Dimensional and Performance Specification for After-Market Gasoline Engine Oil Filters

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DIMENSIONAL AND PERFORMANCE SPECIFICATION FOR AFTER-MARKET GASOLINE ENGINE OIL FILTERS

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1. SCOPE

This specification defines the dimensional and performance requirements for aftermarket spin-on oil filters intended for use on gasoline engines. Filters meeting this specification may also be suitable for use on some diesel applications.

Filters meeting these dimensional limits are intended to meet the oil filter fit and package requirements for engine and vehicle designs.

Filters meeting the performance requirements are intended to maintain sufficient durability to support typical 10000 mile oil change intervals. Some OEM engines may require special filters for which this specification would not support.

Filters that meet or exceed this specification requirements for both dimensional and performance can claim "**Conformance to SAE/USCAR - 36 Specifications**." Filters that meet just the performance specifications (ie. may have different thread) can claim "**Aligns to SAE/USCAR - 36 Performance Specifications**."

2. REFERENCE DOCUMENTS

SAE HS 806-2009, ISO 4548-5, ISO 4548-7, ISO 4548-9 ISO 4548-12, ISO 2942, ISO 16232, ASTM B117, ASTM D1654.

3. DIMENSIONAL SPECIFICATIONS

Table 1 - Dimensional requirements

Filter Type	Type A	Type B	Type C	Type D
Filter height maximum "A" (mm)	75	87	115	97
Shell OD maximum "B" (mm)	77	77	77	97
Lockseam maximum OD "C" (mm)	77	77	77	97
Minimum number of full threads	3	3	3	3

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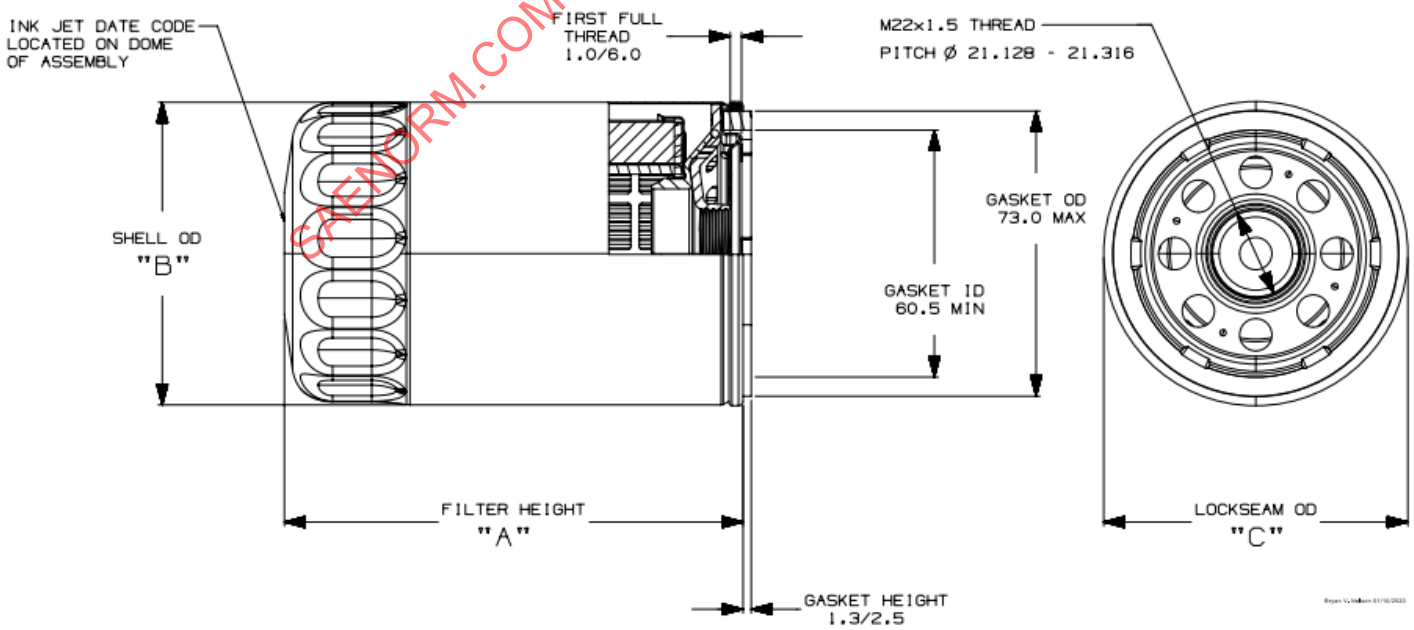

Figure 1 - Dimensions

4. IDENTIFICATION REQUIREMENTS

The filter assembly shall have a durable identification text on the shell, which identifies the production date, shift, line, and manufacturer identification (ID).

EXAMPLE: 02519-1-2-ID or (DDDYYSLI - **D**ay **Y**ear **S**hift **L**ine **I**dentification)

NOTE: The **02519-1-2** is the 25th day of year 2019, shift **1**, line **2**. **ID** is the identification of the filter assembly manufacturer.

5. PERFORMANCE REQUIREMENTS

Performance requirements define the sample size, test procedures, and acceptance criteria. Samples should be selected at random. When multiple production lines are utilized, samples need to cover all production lines when specified. All specimens must meet the requirements.

5.1 Resistance to Flow Test

The purpose of this test is to determine the pressure loss under predetermined conditions of flow and fluid viscosity. The “cold oil test” evaluates the relief valve function at cold temperatures.

5.1.1 Procedure

- Test a minimum of three parts
- Test per SAE HS 806-2009, Section 5
  - Test oil, hot: RFO-3 test oil, viscosity = 10 cSt ± 1 cSt (above 90 °C)
  - Test oil, cold: 5W30 motor oil, viscosity = 2500 cSt ± 250 cSt (below -15 °C)

5.1.2 Acceptance Criteria

- Maximum pressure loss at the specified flow rate
- Hot oil test:
  - Type A: 50 kPa at 40 L/min
  - Type B: 50 kPa at 50 L/min
  - Type C: 50 kPa at 70 L/min
  - Type D: 50 kPa at 70 L/min
- Cold oil test:
  - Type A: 75 kPa at 0.8 L/min, 250 kPa at 5 L/min
  - Type B: 75 kPa at 1.0 L/min, 250 kPa at 5 L/min
  - Type C: 75 kPa at 1.5 L/min, 250 kPa at 5 L/min
  - Type D: 75 kPa at 1.5 L/min, 250 kPa at 5 L/min

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5.2 Filtration Efficiency and Capacity Test

The purpose of the test is to evaluate the filtration performance with continuous contamination injection and using the online particle counting method for evaluating the performance of oil filters. This test determines the contaminant capacity of the filter, its particulate removal characteristics and differential pressure.

5.2.1 Procedure

- Test a minimum of six parts
- Prior to the test, stress the filter assembly by cycling pressure from 0 to 1400 kPa for ten times
- Test per ISO 4548-12
- Base upstream gravimetric level which is also the contaminant add rate: 10 mg/L
- Terminating differential pressure: 30 kPa below the nominal relief valve opening pressure as measured in 5.13 of this document
- Flow rate:
  - Type A: 20 L/min
  - Type B: 25 L/min
  - Type C: 35 L/min
  - Type D: 35 L/min

5.2.2 Acceptance Criteria

- Weighted average efficiency to be 95% minimum for particle size larger than 30 µm
- Minimum contaminate capacity:
  - Type A: 4 g
  - Type B: 5 g
  - Type C: 7 g
  - Type D: 8 g

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5.3 Cleanliness and Media Migration Test

The purpose of this test is to determine if the filter introduces contaminant and media into the engine. The source of the contaminant is not necessarily the filter media. Any component of the filter, or manufacturing techniques in fabricating the filter, can also be a source of passed contaminant.

5.3.1 Cleanliness Procedure (to Measure Debris in the Filter)

- Test a minimum of three parts; it is required that a single filter be tested instead of averaging results from multiple filters
- Test per ISO 16232-2018(E), using internal rinsing method with a setup illustrated in Fig D.10 with an analysis filer of 10 µm or smaller, flow mineral spirits at 11.5 L/min for a minimum of an accumulative flow time of 1 minute to flush out the contaminants; measure the total mass of the contaminants and record as Weight #1
- Repeat the step above with a new analysis filter and record the mass of the contaminants as Weight #2

5.3.2 Acceptance Criteria

- Weight #1 / (Weight #1 + Weight #2) > 60%; when this condition is not met, flow duration can be increased to be more efficient in flushing out the contaminants
- Sum of Weight #1 and Weight #2 (for each filter) < 5 mg

5.3.3 Media Migration Procedure

- Test per SAE HS 806-2009, Section 8, rated flow as specified below:
  - Type A: 40 L/min
  - Type B: 50 L/min
  - Type C: 70 L/min
  - Type D: 70 L/min

5.3.4 Acceptance Criteria

- Maximum 5 mg

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5.4 Element Collapse with Heat Aged Filter Test

The purpose of the test is to ensure that a filter element will withstand the anticipated maximum differential pressure without breakage or collapse while filtering after being heat aged appropriately.

5.4.1 Procedure

- Test a minimum of three parts
- Filter to be aged per Appendix A
- Test per SAE HS 806-2009, Section 9
- Record pressure trace, increase pressure to 1000 kPa or when element collapse occurs

5.4.2 Acceptance Criteria

- Element collapse pressure must be greater than 525 kPa

5.5 Element Collapse with Ethanol Exposure Test

The purpose of the test is to ensure that a filter element will withstand the anticipated maximum differential pressure without breakage or collapse with some level of ethanol exposure.

5.5.1 Procedure

- Test a minimum of three parts
- Filter to be aged per Appendix B
- Test per SAE HS 806-2009, Section 9
- Record pressure trace, increase pressure to 1000 kPa or when element collapse occurs

5.5.2 Acceptance Criteria

- Element collapse pressure must be greater than 525 kPa

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5.6 Anti-Drain Valve Leakage Test

The purpose of the test is to measure the effectiveness of the anti-drain valve fitted within the oil filter.

5.6.1 Procedure

- Test a minimum of three parts
- Filter to be aged per Appendix A
- Test per ISO 4548-9

5.6.2 Acceptance Criteria

- Maximum leakage in 3 hours not to exceed 50 mL

5.7 Water Resistance Test

The purpose of the test is to evaluate the effect of water in the oil on contaminant capacity of the filter.

5.7.1 Procedure

- Test a minimum of three parts
- Test per SAE HS 806-2009, Section 11.2
- Dust addition rate: 1.5 g/h
- Water addition rate: 0.1% per hour
- Oil flow rate:
  - Type A: 10 L/min
  - Type B: 10 L/min
  - Type C: 15 L/min
  - Type D: 15 L/min

5.7.2 Acceptance Criteria

- Minimum time to condemning pressure of 100 kPa is 2 hours

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5.8 Low Temperature Gasket Sealing Test

The purpose of the test is to evaluate the low temperature sealing characteristics of the oil filter gasket.

5.8.1 Procedure

- Test a minimum of three parts from each production line
- Test per SAE HS 806-2009, Section 11.5
- Use Starburst SAE 0W-20, API latest available category
- Tighten filter 3/4 of a turn ±5 degrees after gasket contact
- Soak at a minimum of 8 hours at -30 °C

5.8.2 Acceptance Criteria

- After 5 seconds, no leakage at minimum 1400 kPa

5.9 Gasket Compliance Test

The purpose of the test is to evaluate the torque required to tighten the oil filter in service.

5.9.1 Procedure

- Test a minimum of six parts
- Lubricate the gasket with engine oil (Starburst SAE 5W-30, API latest available category)
- Install the oil filter and tighten it down to 3/4 turn after the gasket contacts the sealing surface
- Record the final torque

5.9.2 Acceptance Criteria

- Final torque not to exceed 12 N-m

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5.10 Pressure Impulse Fatigue Test

The purpose of the test is to evaluate the pressure impulse fatigue life of the filter. This test simulates conditions of engine lubrication system cyclic pressure pulsation.

5.10.1 Procedure

- Test a minimum of six parts from each production line
- Test per SAE HS 806-2009, Section 13.2, or ISO 4548-5
- Tighten filter 3/4 of a turn ±5 degrees after gasket contact
- Test oil with fluorescent tracer
- Oil pressure impulse of 0 to 1400 kPa applied at a frequency of 1.0 Hz, square wave
- Cycle duration: 10000 cycles

5.10.2 Acceptance Criteria

- Inspect for oil leak with black light, no leakage/weepage is allowed

5.11 Vibration Fatigue Test

The purpose of the test is to evaluate the constructional integrity of oil filters to withstand engine vibration.

5.11.1 Procedure

- Test a minimum of three parts from each production line
- Test per ISO 4548-7
- Filter mount: Horizontal
- Vibration axis: Vertical
- Sweep frequency from 0 to 500 Hz
- Set frequency: At resonance of filter filled with oil
- Tighten filter 3/4 of a turn ±5 degrees after gasket contact
- Maintain filter at 400 kPa pressure and a peak input acceleration equal to 60 m/s^2
- Duration is 10 million cycles

5.11.2 Acceptance Criteria

- No leakage or damage allowed

5.12 Hydrostatic Burst Pressure Test

The purpose of the test is to evaluate the ability of the filter to withstand the maximum engine oil pressure.

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5.12.1 Procedure

- Test a minimum of six parts from each prodcution line
- Test per SAE HS 806-2009, Section 13.4
- Tighten filter 3/4 of a turn ±5 degrees after gasket contact

5.12.2 Acceptance Criteria

- Burst pressure to exceed 1700 kPa

5.13 Relief Valve Performance Test

The purpose of the test is to evaluate the relief valve with respect to its leakage rate, opening and reseat pressures, and resistance to flow.

5.13.1 Procedure

- This test is to be conducted with six complete filter assemblies but with a solid center tube (to force all oil flow through the bypass valve)
- Test per SAE HS 806-2009, Section 14
- Use RFO-3 test oil, viscosity = 10 cSt ± 1 cSt (above 90 °C)

5.13.2 Acceptance Criteria

- Maximum permissible leakage rate of 50 cc/min at 75% of the minimum opening pressure specification
- Valve opening and reseat pressure: nominal opening and reseat pressure to be in the range of 100 to 200 kPa; tolerance to be ±20% of the nominal (example, nominal of 100 kPa, the opening pressure be within 80 to 120 kPa)
- Valve flow restriction: 300 kPa maximum at 40 L/min ± 2%

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