INTERNATIONAL STANDARD

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Vitreous and porcelain enamels — Glass-lined apparatus for process plants —

Part 2: Designation and specification of resistance to chemical attack and thermal shock

Émaux vitrifiés — Appareils émaillés pour les installations industrielles —

Partie 2: Désignation et spécifications de la résistance à l'attaque chimique et au choc thermique

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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

ISO 28721-2 was prepared by the European Committee for Standardization (CEN) (as EN 15159-2) and was adopted, under a special “fast-track procedure”, by Technical Committee ISO/TC 107, *Metallic and other inorganic coatings*, in parallel with its approval by the ISO member bodies.

ISO 28721 consists of the following parts, under the general title *Vitreous and porcelain enamels — Glass-lined apparatus for process plants*:

— *Part 1: Quality requirements for apparatus, components, appliances and accessories*

— *Part 2: Designation and specification of resistance to chemical attack and thermal shock*

— *Part 3: Thermal shock resistance*

Introduction

For many materials, the chemical composition can serve as a basis for a specification. This is not possible for chemical enamels because the composition is tied very closely to the specific enamelling technique and is therefore not disclosed by the manufacturer for competitive reasons. In order to ascribe measurable attributes to an enamel besides its general designation, the manufacturer conducts standardized tests and specifies its enamel in terms of the resulting resistance to corrosion and thermal shock, together with a declaration of the structure of the cover coat enamel and the colour of the enamel.

The quality requirements stated in this part of ISO 28721 represent the minimum requirements a chemical enamel is expected to meet based on the current state of the art.

Vitreous and porcelain enamels — Glass-lined apparatus for process plants —

Part 2: Designation and specification of resistance to chemical attack and thermal shock

1 Scope

This part of ISO 28721 specifies requirements for the resistance to chemical attack and thermal shock of chemical enamels and their designation for ordering purposes.

It is applicable to enamelled apparatus, piping and other components primarily used for process equipment in chemical plants.

It only applies to unalloyed and low-alloy carbon steels suitable for enamelling.

NOTE The main criteria for assessing enamel quality are the resistance to chemical attack and thermal shock and the structure of the cover coat enamel.

2 Normative references

The following referenced documents are indispensable for the application 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 13807, *Vitreous and porcelain enamels — Determination of crack formation temperature in the thermal shock testing of enamels for the chemical industry*

ISO 28706-2, *Vitreous and porcelain enamels — Determination of resistance to chemical corrosion — Part 2: Determination of resistance to chemical corrosion by boiling acids, boiling neutral liquids and/or their vapours*

ISO 28706-4, *Vitreous and porcelain enamels — Determination of resistance to chemical corrosion — Part 4: Determination of resistance to chemical corrosion by alkaline liquids using a cylindrical vessel*

3 Designation

The enamel quality shall be designated by stating the following information:

— the rate of corrosion in hydrochloric acid, determined in accordance with ISO 28706-2;

— the rate of corrosion in sodium hydroxide solution, determined in accordance with ISO 28706-4;

— the crack formation temperature, determined in accordance with ISO 13807;

— the structure of the cover coat enamel, e.g. all-vitreous, all-semicrystalline, vitreous on a semicrystalline intermediate layer and semicrystalline on a vitreous intermediate layer;

— the colour of the enamel.

The designation of data on quality requirements in accordance with this part of ISO 28721 shall be as follows:

Enamel quality requirements in accordance with ISO 28721-2.

4 Quality requirements

4.1 Rate of corrosion in hydrochloric acid

When determined in accordance with ISO 28706-2, the resistance to condensing hydrochloric acid vapour shall be equal to or less than 0,08 mm/year.

4.2 Rate of corrosion in sodium hydroxide solution

When determined in accordance with ISO 28706-4, the rate of corrosion in sodium hydroxide solution shall be equal to or less than 0,40 mm/year.

The ratio of the volume, in cubic centimetres, of the attacking sodium hydroxide solution to the area, in square centimetres, of the exposed enamel surface shall be 3,5:1.

4.3 Crack formation temperature

When determined in accordance with ISO 13807, the crack formation temperature shall be equal to or greater than 190 °C.

For enamels used on accessories such as agitators, baffles, thermometer wells, immersion tubes, intermediate rings, sensors and perforated plates, and also for piping accessories and pumps, a crack formation temperature of at least 170 °C may be permissible.

The crack formation temperature determined in accordance with ISO 13807 represents a characteristic of the specimens tested. The test result shall not, therefore, be applied directly to an apparatus or accessories.

Temperature limits for thermal shock and for heating and cooling of an apparatus are given in the thermal shock diagram and the heating/cooling diagram in ISO 28721-3.