

## Calculated Load and Absolute Load Calculations / Definition

There are two types of LOAD specified in SAE J1979

One is CALCULATED LOAD VALUE and the other is ABSOLUTE LOAD VALUE.

### Calculated LOAD Value (PID 04)

The OBD regulations previously defined CLV as:

$(\text{current airflow} / \text{peak airflow @sea level}) * (\text{BARO @ sea level} / \text{BARO}) * 100\%$

Various manufacturers have implemented this calculation in a variety of ways. The following definition, although a little more restrictive, will standardise and improve the accuracy the calculation.

$\text{LOAD\_PCT} = [\text{current airflow}] / [(\text{peak airflow at WOT@STP as a function of rpm}) * (\text{BARO}/29.92) * \text{SQRT}(298/(\text{AAT}+273))]$

Where:

- STP = Standard Temperature and Pressure = 25 °C, 29.92 in Hg BARO, SQRT = square root,
- WOT = wide open throttle, AAT = Ambient Air Temperature and is in °C

Characteristics of LOAD\_PCT are:

- Reaches 1.0 at WOT at any altitude, temperature or rpm for both naturally aspirated and boosted engines.
- Indicates percent of peak available torque.
- Linearly correlated with engine vacuum
- Often used to schedule power enrichment.
- Compression ignition engines (diesels) shall support this PID using fuel flow in place of airflow for the above calculations.

NOTE Both spark ignition and compression ignition engines shall support PID \$04. See PID \$43 for an additional definition of engine LOAD.

05 Engine Coolant Temperature A -40 °C +215 °C 1 °C with -40 °C offset

ECT: xxx °C (xxx °F)

ECT shall display engine coolant temperature derived from an engine coolant temperature sensor or a cylinder head temperature sensor. Many diesels do not use either sensor and may substitute Engine Oil Temperature instead.

### Absolute Load Value (PID 43)

The absolute load value has some different characteristics than the LOAD\_PCT defined in PID 04 This definition, although restrictive, will standardise the calculation. LOAD\_ABS is the normalised value of air mass per intake stroke displayed as a percent.

$LOAD\_ABS = [\text{air mass (g / intake stroke)}] / [1.184 \text{ (g / intake stroke)} * \text{cylinder displacement in litres}]$

Derivation:

- $\text{air mass (g / intake stroke)} = [\text{total engine air mass (g/sec)}] / [\text{rpm (revs/min)} * (1 \text{ min} / 60 \text{ sec}) * (1/2 \text{ \# of cylinders (strokes / rev)})]$ ,
- $LOAD\_ABS = [\text{air mass (g)/intake stroke}] / [\text{maximum air mass (g)/intake stroke at WOT@STP at 100\% volumetric efficiency}]$
- \* 100%. Where:
- — STP = Standard Temperature and Pressure = 25 °C, 29.92 in Hg (101.3 kPa) BARO, WOT = wide open throttle.

The quantity (maximum air mass (g)/intake stroke at WOT@STP at 100% volumetric efficiency) is a constant for a given cylinder swept volume. The constant is  $1.184 \text{ (g/litre}^3) * \text{cylinder displacement (litre}^3/\text{intake stroke)}$  based on air density at STP.

Characteristics of  $LOAD\_ABS$  are:

- Ranges from 0 to approximately 0.95 for naturally aspirated engines, 0 – 4 for boosted engines,
- Linearly correlated with engine indicated and brake torque,
- Often used to schedule spark and EGR rates,
- Peak value of  $LOAD\_ABS$  correlates with volumetric efficiency at WOT.,
- Indicates the pumping efficiency of the engine for diagnostic purposes.

Spark ignition engine are required to support PID \$43. Compression ignition (diesel) engines are not required to support this PID.