



**International
Standard**

ISO 20182

**Refractory test-piece preparation —
Gunning refractory panels by the
pneumatic-nozzle mixing type guns**

*Préparation d'éprouvettes réfractaires — Panneaux réfractaires
pour gunitage au pistolet mélangeur pneumatique*

**Third edition
2024-10**

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 33, *Refractories*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 187, *Refractory products and materials*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This third edition cancels and replaces the second edition (ISO 20182:2008), which has been technically revised.

The main changes are as follows:

- Scope has been broadened to include preparation of gunned panels under both controlled laboratory (“standard”) conditions and “site” conditions; this broadening of scope aligns with that adopted in ISO18886;
- in [6.5](#), details of two acceptable support plates have been amended;
- in [Clause 4](#), provision has been made for the use of a gunning liquid other than water and examples of liquids other than water that might typically pertain, are given;
- [Clause 8](#) has been revised;
- in [Clause 9](#) test report item a), details of any stainless-steel wire fibre additions are to be reported;
- [A.2](#) has been amended, specifying that it is the as-cured mass of the panel that is to be used as the basis for rebound calculations.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Refractory test-piece preparation — Gunning refractory panels by the pneumatic-nozzle mixing type guns

WARNING — This document can involve the use of hazardous materials, operations and equipment. It does not attempt to address the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations prior to use.

1 Scope

This document describes the procedure for the preparation of test panels from refractory materials by gunning through pneumatic nozzle mixing type guns at ambient temperatures. The test pieces are for the determination of properties on as-gunned products prepared under either “standard conditions” (as required for quality assurance or product development) or “site conditions”. In the case of “site conditions”, the purpose of the testing is to establish the properties pertaining to a given installation or a given set of installation conditions. In this case, the panel can be obtained during the on-site installation. Parameters such as ambient temperature, gunning elevation, air pressure and curing conditions (temperature, orientation of the panel) applicable during the preparation of the panel are as near as possible to the respective parameters pertaining to the site installation.

It is also possible to simulate certain “site conditions” by gunning panels off-site, for example, in a laboratory setting. This is acceptable under this document, by agreement between interested parties.

This document does not apply to plastic gunning mixes and to those mixes that contain aggregates that are susceptible to hydration.

This document does not apply to shotcrete type mixes, which are dealt with in ISO 18886.

2 Normative references

The following documents are referred to in the text in such a way that some or all 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.

ISO 836, *Terminology for refractories*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 836 and the following apply.

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

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

3.1 gun

assembly, essentially comprising a chamber into which the refractory is added, together with a mechanism that controls the flow of the material through the unit

Note 1 to entry: Depending on the type used, the gun may be open at the top, or a closed pressurized unit may be used.

3.2

rebound material

material that fails to adhere to the surface when being sprayed and ricochets out of the immediate area

4 Principle

Refractory material is conveyed pneumatically in either a dry or (occasionally), pre-dampened form to the test site, using equipment of the nozzle mixing type. Then liquid (most commonly, water) is introduced to the refractory mix at the nozzle and the mixture is projected onto a support plate (see [6.5](#)).

Examples of liquids other than water that can be used during the “dry gunning” operation described above, include “binders” such as colloidal silica; or setting-time accelerators (which are typically alkaline solutions). Water is the default gunning liquid. Any other gunning liquid, if used, shall be specified.

5 Precision

Differences between various types of equipment and in operator techniques can result in variations in the physical properties of the gunned specimens. For referee testing, the same operator should use the same equipment to produce test specimens.

NOTE At time of publication, interlaboratory testing to determine the precision of this document with respect to different types of material and with respect to the physical tests most performed on specimens cut from gunned panels, has not been scheduled. If such work is completed, a suitable addendum can be included in a future edition. It is stressed that this document deals only with sample preparation. At time of publication, it is considered that interlaboratory testing to evaluate the precision (and accuracy) of specific test methods, is a higher priority.

6 Apparatus

6.1 Gun of the pneumatic nozzle mixing type.

6.2 Air Compressor, capable of supplying a steady airflow at the required pressure and volume.

In some cases, depending on the material to be gunned and the layout, a dedicated air compressor is not necessary to achieve satisfactory results. “Plant air” can be sufficient. In either case, it is recommended that an air filter with “water trap” be fitted on the air inlet side, so that clean, de-humidified air is supplied for use in gunning.

6.3 Mixer. The mixer shall be capable of producing a homogeneous mixture of the material to be tested.

6.4 Hose/nozzle assembly, comprising a reinforced pneumatic hose and a nozzle assembly suitable for the material being gunned.

6.5 Gunned-material support plate, flat, capable of producing a panel having minimum usable dimensions of 380 mm x 380 mm x 115 mm thickness that is suitable for the tests intended to be carried out, after allowance for any material to be cut off as described in [Clause 8](#). The preferred support plate has ledges at both sides and the top edge. An example of the preferred support plate is given in [Figure 1a](#)).

An alternative support plate may be used, 300 mm to 500 mm in length, and having top and bottom support edge 100 mm in width and of the same overall length as the support plate. An example of the alternative support plate is given in [Figure 1b](#)).

The support plate may be made of wood or steel and shall not flex during use. The support plate may be larger than the minimum panel size, to allow the edges to be removed from the gunned panel, for example, to remove trapped rebound material at the bottom, and other edge effects.

Interested parties shall agree which type of support plate is to be used. The test report shall state the dimensions of the gunned-material support plate and panel produced, and the type of support plate used.