Southwest Research Institute®

Fuels and Lubricants Research Division

Automotive Diesel Engine Oils

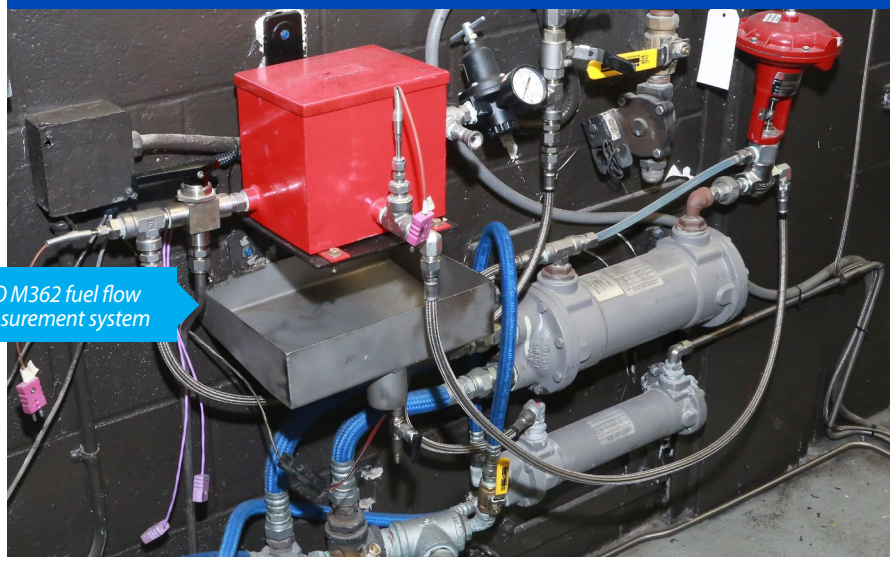
Detergency Test Procedure
JASO M336

Valve Train Wear Test Method
JASO M354

Fuel Economy Test
JASO M362

JASO M336 piston deposits

JASO M354 tappet wear



JASO M362 fuel flow measurement system

Specifications

- Japanese Automobile Standard Organization (JASO)

Objectives

- The JASO M336 Standard specifies the test method for evaluating the detergency of automotive diesel engine oils under high temperature and high load.
- The JASO M354 Standard specifies a test method for evaluating the wear resistance performance of a sliding-type valve train for automotive diesel engine oils.
- The JASO M362 Standard evaluates the net change in fuel economy between a standard test oil and a fully formulated heavy-duty diesel oil to meet the new JASO DH-2F fuel economy oil category.

Field Service Simulated

- High-load heavy-duty diesel engine operation such as highway transport.

Test Fixture

- A Hino N04C-VH water-cooled 4-cycle diesel engine of 4L displacement making 120 kW at 2800 rpm is used for all three JASO standards.
- The engine is direct fuel injected with an electronically controlled common rail system and is turbo-charged, intercooled, and equipped with cooled exhaust gas recirculation.

Test Parameters

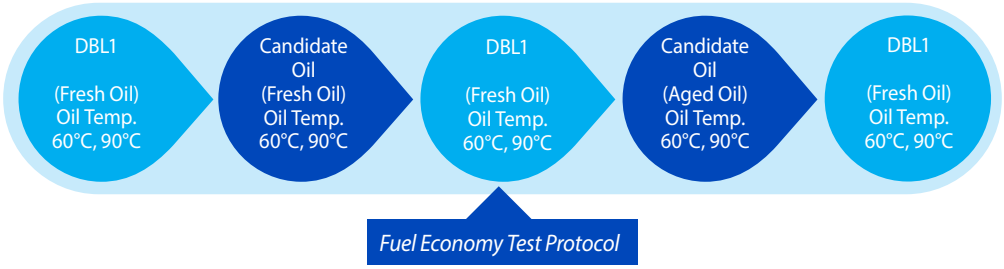
M336 and M354 Standards

- Engine performance is confirmed at the beginning of the test prior to beginning the oil aging.
- Engine operation is 200 hours at wide-open throttle with shutdown every 40 hours for oil consumption measurement and topping up of oil level.

Parameter		Test Conditions
Engine speed	rpm	2800 ± 20
Fuel injection rate	mm^3/st-cyl	(97)
Load	N·m	(385)
Cooling fluid outlet temperature	°C	93.0 ± 2.0
Cooling fluid inlet and outlet temperature difference	°C	within 10.0
Oil temperature (oil gallery)	°C	(113)
Fuel temperature (fuel filter outlet)	°C	35.0 ± 5.0
Exhaust gas temperature (engine outlet)	°C	(610)
Exhaust gas pressure (engine outlet)	kPa	19.0 ± 1.0
Tailpipe smoke emission (engine outlet)	%	25 ± 8
Intake air temperature	°C	25.0 ± 5.0
Intercooler outlet temperature	°C	45.0 ± 2.0

M362 Fuel Economy Standard

Multi-speed, multi-load steady-state operation on both fresh and aged oils is compared to a standard diesel baseline (DBL1) oil per the protocol below.



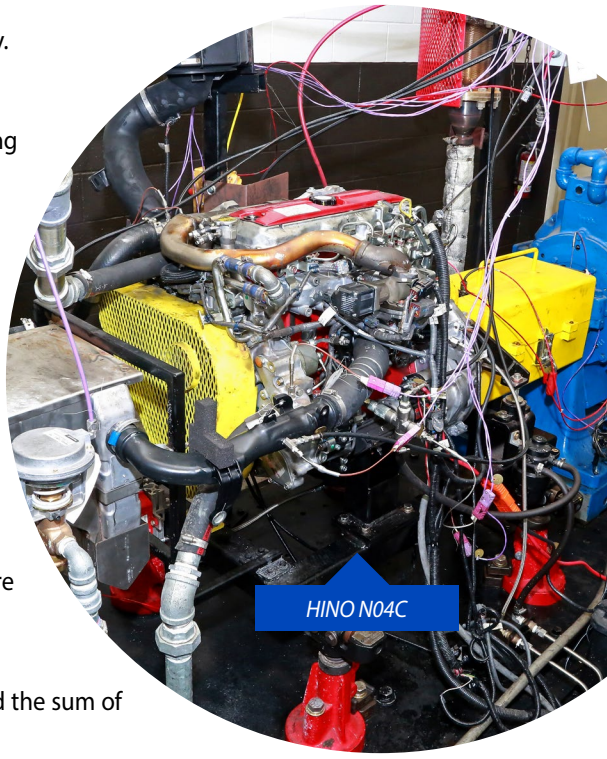
Fuel Economy Test Protocol

Fuel Economy Test Protocol

- Aged oils are provided by end-of-test oil from either the M336 or M354 test procedure.
- Multi-modal conditions are repeated at 60°C and 90°C engine oil temperatures.
- Compensation for engine friction is included in the fuel economy calculations.
- 43 steady-state points at 2 oil temperatures are run 5 times for a total of 430 test points.
- Multi-modal data are input to a dedicated JASO program for final calculation of fuel economy.

Test Parts Evaluation

- M336 deposit test rates the carbon and varnish deposits in the piston ring grooves, on the ring lands, piston skirts, oil return holes, and under crown. Ring sticking is also evaluated.
- M354 wear test measures the depth of wear on the top of the tappets.
- No parts are evaluated for the M362 fuel economy test.



HINO N04C

Used Lubricant Analysis

- During the M336 and M354 tests, used oil samples are analyzed every 40 hours.

Pass/Fail Criteria

- Oil consumption during the M336 and M354 tests cannot exceed 30 g/hr, nor can engine power drop by more than 10 percent compared to the initial value. The carbon residue in the oil must increase by at least 3 percent over 200 hours.
- M336 Deposit Test – Weighted Total Demerit (WTD) must be 740 or less, and no stuck rings are allowed.
- M354 Wear Test – Average tappet wear of 11.3 µm or less.
- M362 Fuel Economy Test – Average fresh oil fuel economy improvement of 3.7% or more, and the sum of both fresh and aged oil fuel economy improvements must be 6.8% or more.

We welcome your inquiries. For additional information, please contact:

Jose Starling
Sr. Research Engineer
210.522.2902
jose.starling@swri.org

Fuels and Lubricants Research Division

Southwest Research Institute
6220 Culebra Road • P.O. Drawer 28510
San Antonio, Texas 78228-0510

lubricanttesting.swri.org

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