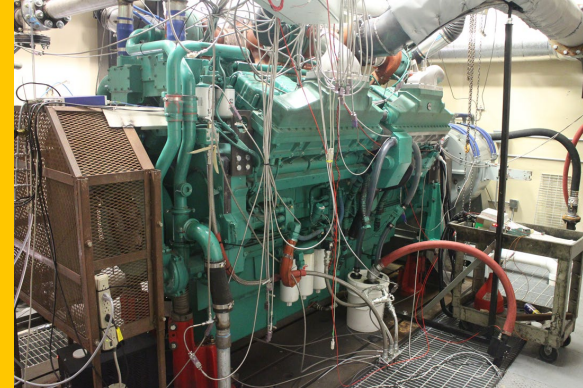


**INTERTEK AUTOMOTIVE RESEARCH
SAN ANTONIO, TEXAS**



SAN ANTONIO - AUTOMOTIVE RESEARCH OVERVIEW

- 70 years of independent testing
- Fuels and Lubricants Industry
- Engine/Vehicle OEM and Tiered Suppliers
- 4 stand alone laboratories in San Antonio, Texas
- 30+ Engineers, ~300 employees
- 24/7/365 operation
- **Over 120 Engine Dynamometer Test Cells**
- Vehicle level Development and Durability Testing
- Fuel System Testing
- Evaporative Emission (SHED) Testing
- Automatic Transmission Fluid Testing
- Axle efficiency Testing
- Analytical Testing
- Quality: ISO 17025



ENGINE FUELS TEST TYPES





FORD IVD, ASTM D6201

Objective – The test method was developed to evaluate a fuel’s tendency to form intake valve deposits. The EPA, CARB, and Top Tier™ have adopted the method for fuel additive certification purposes.

Engine – 1994 Ford 2.3L in-line four cylinder.

Operating Conditions – The test consists of two stages. During stage 1, the engine runs at 2000 rpm/30.6 kPa MAP for four minutes then transitions to stage 2 at 2800 rpm/71.8 kPa MAP for eight minutes. This cycle is repeated for a total of 100 hours (approximately 462 cycles).



Operating Conditions			
	Units	Stage 1	Stage 2
Duration	min	4	8
Engine Speed	RPM	2000	2800
Oil Inlet Temperature	°C	101	101
Coolant Out Temperature	°C	90	90
Intake Air Temperature	°C	32	32
MAP	kPa	30.6	71.8

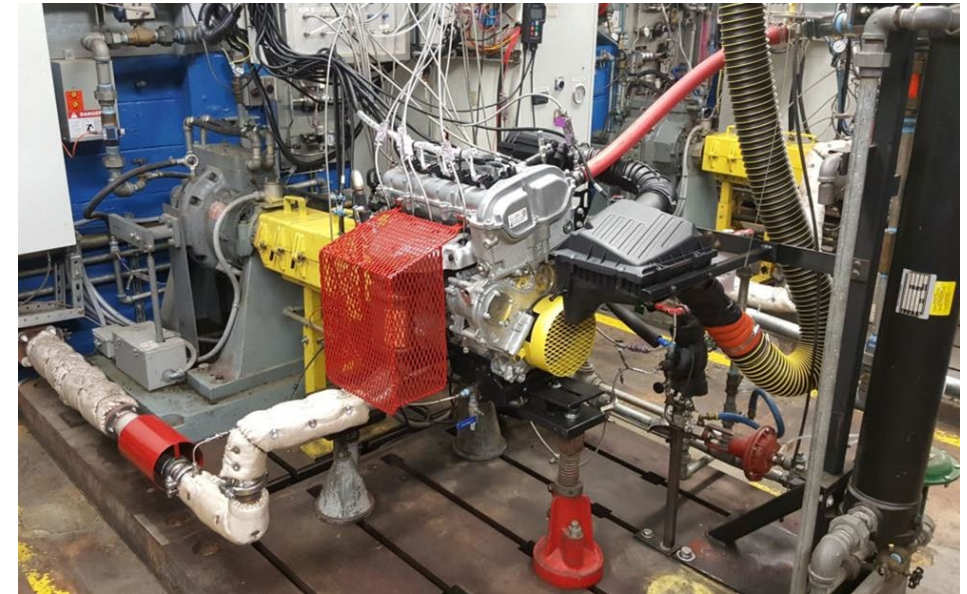


GM IVD TEST

Objective – The test method was developed to evaluate a fuel’s tendency to form intake valve deposits in a newer architecture engine (vs Ford 2.3L or the ASTM D5500 BMW test).

Engine – GM LE9 2.4L in-line four cylinder.

Operating Conditions – The test consists of two stages. During stage 1, the engine runs at 2000 rpm/29 kPa MAP for four minutes then transitions to stage 2 at 2000 rpm/80 kPa MAP for eight minutes. This cycle is repeated for a total of 50 hours (approximately 231 cycles).



Operating Conditions			
	Units	Stage 1	Stage 2
Duration	min	4	8
Engine Speed	RPM	2000	2000
Oil Gallery Temperature	°C	101	101
Coolant Out Temperature	°C	90	90
Intake Air Temperature	°C	32	32
MAP	kPa	29.0	80.0



GM FUEL INJECTOR DEPOSIT TEST

Objective – The test method was developed to evaluate a fuel’s tendency to form fuel injector deposits in a gasoline direct injection engine.

Engine – GM LHU 2.0L in-line four cylinder.

Operating Conditions – The test operates in a steady state mode at 2000 rpm/100 NM of torque. Test length is per customer request (typically 60 hours).



Operating Conditions		
	Units	Stage 1
Duration	min	4
Engine Speed	RPM	2000
Oil Gallery Temperature	°C	87
Coolant Out Temperature	°C	80
Intake Air Temperature	°C	32
Torque	NM	100

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