National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER
WHITE SANDS TEST FACILITY

FRICTIONAL IGNITION (ROTATING SAMPLE) TEST SYSTEM CAPABILITIES

SUMMARY

In this test method, materials are rubbed and galled in the presence of oxygen to determine at what point they are susceptible to ignition by frictional heating. The test system can subject materials to a variety of normal loads, at various speeds, with a variety of chamber pressures in either gaseous or liquid oxygen. Typically, the test is run at a constant chamber pressure and rotating speed while the normal load is increased to the point of sample ignition. However, other test protocols such as determining the time to ignition at a set load, or cycles necessary for ignition, have been run with this system.

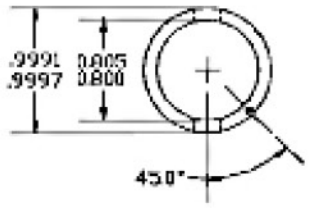
TEST APPARATUS AND PROCEDURE

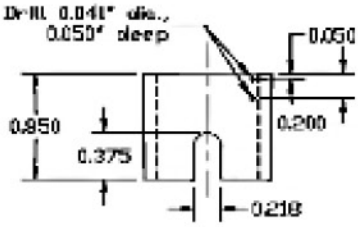
The test apparatus features a pressure vessel containing stationary and rotary sample holders. The test apparatus features an 11.2-kW (15-hp) electric motor for driving the rotary sample and an air cylinder to impart a normal load on the samples. The system includes data acquisition equipment to measure normal load, stationary sample temperatures, torque, shaft speed, and fluid pressure. There are two complete rotary friction systems. One system is dedicated to testing with liquid oxygen, and the other is used with gaseous oxygen or oxygen-diluent mixtures.

To test, the samples are installed in their respective holders, and the three-piece pressure vessel is assembled. The vessel is sealed, purged, and pressurized to the appropriate test fluid pressure. The drive motor brings the rotary sample up to speed, and the air cylinder causes the two samples to come in contact with increasing force. The test continues until the samples ignite, fail mechanically, or the test system limits are reached.

TEST SAMPLES

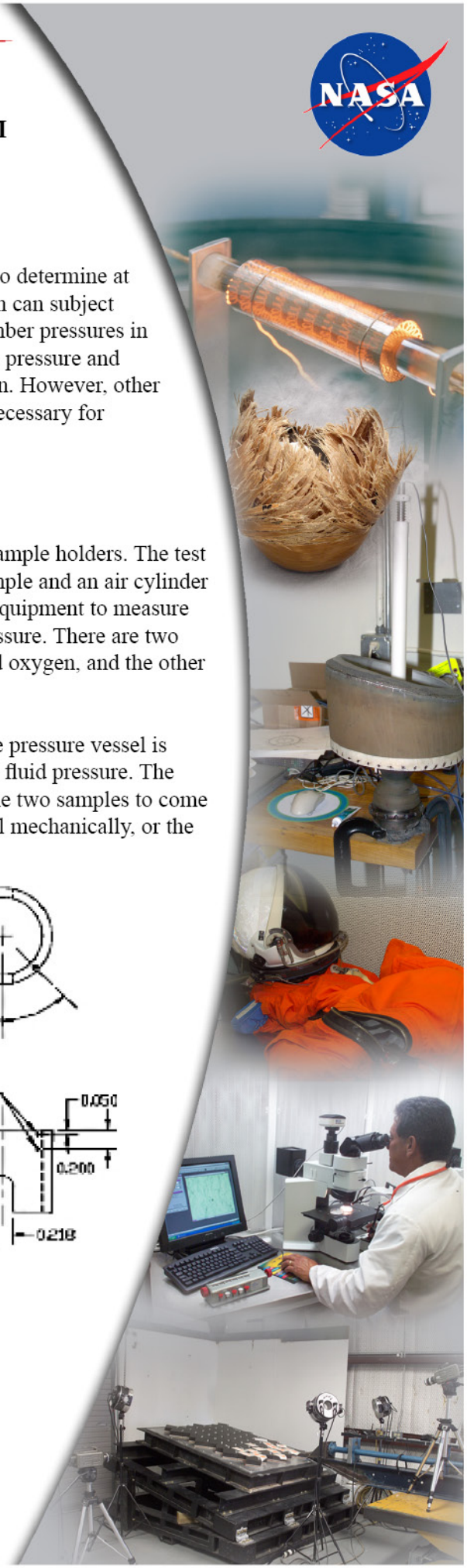
Test samples are configured as 25-mm (1-in.) diameter cylinders as illustrated at right. The rotary sample is mounted on the drive shaft and the stationary sample rests inside a cup-shaped mount.





TEST CAPABILITIES

Tests can be conducted in oxygen gas and mixtures of gases at pressures up to 27.6 MPa (4000 psi) or in liquid oxygen at pressures up to 6.9 MPa (1000 psi). Rotational speeds range from 1000 to 27,000 rpm. The maximum normal load is 4450 N (1000 lbf).

CONTACT

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