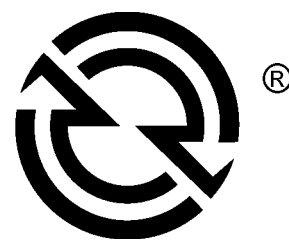


# DETROIT DIESEL



## MBE4000 Service Information

**NUMBER:** 1-MBE 4000-07    **S.M. REF.:** see table 1    **ENGINE:** MBE 4000    **DATE:** February 2007

**SUBJECT:** LOW POWER CONCERN

**PUBLICATION:** EPA-04 MBE 4000 SERVICE MANUAL (6SE412)

The service manual has been restructured to add a “Low Power Concern” chapter. Previously the troubleshooting concerns were found in chapter 15, now each troubleshooting concern has its own chapter.

Service Manual Chapter	Description
15	Troubleshooting The Electronic Engine Control System
16	General Mechanical Troubleshooting
17	Low Power Concern

**Table 1 Troubleshooting Chapters**

Chapter 17 includes factors that affect wheel horsepower and other associated low power information.

### ADDITIONAL SERVICE INFORMATION

Additional service information is available in the Detroit Diesel *MBE 4000 Service Manual*, 6SE412. The next revision to this manual will include the revised information.

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# 15 TROUBLESHOOTING THE ELECTRONIC ENGINE CONTROL SYSTEM

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## 15.1 ELECTRONIC ENGINE CONTROL SYSTEM

When the electronic engine control system detects a fault, it broadcasts a message on the datalink. The dash display will show the code "ECU 128," indicating there is an engine fault.

**NOTE:**

To read the complete fault code, refer to the *MBE Electronic Controls Troubleshooting Guide* (6SE422) or bring the vehicle to an authorized repair facility. Complete fault codes can be read using minidiag2.



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# 16 GENERAL MECHANICAL TROUBLESHOOTING

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## 16.1 MECHANICAL TROUBLESHOOTING

The tables that follow are designed to identify the causes of common problems, suggest further checks and appropriate remedies. When dealer service is necessary, this is mentioned in the table.

<b>Problem - The Engine Will Not Crank</b>	
<b>Cause</b>	<b>Remedy</b>
The batteries are damaged or weak.	Test the batteries. Replace them, if needed.
The ignition switch is damaged.	Replace the ignition switch.
The battery cables are damaged and/or corroded.	Replace the battery cables.
The starter is damaged and/or worn.	Have an authorized dealer replace the starter.
The clutch or transmission is damaged.	Bring the vehicle to an authorized dealer for service.
There is internal damage to the engine.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Turns Over Slowly</b>	
<b>Cause</b>	<b>Remedy</b>
The batteries are damaged or weak.	Test the batteries. Replace them, if needed.
The ignition switch is damaged.	Replace the ignition switch.
The battery cables are damaged and/or corroded	Replace the battery cables.
The starter is damaged and/or worn.	Have an authorized dealer replace the starter.
The engine oil does not meet the correct specifications.	Change the engine oil, using the correct type of oil.
The transmission fluid does not meet the correct specifications.	Change the transmission fluid, using the correct type of fluid.



<b>Problem—The Engine Cranks, But Won't Start</b>	
<b>Cause</b>	<b>Remedy</b>
The batteries are damaged or weak.	Test the batteries. Replace them, if needed.
The cranking speed is not set correctly.	Bring the vehicle to an authorized dealer for service.
No intake air preheater is installed, and it is too cold to start without one.	Install an intake air preheater.
The intake air preheater is malfunctioning.	Check the intake air preheater, and replace it, if necessary.
The camshaft TDC sensor and/or the crank angle position sensor are out of adjustment.	Push both sensors into their holes as far as they will go. If this does not solve the problem, bring the vehicle to an authorized dealer for service.
The camshaft TDC sensor and/or the crank angle position sensor are damaged.	Bring the vehicle to an authorized dealer for service.
There is air in the fuel system.	Check the fuel lines for air pockets. Bleed the fuel system and start the engine.
The air filter is clogged.	Clean or replace the air filter.
The fuel filter is clogged.	Replace the filter element.
The exhaust brake valve is malfunctioning.	Have an authorized dealer check the operation of the valve.
The valves are not adjusted properly.	Check the valve lash.
There are other problems in the fuel system.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Starts Only After Cranking for a Long Time</b>	
<b>Cause</b>	<b>Remedy</b>
The fuel tank is low or empty.	Add fuel and bleed the fuel system, if necessary.
There are leaks in the fuel lines.	Check the fuel lines for leaks and repair them, if necessary.
The fuel filter is clogged.	Replace the filter element.
The fuel line, the fuel pre-filter, or the screen in the fuel tank is blocked.	Clean and bleed the system. Have the fuel lines and filters checked by an authorized dealer.
The camshaft TDC sensor and/or the crank angle position sensor are out of adjustment.	Push both sensors into their holes as far as they will go. If this does not solve the problem, bring the vehicle to an authorized dealer for service.
The camshaft TDC sensor and/or the crank angle position sensor are damaged.	Bring the vehicle to an authorized dealer for service.
There are other problems in the fuel system.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Starts, But Dies</b>	
<b>Cause</b>	<b>Remedy</b>
The fuel tank is low or empty.	Add fuel and bleed the fuel system, if necessary.
The fuel filter is clogged.	Replace the filter element.
The fuel line, the fuel pre-filter, or the screen in the fuel tank is blocked.	Clean and bleed the system. Have the fuel lines and filters checked by an authorized dealer.
The camshaft TDC sensor and/or the crank angle position sensor are out of adjustment.	Push both sensors into their holes as far as they will go. If this does not solve the problem, bring the vehicle to an authorized dealer for service.
The camshaft TDC sensor and/or the crank angle position sensor are damaged.	Bring the vehicle to an authorized dealer for service.
The constant-throttle valves are malfunctioning.	Bring the vehicle to an authorized dealer for service.
There are other problems in the fuel system.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Fan Doesn't Work</b>	
<b>Cause</b>	<b>Remedy</b>
The fan hub is damaged.	Replace the fan hub.
The fan wiring is damaged.	Repair the fan wiring.
The parameter settings in the PLD or VCU control unit are incorrect.	Have an authorized dealer reprogram the control unit.

<b>Problem—The Engine Fan Is Constantly On</b>	
<b>Cause</b>	<b>Remedy</b>
The fan override switch is on.	Check the operation of the fan override switch.
The fan hub is damaged.	Replace the fan hub
The parameter settings in the PLD or VCU control unit are incorrect.	Have an authorized dealer reprogram the control unit.

<b>Problem—Fuel Consumption Is Too High</b>	
<b>Cause</b>	<b>Remedy</b>
The tires are not properly inflated.	Check all tires for correct pressure.
The air filter and/or intake air system is clogged.	Check the air restriction indicator. Clean the intake air system and replace the air filter if necessary.
The fuel filter is clogged.	Replace the filter element.
The exhaust brake valve is malfunctioning.	Have an authorized dealer check the operation of the valve.
The engine performs poorly, or does not develop full power.	The remedies are listed in "The Engine Performs Poorly, Does Not Develop Full Power."

<b>Problem—The Engine Performs Poorly, Does Not Develop Full Power</b>	
<b>Cause</b>	<b>Remedy</b>
The air filter and/or intake air system is clogged.	Check the air restriction indicator. Clean the intake air system and replace the air filter if necessary.
The exhaust brake valve is malfunctioning.	Have an authorized dealer check the operation of the valve.
The fuel filter is clogged.	Replace the filter element.
There are other problems with the fuel system.	Bring the vehicle to an authorized dealer for service.
The valves are not adjusted properly	Check the valve lash. See
The coolant temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
The fuel temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
The engine oil temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
The charge-air temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
There are problems with the PLD or VCU control unit.	Bring the vehicle to an authorized dealer for service.
There is internal damage to the engine.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Performs Poorly, Does Not Develop Full Power</b>	
<b>Cause</b>	<b>Remedy</b>
The air filter and/or intake air system is clogged.	Check the air restriction indicator. Clean the intake air system and replace the air filter if necessary.
The exhaust brake valve is malfunctioning.	Have an authorized dealer check the operation of the valve.
The fuel filter is clogged.	Replace the filter element.
There are other problems with the fuel system.	Bring the vehicle to an authorized dealer for service.
The valves are not adjusted properly	Check the valve lash. See
The coolant temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
The fuel temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
The engine oil temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
The charge-air temperature sensor is damaged or reading incorrectly.	Bring the vehicle to an authorized dealer for service.
There are problems with the PLD or VCU control unit.	Bring the vehicle to an authorized dealer for service.
There is internal damage to the engine.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Is in Emergency Running Mode (constant speed 1,300 rpm)</b>	
<b>Cause</b>	<b>Remedy</b>
The PLD or VCU control unit is damaged.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Coolant Temperature Is Above Normal</b>	
<b>Cause</b>	<b>Remedy</b>
The coolant level is too low.	Check for coolant leaks, and repair as needed.
The poly-V belt is loose.	Tighten or replace the poly-V belt.
The coolant temperature gauge and/or sensor is not reading correctly.	Bring the vehicle to an authorized dealer for service.
The radiator is damaged or dirty.	Clean the radiator. Repair or replace the radiator if necessary.
The coolant pump is damaged.	Have an authorized dealer replace the coolant pump.
The thermostat is damaged.	Have an authorized dealer replace the coolant pump.
The fan is not operating properly.	Bring the vehicle to an authorized dealer and have the fan hub checked. Bring the vehicle to an authorized dealer and have the parameter settings reprogrammed in the engine control unit (PLD) or vehicle control unit (VCU).

<b>Problem—The Coolant Temperature Is Below Normal</b>	
<b>Cause</b>	<b>Remedy</b>
The coolant temperature gauge and/or sensor is not reading correctly.	Bring the vehicle to an authorized dealer for service.
The thermostat is damaged.	Have an authorized dealer replace the thermostat.
The fan is not operating properly.	Bring the vehicle to an authorized dealer and have the fan hub checked. Bring the vehicle to an authorized dealer and have the parameter settings reprogrammed in the engine control unit (PLD) or vehicle control unit (VCU).

<b>Problem—The Cooling System Is Losing Coolant</b>	
<b>Cause</b>	<b>Remedy</b>
There is an external coolant leak.	Repair the leaking component.
The radiator cap is leaking.	Replace the radiator cap.
The air compressor head is damaged.	Have an authorized dealer replace the air compressor.
The cylinder head gasket is leaking.	Have an authorized dealer replace the head gasket.

<b>Problem—There Is Coolant in the Engine Oil</b>	
<b>Cause</b>	<b>Remedy</b>
The cylinder head gasket is damaged.	Have an authorized dealer replace the head gasket.
The oil/water heat exchanger is leaking.	Have an authorized dealer replace the heat exchanger.
There is an internal coolant leak.	Bring the vehicle to an authorized dealer for service.

<b>Problem—There Is Foam in the Engine Oil</b>	
<b>Cause</b>	<b>Remedy</b>
The oil level is too low or too high.	Correct the oil level.
The oil has not been changed within the recommended interval.	Change the oil.
The oil is not of the recommended quality.	Change the oil.

<b>Problem—The Engine Oil Pressure Is Low</b>	
<b>Cause</b>	<b>Remedy</b>
The oil pressure gauge and/or sensor is not reading correctly.	Bring the vehicle to an authorized dealer for service.
There is fuel in the oil.	Bring the vehicle to an authorized dealer for service.
The oil filter is clogged.	Replace the filter element.
The oil filter bypass valve is damaged.	Replace the bypass valve.
The oil pump and/or relief valve is damaged.	Have an authorized dealer replace the oil pump.

<b>Problem—The Engine Exhaust Is White</b>	
<b>Cause</b>	<b>Remedy</b>
The fuel is of poor quality.	Add fuel of the right quality.
The intake air preheater is malfunctioning.	Check the intake air preheater, and replace it, if necessary.
The valves are not adjusted properly.	Check the valve lash.

<b>Problem—The Engine Exhaust Is Black</b>	
<b>Cause</b>	<b>Remedy</b>
The air filter and/or intake air system is clogged.	Check the air restriction indicator. Clean the intake air system and replace the air filter if necessary.
The exhaust brake valve is malfunctioning.	Have an authorized dealer check the operation of the valve.
The intake air preheater is malfunctioning.	Check that the heater is not staying on all of the time.
The valves are not adjusted properly.	Check the valve lash.
There is damage to the fuel system: the fuel pump, one or more fuel injectors, or one or more unit pumps are damaged.	Bring the vehicle to an authorized dealer for service.
The charge-air temperature sensor is damaged.	Bring the vehicle to an authorized dealer for service.
There is internal damage to the engine.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Engine Exhaust Is Blue</b>	
<b>Cause</b>	<b>Remedy</b>
The engine oil level is too high (engine oil is reaching the combustion chamber).	Adjust the oil level, and then have the oil level checked by an authorized dealer.
The turbocharger is leaking oil.	Have an authorized dealer replace the turbocharger
The valve stem seals are loose or damaged.	Have an authorized dealer replace the seals.
The piston rings are worn.	Have an authorized dealer replace the piston rings.

<b>Problem—Engine Brake Performance Is Poor</b>	
<b>Cause</b>	<b>Remedy</b>
The engine brake control switch is damaged.	Replace the switch
The exhaust brake is not operating properly.	Have an authorized dealer check the operation of the valve.
The constant-throttle valves are malfunctioning.	Bring the vehicle to an authorized dealer for service.
Components of the PLD and/or VCU control unit are damaged.	Bring the vehicle to an authorized dealer for service.

<b>Problem—Cruise Control Is Not Working</b>	
<b>Cause</b>	<b>Remedy</b>
One or more of the cruise control switches are damaged.	Replace the damaged switch.
Components of the PLD and/or VCU control unit are damaged or not working properly.	Bring the vehicle to an authorized dealer for service.

<b>Problem—The Battery Charge Indicator Light Does Not Come On When the Engine Is Not Running</b>	
<b>Cause</b>	<b>Remedy</b>
The bulb is damaged.	Change the bulb.
The circuit is broken.	Repair the break in the circuit.

<b>Problem—The Battery Charge Indicator Light Comes On When the Engine is Running</b>	
<b>Cause</b>	<b>Remedy</b>
The poly-V belt is too loose.	Check the belt tension; if necessary, have an authorized dealer replace the belt tensioner.
The belt tensioner is damaged.	Have an authorized dealer replace the belt tensioner.
he poly-V belt is worn or damaged.	Replace the belt.
The alternator is damaged (has a damaged rectifier or voltage regulator).	Have an authorized dealer replace the alternator.

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## 17 LOW POWER CONCERN

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## 17.1 FACTORS THAT AFFECT WHEEL HORSEPOWER

The factors affecting wheel horsepower are listed in Table 17-1.

To begin low horsepower diagnosis, refer to section 17.2

Factors	Considerations
Power Rating	Is the correct power rating programmed into the PLD? Is the driver aware of the effects that cruise power, or the lack of cruise power has on perceived power?
Road Speed Setting	Is the road speed setting causing a perceived lack of power?
Crank Case Overfilled	If the crank case level is too high, there will be a loss of power due to churning losses created by the crank shaft throws contacting the oil.
Fuel Blend (specific gravity)	Check the specific gravity of the fuel/vehicle system. A good number 2 diesel fuel has a specific gravity of 0.840 or higher @ 60°F. It should be noted that No. 1 diesel fuel can reduce horsepower to 7% less than No. 2 fuel. Blends of No. 1 and No. 2 (common in winter) will produce less horsepower, depending on the percent of the blend. This is a common concern when dealing with low power complaints in cold climate locations.
Fuel Filter Restriction	Check for fuel flow restrictions which can be caused by fuel heaters, water separators, fuel flow meters, undersize or improperly routed/damaged fuel lines, faulty check valves, contaminated fuel filters or high fuel pressure resulting from a plugged restricted fitting or regulator valve. Replacing the fuel filter is often the best recommendation in lieu of testing for the filter condition. Make sure the recommended fuel filter is being used. Refer to Technical Service Letter (05-TS-12REV – MBE 4000 Fuel Filter Update).
Fuel System Leak	Fuel system leaks which result in aerated fuel are normally caused by a leak at the connections and /or filters between the suction side of the fuel pump to the supply tank and not between the pressure side of the pump and engine.
Fuel Tank Vent Restriction	A plugged fuel tank vent will create a vacuum in the tank and result in a loss in fuel pressure at the injectors. This will reduce fuel delivery rate.
Air in Fuel	Aerated fuel, caused by a fuel system leak, will result in reduced fuel delivery and late injection timing.
Plugged or Cracked Fuel Tank Stand Pipe	If the fuel tank stand pipe is plugged by a shop rag, fuel delivery will be restricted. A cracked stand pipe will allow air to enter the fuel system and reduce fuel flow and cause late injection timing.
Faulty Injector/Unit Pump	A faulty injector/unit pump will limit fuel delivery and alter the combustion process such that power is compromised. Using Idle Smooth Balance (ISB) in DDDL can help identify a faulty injector nozzle.
Valve Lash	Incorrect valve lash will alter the combustion process such that power is compromised.
Air Flow Restriction	Air flow must not be inhibited by a plugged filter, or inadequate inlet air duct shrouding.
Faulty Turbocharger	A turbocharger that has wheel rubbing, oil leaks, bent blades, etc. will not provide adequate air supply.

Factors	Considerations
Temperature Controlled Fan	A faulty thermo control will cause the fan to be locked on and drain power on a continuous basis.
Air System Leaks (gaskets and seals)	Air system leaks will result in insufficient air for optimum combustion.
Biodiesel	Should not be higher than 5%. Refer to <i>Engine Requirements – Lubricating Oil, Fuel and Filters</i> , (7SE270), available from authorized Detroit Diesel distributors.
Charge Air Cooler Leak	Air system leaks will result in insufficient air for optimum combustion.
Climate (fresh air temp)	The maximum allowable temperature rise from ambient air to engine inlet is 15°F. Undersized or dirty air cleaner element, as well as damaged or obstructed air inlet piping can cause low power. Make sure under-hood hot air is not being taken in. Pressure drop across the air to air charge cooler should be checked (3.0 in. Hg maximum from turbo discharge to intake manifold). Check turbocharger boost pressure and compare to specification.
Altitude Performance	Site altitude has an effect on engine horsepower. Expect approximately 2% loss in power when operating at an altitude of 1 mile, relative to sea level.
PLD/VCU Settings	Make sure vehicle settings such as: axle ratio, tire size, top gear ratio, etc. are set correctly to avoid a false sense of engine performance.
EGR Valve	A misadjusted or malfunctioning EGR valve will alter the amount of oxygen available for combustion as well as introduce inert gas that does not promote combustion.
Exhaust Restriction	A damaged, undersized, or otherwise restricted muffler or exhaust system can result in high exhaust back pressure. Refer to the engine specification sheets for maximum allowable pressure.
Barometric Pressure Sensor	The engine will transition between EGR and boost mode at an altitude of 13,120 ft. Altitude is determined by the Barometric Pressure Sensor located in the PLD. A faulty Barometric Pressure Sensor will compromise the availability of boost pressure.
EPV and Supply Lines	Variable pressure output devices control the variable geometry turbo vanes and EGR valve position. Improper turbo vane or EGR valve positions will alter the air flow system balance and subsequently the combustion process.
Air Compressor Leak	An air compressor leak will cause the air compressor to work more and increase the parasitic load on the engine.
Air Conditioner Leak	An air conditioner leak will cause the air conditioner to work more and increase the parasitic load on the engine.
Excessive Play in Power Steering System	Continuous movement of the steering wheel will call for continuous work by the power steering unit. This will increase the parasitic load on the engine.
Alternator Load	Excessive use of vehicle electrical power will cause increased use of the alternator. This will increase the parasitic load on the engine.
Tire Pressure	Under inflated tires will significantly increase driveline resistance to rotation.
Trailer Aerodynamics/Alignment	A trailer that has poor aerodynamics or has misaligned axles (causing dog tailing) will significantly increase vehicle inertia and resistance to forward motion.
Vehicle Payload	As vehicle loading increases, vehicle inertia and resistance to forward motion increases.

Factors	Considerations
Winter-front Installation	Improper installation or usage of a winter-front will result in extremely high intake air temperatures and reduced mass flow of air into the combustion chamber.
Vehicle Application	Unusual applications such as triple drive axles, PTO's, pumps, high air compressor duty cycle, etc., will have higher parasitic losses resulting in less horsepower at the wheels.
Foot Pedal	Make sure the foot pedal has complete travel. The foot pedal position can be monitored on DDDL (accelerator pedal pos.)

**Table 17-1 Factors Affecting Wheel Horsepower**

## **17.2 LOW HORSEPOWER INTERVIEW**

To determine if low horsepower is causing a power concern, use the driver questionnaire, the troubleshooting tree, and the low power troubleshooting chart.

### **17.2.1 Driver Questionnaire**

This section should serve as a guideline for the technician.

For an example of the driver questionnaire see Figure 17-1.

<b>Engine Diagnostic Questionnaire</b>		<b>RO #</b>	
Customer Name: _____			
Contact Person: _____			
<b>LOW POWER/POOR FUEL ECONOMY:</b>			
Does check engine light come on?	Yes	No	
Does the engine miss, run rough, hard starting?	Miss	Run Rough	Hard Starting
Power Loss sudden or has decreased with time?		Sudden	Decreased with time
Excessive engine exhaust smoke (see #3)?	Yes	No	
If yes, what color?	Black	Blue	White
Heard any unusual engine noise? Yes _____		No	
Power loss occurs on	Foot	Cruise	Both
Have injectors been replaced recently?	Yes	No	
When was last tune up?	Mileage _____	Date _____	
Comments: _____			
_____			
<b>ANY INTERMITTENT PROBLEMS:</b>			
Last time it happened: _____			
Does the check engine light come on?		Yes	No
Does the problem occur only in damp or rainy conditions?		Yes	No
When the vehicle hits a bump or rough road?		Yes	No
Does the engine:	Miss	Drop to idle	Quit running
	Gauge Sweep	Hard Starting	
Comments: _____			
_____			
e.g. Does the driver do anything to correct the problem?			
<b>SMOKING:</b>			
Where is the smoke coming from? _____			
What color is the smoke?	Blue	Black	White
			BI/White
When does it smoke?	Start-up	Cold Eng.	Hot Eng.
			U.Load
Have you noticed any oil consumption?			Yes
			No
Have you noticed a miss in the engine?			Yes
			No
Was the smoke intermittent?-	Start all at once?	Been getting worse over time?	
Comments: _____			
_____			
<b>COOLANT LOSS</b>			
Has the oil level risen?	Yes	No	
Have you noticed any coolant leaks?	Yes	No	
How often do you add coolant?	How Much? _____		
What kind of coolant do you use? _____			
What kind of inhibitor do you use? _____			
Comments: _____			
_____			
<b>OIL CONSUMPTION:</b>			
How much oil are you adding?	How often (miles)? _____		
Have you noticed any oil leaks?		Yes	No
Have you noticed any smoke out the exhaust?		Yes	No
	At Idle	Light or no load	Heavy load
How often do you change oil?	What Brand? _____		
Have you changed brands recently?		Yes	No
How & when do you check your oil? _____			
Comments: _____			
_____			

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**Figure 17-1 Driver Questionnaire**


### 17.2.1.1 Driver Questionnaire

Ask the driver to answer the following questions before attempting to repair an intermittent problem, or a problem with symptoms but no diagnostic codes. Use this and the response as a guideline. Refer to section 17.2.1.2, “Questionnaire Response Guideline.”

1. How often does the problem occur? Can you and the driver take the vehicle and demonstrate the problem in less than 30 minutes?
2. Has the vehicle been to other shops for the same problem? If so, what was done there?
3. Did the radio, dash gages, or lights momentarily turn OFF when the problem occurred?
4. Does the problem occur only at specific operating conditions? If so, at what load? Is it light, medium, or heavy?
5. Does the problem occur at a specific engine operating temperature? If so, at what engine temperature?
6. Does the problem occur at a specific engine operating altitude? If so, at what altitude?
7. Does the problem occur only when above or below specific outside temperatures? If so, what temperature range?
8. Does the problem occur during other conditions e.g. during or after rain, spray washing, snow?
9. Did the problem occur at a specific vehicle speed? If so, at what vehicle speed?
10. Does the problem occur at specific engine RPM? If so, at what engine RPM?

### 17.2.1.2 Questionnaire Response Guideline

The following are typical responses to the driver questionnaire:

 <b>WARNING:</b>  <b>PERSONAL INJURY</b>
<p><b>To avoid injury from loss of vehicle/vessel control, the operator of a MBE electronic controlled engine must not use or read any diagnostic tool while the vehicle/vessel is moving.</b></p>

1. If the problem is repeatable, take the vehicle for a drive with Detroit Diesel Diagnostic Link (DDDL) connected and note the conditions when the problem occurs. Be prepared to take snapshot data using DDDL. **Ensure you operate the vehicle after correcting the problem and duplicate the operating conditions before releasing the unit, in order to verify the problem is corrected.**
2. If the vehicle has been to other shops for the same problem, call the other shops and find out what has been done. Avoid replacing the same components again unless absolutely

sure they are the problem! It is unlikely a component will fail again following a recent replacement.

3. If other vehicle devices are affected, this indicates there may be something wrong with the ignition wiring.
4. Operate the engine under similar load and temperature conditions. Check the fuel system for restrictions, fuel filter, and fuel tanks for foreign objects blocking the fuel supply. Also, check the air system. Utilize the DDDL snapshot feature.
5. Operate the engine at this temperature while attempting to duplicate the problem. Use the DDDL snapshot feature.
6. It may not be possible to duplicate the fault or problem unless you can operate the unit in a similar environment. You may want to talk to the Customer Support Center, or a dealer in that area. They may have helpful experience.
7. If possible, troubleshoot the problem in a similar temperature range.
8. If the problem seems to occur during or after the engine is subjected to rain/spray washing, thoroughly inspect the connectors for moisture entry.
9. If the problem occurs at a specific vehicle speed, check the parameters affecting vehicle speed to verify they are programmed close to the vehicle speed where the problem occurs. Check vehicle speed and watch DDDL (snapshot) for changes to see if the pulse wheel (VSS signal) is loose.
10. If the problem occurs at a specific engine rpm, unplug the oil, coolant, and air temperature sensors, and note any changes to the problem. Gather this data and contact the DDC Customer Support Center at 313-592-5800.



## 17.2.2 Troubleshooting Tree

Following is the troubleshooting tree for low horsepower:

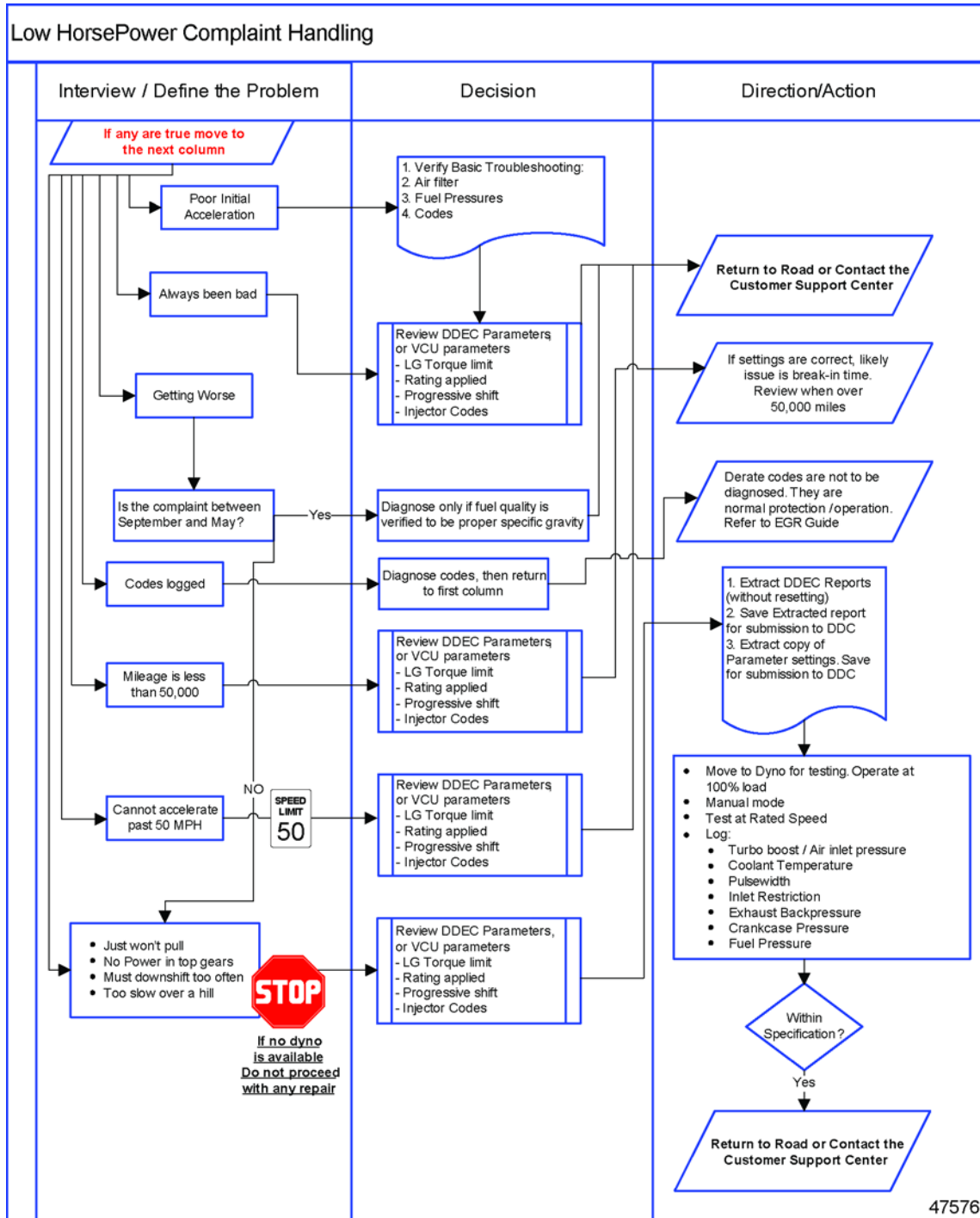


Figure 17-2 Troubleshooting Tree

### 17.2.3 Low Power Troubleshooting Chart

There are three basic checks that should be performed:

- Check for active/historic codes. Refer to MBE DDEC Application/Installation Manual (7SA825) Appendix A (fault codes). All causes need to be checked once the fault is identified. Record faults on the Application For Adjustment (AFA) claim, if there is to be a claim.
- Check the VCU/PLD parameters, progressive shift settings, and torque limiting values. Are they correct? Is proper rating applied? If vehicle is new, is it spec'd correctly?
- Check that the dyno-measured power is within DDC specifications as listed in Table 17-3 for minimum acceptable wheel HP data. Record data on AFA claim.

**NOTE:**

Service information letter instructions published following the date of this document take precedence.

Possible causes of low power and symptoms are listed in Table 17-2.

Possible Causes	Symptoms						
	Loss of Power	Misfires	Poor Acceleration	Erratic Idle	Engine Dies	Black Smoke	Excessive Oil Consumption
Fuel Filter Restriction refer to section 17.1	X	X	X	—	X	—	—
Air in the Fuel refer to section 17.3	X	X	X	X	—	—	—
Faulty Injector(s) refer to section 17.1	X	X	X	X	X	X	—
Faulty Turbocharger refer to section 17.1	X	—	X	—	—	X	—
EGR Valve refer to section 17.1	X	—	X	X	—	X	—
EPV or Air Supply Lines refer to section 17.1	X	—	X	X	—	X	—
Charge Air Cooler Leak refer to section 17.5	X	—	X	—	—	X	—
Intake or Exhaust Manifold Leak refer to section 17.5 and section 17.6	X	—	X	—	—	X	—
Quality/Grade of Fuel refer to section 17.1	X	X	X	X	—	X	—
Restricted Air Intake refer to section 17.1	X	—	X	—	—	X	—
Crankcase Overfilled refer to section 17.1	X	—	X	—	—	—	X
Faulty Fan Operation, Always On refer to section 17.1	X	—	X	—	—	—	—
Debris in Fuel Tank - Air Vent Plugged refer to section 17.1	X	X	X	X	X	—	—

**Table 17-2 Low Power Troubleshooting Chart**

## 17.3 AERATED FUEL

To determine if aerated fuel is causing lack of power, perform the following steps:

1. Disconnect the fuel line return hose from the fitting located at the fuel tank; refer to OEM guidelines.
2. Place the open end of the fuel line into a suitable container.

 **CAUTION:**

**To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

 **WARNING:**

**ENGINE EXHAUST**

**To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.**

3. Start and run the engine.
4. Operate the engine at 1000 rpm.
5. Visually check to see if air bubbles are rising to the surface of the fuel within the container.
  - [a] If air bubbles are not present, shut down engine, check for high fuel pressure; refer to section 17.4.
  - [b] If air bubbles are present, shut down engine; refer to section 17.3.1.

### 17.3.1 Aerated Fuel Resolution

Perform the following steps to resolve aerated fuel:

1. Tighten all fuel line connections between the fuel tank and fuel pump; refer to OEM guidelines.
2. Visually inspect all fuel lines between the fuel tank and fuel pump for leaks.
3. Repair damaged components as required; refer to OEM guidelines.
4. Verify aerated fuel resolution; refer to section 17.3.1.1.

#### 17.3.1.1 Test the Engine with Aerated Fuel Resolution

Perform the following steps to determine if aerated fuel resolution resolved lack of power condition:

1. Start and run the engine.
2. Run the engine at idle with a no-load for approximately 5 minutes, allowing the engine coolant to reach normal operating range.
3. Test drive the vehicle to ensure lack of power has been resolved.
  - [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
  - [b] If lack of power occurred during the test drive, shut down the engine and refer to section 17.4.

## 17.4 RESTRICTED AIR CLEANER ELEMENT

To determine if a restricted air cleaner element is causing lack of power, perform the following steps:

1. Remove the air filter element from the air cleaner container; refer to OEM guidelines.
2. Visually inspect the air cleaner element for damage or clogging.
  - [a] If no damage or clogging is found, check the charge air cooler; refer to section 17.5.
  - [b] If damage or clogging is found; refer to section 17.4.1.

### NOTE:

Replace the air filter, if close to a maintenance interval.

### 17.4.1 Air Filter Element Replacement

Perform the following steps to replace the air filter element:

1. Remove and replace the damaged or clogged air filter element; refer to OEM guidelines.
2. Verify air filter element replacement; refer to section 17.4.1.1.

#### 17.4.1.1 Test the Engine with Replaced Air Filter Element

Perform the following steps to determine if the new filter element resolved lack of power:

 **CAUTION:**

**To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

 **WARNING:**

**ENGINE EXHAUST**

**To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.**

1. Start and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
  - [a] If lack of power did not occur during the test drive, no further troubleshooting is required. Shut down the engine.
  - [b] If lack of power occurred during the test drive, shut down the engine. Check the charge air cooler; refer to section 17.5.

## 17.5 RESTRICTED OR CRACKED CHARGE AIR COOLER OR LEAKING INTAKE MANIFOLD

To determine if a restricted or cracked charge air cooler or leaking manifold is causing lack of power, perform the following steps:

1. Attach air-to-air charge air cooler test kit, (J-41473); refer to OEM guidelines.
2. Disconnect the air inlet hose from the outlet side of the turbocharger compressor housing; refer to appropriate service manual, air intake system chapter.
3. Attach the air-to-air cooler test kit adaptor plug to fit into the hose at the compressor connector; refer to OEM guidelines.
4. Attach an air pressure hose to the air chuck at the regulator and gradually pressurize the air inlet system to a pressure of 207 kPa (30 psi).
5. Apply a water and soap solution to each hose connection, across the face of the charge air cooler.
6. Apply a water and soap solution to the air intake manifold and cylinder head mating surface area.
7. Visually inspect all joints for air leaks and all charge air cooler welded surfaces for stress cracks.
  - [a] If charge air cooler leaks are present around the joints, replace the charge air cooler; refer to section 17.5.1.
  - [b] If the intake manifold leaks, repair intake manifold; refer to section 17.5.2.
  - [c] If neither charge air cooler nor intake manifold leaked, check the exhaust system; refer to section 17.6.
8. Inspect charge air cooler for leaks (hoses, clamps, etc.).

### 17.5.1 Charge Air Cooler Replacement

Perform the following steps to replace the charge air cooler:

1. Remove and replace the charge air cooler; refer to OEM guidelines.
2. If the intake manifold doesn't leak, verify replacement of the charge air cooler; refer to section 17.5.2.1.
3. If the intake manifold leaks, repair intake manifold; refer to section 17.5.2.

### 17.5.2 Air Intake Manifold Repair

Perform the following steps to repair the air intake manifold:

1. Remove the air intake manifold; refer to *MBE 4000 Service Manual (6SE412)*, Air system chapter 6.1.

2. Inspect the air intake manifold; refer to *MBE 4000 Service Manual (6SE412)*, Air system chapter 6.1.
3. Install the air intake manifold; refer to *MBE 4000 Service Manual (6SE412)*, Air system chapter 6.1.2.
4. Verify repair of the intake manifold; refer to section 17.5.2.1.

### 17.5.2.1 Test the Engine with Replaced Charge Air Cooler and Air Intake Manifold

To determine if the repairs resolved the lack of power condition, perform the following steps:

 **CAUTION:**

**To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

 **WARNING:**

**ENGINE EXHAUST**

**To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.**

1. Start and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
  - [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
  - [b] If lack of power occurred during the test drive, shut down the engine. Check the exhaust system; refer to section 17.6.



## 17.6 FAULTY EXHAUST SYSTEM

To determine if a faulty exhaust system is causing lack of power, perform the following steps:

1. Drill an 11/32 in. hole in the exhaust pipe, 127 - 305 mm (5 - 12 in.) from the turbocharger exhaust outlet.

### NOTE:

The tapped hole must be in a comparatively straight area of the turbocharger exhaust outlet.

2. Tap the hole to accommodate a 1/8 in. pipe plug. Connect a manometer to the tapped hole.

 **CAUTION:**

**To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.**

 **WARNING:**

**ENGINE EXHAUST**

**To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.**

3. Start and run the engine at idle with a no-load for approximately 5 minutes, allowing the engine coolant to reach normal operating range.
4. Install the vehicle on a chassis dynamometer and run the engine speed to full load.
  - [a] If the exhaust back pressure at full load is less than 10 kPa (4.0 in. H<sub>2</sub>O), check for high inlet air temperature; refer to section 17.7.
  - [b] If the exhaust back pressure at full load is 10 kPa (4.0 in. H<sub>2</sub>O) or greater, refer to section 17.6.1.

### 17.6.1 Engine Exhaust System Resolution

Perform the following steps to resolve the engine exhaust system:

1. Visually inspect the engine exhaust system; refer to OEM guidelines.
2. Repair or replace defective exhaust system components; refer to OEM guidelines.
3. Verify exhaust system resolution; refer to section 17.6.1.1.

### 17.6.1.1 Test the Engine with Replaced Exhaust System

Perform the following steps to determine if replaced engine exhaust system components resolved lack of power condition:

1. Start and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.
  - [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
  - [b] If lack of power occurred during the test drive, shut down the engine. Check for high inlet air temperature; refer to section 17.7.

## 17.7 HIGH INLET AIR TEMPERATURE

To determine if high inlet air temperature is causing lack of power, perform the following:

1. Test the radiator fan, fan drive, or fan shroud for proper operation or configuration; refer to OEM guidelines.

### NOTE:

The engine will be torque limited to protect the turbocharger and charge air cooler; this is normal engine operation for component protection.

2. Examine test results.
  - [a] If the radiator fan, fan drive, or fan shroud pass OEM test, check high altitude operation; refer to section .
  - [b] If the radiator fan, drive or shroud did not operate correctly; refer to section 17.7.1.



### 17.7.1 Radiator Fan, Drive and Shroud Replacement

Perform the following steps to replace the radiator fan, drive and or shroud:

1. Remove and replace the radiator fan, drive and/or shroud; refer to OEM guidelines.
2. Verify replacement; refer to section 17.7.1.1.

#### 17.7.1.1 Test the Engine with Radiator Fan, Fan Drive, or Fan Shroud Replacement

Perform the following steps to determine if replaced radiator fan, fan drive, or fan shroud resolved lack of power condition:

 <b>CAUTION:</b>
<p><b>To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.</b></p>
 <b>WARNING:</b> <b>ENGINE EXHAUST</b>
<p><b>To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.</b></p>

1. Start and run the engine.
2. Test drive the vehicle to ensure lack of power has been resolved.


- [a] If no lack of power occurred during the test drive, no further troubleshooting is required. Shut down the engine.
- [b] If lack of power occurred during the test drive, shut down the engine, contact the Detroit Diesel Customer Support Center (313-592-5800).


## 17.8 VERIFICATION OF POWER WITH CHASSIS DYNAMOMETER

The chassis dynamometer is a device for applying specific loads to a vehicle to determine if the vehicle will perform to published specifications and to permit a physical inspection for leaks of any kind. It is an excellent method for detecting improper tune-up, misfiring injectors, low compression, and other malfunctions.

### 17.8.1 Chassis Dynamometer Room Ventilation Recommendations

For safe and accurate dynamometer readings, the chassis dynamometer room must be properly ventilated.

 <b>CAUTION:</b>
<b>To avoid injury before starting and running the engine, ensure the vehicle is parked on a level surface, parking brake is set, and the wheels are blocked.</b>

 <b>WARNING:</b>
<b>ENGINE EXHAUST</b>
<b>To avoid injury from inhaling engine exhaust, always operate the engine in a well-ventilated area. Engine exhaust is toxic.</b>

If a vehicle is tested on a dynamometer located in an area without proper ventilation, the engine will be subject to high ambient air temperatures. High air inlet temperatures can result in false low power readings on the dynamometer.

To help ensure accurate horsepower readings, the dynamometer room should have a ceiling-mounted fan with a 850 to 1133 m<sup>3</sup> /min (30,000 to 40,000 ft<sup>3</sup> /min) capacity. This will provide proper ventilation of exhaust gases and heat radiated by the operating engine.

For direct engine cooling, Detroit Diesel recommends the use of a 368 m<sup>3</sup> /min (13,000 ft<sup>3</sup> /min) or greater capacity barrel-type ram air fan. This should be portable so that it can be conveniently placed three to five feet (approximately one to two meters) in front of the truck and aimed directly at the radiator/charge air cooler package.

### 17.8.2 Chassis Dynamometer Test and Run-in Procedure

The function of the dynamometer is to absorb and measure the engine output after it has been transmitted through the vehicle transmission and driveline to the drive tires.

The vehicle is connected to dynamometer through the roller absorption unit. The load on the vehicle may be varied from zero to maximum by decreasing or increasing the resistance in the unit. The amount of power absorbed in a water brake type dynamometer, as an example, is governed by the volume of fluid within the working system. The fluid offers resistance to a rotating motion. By controlling the volume of water in the absorption unit, the load may be increased or decreased as required.

The following are some tips to keep in mind in preparing the vehicle before the dynamometer run and during the actual testing:

- Follow all applicable safety procedures from the chassis dynamometer manufacturer.
- Observe the air intake duct and charge air fan shrouding to identify misalignments. Correct as necessary.
- Make sure the differential lock is “on” if equipped.
- Make sure the radiator/charge air cooler system fan(s) are locked on.
- If the vehicle is equipped with anti-lock brakes (ABS), disable the ABS controller by unplugging it or removing its power fuse/breaker.
- Instrument the engine for fuel pressure, air inlet restriction, exhaust backpressure, and crankcase pressure, and note these readings during the dynamometer run.
- Make sure the vehicle hood is down and locked into its normal position.
- Make sure the engine is fully warmed up before placing the vehicle on the dynamometer. Both oil and coolant temperature should be at least 82°C (180°F).
- When loading the vehicle on the dynamometer, make sure the vehicle is positioned onto the rollers as straight as possible.
- For direct engine cooling, Detroit Diesel recommends the use of a 368 m<sup>3</sup> /min (13,000 ft<sup>3</sup> /min) or greater capacity barrel-type ram air fan. This should be portable so that it can be conveniently placed three to five feet (approximately one to two meters) in front of the truck and aimed directly at the charge air cooler. This is especially important at high altitudes.
- During high ambient temperature conditions [+90°F, (+32°C)], it may also be necessary to use a water spray mist fan in front of the vehicle to prevent overheating.
- Running the dynamometer in “manual” mode instead of “automatic” mode allows for maximum control of the test process and may result in more consistent test results.
- During the horsepower test, make sure “percent engine load” is 100% and smoke limited is not active by monitoring them with a computer equipped with DDDL.
- Select a transmission gear with a 1:1 gear ratio during the horsepower test.
- Take horsepower reading at 1300 rpm and 1850 rpm. Stabilize at rated speed for at least one minute before taking a final horsepower reading. Compare the recorded horsepower to the appropriate minimum horsepower tables below for particular ratings.

- Note that the following charts are for vehicles with manual transmissions. Vehicles with automatic transmissions (i.e. equipped with torque converters) will have slightly lower minimum horsepower values than listed in Table 17-3.

<b>MBE 4000 (Model 460)</b>		
<b>Engine HP Rating (Peak Torque)</b>	<b>Minimum Acceptable Wheel HP @</b>	
	<b>1500 rpm</b>	<b>1750 rpm</b>
350 bhp @ 1900 RPM (1350 lb-ft @ 1100 RPM)	258	272
370 bhp @ 1900 RPM (1350 lb-ft @ 1100 RPM)	258	287
370 bhp @ 1900 (1450 lb-ft @ 1100 RPM)	276	287
410 bhp @ 1900 (1450 lb-ft @ 1100 RPM)	276	318
410 bhp @ 1900 (1550 lb-ft @ 1100 RPM)	295	318
435 bhp @ 1900 (1450 lb-ft @ 1100 RPM)	276	338
435 bhp @ 1900 (1550 lb-ft @ 1100 RPM)	295	338
450 bhp @ 1900 (1550 lb-ft @ 1100 RPM)	295	349

**Table 17-3 Minimum Acceptable Wheel HP Model 460**

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