BRITISH STANDARD

BS EN
1395-4:2007

Thermal spraying — Acceptance inspection of thermal spraying equipment —

Part 4: Plasma spraying

The European Standard EN 1395-4:2007 has the status of a British Standard

ICS 25.220.20

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 1395-4:2007. This standard together with BS EN 1395-1, BS EN 1395-2, BS EN 1395-3, BS EN 1395-5, BS EN 1395-6 and BS EN 1395-7 supersedes BS EN 1395:1996.

The UK participation in its preparation was entrusted to Technical Committee STI/40, Thermally sprayed inorganic finishes.

A list of organizations represented on STI/40 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Thermisches Spritzen - Abnahmeprüfungen für Anlagen zum thermischen Spritzen - Teil 4: Plasmaspritzen

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Foreword

This document (EN 1395-4:2007) has been prepared by Technical Committee CEN/TC 240 “Thermal spraying and thermally sprayed coatings”, 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of an identical text or by endorsement, at the latest by July 2007, and conflicting national standards shall be withdrawn at the latest by July 2007.

This document together with EN 1395-1, 1395-2, 1395-3, 1395-5, 1395-6 and 1395-7 supersedes EN 1395:1996.

EN 1395 consists of the following Parts, under the general title *Thermal spraying — Acceptance inspection of thermal spraying equipment*:

— *Part 1: General requirements;*

— *Part 2: Flame spraying including HVOF;*

— *Part 3: Arc spraying;*

— *Part 4: Plasma spraying;*

— *Part 5: Plasma spraying in chambers;*

— *Part 6: Manipulator systems;*

— *Part 7: Powder feed systems.*

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1 Scope

This European Standard specifies requirements for the acceptance inspection of thermal spraying equipment, in this case plasma spraying, used in spray jobs to produce thermally sprayed coatings of reproducible quality.

This part should be used in conjunction with EN 1395-1, which includes general requirements and explanations of procedures.

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.

EN 657:2005, *Thermal spraying — Terminology, classification*

EN 1274:2004, *Thermal spraying — Powders — Composition, technical supply conditions*

EN 1395-7, *Thermal spraying — Acceptance inspection of thermal spraying equipment — Part 7: Powder feed systems*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 657:2005 and the following apply.

3.1
high voltage ignition device
unit that generates a high voltage (kV) and low current (mA) between the electrodes of the plasma spraying torch in order to ignite the arc

4 Principles of acceptance inspection

4.1 General

The following clauses reveal state of the art technology in thermal spray equipment and the minimum requirements concerning a stable parameter setting and maintenance according to the classes given in Annex A.

4.2 High-voltage ignition device

Other components and functions of the spraying equipment and other machines and/or equipment operated near by to the spraying equipment shall not be affected by operation of the high-voltage ignition device.

4.3 Plasma gases

The plasma spraying equipment shall be designed and installed in such a manner, that safe operation with plasma gases specified by the user will be achieved.

4.4 Plasma spray nozzle

Processing of the spraying powder shall be possible without producing any disturbing deposits on and/or in the nozzle. Nozzles with different shapes and powder ports (internal or external) may be used for special applications.

4.5 Spraying powder feed unit

The powder feed unit shall be suitable for operation with the spraying equipment to be taken.

The unit shall permit uniform processing of the powder required. It shall be possible to adjust the powder feed rate. The set points shall be constant and reproducible, which is a precondition for this being adequate and constant carrier gas pressure and flow.

5 Procedure of acceptance inspection

5.1 General

Spraying equipment shall be deemed properly supplied for all suitable spraying applications and for use with all suitable spraying materials required for the spraying process if it complies with the following requirements:

5.2 Electrical power

Proof of the power rating required shall be given by 20 min of spraying with the parameters for aluminium oxide according to EN 1274:2004, 12.1 as recommended by the equipment manufacturer.

During the test, the following items will be examined:

— electrical control;

— gas control;

— cooling water temperature.

Limits of deviation: see Annex A; Class A and Class B.

After stabilisation of arc and plasma, the deviation of the voltage (variable parameter) from the set point shall not exceed 3 % (Class A) and 12 % (Class B).

5.3 High-voltage ignition device

The high-voltage ignition device shall be deemed to meet the requirements given in 4.2 if it does not interfere with any appliances and functions of the spraying equipment during the test as specified in 5.2. There should be no excessive erosion wear visible on the nozzle (spark).

5.4 Plasma gases

The system shall be deemed to comply with the specified requirements if the following requirements are satisfied by the acceptance inspection. The values of gas pressure and gas flow shall not deviate by more than $\pm$ 1,5 % (Class A) and $\pm$ 5 % (Class B) from the set points over a 20 min period of spraying. If the secondary gas is the variable parameter, the deviations from the set point shall not exceed 3 % (Class A) and 12 % (Class B) after stabilisation. Setting the primary gas pressure and/or flow rate shall not affect the corresponding values of the secondary gas and carrier gas and vice versa.

5.5 Plasma spray nozzle

The nozzle shall be deemed to comply with the requirements specified in 4.4 if there are no disturbing deposits of spraying material on or in the nozzle when testing as specified in 5.2.

5.6 Powder feed unit

The suitability of the system to process powders as specified in 4.5 shall be tested according to EN 1395-7.

6 Designation

Acceptance inspection of the thermal spraying equipment for plasma spraying shall be designated as follows:

Acceptance inspection according to EN 1395-4.

7 Inspection report

An example for the inspection report is given in Annex A.

Annex A
(informative)

Inspection report for plasma spraying equipment (initial test/retest)

The initial test/retest fulfils the requirements of the acceptance inspection according to EN 1395-4.

User: .....

Manufacturer:.....

Year of manufacture: .....

Type of equipment:.....

Type of spraying gun: .....

Powder used for testing:.....

Type of powder feed unit: ..... Size range: .....
.....

CE-documentation complete: yes / no

Item tested, where applicable			Full scale	Set point	Change after 20 minute continuous testing			Limit		Evaluation	
					actual value		maximum deviation in %	in %		passed	failed
					min.	max.		Class A	Class B		
Electrical power	current	A						± 1,5	± 5		
	voltage	V						± 1,5	± 5		
Primary gas	pressure	bar						± 1,5	± 5		
	flow	Nl/min[1)]						± 1,5	± 5		
Secondary gas	pressure	bar						± 1,5	± 5		
	flow	Nl/min[1)]						± 1,5	± 5		
Carrier gas	pressure	bar						± 1,5	± 5		
	flow	Nl/min[1)]						± 1,5	± 5		
Cooling water	flow	l/min						± 5	± 10		
	inlet temperature to spray gun	°C						5 °C	10 °C		

[1)] Referred to temperature 0 °C and normal pressure (1 013,25 hPa).

High-voltage ignition device (interferes with other devices or functions): yes / no

Deposits: yes / no

Nozzle disturbance: yes / no

Time needed for stabilisation: .....

Automatic energy shutdown: – Lack of gas: yes / no

– Lack of cooling water: yes / no

Limits of error of measuring instruments: ..... % of set point (max. 5 %)

– Class 2,5 [2)]: yes / no

Comments:.....

.....

.....

.....

.....

.....

The thermal spraying equipment has been accepted: yes / no

Date:..... Inspector's signature: .....

Date:..... Customer's signature: .....

Date:..... Supplier's signature:.....

[2)] Maximum permissible error expressed by percentage of measuring span.

Bibliography

[1] EN 1395-1, *Thermal spraying — Acceptance inspection of thermal spraying equipment — Part 1: General requirements*

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