



Fueling Control States Combustion Control Path Owners

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Fueling/Control States

- **The following slides contain descriptions of the various Fueling Control States / Combustion Control Path Owners used primarily on Cummins Heavy Duty Automotive Engines built starting in January 2004.**
- **Prior to 2007 engines (Core 1 software) these were referred to as Fueling Control States**
- **For 2007 and later engines (Core 2 software) these are referred to as Combustion Control Path Owners**
- **The current value indicates the current winning governor or controlling limit.**



Fueling/Control States

- **Can be used to troubleshoot performance complaints**
 - May show derates and “unusual” behavior
 - Calterm Names
 - FSFNFLST (pre-EGR – Core 1)
 - FUELING_CONTROL_STATE (EGR – Core 1)
 - COMBUSTION_CONTROL_PATH_OWNER (2007 AND LATER – Core 2)
- **Most values exist in all generations of engines but some only apply to a certain generation**
- **Differences between engine generations are highlighted on the slides**
- **Some of these do not have detailed information but for the most part those will not be seen on Heavy Duty engines**



Fueling/Control States

■ States

- 1 - JCOMM Torque State
 - Engine Torque has been limited or altered by an external device (typically a transmission)
 - Typically see this condition with an automated manual (Autoshift, SureShift, Ultrashift, Ultrashift Plus) or a fully automatic transmission at shift points
- 2 - JCOMM Speed State
 - Engine Speed has been limited or altered by an external device (typically transmission)
 - Typically see this condition with an automated manual (Autoshift, SureShift, Ultrashift, Ultrashift Plus) or a fully automatic transmission at shift points
- 3 - Progressive Shift Speed (Not used since 2004)
- 4 - PTO state (PTO Governor is controlling the engine)
- 5 - User Command State (Not used since 2004)
 - Indicated that fueling was being overridden



User Fueling States

■ States

- 6 - Limp Home Torque
 - Accelerator Pedal problems have forced control system into Limp Home state
 - Torque is limited but enough torque should be available to “limp” the vehicle to a repair shop or off the roadway
- 7 - ASG Governor State
 - Variable Speed Governor must be selected
 - Typically seen during part load/part throttle condition leading up to max throttle conditions
- 8 - 4-D (Automotive) Governor State
 - Typically seen during part load/part throttle condition leading up to max throttle conditions
 - Note: On some products at full load, fueling state will fluctuate between 8 and 19 (Maximum throttle)
- 9 - Cruise Control State
 - Cruise control is active and cruise control is the winning governor
 - Other governors can be the winner even though Cruise is active



User Fueling States

■ States

- 10 - Road Speed Governor State
 - Road Speed is being limited by Max Road Speed Trim or one of several road speed limiters (i.e. Gear Down Protection, Driver Reward)
 - A max vehicle speed must be set as a parameter in INSITE
- 11 - Low Speed Governor State
 - This is the normal state at idle condition, may be seen while motoring
- 12 - High Speed Governor State
 - This is the normal state at high speed conditions (typically fueling is being reduced when on HSG)
 - Engine will typically go on HSG state approximately 100-200 rpm below rated speed
 - Prematurely hitting HSG state can be an indication of other issues (acceleration noise control, etc)



User Fueling States

■ States

- 13 – Torque Derate Override (Not used since 2004)
- 14 – Low Gear State (Not used since 2004)
- 15 – Altitude Derate (2004) Turbo Overspeed (2007 and later)
 - Fueling is limited to a set value less than maximum fueling
 - Can be caused by high altitude operation



User Fueling States

■ States

- 16 - AFC (Air / Fuel Command) Derate (2004)
 - OFC (Oxygen Fuel Control) Derate (2007 and later)
 - Fuel limited for amount of intake air
 - Not enough boost for commanded fueling
 - Too much boost for commanded fueling
 - Inoperable wastegates
 - Typically seen very briefly on an acceleration (Pre 2007 Only)
 - Extended periods of time in AFC derate are an indication of other issues (ex: recent issues on midrange injectors) (Pre 2007 Only)
 - For 2010 and later a few seconds of OFC is normal during hard accelerations
- 17 – Acceleration Noise Control
 - Fueling/Torque is being limited in order to reduce drive by noise
- 18 – Engine Protection Speed Derate
 - Engine Protection System is asking for speed derate due to a malfunction



User Fueling States

■ States

- 19 - Maximum Throttle (2004) / Torque Curve (2007 and later) State
 - Normal state for maximum throttle/max load condition (on torque curve)
- 20 – JCOMM Torque Derate
 - Data Link device (i.e Automated Manual Transmission, ABS, Traction Control) has asked for a torque derate
- 21 – Out of Gear Torque Limit
 - Vehicle speed is above RSG limit and driver is attempting to shift gears
 - Provides just enough torque (200 ft lb) to allow engine speed to change in order to complete gear change
 - Road Speed Governor will also be disabled for a short period of time
 - Typically seen while going down a grade



User Fueling States

■ States

- 22 - Cranking State
 - Normal State during cranking of the engine
 - Some engines have a 'jump start' portion of the cranking state
 - If the engine doesn't start after so many seconds of cranking, commanded fueling is increased to assist in starting
- 23 – Fuel Override
 - Used by Natural Gas Engines to override fueling
- 24 - Braking State
 - Normal state during active braking (retarder) condition (0 commanded fueling)
- 25 – Engine Overspeed
 - Control system has detected that engine speed is above the overspeed limit
 - Typically 2450 RPM on an ISX
- 26 - Stop State
 - Normal state once engine has shutdown (0 rpm)



User Fueling States

■ States

- 27 - Shutdown State
 - Engine has been shutoff but still reading RPM
 - Should switch to 26 when engine speed reads 0 RPM
- 28 - FSS Specific Derate
 - Fuel System Specific controlled derate – Fuel System software has detected a fuel system specific malfunction
- 29 – EPD Torque Limit
 - Torque Derate due to an active engine protection fault (low oil pressure, etc.)
- 30 – ASG Application State (Not used since 2004)
- 31 – Alternate Torque State (Not used since 2004)
- 32 – MS Override State (Not used since 2004)



User Fueling States

■ States

- 33 – Engine Start Oil Limit
 - Prevents revving of engine until oil pressure has built up
- 34 – PTO Torque Limit
 - PTO Governor is limiting engine torque based on PTO Torque Limit set in INSITE
 - PTO will ramp engine speed down at a rate of 250 RPM/sec by controlling torque
- 35 – Torque Control State (Not used since 2004)
- 36 - Powertrain Protection Derate
 - Powertrain protection is active and causing a derate
 - This can be normal for some applications with Allison automatic transmissions (requested by Allison)
 - Inadvertently turning on powertrain protection and/or incorrect PTP settings can cause problem



User Fueling States

■ States

- 37, 38, 39 - Top 2 Transmission Shift States (2004 only)
 - These states will be seen during a Top 2 up or downshift
 - Cummins does not support Top 2 transmissions in 2007 and later products
- 40 – No Derate State (Not used since 2004)
- 41 – Anti Theft
 - Anti Theft algorithm is active
- 42 – Partial Throttle State (Not used since 2004)



User Fueling States

■ States

- 43 – SS Ambient Derate State (Not used since 2004)
- 44 – Transient Coolant Derate State (Not used since 2004)
- 45 – Vehicle Acceleration Management
 - Not typically used in North America HD applications
 - Vehicle acceleration is being limited
 - Commonly used to decrease noise or fuel consumption



User Fueling States

■ States

- 46 – Air Density Limit
 - Derate to protect the turbocharger from excessive temperatures and turbocharger speed, typically due to high altitudes
 - Now tracked via Fault Code 1963 when > 10% Fueling derate (Pre 2010)
 - In 2010 and later products FC 2346 (No Lamp) will indicate if this happens for long durations
- 47 – Chi Fuel Limit (2007 and later could also indicate a torque limit)
 - Max allowed fuel for the CHI state you are in
 - CHI state is determined based on air density and operating mode
- 48 – Turbo Fueling Control (TFC) Derate
 - Fueling and torque is limited due to turbo overspeed
 - Turbo speed must be above the limit for 1 second
 - Derate will be active for 10 seconds following turbo speed falling below limit



User Fueling States

■ States

- 49 – Gross Fuel Override
- 50 – CHM Torque Limit
- 51 – JCOMM PTP Derate
 - J1939 device has asked for powertrain protection
- 52 – Auxliary NDot (2004) Limp Home Speed Limit (2007 and later)
 - Limp Home occurs when accelerator pedal has failed
- End of 2004 states
- States 53 to 78 are new for 2007



User Fueling States

■ States

- 53 – Dyno Operations
 - Vehicle is being tested on a Dyno
- 54 – VSS Diagnostics
 - Vehicle Speed Signal Lost or Tamper faults are active
- 55 – ESCC
 - Engine Speed Cruise Control (Industrial applications only)
- 56 – WPD (Cold Idle Adjust)
 - If engine coolant temp is below one of two thresholds engine speed is raised to one of two calibrated settings.



User Fueling States

■ States

- 57 – TSD
 - Turbo Speed Derate

- 58 – EWP (Engine Warmup Protection)
 - Disables accelerator pedal torque request in order to give time for oil pressure to build up and thus prevent damage to the engine.
 - Time limit is based on coolant temp, colder the coolant the longer the delay

- 59 – JCOMM Speed Limit
 - J1939 device has requested an engine speed limit

- 60 – Auxiliary Ndot
 - An auxiliary device is providing governor control
 - Typically seen on firetrucks



User Fueling States

■ States

- 61 – Fast Idle Warmup (Midrange Only)
 - Engine speed has been raised to quickly warm up the engine
- 62 – Fast Idle Warmup Ramp (Midrange Only)
 - Fast Idle Warmup is ramping up engine speed
- 63 – Alternator Failure Warning
 - This feature has detected low battery voltage and has increased engine speed in order to increase alternator output
- 64 – Not Used
- 65 – Hot Idle Adjustment (New for 2010 and later)
 - Raises idle speed if the engine is hot in order to cool the engine



User Fueling States

■ States

- 66 – Regen
 - DPF Regen in progress
 - 2007 engines idle speed is increased to 1100 RPM
 - 2010 and 2013 engines idle speed is increased to 900 RPM
- 67 – RTD (PowerGen Only)
- 68 – IRD (PowerGen Only)
- 69 – Load Based Speed Control
 - Feature is limiting engine speed in order to decrease drive by noise
 - Feature is also used to increase fuel economy
 - Effectively lowers the HSG limit



User Fueling States

■ States

- 70 – XSC – Auxiliary Speed Control (Industrial Applications Only)
- 71 – XPC – Auxiliary Pressure Control (Industrial Applications Only)
- 72 – CACLK (New for 2013)
- 73 – Torque Rate Limiting
 - Torque is limited to allow slack in driveline to be taken up
- 74 – On Board Diagnostics
- 75 – JCOMM MEO (Momentary Engine speed Override)
 - J1939 transmission is overriding engine speed



User Fueling States

■ States

- 76 – Fueling Surge Limit
- 77 – Customer Power Limiter
 - PowerGen Only
- 78 – ESM Xwire
 - Chrysler products only



User Fueling States

■ States

- States 79 – 512 are new for 2010 and later
- 79 – JCOMM Max LSI
 - Automated Manual Transmission is in gear during a mobile regen
 - LSI will be upper bounded based on a calibration setting
 - Should only be seen on a 2010 engine, if seen on 2013 engine then a calibration is set incorrectly
- 80 – Hybrid Power
 - Used for Hybrid vehicles only
- 81 – Light Duty Interface
 - Light Duty Applications Only
- 82 – AC LSI
 - Air Conditioning is affecting Low Speed Governor



User Fueling States

■ States

- 83 – ACI Torque Limit
 - Accelerator Interlock is limiting torque (busses only)
- 84 – RS
 - Unknown what this is!
- 85 – Hybrid Speed
 - Used only on Hybrid vehicles
- 86 – Not Used
- 87 – JCOMM LSI
 - J1939 device is controlling Low Speed Governor



User Fueling States

■ States

- 88 – JCOMM Headway Torque Limit
 - Adaptive Cruise Control Torque device is limiting torque in order to reduce vehicle speed
- 89 – Cold Ambient Limit
 - Engine speed is limited due to cold ambient temperatures
- 90 – JCOMM PTO
 - A J1939 PTO device is in control
- 91 – Inducement
 - Engine torque, engine speed, and / or vehicle speed are being limited due to extremely low DEF level or a malfunction with the emissions system



User Fueling States

■ States

- 92 – DTC
 - J1939 device is controlling engine due to a Diagnostic Trouble Code
- 93 – MCA Auxiliary Shutoff
 - Machine Control Agent Auxiliary device has commanded shutdown
- 94 – Not Used
- 95 – Mobile PTO (Used on Chrysler vehicles)
- 96 – SWD
 - System Watchdog (low level software) is in control
- 97 – Not Used



User Fueling States

■ States

- States 98 - 107 are new for 2013
- 98 – Hybrid LSI – Hybrid vehicle only
- 99 – Hybrid HSI – Hybrid vehicle only
- 100 – Hybrid Power Manager – Hybrid vehicle only
- 101 – Accelerator Based Torque Min Torque
- 102 – Antitheft Lockout
 - Antitheft feature has control of the control system



User Fueling States

■ States

- 103 – MCAHB Min Torque – Hybrid only
- 104 – Frequency Throttle - PowerGen Only
- 105 – User Selected Fuel Economy – Not used in North America
- 106 – Transmission Parameter Idle Adjust
 - Gear Ratio based idle speed (Not used in North America)
- 107 – Interactive Vehicle Control Module – Hybrid Only



User Fueling States

■ States

- 202 – IDD (2007 and later)
 - Idle Ramp Down – Industrial Only
- 256 – FSS Torque Derate
 - Fuel system has asked for a torque derate due to a malfunction
- 514 – EPD Fuel Temp (2007 Only)
- Questions? Contact Russ Poling Sr in HDD Controls