



Engine Oil Pump – Accelerated Relief Valve Bore Wear Test

1 Introduction

Note: Nothing in this procedure supercedes applicable laws and regulations unless a specific exemption has been obtained.

Note: If there is a conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose.

The purpose of this test is to provide an indication of oil pump relief valve durability due to bore wear.

Generally, this test is performed prior to extensive durability testing of an oil pump assembly on actual running engines and thus provides an early indication of the durability of the pump. This testing should not be regarded as a substitute for conventional engine based durability testing. It is, however, a valuable method of detecting many oil pump design flaws or manufacturing irregularities prior to availability of running engines and can be performed at a minimum cost. This is a good comparative evaluation tool for selecting design features.

1.2 Foreword.

1.3 Applicability.

All Oil Pump Using a Piston Style Pressure Relief Valve.

1.4 Definitions.

The Relief valve is defined as the device or feature of an engine oil pump which limits pump outlet oil pressure to a predetermined or desired value depending primarily on operating conditions and oil viscosity. The relief valve is spring-based device that redirects a portion of the outlet flow from the pump back to its inlet port, based on outlet pressure.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 Normative.

2.2 GM.

Reference documents:

3701 – “Engine Oil Pump Durability Bench Durability Test”

2.3 Additional.

3 Resources

3.1 Facilities.

3.1.1 Major Facility - Component Test Laboratory.

3.1.2 Minor Facility - Oil Pump Test Facility (Test cell with ventilation system to remove airborne oil vapor and protection/ safety for thermal incident).

3.2 Equipment.

3.2.1 An Adapter plate or brackets required to mount Oil Pump to the test fixtures in an appropriate orientation relative to the fixture drive spindle.

3.2.2 The Oil Pump durability fixture to include a drive (electric motor) for an oil pump with drive torque monitor unit and rubber coupling to couple the oil pump assembly.

3.2.3 Oil heat exchanger with its temperature controls.

3.2.4 Flow meter (with its controls/ data read out/ monitor and or its data acquisition) installed on discharge side of oil pump.

3.2.5 Drive adapter that replicates the production intent interface.

3.2.6 Instrumentation (Permanent part of test facility)

3.2.6.1 Pressure transducer at suction side of the pump as specified by test engineer.

3.2.6.2 Pressure transducer at discharge side of the pump as specified by test engineer.

3.2.6.3 Display unit to monitor test parameters like RPM, Oil Temperature, Pressures both at suction as well as discharge, Oil flow and other parameters as set by Test Engineer.

3.2.6.4 Controller for programming test schedule and capable to run test on 24 hour basis.

3.2.6.5 Controller to maintain set oil Temperature for the test.

3.2.6.6 Data acquisition equipment capable of storing oil pump output pressure data at 100 Hz. Note: Capability requirement must only be sufficient to record data for 2 to 3 test cycles.

3.3 Test Vehicle / Test Piece.

3.3.1 Text Components/Material:

3.3.1.1 Oil Pump assembly to be tested. It is suggested that a Material Critical Data Sheet (See section below) should be provided with each test part for the following reasons.

- To describe the design content of oil pump & its components with tracking identifications.
- To include any prior part/component dimensional analysis or material analysis of the test part before and after test.

3.3.1.2 Production released or design intent gasket and fasteners with torque specification (Preferred).

3.3.1.3 Production released or design intent Suction Tube with Screen (Preferred) or as specified suction tube assembly.

3.3.1.4 Synthetic Oil (Ex. Mobil-1) Preferred.

3.3.2 MATERIAL CRITICAL DATA SHEET (MCDS) Document #TEFW 103:

A pre-test and post-test inspection requirement providing part characteristics to be used to develop "stick free" pressure relief components.

The MCDS document is mainly a guide for (a) Inspection Dimensional Measurement. See Section 4.1.2 and Section 4.4.3, (b) Material Analysis at end of test and (c) Information required for test setup & controls.

It (MCDS) gives an opportunity to conduct and document measurements before and after test. This information is needed for the decision making process.

It is recommended that items listed in Material Critical Data Sheet be reviewed with DRE and or with HRC Technical Specialist at a beginning stage of the test project.

The MCDS would become the cover sheet for reports from Inspection layout (both pre-test and post-test) and report from material engineering lab etc

3.4 Test Time.

Calendar time: days (range)

Test hours: hours (range)

Coordination hours: hours (range)

3.5 Test Required Information.

3.6 Personnel / Skills.

4 Procedure

4.1 Preparation.

4.1.1 SAMPLE INSPECTION

Visually inspect Oil Pumps (to be tested) to ensure that they are clean and free of any debris. Ensure that pumping elements rotates freely without binding.

4.1.2 PRE-TEST SAMPLE PART INSPECTION LAYOUT:

Optionally, detailed dimensional analysis may be performed to determine pumping element (gear) clearances or relief valve to pump body clearances and relief valve or valve bore surface finishes.

Conduct Inspection layout as follows. Attach the layout data/ inspection report with Material Critical Data Sheet.

4.1.2.1 BORE – RELIEF VALVE

4.1.2.1.1 Radial Profile Measurement - **Bore** Relief Valve:
See Material Critical Data Sheet.
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4.1.2.1.2 Axial profile measurement - **Bore** Relief Valve:
See Material Critical Data Sheet.
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4.1.2.1.3 Surface Finish Texture - **Bore** Relief Valve:
See Material Critical Data Sheet.
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4.1.2.1.4 Surface Hardness - **Bore** Relief Valve:
See Material Critical Data Sheet.
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4.1.2.2 VALVE

4.1.2.2.1 Radial profile - **Valve**:
See Material Critical Data Sheet.
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4.1.2.2.2 Surface Finish Texture - **Valve**:
See Material Critical Data Sheet.
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4.1.2.2.3 Surface Hardness - **Valve**:
See Material Critical Data Sheet.
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4.1.2.3 SPRING: Spring Stiffness Measurement
See Material Critical Data Sheet. Page 6:7

Update Material Critical Data Sheet to enter Data from above Sections.

4.1.3 SAMPLE PREPARATION

4.1.3.1 If required, the oil pump inlet tubes may be modified to properly fit the dimensional constraints of the test fixture. However, care should be taken to ensure that minimum changes be made to the inlet tube's length and bend radii. Also any welding required on the inlet tubes should not impact the internal smoothness, cross sectional area of the tubes or the airtight integrity of the tubes. The inlet tubes should be inspected to ensure cleanliness and freedom from debris such as solder particles and metal chips prior to its installation on the pump.

4.1.3.2 Install any specific instrumentation as specified: such as thermocouple, pressure transducer, etc.

4.1.3.3 Identify the oil pump to be tested with Test Part ID number (see Test Engineer) for test tracking and post-test inspection requirement or for follow up processes.

4.1.3.4 Also specify, if needed, by attaching the build sheet the installation of oil pump to the fixture like bolt torque, bolt tightening sequence and any ORIENTATION of oil pump mounting on test stand.

4.1.3.5 Ensure the test sample(s) or components / design information be included in