

## Test Apparatus for Determining the Combustion Behaviour of Metallic Materials in High Pressure Oxygen

### Key words

Combustion behaviour, high pressure, oxygen, metallic materials, safety engineering

### Applications

Evaluation, regarding technical safety, of metallic materials for high pressure oxygen service (up to 500 bar or 7 250 psi).

### Test method and Equipment

A metallic profile is ignited using an electrical ignition device. By use of contactless IR-sensors, it is finally possible to calculate the combustion velocity. The combustion behaviour can be characterized by the recorded video. It is possible to heat the investigated metallic profile at temperatures up to 400 °C, the test chamber allows to investigate promoted ignition combustion tests at pressures up to 500 bar.

### Test Object

Test objects are standardized metallic profiles. According to ASTM Standard G 124, the diameter of the solid cylindrical metallic rod is 3.2 mm ( $\frac{1}{8}$  inch) and its visible length is 150 mm (6 inch). The chemical composition of the metallic material needs to be known (certificate / data sheet).

### Test Parameters / Test Criteria

There are many test parameters that may be considered to evaluate the technical safety of the tested metallic material. The most important test parameter is the oxygen pressure, at which no combustion can be observed and the fire is self-extinguishing. Further criteria are the burn length of the rod and the intensity of the combustion compared to other metallic materials.

### Result Uncertainty / Reliability

Temperature:	$\pm 0.3$ % of the measurement in K + 1 K (manufacturer's instructions for IR-sensor, calibration protocol), $\pm 1$ K (manufacturer's instructions for thermocouple type K, calibration protocol)
Pressure:	$\pm 1$ bar (manufacturer's instructions, calibration protocol)
Combustion length:	$\pm 1$ mm (standard measuring error)
Combustion velocity: max.	$\pm 0.7$ % of maximum value

### Qualification und Quality Assurance

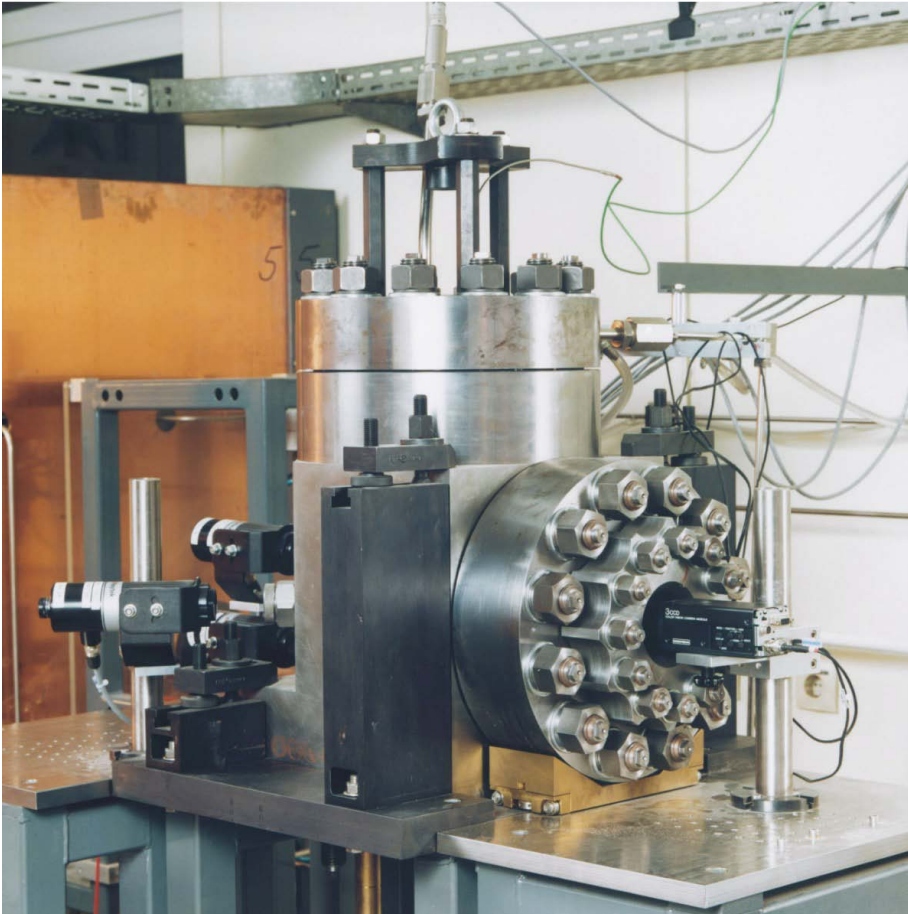
This test method is the only one of its kind in Europe. Worldwide, there are less than ten similar test apparatuses. More than twenty metallic materials have been tested at BAM and the results are in accordance with other published results. The results and conclusions have been published.

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**Further information**

The test method is in accordance with the following standards:

- ASTM G 124-95 (2003) "Standard Test Method for Determining the Combustion Behaviour of Metallic Materials in Oxygen-Enriched Atmospheres", Edition 2003
- EIGA publication "Oxygen Pipeline Systems", IGC Doc 13/02/E.



Technical data:

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|--|---------|
| • Max. test pressure                           | 500 bar |
| • Max. test temperature of the heated test rod | 400 °C  |
| • Max. oxygen temperature                      | 400 °C  |
| • Max. length of test rod                      | 300 mm  |

## Literature

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