



SLOVENSKI STANDARD
SIST EN 16989:2018
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Železniške naprave - Požarna zaščita na železniških vozilih - Preskus obnašanja ognja po celotnem sedežu

Railway applications - Fire protection on railway vehicles - Fire behaviour test for a complete seat

Bahnanwendungen - Brandschutz in Schienenfahrzeugen - Prüfung des Brandverhaltens von Sitzen in Schienenfahrzeugen

Applications ferroviaires - Protection contre les incendies dans les véhicules ferroviaires - Essais de comportement au feu de siege complet

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ICS:

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45.060.20	Železniški vagoni	Trailing stock

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Railway applications - Fire protection on railway vehicles - Fire behaviour test for a complete seat

Applications ferroviaires - Protection contre les incendies dans les véhicules ferroviaires - Essais de comportement au feu de siège complet

Bahnanwendungen - Brandschutz in Schienenfahrzeugen - Prüfung des Brandverhaltens von kompletten Sitzen

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CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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EN 16989:2018 (E)**European foreword**

This document (EN 16989:2018) has been prepared by Technical Committee CEN/TC 256 “Railway applications”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by December 2018, and conflicting national standards shall be withdrawn at the latest by December 2018.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN/CENELEC/ETSI by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2008/57/EC.

For relationship with EU Directive 2008/57/EC, see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

This document has been developed from EN 45545-2:2013+A1:2015, Annexes A and B, and relevant European and ISO standards.

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EN 16989:2018 (E)**1 Scope**

This document sets out a test protocol to determine the burning behaviour of a rail vehicle seat design using a set of complete seats prepared and tested according to the procedures given in this document. It also sets out a standardized procedure to assess a seat's potential for vandalization.

This document describes:

- fire test method;
- test equipment specification;
- protocol for test specification procedure;
- vandalization procedure;
- calibration procedure.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 13238, *Reaction to fire tests for building products — Conditioning procedures and general rules for selection of substrates*

EN 13823:2010+A1:2014, *Reaction to fire tests for building products — Building products excluding floorings exposed to the thermal attack by a single burning item*

EN 45545-1, *Railway applications — Fire protection on railway vehicles — Part 1: General*

EN 45545-2:2013+A1:2015, *Railway applications — Fire protection on railway vehicles — Part 2: Requirements for fire behaviour of materials and components*

EN 60584-1, *Thermocouples — Part 1: EMF specifications and tolerances (IEC 60584 1)*

EN ISO 13943, *Fire safety — Vocabulary (ISO 13943)*

ISO 3966, *Measurement of fluid flow in closed conduits — Velocity area method using Pitot static tubes*

ISO 5725-1, *Accuracy (trueness and precision) of measurement methods and results — Part 1: General principles and definitions*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 8421-1, *Fire protection — Vocabulary — Part 1: General terms and phenomena of fire*

ISO 9705-1, *Reaction to fire tests — Room corner test for wall and ceiling lining products — Part 1: Test method for a small room configuration*

ISO/TR 9705-2, *Reaction-to-fire tests — Full-scale room tests for surface products — Part 2: Technical background and guidance*

3 Terms and definitions

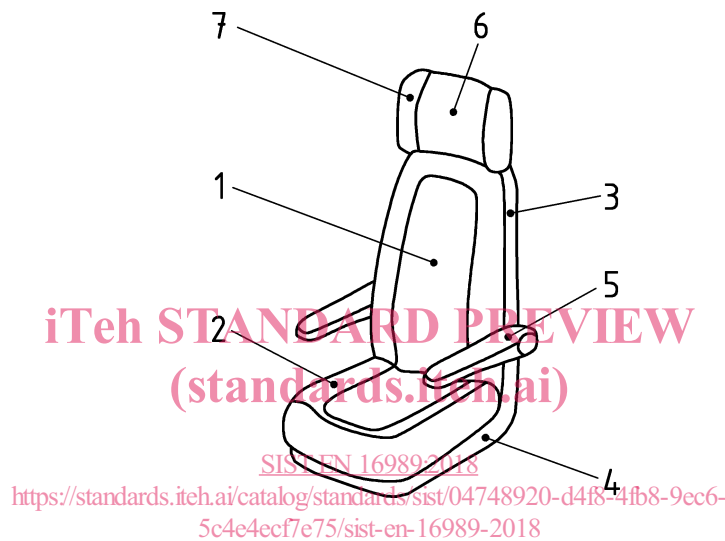
For the purposes of this document, the terms and definitions given in EN ISO 13943 and ISO 8421-1 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

Figure 1 defines the elements that make up a typical seat.

NOTE Depending on the application, not all seats include all of the elements shown. For example, seats can be partially upholstered or without upholstery at all. Seats can also be without armrests or without headrests.



Key

- | | | | |
|---|---------------------|---|-------------------------|
| 1 | seat back (cushion) | 5 | armrest |
| 2 | seat base (cushion) | 6 | anti-Macassar or pillow |
| 3 | seat shell (back) | 7 | headrest |
| 4 | seat shell (base) | | |

Figure 1 — Definition of seat elements

3.1

seat shell

exposed part of a seat structure

Note 1 to entry: A seat shell can be a single assembly or consist of separate base and back units.

3.2

seat structure

part of a seat to which upholstery, armrests, headrests and any accessories are fitted as required by the seat design

3.3

upholstery

fabrics and materials used in the covering and padding of a seat

EN 16989:2018 (E)**3.4
cushion**

soft and flexible part fitted to a seat to give support to the body and provide comfort, typically upholstered

**3.4.1
base cushion**

cushion fitted to a seat to support the bottom and thighs of the user

**3.4.2
back cushion**

cushion fitted to a seat to support the user's back

**3.5
armrest**

fixed or moveable support for the seat user's arms

**3.6
headrest**

part of the seat provided to support the user's head and neck, typically upholstered

Note 1 to entry: It can be integrated into the seat back or fitted as a separate component.

**3.7
anti-macassar**

removable cloth cover for a seat headrest

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Note 1 to entry: It can be regularly changed for cleaning, easily removable by hand.

**3.8
pillow**

loose or removable padded item to provide additional support or comfort

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Note 1 to entry: It can be regularly changed for cleaning, if attached to the seat, easily removable by hand.

**3.9
vandalization**

cutting or slashing of the covering of a rail vehicle seat with a knife or other blade

**3.9.1
full vandalization**

cutting of all the layers of the seat covering

Note 1 to entry: If all the layers of the covering are cut to give a fully vandalized seat, if the inner layer is bonded to the interior construction (i.e. foam), then it could be impossible to lift the cut layer without application of force to pull it away (see A.6).

**3.9.2
partial vandalization**

cutting of some of the outer layers of the seat covering only

Note 1 to entry: Partial vandalization can be achieved for example if anti-vandal materials are used beneath the outer covering.

4 Assessment method for the fire behaviour of rail seats

4.1 General requirements for assessment

The test seats are subjected to a specified flaming ignition source. The reactions are measured and analysed.

The flaming ignition source is a representation of the thermal attack of the ignition model 1 of EN 45545-1 and shall be represented by the application of a gas burner for three minutes, supplying 15 kW of heat (see 5.3 for details of the burner and 7.2 for the test procedure).

The test programme shall be undertaken, using the quantities of seats specified in 4.2.2 to obtain representative results for the type of seat to be assessed. Heat release rate (HRR), maximum average heat release (MARHE), total smoke production (TSP) and flame height shall be evaluated.

Test equipment specifications are set out in Clause 5.

The preparation of the seat specimens is set out in Clause 6 taking into account vandalization.

The fire test procedure for each seat and the requirements for analysis and reporting of the results are set out in Clause 7.

A standardized procedure to assess a seat's potential for vandalization is set out in Annex A.

Calibration procedures are set out in Annex B.

This test protocol does not provide information on the fire performance of seats under conditions other than those specified in this standard.

4.2 Seat test programme (standards.iteh.ai)

4.2.1 Test programme requirements

The seats shall be representative of production for the type of seat being assessed. The seats shall be complete and include back and base shells and all upholstery as used in practice, and if applicable arm rests and head rests. The testing programme is summarized in the flow chart set out in Figure 2.

Items which are removable by hand (e.g. anti-macassars, pillows) which are assessed separately according to EN 45545-2 shall not be included in the test specimens.

Vandalization requirements for the test seats shall be determined according to 4.2.2.

All seats to be tested shall be conditioned according to Clause 6 and tested according to Clause 7. If vandalization is required, it shall be applied according to 6.2.

The test programme shall be in accordance with 4.2.3.

For each individual fire test the results shall be reported according to the requirements of 7.2.7.

In addition a summary of results for the seat type assessed shall be produced to tabulate for all the seats tested the results required for product classification: MARHE, Peak HRR, TSP and flame height.

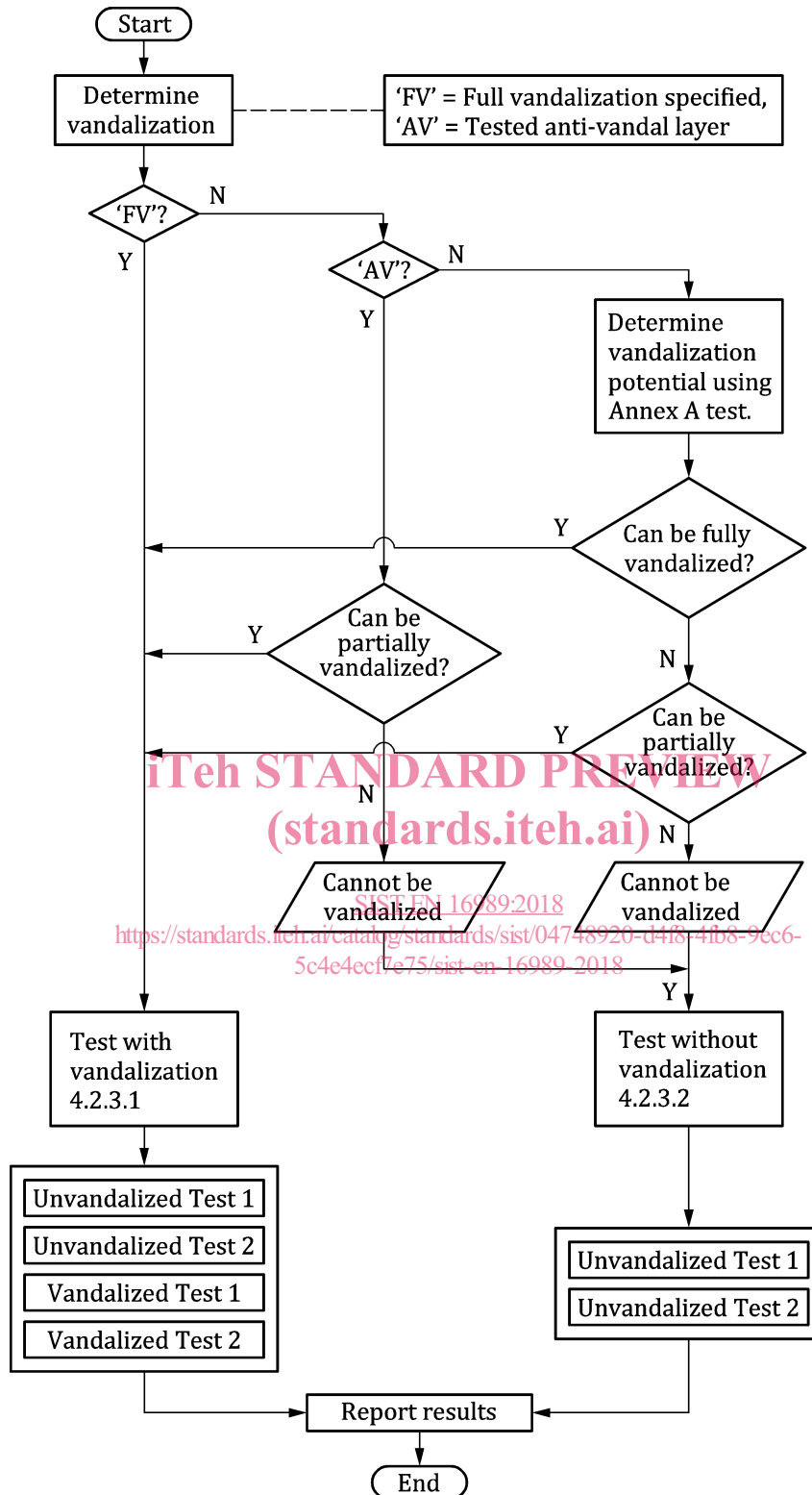


Figure 2 — Seat test flow chart

4.2.2 Seat vandalism

Where a seat's potential for vandalism is known, it is not required to make a new assessment provided that the results of earlier tests according to Annex A of this document are available and are included in the seat test reports.

For upholstered seats, as shown in Figure 2, the seat is either:

- 1) tested in a fully vandalized condition, or
- 2) considered to be unvandalizable or partially vandalizable by incorporating particular materials and construction techniques which have been already assessed using the procedure set out in Annex A, or
- 3) assessed using the procedure set out in Annex A to determine if the seat is tested fully vandalized, partially vandalized or unvandalized.

NOTE A seat with a replaceable outer covering which can be cut and layers beneath which cannot be cut when tested according to Annex A is an example of a seat construction which is partially vandalizable.

For seats to be tested in a fully or partially vandalized condition, the test programme shall be according to 4.2.3.1.

For seats to be tested in an unvandalized condition, the test programme shall be according to 4.2.3.2.

Seats without upholstery shall be tested without vandalization (according to 4.2.3.2).

4.2.3 Seat fire test programme

4.2.3.1 Testing with vandalization

Four fire tests are required if the seat is to be tested fully or partially vandalized.

All seats to be tested shall be conditioned in accordance with 6.1.

The test programme shall be as follows:

- a) two fire tests shall be undertaken according to Clause 7, with the seat in a vandalized condition. Vandalization shall be applied to the seat to be tested in accordance with 6.2;
- b) two fire tests shall be undertaken according to Clause 7, with the seat in an unvandalized condition.

4.2.3.2 Testing without vandalization

All seats to be tested shall be conditioned in accordance with 6.1.

Two fire tests shall be undertaken according to Clause 7 with the seat in an unvandalized condition.

5 Test equipment and facilities

5.1 Test equipment

The air supply should be sufficient to ensure that the combustion process is not affected. There should be a uniform air supply through the opening of the front side under the hood.

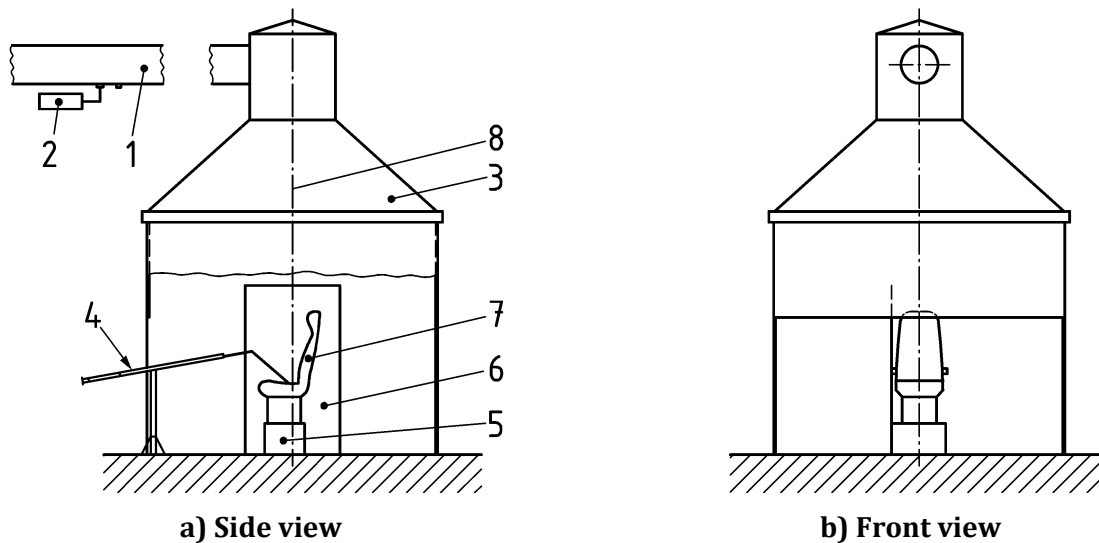
NOTE 1 These conditions can be achieved if the tests are conducted in a room having a volume of at least 250 m³.

To conduct the complete seat fire test described in this document the following test equipment is required as shown in Figure 3:

- a hood and smoke exhaust system (see 5.2);
- a gas burner assembly (see 5.3);
- instrumentation (see 5.4).

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NOTE 2 It is assumed that this equipment is located in facilities similar to those typically found in a fire testing laboratory.



Key

- | | | | |
|---|------------------------------|---|---------------------------|
| 1 | exhaust duct | 5 | seat support |
| 2 | exhaust duct instrumentation | 6 | side panel |
| 3 | hood and side sheets | 7 | seat |
| 4 | burner | 8 | vertical axis of the hood |

Figure 3 — Complete seat test method schematic

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5.2 Hood and smoke exhaust system

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5.2.1 General requirements

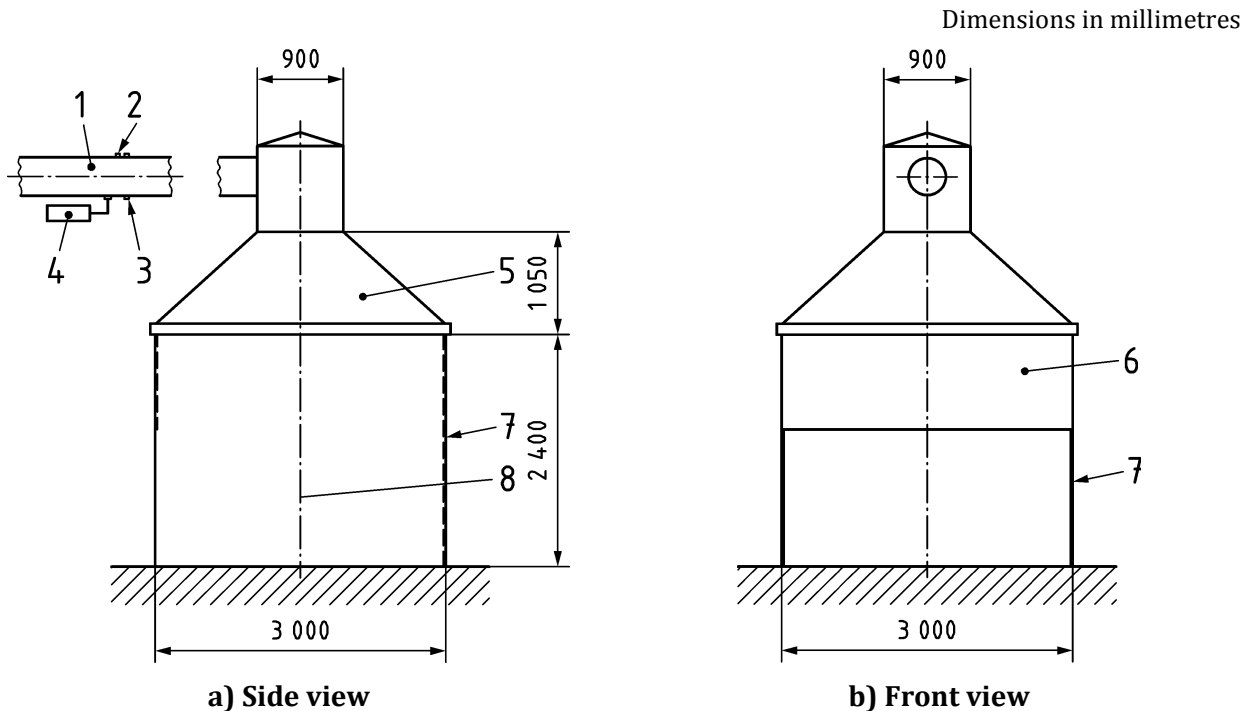
A hood and exhaust system to measure heat release using oxygen depletion calorimetry and to measure smoke production shall be used.

A smoke hood, exhaust duct and associated instrumentation in accordance with the dimensions given in ISO 9705-1 and ISO/TR 9705-2 shall be used.

It is permissible to use alternative systems which shall be demonstrated to not change the reaction to fire behaviour of the seat undergoing test and it shall be demonstrated that the accuracy of the measurements is as least as accurate as the ISO 9705 arrangement.

The lower edge of the hood shall be at a height of 2 400 mm above floor level.

Three sides of the hood shall have non-combustible sidewalls extending to the floor, the fourth side shall be fitted with a steel plate 3 000 mm by 1 000 mm thus enabling ventilation and observations to be taken throughout the test. See Figure 4.

**Key**

- | | | | |
|---|---|---|---------------------------|
| 1 | exhaust duct | 5 | smoke hood |
| 2 | volume flow measurement | 6 | steel plate |
| 3 | smoke measurement system | 7 | side and end walls |
| 4 | gas analysers (O ₂ , CO ₂) | 8 | vertical axis of the hood |

NOTE It is possible for the exhaust system to be located on any of the four faces of the hood plenum chamber.

Figure 4 – Smoke hood and exhaust system

5.2.2 Volume flow measurement system

The volume flow in the exhaust duct shall be measured using a pressure transducer with a range of at least 0 Pa to 250 Pa, and a precision of $\pm 2,5$ Pa. The pressure transducer output shall have a 90 % response time of 1 s or better.

An orifice plate system is recommended for the pressure measurement used to determine the volume flow. Alternatives are a pitot tube or a bi-directional probe.

For calibration of the volume flow system, see Annex B.

5.2.3 Gas analysers

The gas sampling probe shall be connected to a gas conditioning unit and gas analysers for O₂ and CO₂.

The O₂ analyser shall be of the paramagnetic type and:

- shall be capable of measuring at least in the range of 16 % to 21 % oxygen (V_{O_2}/V_{air});
- the response time of the analyser shall be not more than 12 s;
- the noise and drift of the analyser shall be not more than 100×10^{-6} (100 ppm) over a period of 30 min;
- the output from the analyser to the data acquisition system shall have a resolution of not greater than 100×10^{-6} (100 ppm).