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SUBJECT: Troubleshooting Techniques for Low Power Complaints with Cummins ISB/ISL Engine

MODELS AFFECTED: Allison H 40/50 EP System™

Introduction:

The purpose of this bulletin is to provide the Servicing Technician with additional information and troubleshooting techniques in diagnosing engine low power complaints in conjunction with Diagnostic Trouble Codes (DTCs) in the Main Code 17 & 65 category. Table 1 contains the Diagnostic Trouble Codes most often associated with a low power complaint in the H 40/50 EP System™.

Table 1. Diagnostic Trouble Codes Associated With Engine Performance

DTC	Description	Failure Record	PBSS Display	Lamp
17-22	Engine Speed Profile Mismatch	No	Yes	
65-12	Engine Controller Stop	Yes	No	Stop Engine Lamp
65-13	Engine Controller Warning	No	No	Check Engine Lamp
65-14	Engine Controller Malfunction Indicator Lamp	No	No	
65-15	Engine Controller Protect	Yes	No	Flash Stop Engine Light
65-16	Engine Protection System Shutdown	Yes	Yes	Stop System (Stop Engine Lamp) Disable Propulsion
65-17	Engine Controller Idle Shutdown	No	Yes	Flash Stop System
65-23	Engine Torque Verification	Yes	Yes	Stop System
65-24	Engine Torque Verification at Neutral	Yes	Yes	Check System
65-25	Engine Failed to Crank	No	No	
65-26	Engine Performance	Yes	Yes	

Diagnostic Trouble Code (DTC) Descriptions:

DTC 17-22 Engine Speed Profile Mismatch

Description: This DTC will be logged when a deviation (greater than 200 rpm) is detected between the Requested Engine Speed and Actual Engine Speed.

Service: Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

NOTE: The H 40/50 EP System™ over-speed faults (codes with a main code of 81) may be logged in conjunction with this code.

DTC 65-12 Engine Controller Stop

Description: This DTC is logged when the engine has or will shutdown. The engine sends an *Engine Controller Stop* message to the hybrid system indicating that it has detected a fault associated with the engine and will illuminate the stop engine lamp. Typically, the engine will shutdown to protect hardware from extreme conditions, i.e. engine overheat or low oil pressure.

Service: The Engine Control Module (ECM) will have stored a Fault Code associated with this condition. Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

NOTE: The H 40/50 EP System™ does not shutdown the engine or illuminate any dash lamps during this diagnostic condition.

DTC 65-13 Engine Controller Warning

Description: This DTC is logged when the engine sends an *Engine Controller Warning* message to the hybrid system indicating that it has detected a fault associated with the engine and will illuminate the check engine lamp.

Service: The engine ECM will have stored a Fault Code associated with this condition. Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

NOTE: The H 40/50 EP System™ does not shutdown the engine or illuminate any dash lamps during this diagnostic condition.

DTC 65-14 Engine Controller Malfunction Indicator Lamp

Description: This DTC is logged when the engine sends a message to the hybrid system indicating that it has detected a fault associated with the engine and will illuminate the Malfunction Indicator Lamp (MIL).

Service: Typically, the MIL is illuminated when a diagnostic condition exists associated with the emission control system of the engine. The engine ECM will have stored a Fault Code associated with this condition. Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

NOTE: The H 40/50 EP System™ does not shutdown the engine or illuminate any dash lamps during this diagnostic condition.

DTC 65-15 Engine Controller Protect

Description: This DTC is logged when the engine sends an *Engine Controller Protect* message to the hybrid system indicating that it has detected a fault associated with the engine that may warrant an engine shutdown condition.

Service: The engine ECM will have stored a Fault Code associated with this condition. Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

NOTE: The H 40/50 EP System™ does not shutdown the engine or illuminate any dash lamps during this diagnostic condition.

DTC 65-16 Engine Protection System Shutdown

Description: This DTC is logged when the engine has detected a condition that warrants an engine shutdown (i.e. engine overheat or low engine oil pressure).

Service: The engine ECM will have stored a Fault Code associated with this condition. Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

DTC 65-17 Engine Controller Idle Shutdown

Description: Engine controller idle shutdown is an adjustable engine parameter setting. The setting is customer programmable and designed to shutdown the engine while in neutral at idle after a specified period of time.

Service: Engine controller idle shutdown must be disabled with the H 40/50 EP System™ (see Customer Adjustable Engine Parameter Settings). The Customer Adjustable Engine Parameters can be verified using the Cummins INSITE tool.

DTC 65-23 Engine Torque Verification

Description: This DTC is logged when there is a large deviation (greater than 500 N·m) between reported and estimated engine torque while in Forward or Reverse. Either the engine is not producing enough torque or the engine is producing too much torque.

Service: There may not be an ECM code associated with this condition. Refer to the Engine Performance Troubleshooting Tree in the appropriate Cummins Service Manual.

DTC 65-24 Engine Torque Verification at Neutral

Description: This DTC is logged when there is a large deviation (greater than 500 N·m) between reported and estimated engine torque while in Neutral. This condition will inhibit Neutral to range shifts. Either the engine is not producing enough torque or the engine is producing too much torque.

Service: There may not be an ECM code associated with this condition. Refer to the Engine Performance Troubleshooting Tree in the appropriate Cummins Service Manual.

DTC 65-25 Engine Failed to Crank

Description: This DTC is logged if the engine is unable to increase its speed by 25 rpm above the engine cranking speed of 600 rpm (above 32°F transmission sump temperature) or 820 rpm (below 32°F transmission sump temperature), after 10 seconds of cranking. The maximum engine cranking duration is 30 seconds.

Service: Refer to the Engine Performance Troubleshooting Tree in the appropriate Cummins Service Manual. Refer to Allison SIL 2-EP-07 and Troubleshooting Manual TS3715EN.

DTC 65-26 Engine Performance

Description: This DTC code is logged when the engine is not producing the requested torque as measured by the H 40/50 EP System™. The H 40/50 EP System™ will respond by reducing system performance (output torque) in proportion to the engine performance reduction.

There are three conditions that will log this code:

Condition 1: Engine has a problem that is diagnosable (e.g. High engine temperature, low oil pressure) and cannot produce the requested engine torque. Since this condition is diagnosable, the engine still reports the actual engine torque to the hybrid system. In most cases, the ECM will have logged a Fault Code. Retrieve the engine Fault Code(s) and refer to the Fault Code troubleshooting tree(s) in the appropriate Cummins Troubleshooting and Repair manual.

Condition 2: The engine has a problem that is NOT diagnosable by the ECM (e.g. Low fuel pressure, sticking/damaged exhaust brake valve) and cannot produce the torque requested by the hybrid system. The ECM may not log a Fault Code under these conditions. Refer to the Engine Performance Troubleshooting Tree in the appropriate Cummins Service Manual.

Condition 3: Engine has a problem that is NOT diagnosable (e.g. damaged injectors) and cannot produce the engine torque requested by the hybrid system. This condition is NOT diagnosable and the engine reports the incorrect engine torque to the hybrid system. There will not be an ECM code associated with this condition. Refer to the Engine Performance Troubleshooting Tree in the appropriate Cummins Service Manual.

Condition 3 Note: This DTC is different from 65-23: Engine Torque Verification diagnostic. The Engine Torque Verification fault logic is insensitive to minor and medium engine torque reduction problems and only detects when there is a major torque reduction/increase from the engine (greater than 500 N·m).

Allison DOC® for PC–Service Tool (H 40/50 EP™) Troubleshooting Techniques:

Allison DOC® for PC–Service Tool (H 40/50 EP™) can be used to view Requested Engine and Actual Engine Output Torque and Speed. Using the Strip Chart function, the parameters can be plotted and reviewed to assist in diagnosing vehicle low power complaints.

Recording a Snapshot with Allison DOC®:

Connect the laptop and necessary communication hardware to the vehicle diagnostic port.

1. Launch Allison DOC® for PC–Service Tool (H 40/50 EP™) by double clicking the icon on the desktop.
2. Connect to the vehicle and press F6 (*Fire Trigger*) to begin recording.
3. Operate the vehicle while in range until the code becomes active or the low power condition is experienced.
4. Press F7 (*Stop Recording*) and save the Snapshot for replay and analysis.

Playback of a Snapshot with Allison DOC®:

1. Launch Allison DOC® for PC–Service Tool (H 40/50 EP™) by double clicking the icon on the desktop.

2. Select the *Snapshot* / *Playback* / *Open Playback File* feature on the top toolbar and open the Snapshot previously saved.
3. Select the Diagnostic button or press F3 and select Strip Chart. The Strip Chart Configuration screen will appear.
4. Scroll to the Engine Information category, and highlight the parameters desired (i.e. Requested Engine Torque, Actual Engine Torque). Select the *Add* button to add the desired parameters to the graph.
5. Once parameter selection is complete, select the OK button to plot the Strip Chart.
6. Monitor Actual Engine performance vs. Requested Engine performance. Under normal circumstances the Actual Engine Torque will meet the Requested Engine Torque with some initial lag due to turbo spool up. Figure 1 provides a representation for a typical Requested Engine Torque vs. Actual Engine Torque acceleration scenario.
7. When Actual Engine Torque does not meet the Requested Engine Torque, vehicle performance will be degraded and H 40/50 EP™ output torque will be reduced. Figure 2 provides a representation for a typical Requested Engine Torque vs. Actual Engine Torque acceleration scenario where the engine is not capable of providing the requested torque.

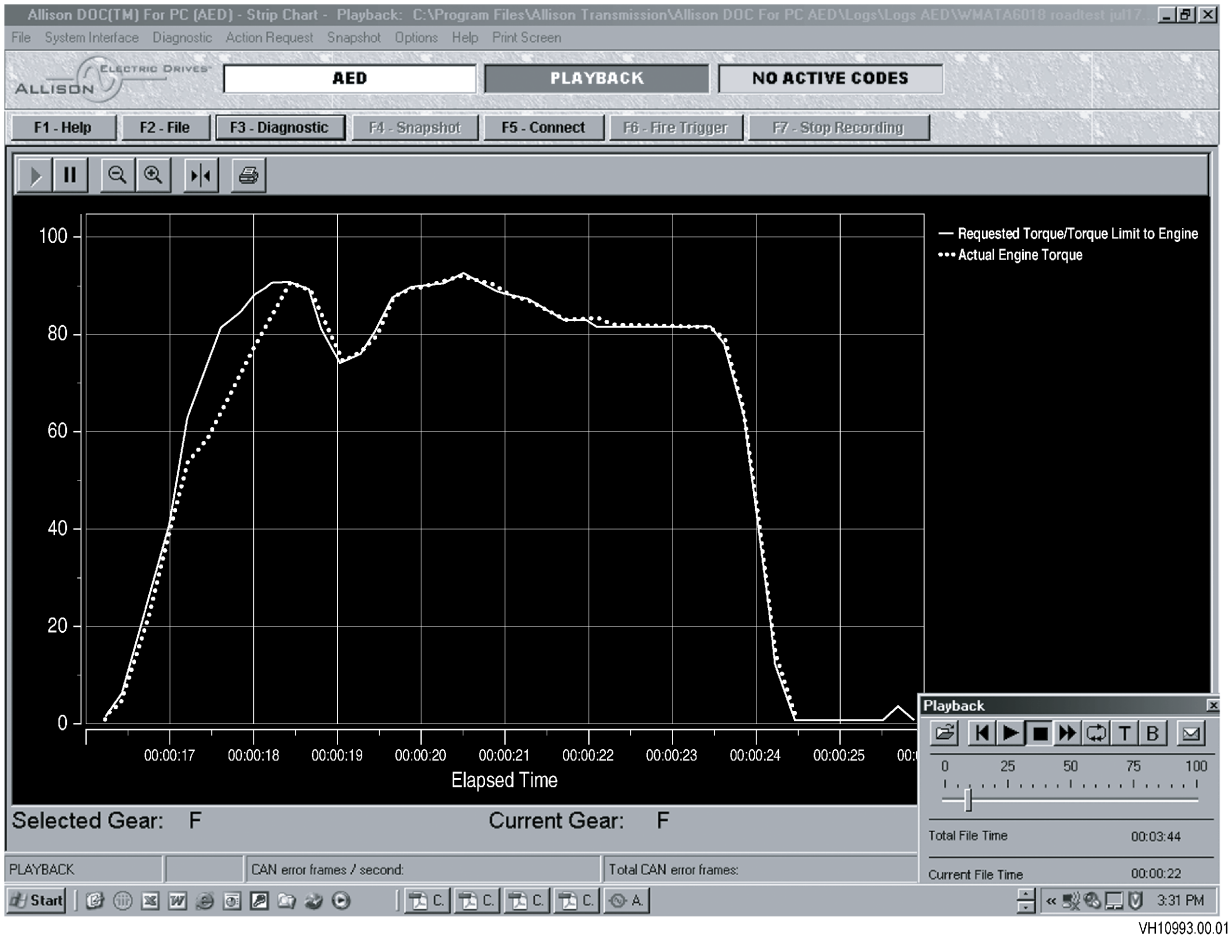

Figure 1. Allison DOC® Strip Chart of Engine Meeting Hybrid Torque Request

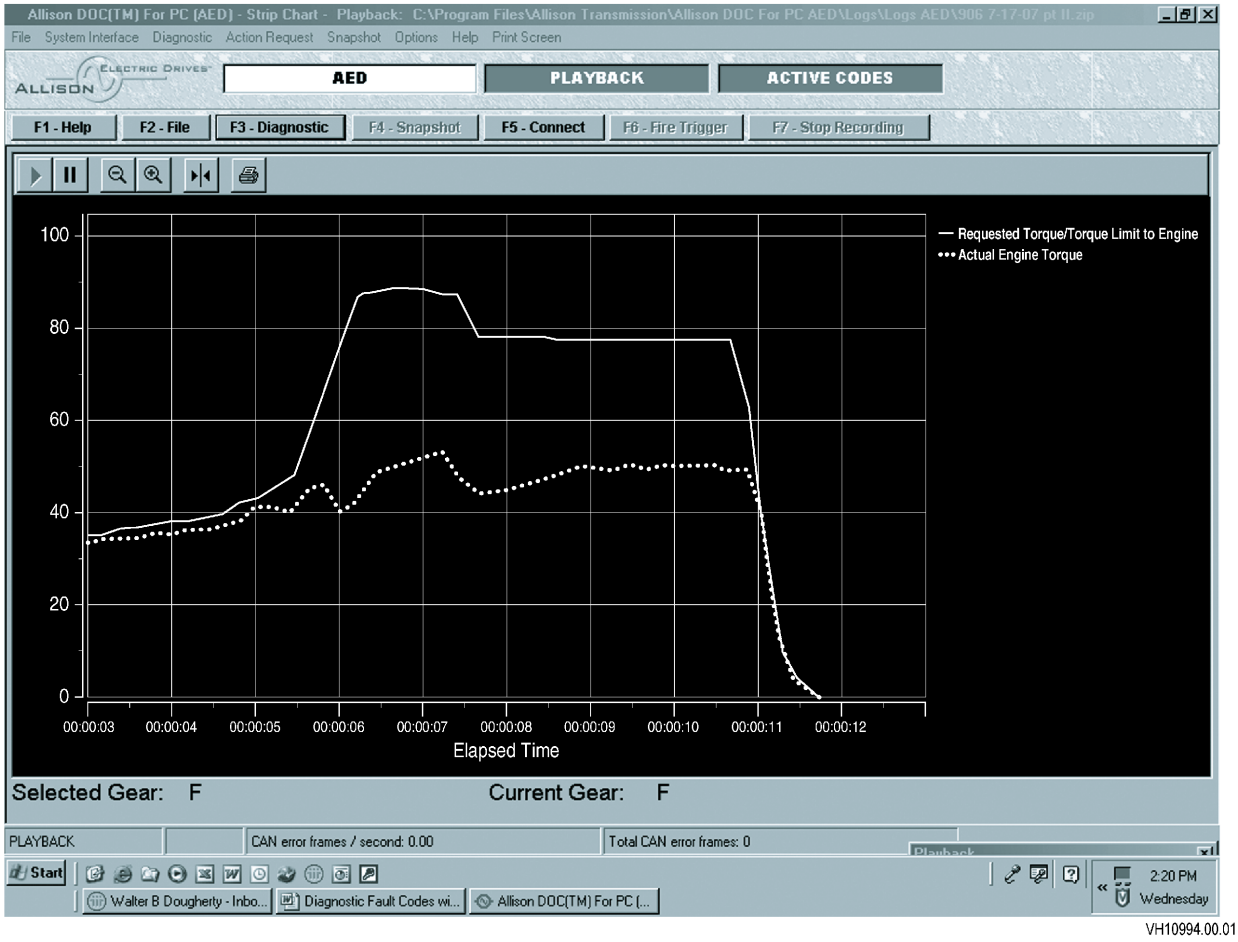

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Figure 2. Allison DOC® Strip Chart of Engine Not Meeting Hybrid Torque Request

Customer Adjustable Engine Parameter Settings:

There are many customer adjustable parameters within the electronic control unit of heavy-duty engines. Several of these impact the operation of the H 40/50 EP System™. They must be set appropriately for optimal performance of the entire vehicle propulsion system. Engine settings for these customer adjustable parameters that affect the H 40/50 EP System™ operation are provided below by engine model year. These lists do not contain all the customer adjustable parameters for the given engine but only those that impact the operation of the H 40/50 EP System™. The remaining parameters are to be assigned by the vehicle OEM or the end-user customer.

CAUTION: For H 50 EP System™ installations, the Customer Adjustable Engine Parameters and Values must be set exactly as shown in the table below. If the engine parameters and values are not set as shown, system performance may be affected or system damage could occur. Do NOT modify the listed parameters and values for use with other vehicle systems.

Table 2. Cummins ISB and ISL (2013)

Accelerator Interlock	Disable
Adjustable Low Idle Speed	
Low Idle Speed	700 or 750 rpm (must be same as CSS selection)
Low Idle Speed Adjustment Switch	Disable
Aftertreatment	
Aftertreatment Diesel Particulate Filter	
Diesel Particulate Filter Regeneration Permit Switch	Enabled (for vehicles with HUSH™ mode; otherwise, no preference)
Alternator Failure Warning	
Alternator Speedup	Disable
Clutch Pedal Position Switch	Not Installed
Cruise Control	Disable
Cruise Control and Engine Brake Interaction	Disable
Engine Brake Control	
Delay Time	0.0 Seconds
Engine Brake Type	Exhaust Brake OR Variable Geometry Turbo
Minimum Vehicle Speed	0.0 mph
Clutch Pedal Activation	Disable
Service Brake Activation	Disable
Fan Control	
Fan on With Engine Brake	Disable
Fast Idle Warm-up	Disable
Gear Down Protection	Disable
Governor Type	
Governor Type	Automotive
Governor Type Switch	Disable
Idle Shutdown	Disable (refer to 6.6)
J1939 Controls	
J1939 Stop Broadcast Allowed	Disable
Powertrain Protection	Disable
PTO	Disable
Road Speed Governor	
Maximum Accelerator Vehicle Speed	Set to 130 mph or maximum allowed
Maximum Vehicle Speed	Set to 130 mph or maximum allowed
Switched Maximum Vehicle Speed	Disable
SAE J1939 Multiplexing	

Table 2. Cummins ISB and ISL (2013) *(cont'd)*

Accelerator Pedal or Lever Position	Enable
Source Address	3 - Transmission #1
Aftertreatment Regeneration Permit Switch	Disable (Enable only for vehicles with HUSH™ Mode)
Source Address	3 – Transmission #1 * (only for vehicles with HUSH™ Mode)
Auxiliary Shutdown Switch	Enable (only for vehicles with HUSH™ Mode)
Source Address	3 - Transmission #1
Fan Control Switch	Enable for vehicles that are configured to "Use engine cooling fan for auxiliary braking" and/or have the transmission cooler stacked with the engine cooler (Vehicle Fan Configurations 1 & 2 on the CSS form)
Source Address	3 - Transmission #1
Idle Validation Switch	Enable
Source Address	3 - Transmission #1
Switched Maximum Engine Operating Speed	Disable
Transmission Setup	
Top Gear Transmission Ratio	0.5
Transmission Type	Automatic
Vehicle Acceleration Management (VAM)	Disable (ISB only; VAM does not apply to ISL)
Vehicle Speed Source	
Number of Transmission Tailshaft Gear Teeth	16
Vehicle Speed Sensor Type	Magnetic (only if wired on the vehicle. If not, set to "Data Link - Tailshaft", which is Cummins' preferred setting)
Two Speed Rear Axle	Disable

* Trap regeneration controller will listen to only one source address. The transmission is an acceptable source address. If the vehicle controller is the source address, then the vehicle controller must listen to the transmission controller CAN message and respond accordingly.

Table 3. Cummins ISB and ISL (2010)

Accelerator Interlock	Disable
Accelerator Options	
Remote Accelerator Pedal or Lever	Enable (only if a throttle is used with the rear start option)
Adjustable Low Idle Speed	
Low Idle Speed	700 rpm
Low Idle Speed Adjustment Switch	Disable
Aftertreatment	
Diesel Particulate Filter Regeneration Permit Switch	Enable (for vehicles with HUSH™ mode; otherwise, no preference)
Alternator Failure Warning	
Idle Speedup	Disable

Table 3. Cummins ISB and ISL (2010) *(cont'd)*

Clutch Pedal Position Switch	Not Installed
Cruise Control	Disable
Cruise Control and Engine Brake Interaction	Disable
Engine Brake Control	Enable
Delay Time	0 sec
Engine Brake Type	Exhaust Brake (if Exhaust Brake can not be selected, use Undefined)
Minimum Vehicle Speed	0 mph
Clutch Pedal Activation	Disable
Service Brake Activation	Disable
Fan Control	
Fan on with engine braking	Disable
Fast Idle Warm-up	Disable
Gear Down Protection	Disable
Governor Type	
Governor Type	Automotive
Governor Type Switch	Disable
Idle Shutdown	Disable (refer to 2.9.6)
J1939 Controls	
J1939 Stop Broadcast Allowed	Disable
Powertrain Protection	Disable
PTO	Disable
Road Speed Governor	Disable (If locked Enabled, set Maximum Vehicle Speed to 130 mph or maximum allowed)
SAE J1939 Multiplexing	
Accelerator Pedal or Lever Position	Enable
Source Address	3 – Transmission #1
Aftertreatment Regeneration Permit Switch	Disable (Enable only for vehicles with HUSH™ Mode)
Source Address	3 – Transmission #1 * (only for vehicles with HUSH™ Mode)
Auxiliary Shutdown Switch	Disable (Enable only for vehicles with HUSH™ Mode)
Source Address	3 – Transmission #1 (only for vehicles with HUSH™ Mode)
Fan Control Switch	Enable (only for vehicles that enable "Use engine cooling fan for auxiliary braking" in the H 40/50 EP System™ cal, otherwise Disable)
Source Address	3 – Transmission #1
Idle Validation Switch	Enable
Source Address	3 – Transmission #1

Table 3. Cummins ISB and ISL (2010) *(cont'd)*

Switched Maximum Engine Operating Speed	Disable
Transmission Setup	
Top Gear Transmission Ratio	0.5
Transmission Type	Automatic
Vehicle Acceleration Management	Disable (ISB only; VAM does not apply to ISL)
Vehicle Speed Sensor Anti-Tampering	Disable (if locked Enabled, set Tampering Sensitivity Level to Low)
Vehicle Speed Source	
Number of Transmission Tailshaft Gear Teeth	16
Vehicle Speed Sensor Type	Magnetic (only if wired on the vehicle. If not, set to DATALINK TAILSHAFT SPEED, which is Cummins' preferred setting)
Two Speed Rear Axle	Disable

* Trap regeneration controller will listen to only one source address. The transmission is an acceptable source address. If the vehicle controller is the source address, then the vehicle controller must listen to the transmission controller H 40/50 EP System™ message and respond accordingly.

Table 4. Cummins ISB CM2150 and ISL CM2150 (2007)

Accelerator Interlock	Disable
Accelerator Options	
Remote Accelerator Pedal or Lever	Enable (only if there is a throttle used with a rear start option)
Adjustable Low Idle Speed	
Low Idle Speed	600 rpm
Low Idle Adjustment Switch	Disable
After Treatment	
Diesel Particulate Filter Regeneration Permit Switch	Enable (for vehicles with HUSH™ mode; otherwise, no preference)
Alternator Failure Warning	
Idle Speedup	Disable
Clutch Pedal Position Switch	Not Installed
Cruise Control	Disable
Cruise Control and Engine Brake Interaction	Disable
Engine Brake Control	Enable
Delay Time	0 sec
Engine Brake Type	Exhaust Brake
Minimum Vehicle Speed	0 mph
Clutch Peal Activation	Disable
Service Brake Activation	Disable
Fan Control	

Table 4. Cummins ISB CM2150 and ISL CM2150 (2007) *(cont'd)*

Fan on with engine braking	Disable
Fast Idle Warm-up	Disable
Gear Down Protection	Disable
Governor Type	
Governor Type	Automotive
Governor Type Switch	Disable
Idle Shutdown	Disable (refer to 2.9.6)
J1939 Controls	
J1939 Stop Broadcast Allowed	Disable
Powertrain Protection	Disable
PTO/Remote PTO	Disable
Road Speed Governor	Disable (if locked Enabled, set Maximum Vehicle Speed to 130 or Max. Allowed)
SAE J1939 Multiplexing	Enable
Accelerator Pedal or Lever Position	Enable
Source Address	3-Transmission #1
After Treatment Regeneration Permit Switch	Disable (Enable only for vehicles with HUSH™ Mode)
Source Address	3 – Transmission #1 * (only for vehicles with HUSH™ Mode)
Auxiliary Shutdown Switch	Disable (Enable only for vehicles with HUSH™ Mode)
Source Address	3 – Transmission #1 (only for vehicles with HUSH™ Mode)
Transmission Setup	
Transmission Type	Automatic
Vehicle Acceleration Management	Disable
Vehicle Speed Sensor Anti-Tampering	Disable (if Locked Enabled, set tampering sensitivity to low)
Vehicle Speed Source	
Number of Transmission Tailshaft Gear Teeth	16
Vehicle Speed Sensor Type	Magnetic (only if wired on the vehicle; if not, set to DATALINK TAILSHAFT SPEED which is the Cummins' preferred setting regardless)
Two Speed Axle	Disable

* Trap regeneration controller will listen to only one source address. The transmission is an acceptable source address. If the vehicle controller is the source address, then the vehicle controller must listen to the transmission controller CAN message and respond accordingly.

Table 5. Cummins ISB CM850 and ISL CM850 (pre 2007)

Accelerator Interlock	Disable
Adjustable Low Idle Speed	
Low Idle Speed	600 rpm

Table 5. Cummins ISB CM850 and ISL CM850 (pre 2007) *(cont'd)*

Low Idle Adjustment Switch	Disable
Battery Voltage Monitor	
Idle Speedup	Disable
Cruise Control	Disable
Engine Brake Control	Enable
Cruise Control Activation	Disable
Engine Brake Delay Time	0 sec
Engine Brake Minimum Vehicle Speed	0 mph
Engine Brake Type	Exhaust Brake
Service Brake Activation	Disable
Fast Idle Warm-up	Disable
Gear Down Protection	Disable
Governor Type (was Accelerator Type)	
Accelerator Type	Automotive
Governor Type Switch	Disable
Idle Shutdown	Disable
J1939 Controls (was Generic Tool Permissions)	
J1939 Stop Broadcast Allowed	Disable
Powertrain Protection	Disable
PTO/Remote PTO	Disable
Remote Accelerator	Enable (only if there is a remote throttle used with the rear start option)
Remote Governor	Disable (if locked Enabled, set Maximum Vehicle Speed to 130)
SAE J1939 Multiplexing	Enable (if controller supports J1939 multiplexing)
Accelerator Pedal Position	
Idle Validation Switch Source Address	3-Transmission #1
Transmission Setup	
Clutch Pedal Position Switch	Not Installed
Transmission Type	Automatic
Vehicle Acceleration Management	Disable
Vehicle Speed Source	
Two Speed Rear Axle	Disable
Vehicle Speed Sensor Type	Magnetic (only if wired on the vehicle; if not, set to DATALINK TAILSHAFT SPEED which is the Cummins' preferred setting regardless)
Number of Transmission Tailshaft Gear Teeth	16