



Transmission Erosion Test

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. This standard defines detailed procedures and minimum equipment requirements to measure the erosion resistance of a gasket material/assembly to minimize testing variation. Performance requirement will be defined on drawings and material specifications.

1.2 Applicability. This standard applies to transmission gasket applications where high pressure and high velocity fluids are expected, such as valve body/spacer plate gasket. It can be used for material development, and part validation. It is not aimed for product batch releasing control purposes.

2 References

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

2.1 External Standards/Specifications.

ASTM D445

2.2 GM Standards/Specifications.

9986153

9986333

9986354

9986368

2.3 Additional References.

- Emerson Electric Company, St. Louis, Missouri (www.emerson.com)
- Mohawk Heaters, Mohawk Heating Company, Incorporated (<http://mohawkheat.com>)
- Rockwell Automation, Incorporated, Milwaukee, Wisconsin (www.rockwellautomation.com)
- Statement of Requirements (SOR)
- Vickers Vane Pumps (available at www.grainger.com)

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Basic Equipment. Labs performing the erosion test should have the equipment listed in this section.

3.2.1.1 Fixture Temperature Control (FTC) Device. Capable of measuring in room temperature range to $150\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ accuracy.

3.2.1.2 Fluid Temperature Monitoring Device. Capable of measuring in room temperature to $150\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ accuracy

3.2.1.3 Fluid Pressure Monitoring and Measuring Pressure Equipment (Pressure Gauge). Capable of measuring pressure as required per test instructions 1.72 MPa (250 psi) for normal application, up to 6.21 MPa

(900 psi) for given applications. Equipment must operate at the required temperatures and be compatible with the test fluid used (designated transmission fluid per 3.3.2). Gauge must not corrode in this test environment.

3.2.1.4 Fluid Velocity Measuring Equipment (Flow Meter). Capable of measuring fluid velocity as required per test instructions. Equipment must operate at the required temperatures and be compatible with the test fluid used. Gauge must not corrode in this test environment.

3.2.1.5 Torque Wrench. Capable of measuring the specified test joint fastening specifications.

3.2.1.6 Shut-off Devices (Mandatory). Provides shutdown of the equipment in the event test assembly exceeds specified fluid temperature and pressure conditions (under or over). Automatic shutdown at low end pressure limit and pressure release at the high end. Made from non-corrosive material(s) that withstand the fluid, temperature and pressure environment of this test.

3.2.2 Fluid Circulation System.

3.2.2.1 Testing Fluid Reservoir. Located external to test fixture with sufficient volume capacity to accommodate fluid heat expansion. The recommended capacity is 24 L (10 gal (U.S.)) or higher. The reservoir is fabricated from nonreactive material to fit the requirements. A high limit thermocouple to monitor reservoir fluid temperature and shut down the system is mandatory. Float level controls with alarm to prevent over fill or over flow are optional.

3.2.2.2 Tube Compression and Flare Fittings. Use brass or other noncorrosive materials to fit diameter of designated tubing.

3.2.2.3 Pump and Heater – ATF Circulation for Erosion Test. A typical pump capacity is 38 L/minute (10 gal/minute (U.S.)), 1.03 MPa to 1.72 MPa (150 psi to 250 psi) pressure range. The equipment is recommended to aim for handling line pressure up to 6.21 MPa (900 psi) (for some transmission applications). Heater output must be capable of reaching specified fluid operating temperature within 15 minutes to 30 minutes from room temperature. The setup must be capable of maintaining test fluid temperature within ± 3 °C in the specified temperature range. Heat must be supplied so that the test fluid is warmed uniformly. Acceptable methods are immersion heaters, external electrical heaters with wall temperature controllers or circulation of externally heated fluid. Chromalox (Emerson Electric) CMXO-550-9H 480 2000 or Mohawk Heater units have a thermocouple for controlling/monitoring fluid temperature leaving fluid pump.

3.2.2.3.1 A vane pump of either V10 or V20 design is recommended due to the fact that vane pumps are quieter and run longer without problems than gear pumps. The pump should be equipped with Viton seals, as most pumps come with nitrile seals and will not last at the 150 °C temperature. Most vane pumps are designed to run between 1200 rpm and 4000 rpm. Suggestion is to use at least a 3 hp (preferably 5 hp), 3-phase, 460 V to 480 V, electric motor with the appropriate sized motor drive, that allows for adjustment to dial in the rpm to achieve the desired flow rate. The pump should be ordered with threaded inlet and outlet connections to hold up to 150 °C temperatures.

3.2.2.3.2 Recommended equipment that meet the flow rate and line pressure requirements:

- **Pump:** Vickers P/N F3-V20-1P11S-1C20L (a V20 series, single stage vane pump). This pump flows 41.6 L/minute (11 gal/minute) at 1200 rpm. It has a Viton front shaft seal and counterclockwise shaft rotation when viewed from front of pump.
- **Motor:** 3 hp to 5 hp, 460 V to 480 V, 3-phase (Any reputable brand would be adequate).
- **Drive:** PowerFlex 525 AC Drive rated for the electric motor (Rockwell Automation, Incorporated).

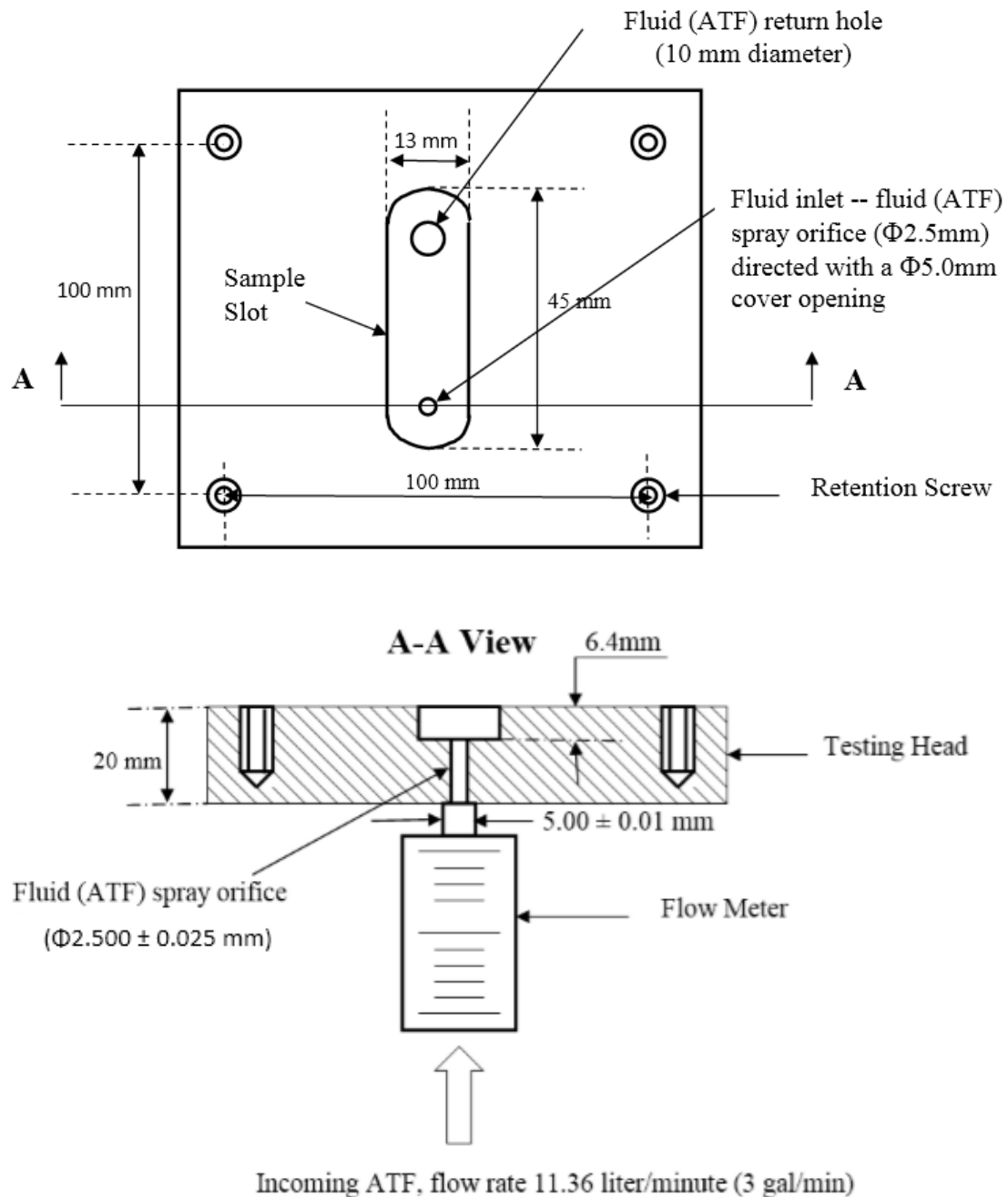
3.2.2.4 Delivery Lines – Supply and Return. Recommended supply lines, 12 mm (0.5 in) inside diameter minimum, braided steel with polytetrafluoroethylene liner. Recommended return line and fixture drain fitting, AN12 (0.75 in) inside diameter minimum. The delivery lines and fittings must be strong enough to handle a minimum of 1.72 MPa (250 psi) transmission line pressure at 150 °C. The supply line should have proper insulations to keep the same fluid temperature as the fluid in reservoir or test fixture.

3.2.2.5 In-line filtration. In-line filtration with 10 µm filter medium is required before fluid being returned back to the fluid reservoir, to prevent sediment from entering into reservoir.

3.2.3 Erosion Rig. Reference Figure 1.

3.2.3.1 The erosion rig should be equipped with heater and temperature control capable of monitoring temperature from room temperature to 150 °C ± 3 °C accuracy.

3.2.3.2 Fluid (suggest to be the same as testing fluid) will be pumped into the rig before the test and drained after the test. No control on pump speed is needed as long as it can deliver the required amount of fluid, a level to cover the top of the test fixture.



Note: ATF = Automatic Transmission Fluid, Φ= Diameter

Figure 1: Erosion Rig (Top and Side Views)