Gehl VT320
Mustang/Manitou 3200VT

Track Loader
Service Manual

50940548 Rev. B 08/20

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Safety

Safety Symbol and Signal Words

This manual and decals on the machine warn of safety hazards and should be read and observed closely.

Manitou, in cooperation with the Society of Automotive Engineers, has adopted this:



Safety Alert Symbol

This symbol is used throughout this operator's manual and on the decals on the machine. It identifies potential safety hazards, which, if not properly avoided, could result in injury. When you see this symbol in this manual or on the machine, you are reminded to BE ALERT! Personal safety is involved!

Signal Words

DANGER

The word "DANGER" indicates an imminently hazardous situation, that, if not avoided, will result in serious injury or death.

WARNING

The word "WARNING" indicates a potentially hazardous situation that, if not avoided, could result in serious injury or death.

CAUTION

The word "CAUTION" indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.

- Before operating the machine, first read and study the safety information in this manual. Be sure that anyone who operates or works on the machine is familiar with the safety precautions. This includes providing translations of the warnings and instructions for operators who are not fluent in reading English.
- It is essential that operators be thoroughly trained in the safe operation of the machine and load handling. Operators must not be physically or mentally impaired. Do not allow minors or unqualified personnel to operate the machine, or to be near the machine unless they are properly supervised. It is recommended that the operator be capable of obtaining a valid motor vehicle operator's license.
- Do not use the machine for any application or purpose other than those described in this manual, or in manuals supplied with any attachments used with the machine.
- Use of the machine is subject to certain hazards that cannot be eliminated by mechanical means, but only by exercising intelligence, care and common sense. Such hazards include: hillside operation, overloading, load instability, poor maintenance, and using the machine for a purpose for which it was not intended or designed.
- Manitou always takes operator's safety into consideration during the design process. Guards and shields are provided, which protect the operator and bystanders from moving parts and other hazards. Operators must be alert, however, because some areas cannot be guarded or shielded without preventing or interfering with proper operation.
- Different applications may require optional safety equipment. Users must evaluate the worksite hazards and equip the machine and the operator as necessary. The information in this manual does not replace any applicable safety rules and laws. Before operating the machine, learn the rules and laws for the local area. Make sure the machine is equipped as required according to these rules/laws.

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Maintenance Schedule

⚠ CAUTION

Do not postpone scheduled maintenance. Postponing maintenance can reduce the service life of the machine, cause more serious and costly equipment failures, and contribute to unsafe operating conditions.

IMPORTANT: *Maintenance intervals apply to average operating conditions and loads. More frequent maintenance may be required depending upon the level and type of use.*

NOTE: *Accumulated operation time is shown on the multi-function display.*

Checks, Cleaning and Inspection

Table 1: Checks Cleaning and Inspection

Service Procedure	Maximum Interval		
	10 Hours (or daily)	250 Hours (or every 6 months)	500 Hours (or annually)
Clean machine	X		
Inspect machine for general wear/damage	X		
Check bucket cutting edge	X		
Check safety interlock system	X		
Inspect tracks for damage/wear	X		
Check automatic track tensioning	X		
Check engine oil level and condition	X		
Check coolant level and condition	X		
Check hydraulic fluid level and condition	X		
Check fuel level and fill if necessary	X		
Check diesel exhaust fluid (DEF) level and fill if necessary	X		
Check windshield washer system and wiper blade(s), if applicable	X		
Check exhaust for excessive smoke emission	X		
Check hydraulic cylinder piston rods for damage/wear; clean if necessary	X		
Check ROPS structure (all fasteners must be installed and tightly secured)	X		
Check coolant system for leaks, dirt and debris	X		
Check hydraulic hoses and tubes for cracks, leaks and/or debris	X		
Check hydraulic tank, valves and cylinders for leaks and/or damage	X		
Check coolant anti-freeze mixture		X	
Check belt tension and condition		X	
Check engine cover lock		X	
Check engine idle		X	
Clean radiator/oil cooler fins		X	

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Engine Error Codes

Error codes may be reported on the multi-function display screen (Fig. 148). More than one error can be reported at one time and each error code will display on a separate screen. Multiple errors will be reported on a summary screen.

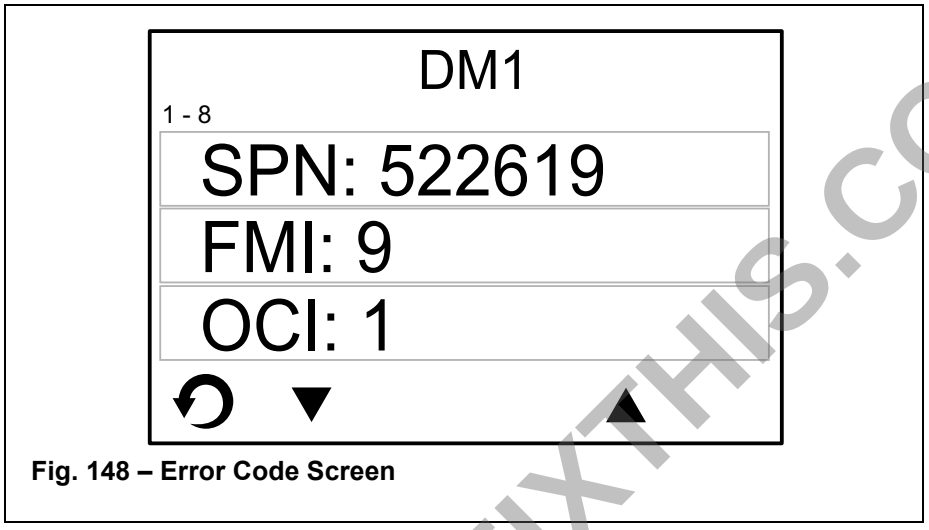


Fig. 148 – Error Code Screen

NOTE: *Error codes remain displayed after the error is corrected. Press the display several times to rotate through all display screens to refresh the display; corrected error codes will not reappear in the screen rotation.*

NOTE: *Refer to official Deutz engine error code documentation for the most complete and up-to-date information.*

Table 8: Engine Diagnostic Trouble Codes (DTC)

DTC			
SPN	**FMI**	**Trouble Code Type**	**Error Description**
29	2	Plausibility Error	Plausibility error between sensor and idle switch; Acceleration pedal detection.
29	3	Short-Circuit Error	Hand throttle idle validation switch; short circuit to battery
29	4	Out-Of-Range/Short Circuit Error	Hand throttle; short circuit to ground
51	0	Out-Of-Range Error	Warning threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L air intake flap
51	1	Out-Of-Range Error	Shut off threshold for an internal actuator error exceeded, < 4L EGR.actuator und >4L air intake flap
51	3	EGR Valve Actuator Error	Actuator of the external EGR valve: the ECU detects a short circuit to battery; short cut to battery on ECU pin A19 or pin A20;

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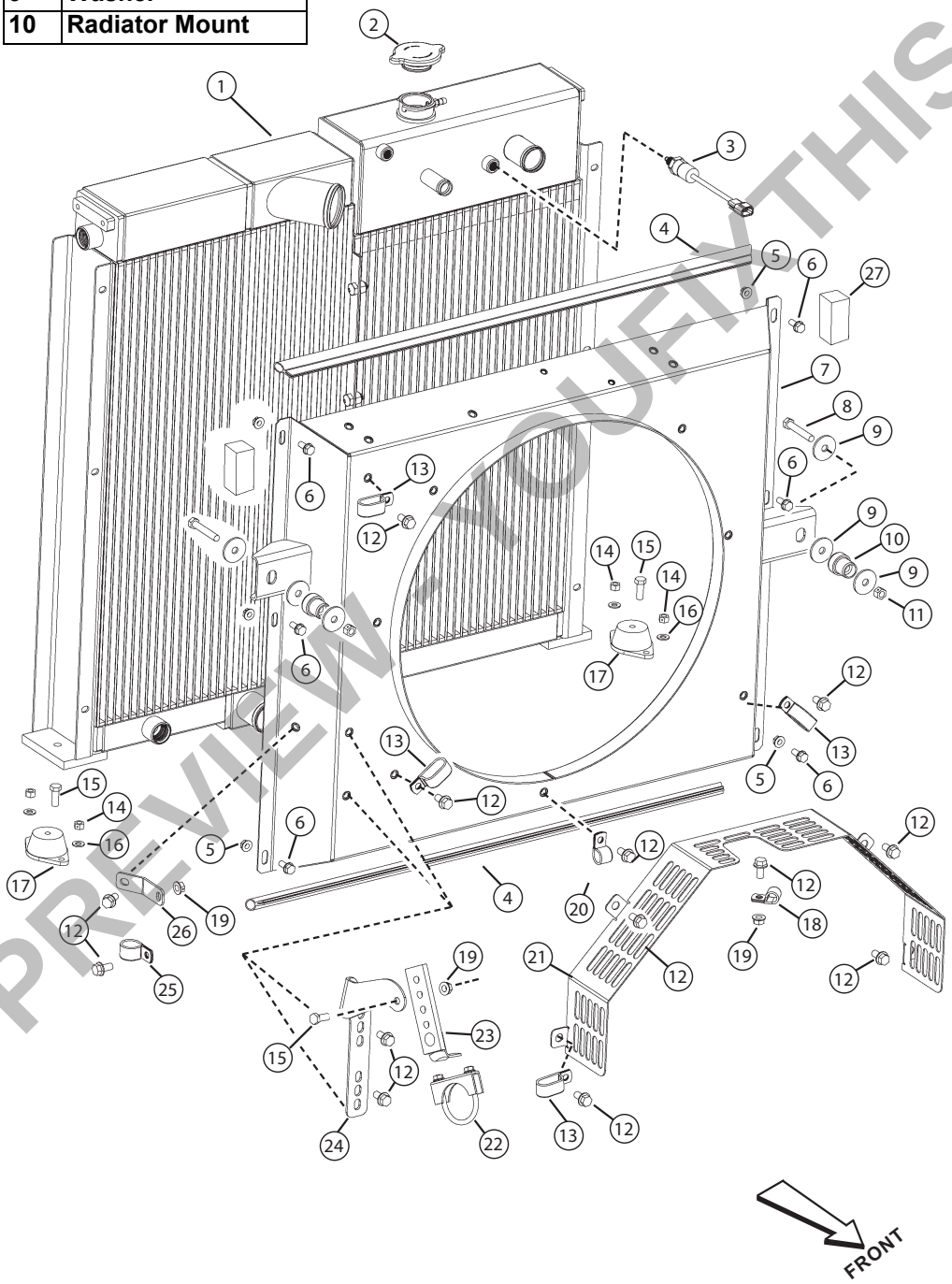
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Radiator/Hydraulic Cooler/Shrouds/Brackets

1	Cooler
2	Radiator Cap
3	Coolant Level Sensor
4	Bulb Seal
5	Locknut
6	Lockscrew
7	Fan Shroud
8	Screw
9	Washer
10	Radiator Mount

11	Locknut
12	Lockscrew
13	Hose Clamp
14	Locknut
15	Capscrew
16	Washer
17	Isolator Mount
18	Hose Clamp
19	Locknut

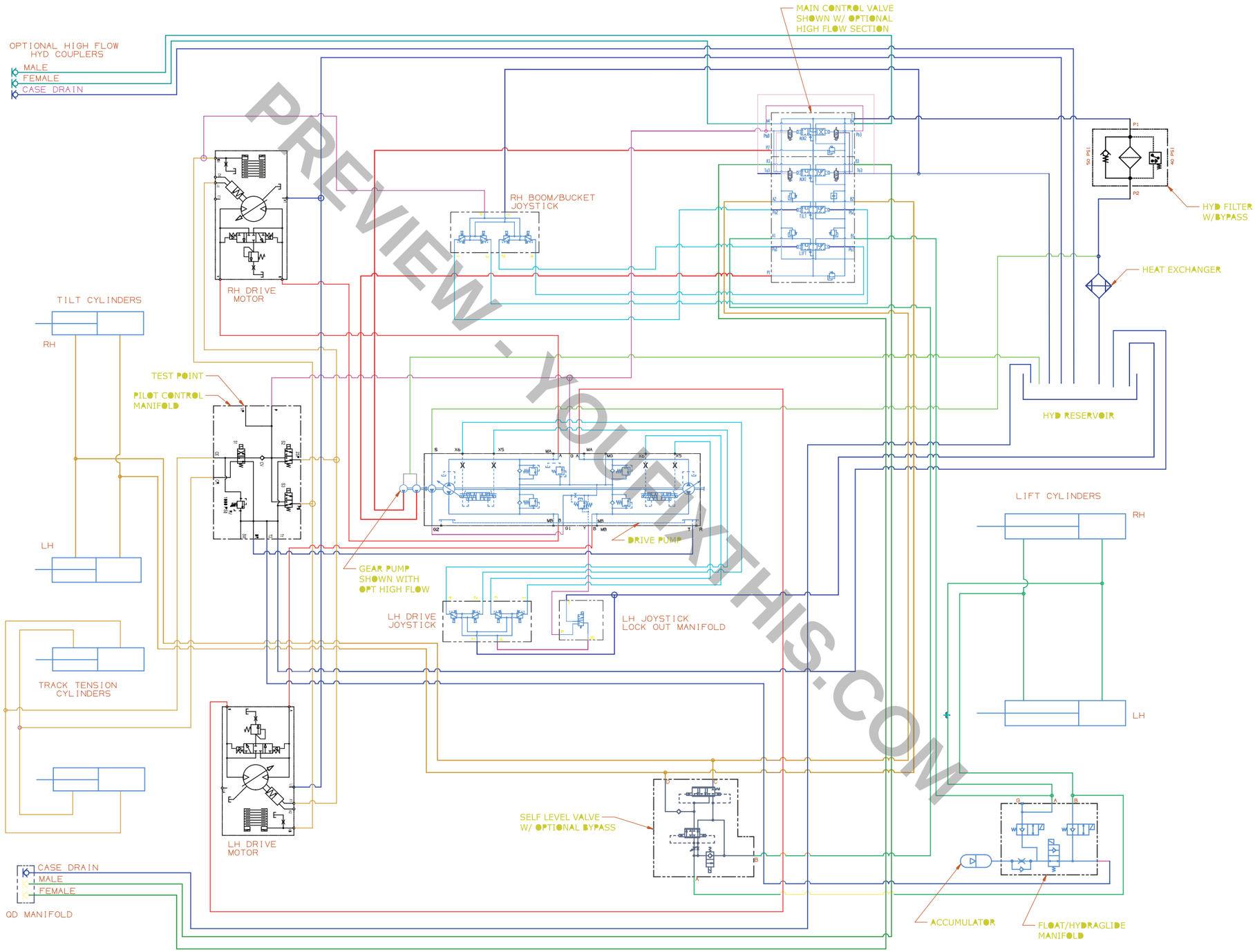
20	Hose Clamp
21	Fan Guard
22	Muffler Clamp
23	Hanger
24	Bracket
25	Hose Clamp
26	Bracket Clamp
27	Foam



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Hydraulic Schematic



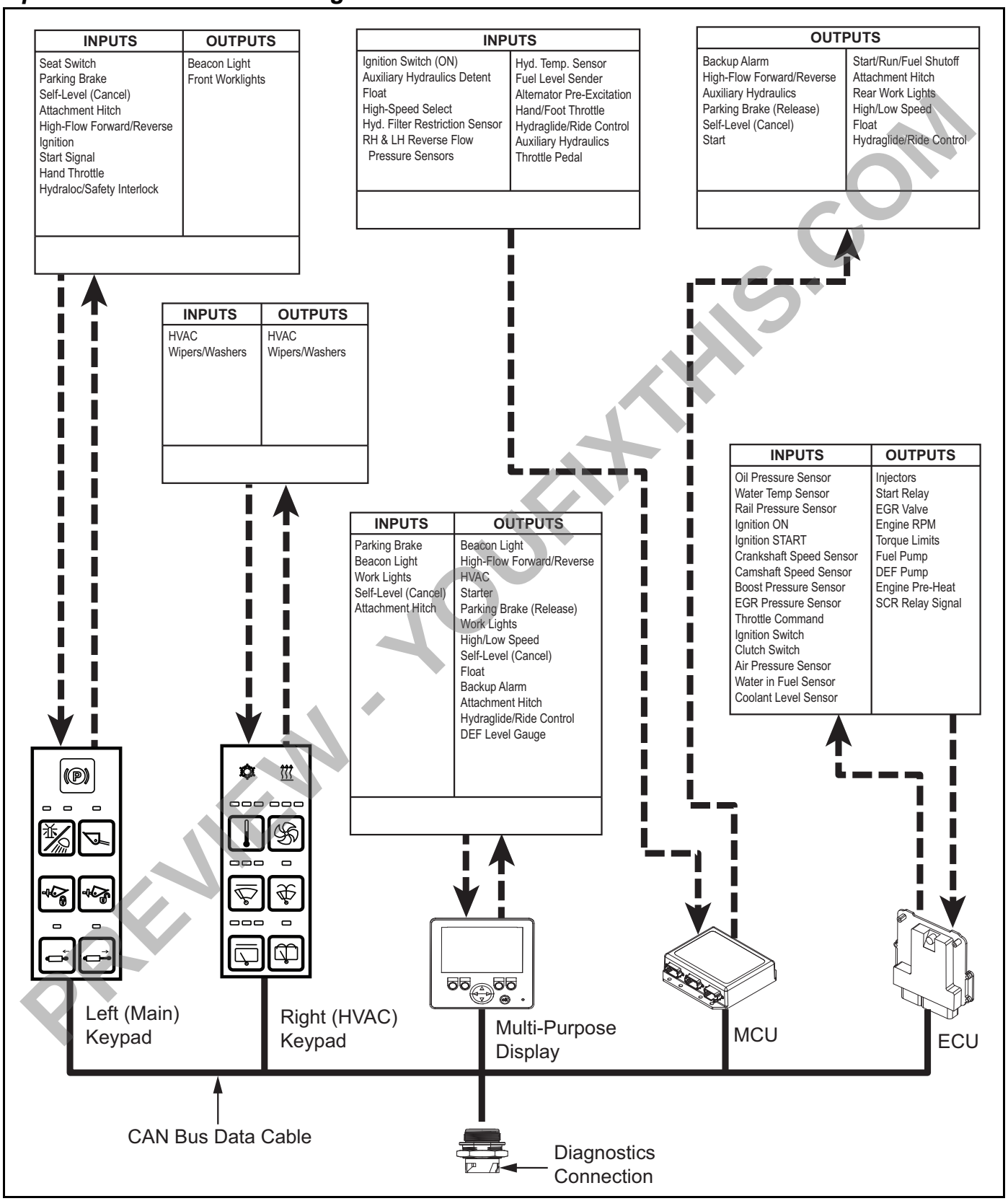
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Operation/Controller Area Network (CAN) Functional Organization

Operation/CAN Function Organization Overview



NOTE: *The following pages provide operation/CAN function details for each system component.*

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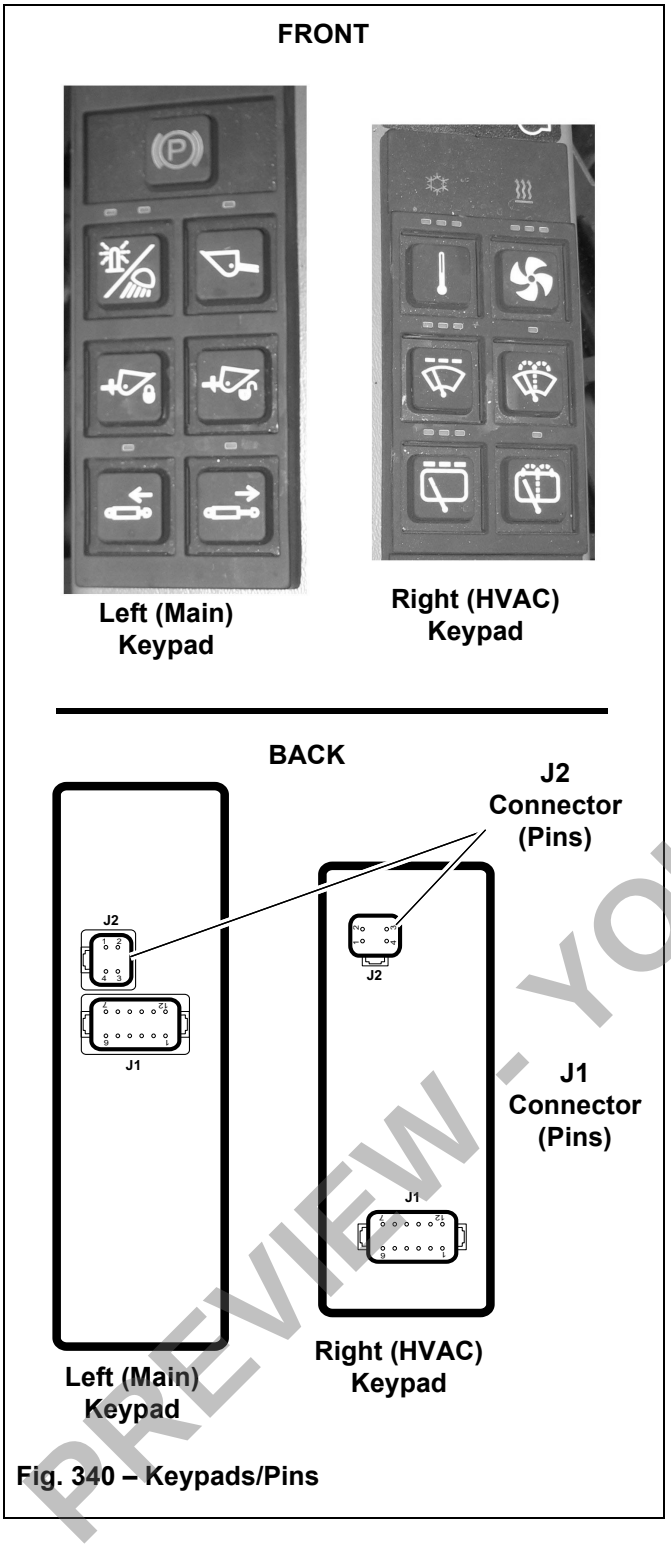


Fig. 340 – Keypads/Pins

Table 12: Left (Main) Keypad Pins

Description	Pin
Battery (12VDC)	J1-1
Safety interlock input (arm rests/swing-out door switch)	J1-2
Throttle pot + input	J1-3

Table 12: Left (Main) Keypad Pins

Description	Pin
5VDC sensor power O/P (20mA max)	J1-4
CAN high	J1-5
CAN low	J1-6
Seat switch input	J1-7
Spare O/P 1 (3A max)	J1-8
Spare O/P 2 (3A max)	J1-9
Beacon light (5A max)	J1-10
Front work lights (9A max)	J1-11
Ground	J1-12
Ignition start switch	J2-1
Ignition run switch	J2-2
N/C	J2-3
N/C	J2-4

Table 13: Right (HVAC) Keypad Pins

Description	Pin
CAN high	J1-1
CAN low	J1-2
Wiper interlock	J1-3
A/C compressor/fan (5.0A max)	J1-4
Switched power (ignition)	J1-5
Rear washer (5.0A max)	J1-6
Switched power (ignition)	J1-7
Rear wiper (10.0A max)	J1-8
Ground	J1-9
Switched power (ignition)	J1-10
Front washer (5.0A max)	J1-11
Front wiper (10.0A max)	J1-12
Fan medium (3.0A max)	J2-1
Fan low (3.0A max)	J2-2
Heat valve (PWM)	J2-3
Fan high (3.0A max)	J2-4

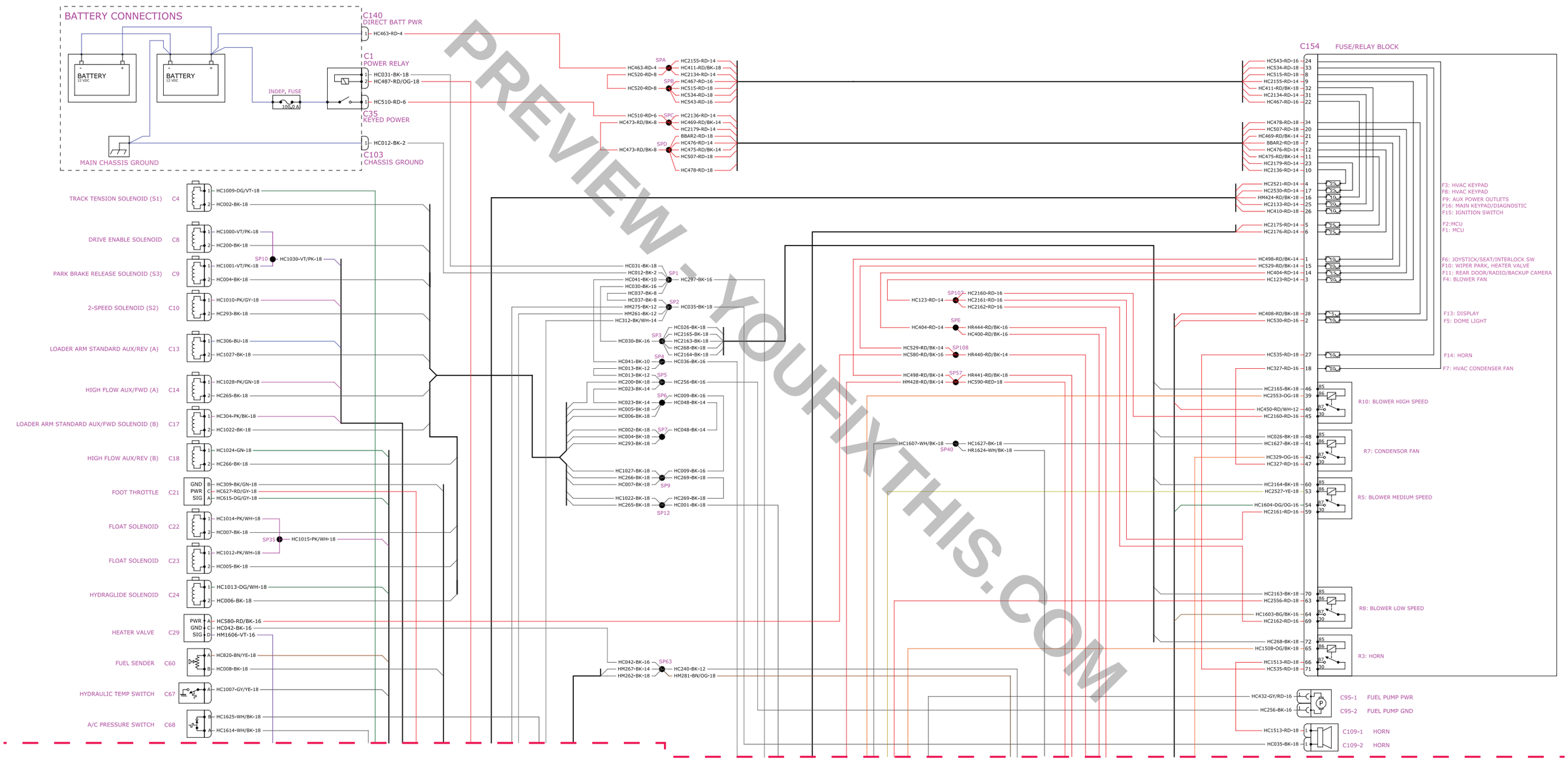
Refer to “Operation/Controller Area Network (CAN) Functional Organization” on page 228 for more information about the keypad controller functional logic.

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Electrical Schematics

Electrical Schematic – Chassis (1 of 2)



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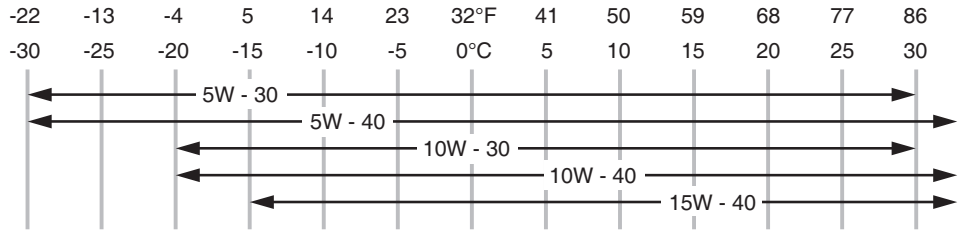
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Specifications

Fluids/Lubricants Types and Capacities

NOTE: *Capacities shown are approximate.*

Table 26: Fluids/Lubricants Types and Capacities

Component/Application	Type	Quantity
Hydraulic Oil Tank	Premium ISO 62 Mfr: PETROCANADA (Mfr. P/N: Premium HVI 60), or equivalent	37.6 L (9.93 gal.)
Hydraulic System – Total		62.5 L (16.50 gal.)
Grease Fittings, Lift Arm	Lithium-saponified, brand-name multi-purpose grease MPG-A	As required
Battery Terminals	SP-B acid-proof Grease	As required
Diesel Fuel Tank	ASTM D975 1-D/2-D with biodiesel content below 0.5% of DIN EN590 type ULSD[1] low sulfur or ultra-low sulfur, below 500 PPM (no additives allowed!)	121 L (32.00 gal.)
Engine Coolant	DQC CA-14 or equivalent minimum (See "Coolant Compound Table" on page 339)	19.3 L (5.10 gal.)
Radiator Cap Pressure		0.90 bar (13.0 psi)
Air Conditioning (option)	R 134a refrigerant ZXL 100PG PAG (DH-PS) lubricant	1134 g. (2.5 lbs.) @ 24° C (76° F) 100 mL (3.4 oz.)
Diesel Exhaust Fluid (DEF)	ISO 22241-1 or DIN 70070 standards	10 L (2.60 gals)
Final Drives: Motor Gearbox	SAE 75W90 Shell transaxle (synthetic fluid) or equivalent	0.8L (0.85 qts.)
Engine Oil (with filter)	**IMPORTANT:** Refer to the Engine Operator's Manual for specific oil recommendations and additional information. **Service Classification:** DQC III LA or API-CJ-4 SM minimum	8.5 L (9.00 qts.)
		

1. Ultra-Low Sulfur Diesel (ULSD) fuel lubricity must have a maximum scar diameter of 0.45 mm, as measured by ASTM D6079 or ISO 12156-1, or a minimum of 3100 grams as measured by ASTM D6078. Contact your fuel supplier for details. Specification 1-D S15 or 2-D S15, ASTM D975.

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Torque Specifications

Note: Use these torque values when tightening hardware (excluding: locknuts and self-tapping, thread forming and sheet metal screws) unless specified otherwise.

Hydraulic fittings with various seals (light application). All torque values are in lb.-ft. (Nm) unless marked otherwise.

Thread	Straight pipe fitting with thread and screwed plug (GE)			Non-return valve with elastic seal	Identification aid outside Ø
	Sealing washer	Elastic seal	O-ring		
M10X1.0	7 (9)	13 (18)	11 (15)	13 (18)	0.4 in. (10 mm)
M12X1.5	15 (20)	18 (25)	18 (25)	18 (25)	0.5 in. (12 mm)
M14X1.5	26 (35)	33 (45)	26 (35)	26 (35)	0.6 in. (14 mm)
M16X1.5	33 (45)	41 (55)	30 (40)	37 (50)	0.6 in. (16 mm)
M18X1.5	41 (55)	52 (70)	33 (45)	52 (70)	0.7 in. (18 mm)
M22X1.5	48 (65)	92 (125)	44 (60)	92 (125)	0.9 in. (22 mm)
M27X2.0	66 (90)	133 (180)	74 (100)	107 (145)	1.0 in. (27 mm)
M33X2.0	111 (150)	229 (310)	118 (160)	155 (210)	1.3 in. (33 mm)
M42X2.0	177 (240)	332 (450)	155 (210)	266 (360)	1.7 in. (42 mm)
M48X2.0	214 (290)	398 (540)	192 (260)	398 (540)	1.9 in. (48 mm)
G1/8A	7 (9)	13 (18)	11 (15)	13 (18)	0.4 in. (9.73 mm)
G1/4A	26 (35)	26 (35)	22 (30)	26 (35)	0.5 in. (13.16 mm)
G3/8A	33 (45)	52 (70)	33 (45)	37 (50)	0.7 in. (16.66 mm)
G1/2A	48 (65)	66 (90)	41 (55)	48 (65)	0.8 in. (20.96 mm)
G3/4A	66 (90)	133 (180)	74 (100)	103 (140)	1.0 in. (26.44 mm)
G1A	111 (150)	229 (310)	118 (160)	140 (190)	1.3 in. (33.25 mm)
G1 1/4A	177 (240)	332 (450)	155 (210)	266 (360)	1.7 in. (41.91 mm)
G1 1/2A	214 (290)	398 (540)	192 (260)	398 (540)	1.9 in. (47.80 mm)

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Engine Troubleshooting

Table 7: Engine Troubleshooting

Problem	Possible Cause	Corrective Action
Engine does not start.	Blown fuse.	Check circuit and replace fuse. See “Fuses and Relays” on page 58.
	Dead batteries.	Charge or replace batter(ies).
	Operator not in operator’s seat.	Operator’s seat must be occupied for the engine to start.
	Malfunctioning seat switch or safety bar arm/rest switch.	Replace seat switch or safety bar arm/ rest switch.
	Swing-out cab door open (if equipped).	Close swing-out cab door.
	Starter malfunction.	Repair/replace starter
	Engine electronics logic error.	See “Engine Error Codes” on page 97.
	Fuel pump malfunction.	Check electrical connections / voltage to fuel pump. Repair/replace as necessary.
Engine turns over but does not start	Engine cranking speed too slow.	Check batteries and charge/replace as necessary.
		Tighten cables at battery terminals.
	Fuel tank empty.	Fill tank and vent fuel system as necessary.
	Fuel filter plugged or restricted.	Replace fuel filter.
	Paraffin separation in winter.	Use winter grade diesel fuel.
	Fuel line leakage.	Tighten all threaded connections and clamps.
	Pre-heating module malfunction.	Check connection and voltage and charge/replace as necessary.
	Fuel filter restricted.	Replace filter.
	Fuel pump malfunction.	Check electrical connections / voltage to fuel pump. Repair/replace as necessary.
	Fuel hose restriction.	Check for pinched fuel hose.

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Engine Maintenance

Engine Access

1. Use the ignition key to unlock the latch (A, Fig. 11) on the top engine compartment cover. Pull up on the latch and lift the cover.

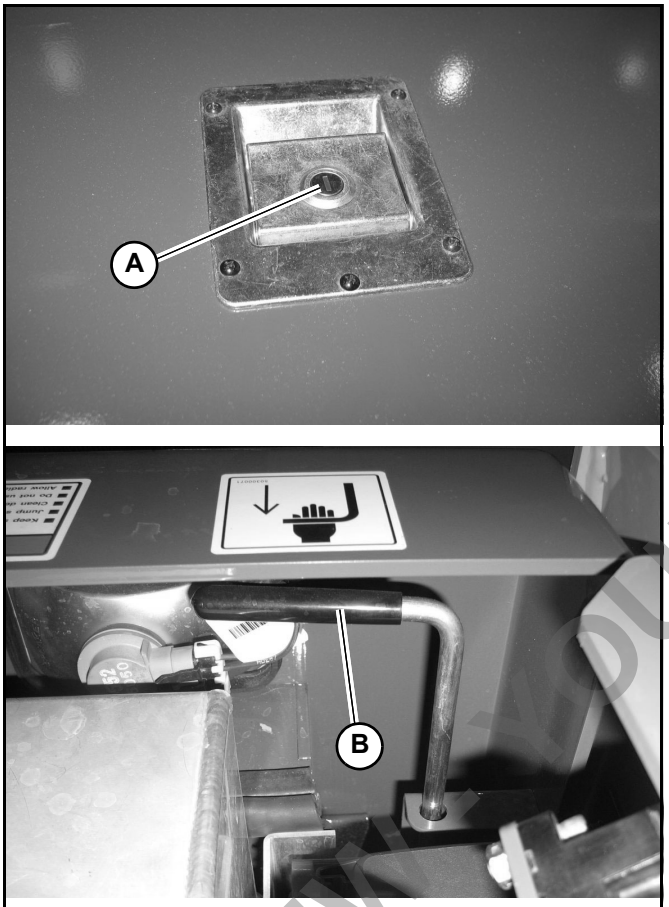


Fig. 11 – Engine Access

2. Pull up on handle (B) inside the top left lip of the rear door. Swing the door open to access engine components.

NOTE: *Opening the rear door all the way engages stop (S, Fig. 12), which holds the door open.*

Closing Engine Covers

⚠ CAUTION

To avoid injury, keep fingers clear when closing engine covers.

1. Lift up on the rear door stop (S), and firmly close the rear door.

NOTE: *It is important for the rear door to close and latch completely, so the top engine cover latch aligns properly with the pin on the rear door. Incomplete latching of the rear door/top cover may cause latches to stick.*

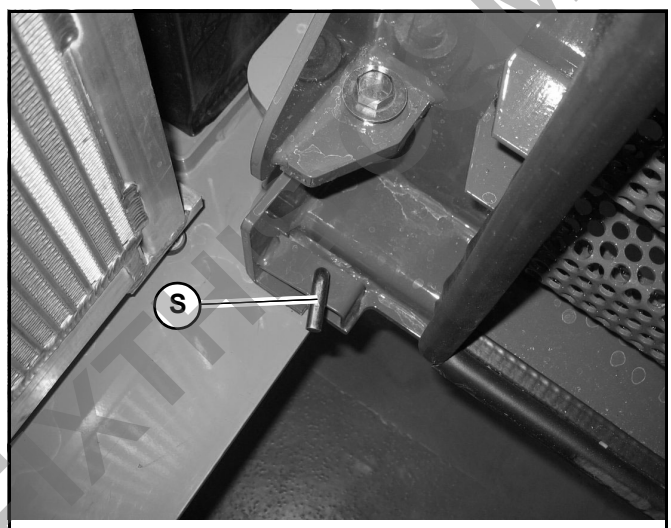


Fig. 12 – Engine Access

2. With the rear door completely closed and latched, firmly close the top engine cover until it is completely closed and latched.

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Loading and Transporting the Machine on a Transport Vehicle

⚠ WARNING

Do not exceed the transport vehicle's gross weight rating and the gross axle weight rating when loading and transporting the machine. The transport vehicle must have sufficient capacity for the size and weight of the machine. See "Payloads/Capacities" on page 338.

Make sure the load does not fall short of the minimum axle load of the steering axle, otherwise the transport vehicle's steering could be seriously affected.

Remove any mud, snow or ice from the tracks on the machine to prevent slipping.

Position the machine at the lowest possible position on the transport platform, with the center of gravity of the load over center line of the transport vehicle. Distribute partial loads to ensure an even load on the axles on the transport vehicle.

Secure the machine properly so it cannot slip, slide, roll, tip over or fall, or cause the transport vehicle to tip over under transport conditions. Use anti-slip bases and linings, load-securing straps and chains, clamping beams, protective pads, nets, edge protectors, etc. as needed to properly secure the load. Consider all possible transport conditions such as: heavy braking, evasive maneuvers, and uneven or rough roadways.

Adjust transport speed to the load, to the road/ traffic conditions and to the handling of the transport vehicle.

Always use the proper tie-down points when using straps and chains. See "Component Identification" on page 26.

Loading and Securing the Machine

⚠ WARNING

Secure the loading ramps to the transport vehicle before loading. Position the loading ramps at the shallowest possible angle. Do not exceed an angle of 15°. Only use ramps with anti-skid surfaces.

Make sure the loading area is clear and access to it is not obstructed.

Make sure the driver of the transport vehicle knows the overall height, width and weight of the vehicle, including the loaded machine, before starting transport.

Know and follow the legal transport regulations for the area in which the transport will occur.

Make sure the loading ramps are free of mud, oil, grease, snow, ice, etc.

Know and follow the legal transport regulations for the area in which the transport will occur.

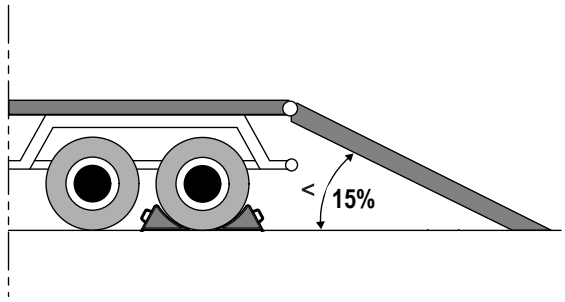


Fig. 3 – Loading Ramp Placement

1. Check the engine oil. The oil level must be at the "MAX" mark on the dipstick. Add oil if needed.

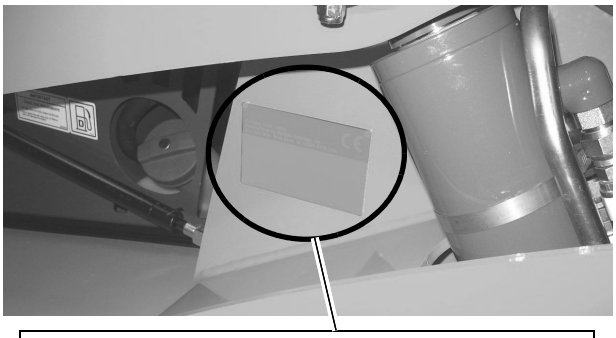
IMPORTANT: *When loading and driving on ramps, the engine can be damaged if the engine oil level is too low.*

2. Start the engine.
3. Raise the hitch plate/attachment enough so that it will not touch the loading ramps.

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Machine Model and Serial Number Locations

When ordering service parts, provide complete information about the part and the quantity required. Also provide the model and serial numbers of the machine. For safety and continued proper operation, use only genuine service parts.



Model/Serial Number Placard

Fig. 6 – Machine Model/Serial Numbers

Component Serial Numbers



Fig. 7 – Engine Model/Serial Numbers



Fig. 8 – Hydraulic Motor Serial Number

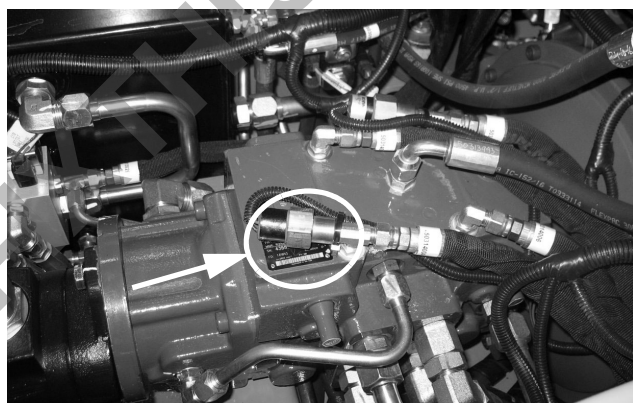


Fig. 9 – Hydrostatic Pump Serial Number

ROPS/FOPS Certification Label

The ROPS/FOPS certification label is located in the right front corner of the ROPS/FOPS ceiling



Fig. 10 – ROPS/FOPS Certification Label

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7. If the indicator lights in the button and the parking brake icon on the indicator panel DO NOT go out:

   a. Press the left/right side of navigation rocker button (A, Fig. 284) on the multi-function display as many times as necessary to display until the *Diagnostic Outputs* screen shown in Fig. 287 is displayed.

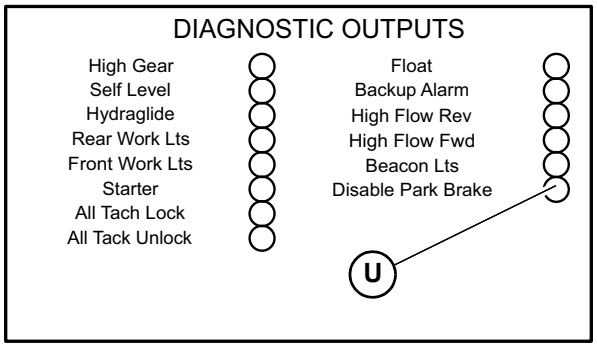


Fig. 287 – Diagnostics Outputs Screen

   b. The *Disable Park Brake* diagnostic output (U) should be green.

   c. If the *Disable Park Brake* output (U) does not turn green as indicated:

   - If the *Disable Park Brake* diagnostic output (U) is yellow, there is a electrical continuity (open) fault between the MCU and the parking brake solenoid (C, Fig. 288) on the parking brake (pilot) valve.
   - If the *Disable Park Brake* diagnostic output (U, Fig. 287) is red, there is a short circuit between the MCU and the parking brake solenoid (C, Fig. 288) on the parking brake (pilot) valve.

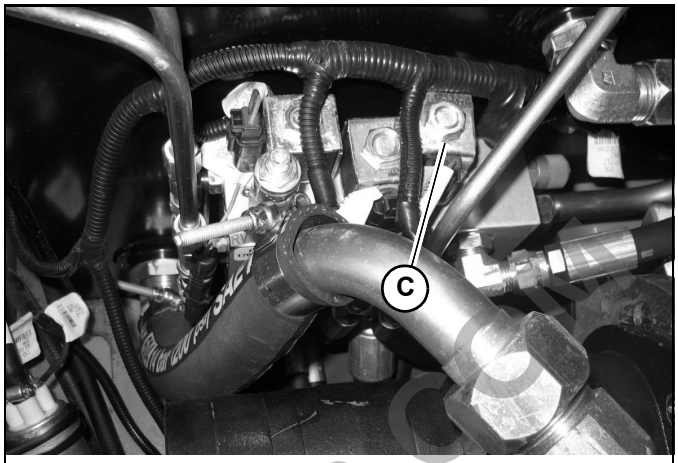


Fig. 288 – Parking Brake (Pilot) Valve

NOTE: *The parking brake (pilot) valve is located on the right under the ROPS/FOPS.*

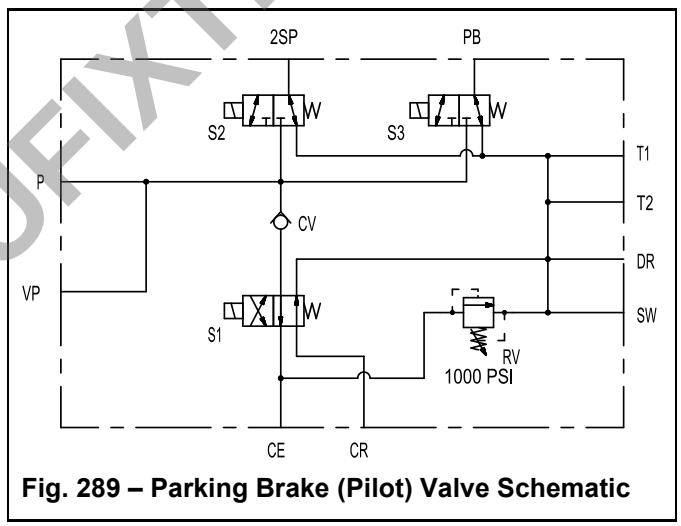


Fig. 289 – Parking Brake (Pilot) Valve Schematic

8. Test the parking brake (pilot) valve solenoid as follows:

   a. Complete the mandatory safety shutdown Procedure. See “Mandatory Safety Shutdown Procedure” on page 8.

   b. Raise the ROPS/FOPS according to “Raising ROPS/FOPS” on page 313.

   c. Apply a 12 VDC current directly to parking brake (pilot) valve solenoid (C, Fig. 288):

   d. Use a thin strip of steel, such as a pocket ruler, to check the valve solenoid by moving the steel strip close to the solenoid coil.

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