
**Thermal spraying — Procedures for the
application of thermally sprayed coatings
for engineering components**

*Projection thermique — Procédure d'application de revêtements obtenus
par projection thermique pour les pièces mécaniques*

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ISO 14921:2001

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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 3.

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 member bodies casting a vote.

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

International Standard ISO 14921 was prepared by the European Committee for Standardization (CEN) in collaboration with ISO Technical Committee TC 107, *Metallic and other inorganic coating*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

Throughout the text of this standard, read "...this European Standard..." to mean "...this International Standard...".

Annexes A, B and C of this International Standard are for information only.

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Contents

	Page
Foreword	iv
1 Scope	1
2 Normative references	1
3 Component and coating design considerations	1
3.1 Pre-inspection	1
3.2 Component substrate	2
3.3 Coating	2
4 Preliminary machining or grinding	2
5 Masking	2
6 Methods of surface preparation	3
7 Spraying	3
8 Inspection after spraying	3
9 Sealing	3
10 Finishing	3
11 Final inspection	3
Annex A (informative) Flow chart for assessment of suitability of thermal spraying	4
Annex B (informative) Check list to assist in determining the most suitable coating system for the intended purpose	5
Annex C (informative) Example of thermal spraying procedure specification or record	6

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Foreword

The text of EN ISO 14921:2001 has been prepared by Technical Committee CEN/TC 240 "Thermal spraying and thermally sprayed coatings", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 107 "Metallic and other inorganic coatings".

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 February 2002, and conflicting national standards shall be withdrawn at the latest by February 2002.

The annexes A to C are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This standard relates to the general procedures of application of thermally sprayed coatings as defined in EN 657. The purpose of these coatings being either to reclaim worn and non conforming parts or to enhance the surface properties of components for specific purposes.

For example, to provide wear resistance, low coefficient of friction, electrical or thermal conductivity or insulation, and resistance to corrosion.

This standard is not intended to provide definitive methods for specific work and attention shall be paid to the proper selection of process and materials for the purpose and to the skills of the thermal sprayer as defined in EN ISO 14918.

Additionally it does not include requirements for the protection of structural steelwork, covered by EN 22063, nor the use of coatings of self fluxing alloys which are subsequently fused, covered by EN ISO 14920.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references, the latest edition of the publication referred to applies (including amendments).

EN 657

Thermal spraying – Terminology, classification

EN 13507

Thermal spraying – Pre-treatment of surfaces of metallic parts and components for thermal spraying

EN ISO 14918

Thermal spraying – Approval testing of thermal sprayers (ISO 14918 : 1998)

EN ISO 14920

Thermal spraying – Spraying and fusing of self-fluxing alloys (ISO 14920 : 1999)

EN 22063

Metallic and other inorganic coatings – Thermal spraying – Zinc, aluminium and their alloys (ISO 2063 : 1991, modified)

3 Component and coating design considerations

The factors to be considered are illustrated in the flow chart shown in Annex A. If any of the following considerations cannot be met satisfactorily, thermal spraying cannot be carried out.

3.1 Pre-inspection

Before carrying out any other procedure the component shall be inspected to determine its suitability for spraying. Attention shall be given to :

- In the case of rotating or reciprocating parts, concentricity shall be checked and, where necessary, corrected.
- Determine that it is free from cracks or damage which may affect performance. If any serious defects cannot be removed, spraying cannot be carried out.
- Establish dimensions of the area to be sprayed.
- Establish if there is any evidence of a previous coating.

3.2 Component substrate

To establish whether a thermally sprayed coating is suitable for the intended purpose, consideration should be given to the following

- Certain substrate materials require special consideration.
- Sprayed coatings do not significantly add to the strength of the part and therefore the effects of any reduction in the dimensions of the original component should be considered.
- The fatigue strength may be affected by the method of surface preparation and application of certain materials.
- Certain surface hardening processes such as nitriding leave gaseous inclusions which may have a detrimental effect on the bonding and porosity of the coating.

Where hardened surfaces prevent proper preparation, the limitations of the coating systems which can be applied, and the properties subsequently derived, shall be considered.

- The surface to be coated shall be accessible for the proper preparation and spraying.

3.3 Coating

The different spraying processes as defined in EN 657 and materials available will result in differences in coating characteristics. To determine the most suitable coating system will require consideration of the following.

- Bond strength requirement;
- thickness requirement;
- surface requirement;
- surface load; thermal spraying may not be suitable for reaction on spot load sensitive;
- the properties required in the final deposit, e. g. resistance to different types of wear mechanism, corrosion, chemical attack, temperature and other environmental conditions;
- where the level of porosity in the coating is unacceptable a suitable method of sealing, and type of sealant, shall be used;
- oxide content; where necessary this may be controlled by process variables and materials.

Annex B shows a check list which details the information required to determine the most suitable coating system for the intended purpose.

4 Preliminary machining or grinding

Any previously applied coatings shall be removed. However consideration shall be given to the possibility that a prior treatment may have been carried out for special purposes. For example, for fatigue strength.

Pre-machining shall be carried out to remove wear profiles and ensure that the final coating thickness will be even. In the case of new parts the area to be sprayed shall be undercut to allow for the coating. Coatings shall be inlaid where possible. The forms or edges of the prepared area shall be suitable for the coating process.

It is important that the surfaces are machined concentric to the relevant axis to ensure an even thickness of deposit. Sharp edges to be removed wherever possible.

Wherever possible, pre-machining shall be carried out without the use of a lubricant. This is particularly important in the case of porous substrate materials. Care shall be taken to ensure that during this operation stresses are not induced into the substrate which may have an adverse effect on the performance of the sprayed component.

Note that, where necessary, the component should be degreased after preliminary machining.

5 Masking

Where appropriate the surfaces that do not require spraying can be masked with a suitable material. Ideally, this material shall be resistant to both abrasive grit blasting and thermal spraying. Otherwise separate masking for each operation shall be used

Precautions shall be taken to ensure that the masking material does not contaminate the surface to be sprayed at all times.

6 Methods of surface preparation

Where trapped contamination is identified under clause 4, this must be removed and the surface cleaned immediately before surface preparation commences.

A well prepared, activated surface is required to achieve maximum bond strength to metallic substrates. Grit blasting is the normal method of achieving this. All other surface preparation methods shall be agreed between the contracting parties.

The surface preparation shall be in accordance with EN 13507:2001.

7 Spraying

The sprayed coating should be applied as soon as possible after preparation with parameters as given in the thermal spraying procedure specification. An example is given in Annex C. Reasonable precautions shall be taken to prevent contamination during the period between blasting and spraying.

Where appropriate the surface to be sprayed may be pre-heated immediately prior to spraying. This shall be carried out in such a manner as to avoid contamination or local overheating of the prepared surface.

Before and during spraying the surface shall be warm enough to prevent moisture condensating. Preheating will remove any condensed moisture from the surface to be coated.

During spraying, control of the temperature of the coating is necessary to avoid excessive residual stresses which may be detrimental to the coating performance.

Dust entrapment in the coating shall be minimized.

All equipment shall be operated in accordance with the manufacturers instructions.

8 Inspection after spraying

Inspection of the sprayed coating shall be carried out after the sprayed deposit has cooled to room temperature by:

- visual inspection for evidence of defects
- measurements taken to verify that the deposit is to the required dimensions. If any defects are observed, such as disbonding, cracking or other unacceptable defects, the coating shall be removed and the preparation and spraying repeated.

9 Sealing

Thermally sprayed coatings may be sealed where required and this shall be carried out as soon as possible after spraying. If the sealant contains a solvent this operation shall be carried out after the coating has cooled to ambient temperature.

A range of materials and procedures are available.

10 Finishing

Coatings may be finished by machining or grinding techniques. However, due to the properties of thermally sprayed coatings, different tools and finishing parameters may be required to achieve the requirements of the specification.

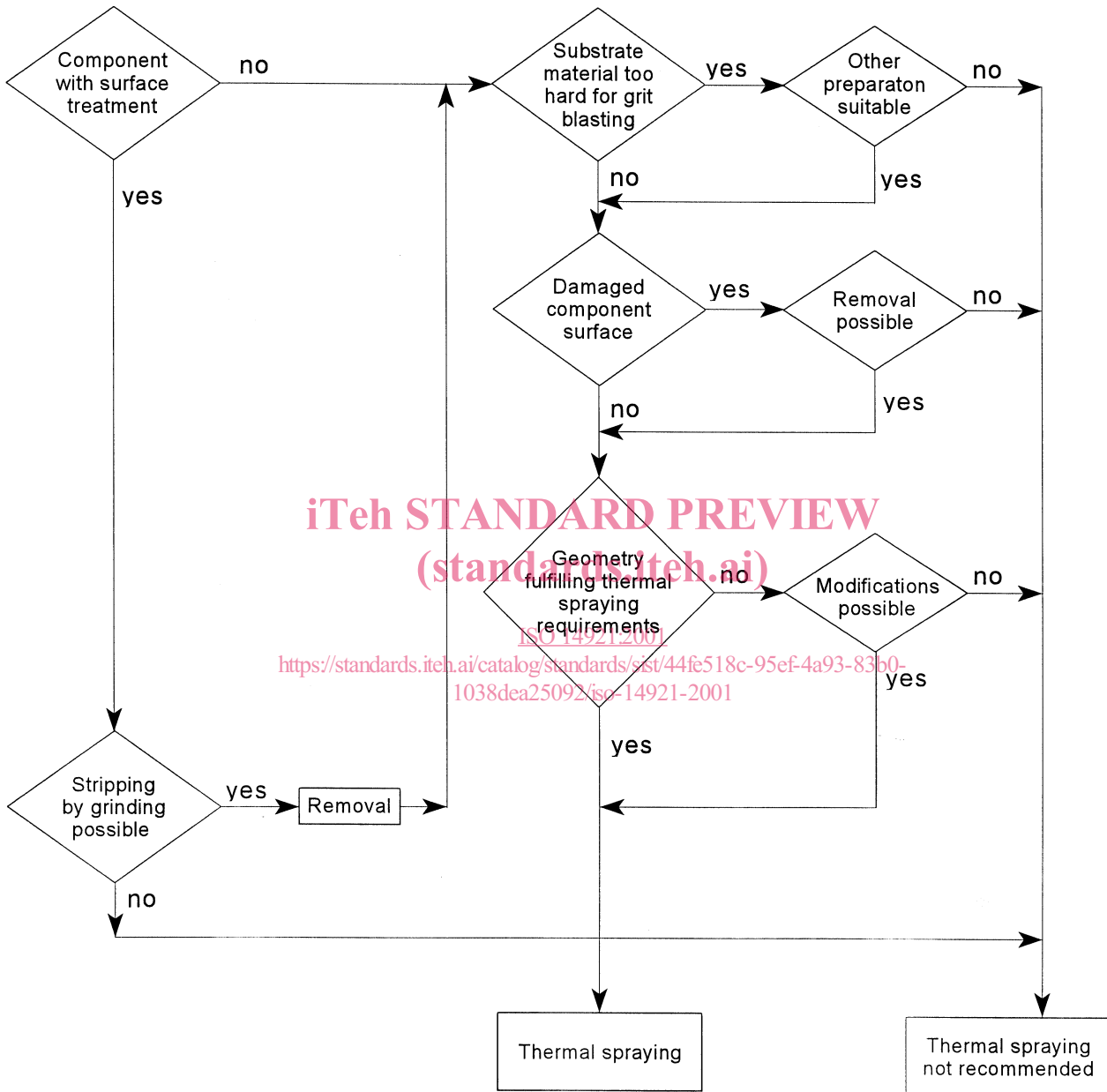
11 Final inspection

The coating may be inspected for the following.

- Dimensional accuracy within the required tolerances, as specified.
- Specified surface finish is obtained
- Absence of coating defects for example, cavities, score marks, cracks or lifting of the coating.
- All overspray has been removed.
- Cleanliness, in particular of oilways.
- Other specified requirements.

Annex A (informative)

Flow chart for assessment of suitability of thermal spraying



Annex B (informative)

Check list to assist in determining the most suitable coating system for the intended purpose

The following data should be determined:

1. Component name.
2. Brief description of its function.
3. The area to be sprayed.
4. Areas to be masked off.
5. Any special precautions to be taken during handling or processing.
6. Function of the coating.
 - Is it a running surface? Yes/No
 - If "Yes", against what?
 - Lubricated? Yes/No
 - If "No" Is it subject to abrasion? Yes/No
 - If "Yes ", state media
7. Is it subject to chemical attack? Yes/No
 - If "Yes", state chemical and concentration
8. Is the operating temperature ambient [ISO 14921:2001](https://standards.iteh.ai/catalog/standards/sist/44fe518c-95ef-4a93-83b0-1038dca25092/iso-14921-2001) Yes/No
 - If "No", state temperature
9. Is there any thermal shock? Yes/No
 - If "Yes", give details
10. Are there any corrosive gases present? Yes/No
 - If "Yes", give details
11. If repair job, state thickness requirement
12. Is the coating to be finished? Yes/No
13. What surface finish is required?
14. If "Yes". state finish size and tolerance
15. Where applicable, state concentricity requirement
16. State any special requirement not covered by the above

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