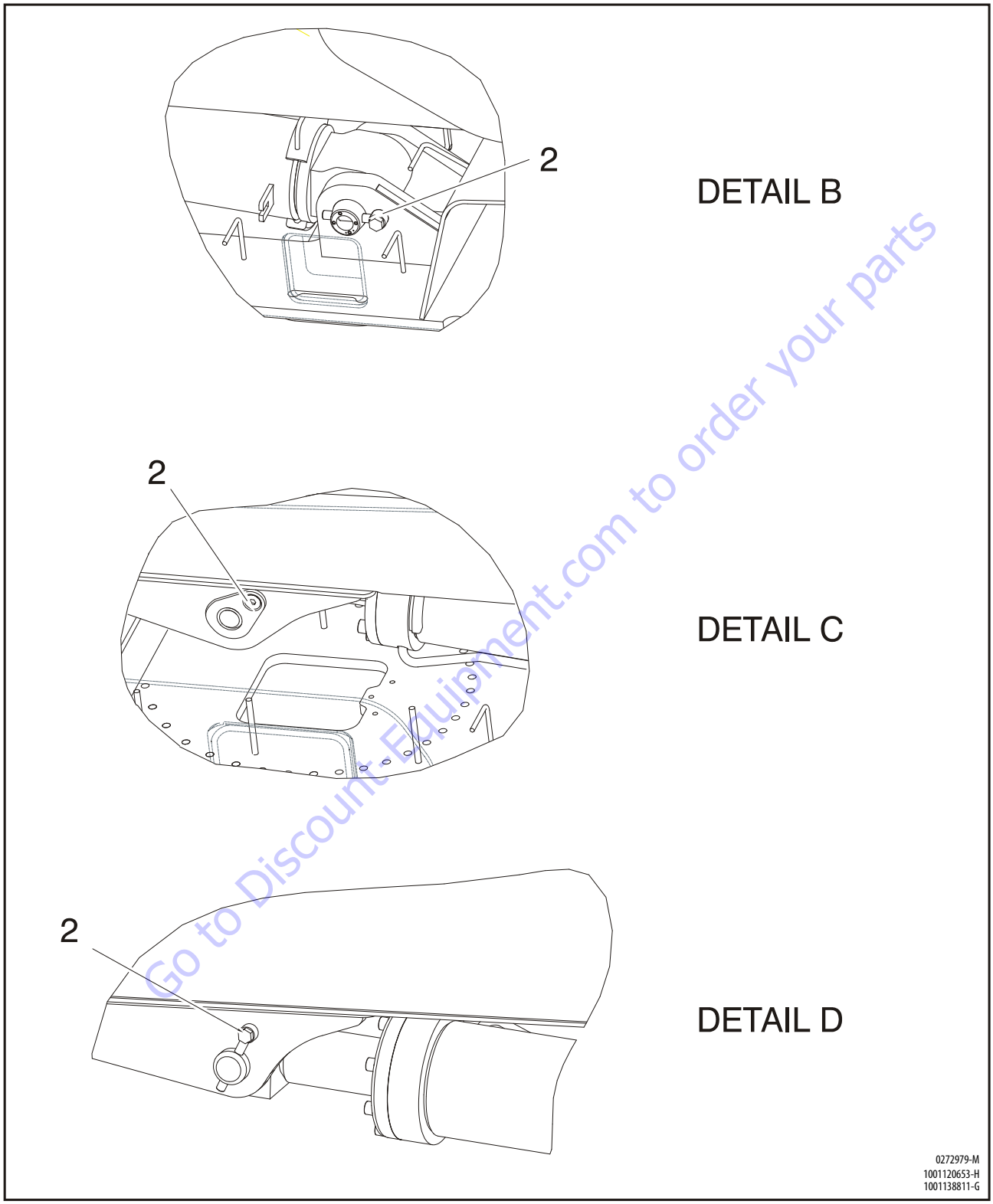

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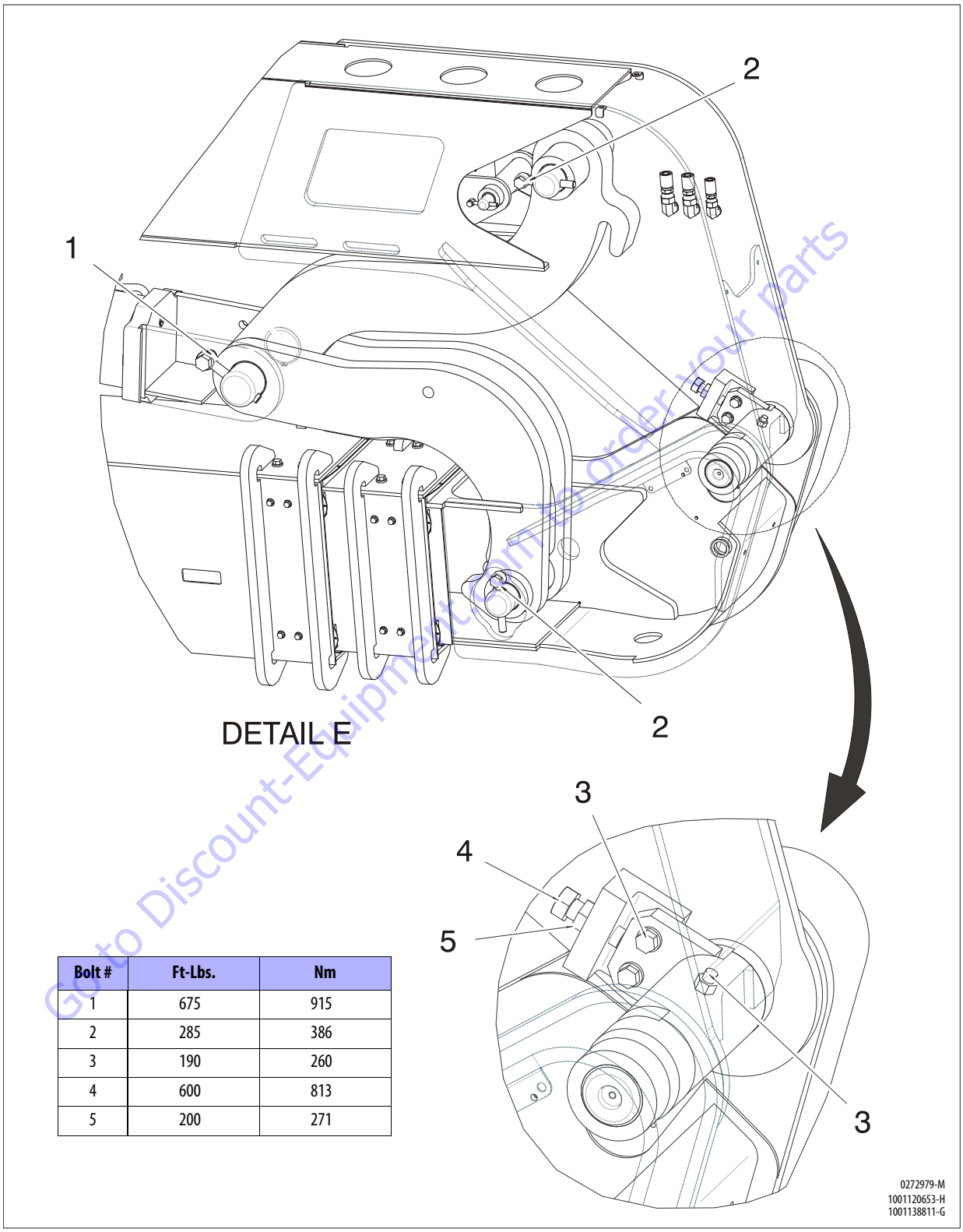
Figure 4-23. Boom and Cylinder Installation Torque Values - Sheet 2 of 3



Bolt #	Ft-Lbs.	Nm
1	675	915
2	285	386
3	190	260
4	600	813
5	200	271

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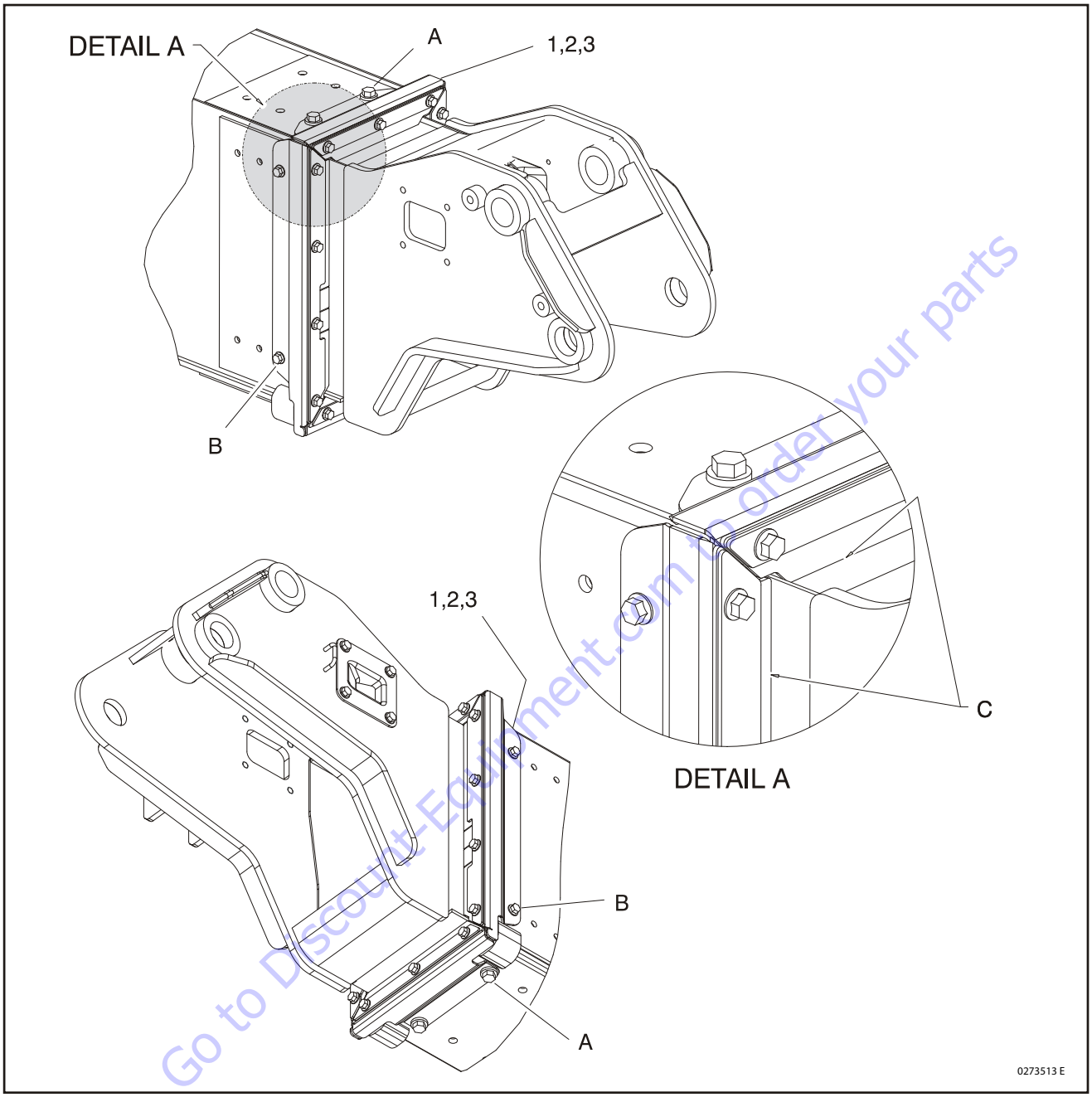
Figure 4-24. Boom and Cylinder Installation Torque Values - Sheet 3 of 3



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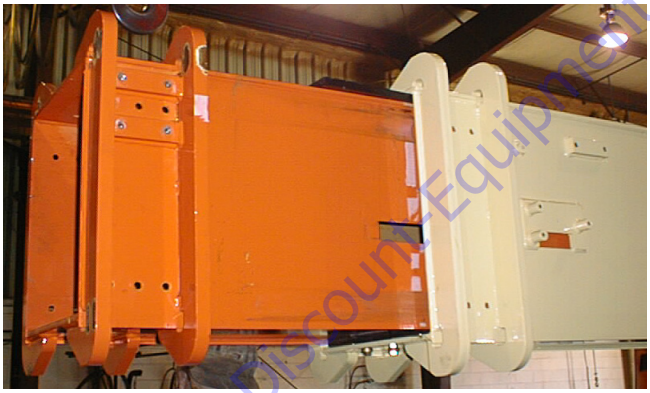
1. Bar
2. Blade
3. Plate

A Apply JLG Threadlocker PN 0100011 & torque to 85 ft.lbs. (115 Nm)

B Apply JLG Threadlocker PN 0100011 & torque to 35 ft.lbs. (47 Nm)

C Adjust all blades 0.000 to 0.063" (0 to 1.6 mm) from side boom plate

Figure 4-25. Boom Wiper Installation



1. Install the tower mid section into the tower base section. Install the wear pads in the tower base section.

NOTE: *Keep the tower fly section out of the tower mid section enough to allow for installation of the telescope cylinder retaining pin.*

2. Install the tower fly section into the tower mid section. Install the wear pads in the tower mid section.

3. Extend the telescope cylinder so the rod will be extended enough to install the retaining pin holes in the tower fly section. It may be necessary to secure one end to make sure the desired rod end extends. Install the telescope cylinder into the tower boom. Refer to the Service Mode procedure in Section 4.25, Tower Telescope Cylinder.

4. Align the telescope cylinder trunnions. Install the keepers and shims. Secure them in place with the retaining bolts.

5. Install the upper and lower length sensors.

6. Connect all hoses and electrical lines as tagged during disassembly.

7. Install the power track to the side of the tower boom. Connect all hoses as tagged during disassembly.

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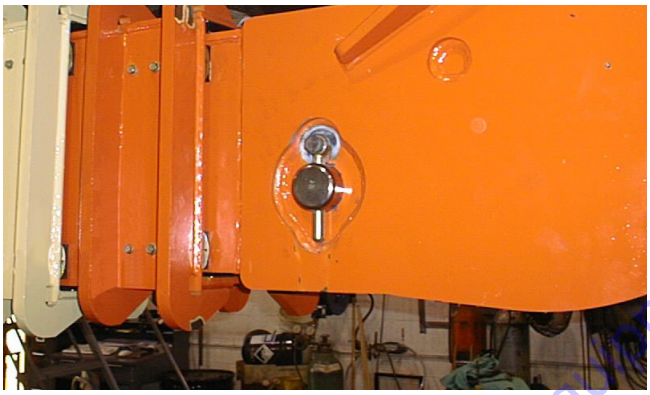
NOTE: *The lower link weighs approximately 659 lbs. (299 kg).*

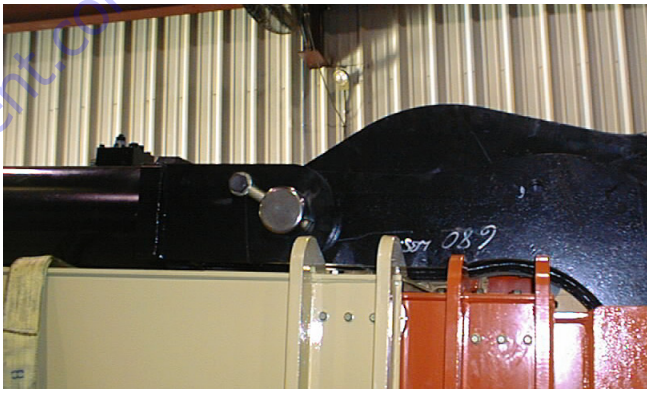
8. Insert a pin through the hole in the lower link so that a lifting strap can be used to position the link in the tower fly section.



9. Install the pivot pin. Install the keeper pin and apply JLG Threadlocker PN 0100019 to the retaining bolt. Torque the bolt to 285 ft.lbs. (386Nm).

NOTE: *The main lift cylinder weighs approximately 785 lbs. (356 kg). The upper link weighs approximately 412 lbs. (187 kg).*

10. Lift the main lift cylinder into position with the lower link. Install the pivot pin in part way. Lift the upper link to align the pivot pin bushings in the lower link, lift cylinder, and upper link.



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11. Install the pivot pin. Install the keeper pin and apply JLG Threadlocker PN 0100019 to the retaining bolt. Torque the bolt to 675 ft. lbs. (915 Nm).

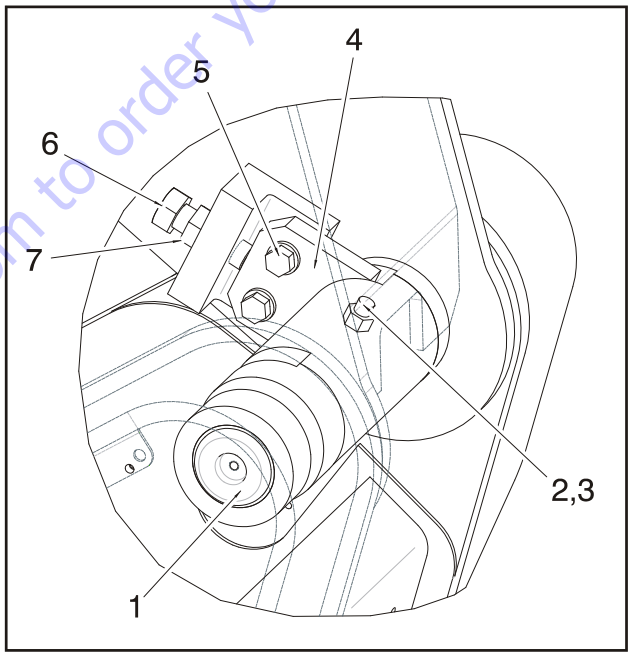
NOTE: *The main boom assembly weighs approximately 5,186 lbs. (2357 kg).*

12. Lift the main boom in position to align the pivot pin bushings in the main boom and tower boom. Install the main boom pivot pin as described in the Pin Clamp Installation Procedure below.

13. Lift the upper link into position to align the pivot pin holes in the main boom with the pivot pin bushings in the upper link. Install the keeper pin and apply JLG Threadlocker PN 0100019 to the retaining bolt. Torque the bolt to 285 ft.lbs. (386Nm).

Pin Clamp Installation Procedure

1. Install the main boom pivot pin and loosely install the cross bolt and nut.
2. Install the pin clamp bar. Clamp the bolts and washers. Tighten the clamp bolts enough to hold the pin clamp in position for the following steps (5 ft. lbs. [7 Nm] maximum).
3. Install the jack screws and jam nuts. Torque the jack screws to 600 ft. lbs. (813 Nm). Torque the jam nuts to 200 ft. lbs. (271 Nm).
4. Torque the clamp bolts to 190 ft. lbs. (260 Nm).
5. Torque the cross bolt and nut to 190 ft. lbs. (260 Nm).



1. Pivot Pin
2. Cross Bolt
3. Nut
4. Pin Clamp Bar
5. Clamp Bolt
6. Jack Screw
7. Jam Nut

Figure 4-26. Pin Clamp Detail

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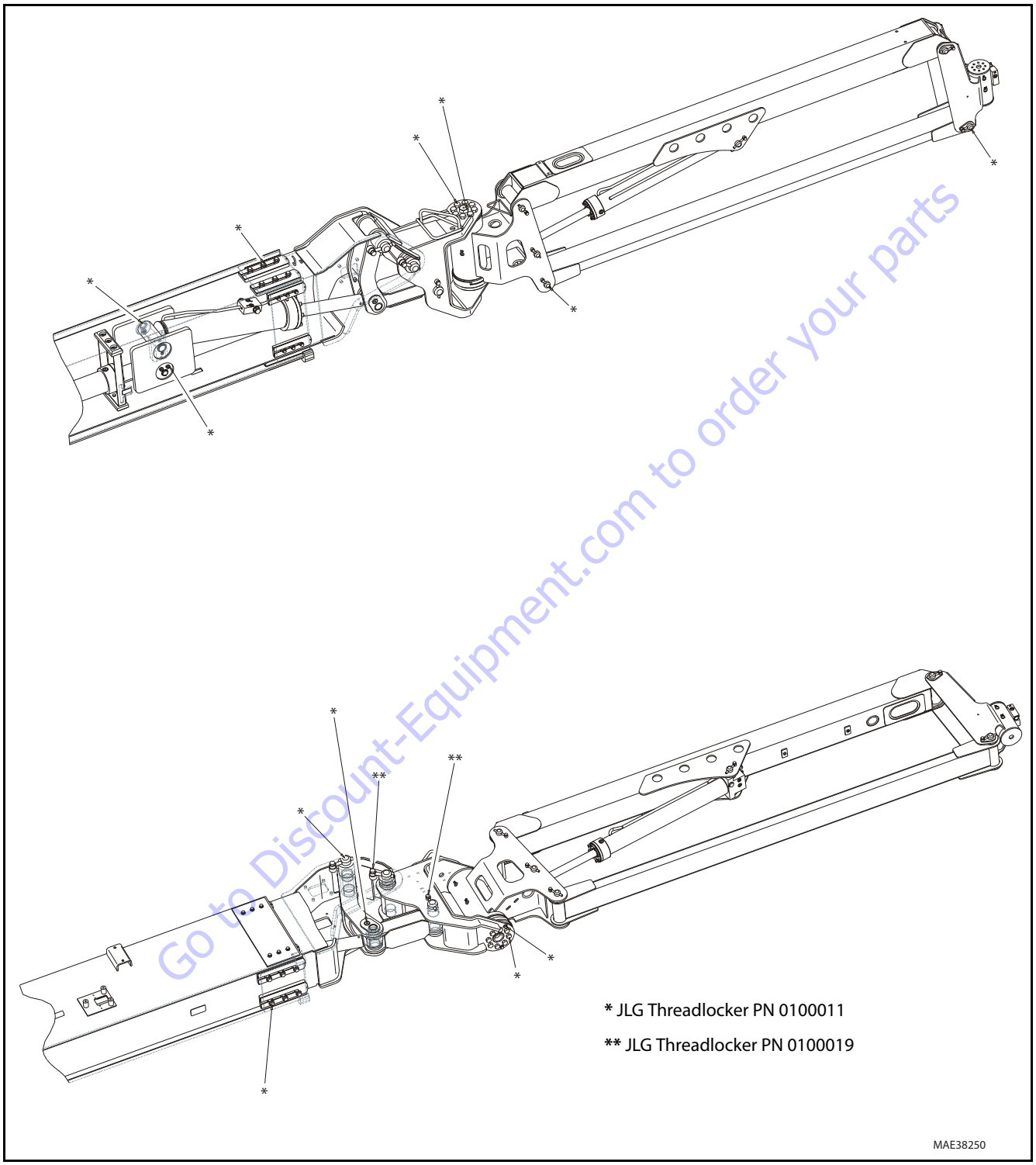

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Figure 4-27. Locations for JLG Threadlocker Application - Sheet 1 of 5