BS EN 10228-4:2016

BSI Standards Publication

Non-destructive testing of steel forgings

Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings

Documents
Document Sharing Hub

Full document details: BS EN 10228-4:2016

National foreword

This British Standard is the UK implementation of EN 10228-4:2016. It supersedes BS EN 10228-4:1999 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee ISE/111, Steel Castings and Forgings.

A list of organizations represented on this committee 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.

© The British Standards Institution 2016.
Published by BSI Standards Limited 2016

ISBN 978 0 580 80532 5

ICS 77.040.20; 77.140.85

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 June 2016.

Amendments/corrigenda issued since publication

Date	Text affected

Documents
Document Sharing Hub

Full document details: BS EN 10228-4:2016

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 10228-4

June 2016

ICS 77.040.20; 77.140.85

Supersedes EN 10228-4:1999

English Version

Non-destructive testing of steel forgings - Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings

Essais non destructifs des pièces forgées en acier - Partie 4: Contrôle par ultrasons des pièces forgées en aciers inoxydables austénitiques et austéno-ferritiques

Zerstörungsfreie Prüfung von Schmiedestücken aus Stahl - Teil 4: Ultraschallprüfung von Schmiedestücken aus austenitischem und austenitisch-ferritischem nichtrostendem Stahl

This European Standard was approved by CEN on 3 October 2015.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

© 2016 CEN All rights of exploitation in any form and by any means reserved worldwide for CEN national Members.

Ref. No. EN 10228-4:2016 E

Documents
Document Sharing Hub

Full document details: BS EN 10228-4:2016

Contents

Page

European foreword ... 4
1 Scope ... 5
2 Normative references ... 5
3 Terms and definitions ... 5
4 Mandatory information ... 6
5 Test procedure ... 6
5.1 General ... 6
5.2 Form ... 6
5.3 Content ... 7
6 Personnel qualification ... 7
7 Equipment and accessories ... 7
7.1 Instrument ... 7
7.2 Probes ... 7
7.2.1 General ... 7
7.2.2 Contouring ... 8
7.2.3 Nominal frequency ... 8
7.2.4 Normal-beam probes ... 8
7.2.5 Angle-beam probes ... 8
7.2.6 Dual-element probes ... 8
7.3 Calibration blocks ... 8
7.4 Reference blocks ... 8
7.5 Couplant ... 8
8 Routine calibration and checking ... 9
9 Stage of manufacture ... 9
10 Surface condition ... 9
10.1 General ... 9
10.2 Surface finish related to quality class ... 9
10.3 As-forged surface condition ... 9
11 Test sensitivity ... 10
11.1 General ... 10
11.2 Normal-beam probes ... 10
11.3 Angle-beam probes ... 10
11.4 Repeat testing ... 10
12 Scanning ... 10
12.1 General ... 10
12.2 Complex forgings ... 11
12.3 Grid scanning coverage ... 11
12.4 100 % scanning coverage ... 11
12.5 Scanning speed ... 11
13 Classification ... 14
13.1 Classification of indications ... 14
13.2 Classification of discontinuities ... 16

Documents
Document Sharing Hub
Full document details: BS EN 10228-4:2016

14 Recording levels and acceptance criteria **19**

15 Sizing **20**

16 Test report **21**

Annex A (informative) Maximum testable depth for corresponding beam path range for circumferential angle-beam scans **22**

Annex B (informative) Amplitude of indication in dB relative to % DAC **24**

Annex C (informative) Significant technical changes to the version EN 10228-4:1999 ..... **25**

Documents
Document Sharing Hub
Full document details: BS EN 10228-4:2016

European foreword

This document (EN 10228-4:2016) has been prepared by Technical Committee ECISS/TC 111 "Steel castings and forgings", the secretariat of which is held by AFNOR.

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 2016 and conflicting national standards shall be withdrawn at the latest by December 2016.

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

This document supersedes EN 10228-4:1999.

Annex C provides the significant technical changes to the previous version EN 10228-4:1999.

EN 10228 consists of the following parts under the general title *Non-destructive testing of steel forgings*:

— *Part 1: Magnetic particle inspection*;

— *Part 2: Penetrant testing*;

— *Part 3: Ultrasonic testing of ferritic or martensitic steel forgings*;

— *Part 4: Ultrasonic testing of austenitic and austenitic-ferritic stainless steel forgings.*

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, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Documents
Document Sharing Hub
Full document details: BS EN 10228-4:2016

1 Scope

This European Standard describes techniques for the manual, pulse-echo, ultrasonic testing of forgings manufactured from austenitic and austenitic-ferritic stainless steels. Mechanized scanning techniques, such as immersion testing, may be used but should be agreed between the purchaser and supplier (see Clause 4).

This part of EN 10228 applies to four types of forgings, classified according to their shape and method of production. Types 1, 2 and 3 are essentially simple shapes. Type 4 covers complex shapes.

This part of EN 10228 does not apply to:

— closed die forgings;

— turbine rotor and generator forgings.

Ultrasonic testing of ferritic and martensitic steel forgings is the subject of Part 3 of this European Standard.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1330-1, *Non destructive testing - Terminology - Part 1: List of general terms*

EN 1330-4, *Non-destructive testing - Terminology - Part 4: Terms used in ultrasonic testing*

EN 12668-1, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 1: Instruments*

EN 12668-2, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes*

EN 12668-3, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3: Combined equipment*

EN ISO 2400, *Non-destructive testing - Ultrasonic testing - Specification for calibration block No. 1 (ISO 2400)*

EN ISO 9712, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712)*

EN ISO 16811, *Non-destructive testing - Ultrasonic testing - Sensitivity and range setting (ISO 16811)*

EN ISO 16827, *Non-destructive testing - Ultrasonic testing - Characterization and sizing of discontinuities (ISO 16827)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1330-1 and EN 1330-4 apply.

AVA Documents
Document Sharing Hub

Full document details: BS EN 10228-4:2016

4 Mandatory information

The following aspects concerning ultrasonic testing shall be agreed between the purchaser and supplier at the time of the enquiry or order:

a) the manufacturing stage(s) at which ultrasonic testing shall be performed (see Clause 9);

b) the volume(s) to be tested and whether grid scanning coverage or 100 % scanning coverage is required (see Clause 12);

c) whether near surface testing is required (see 7.2.6);

d) the quality class required, or the quality classes and the zones to which they apply (see Clause 14);

e) the applicable recording/acceptance criteria if different from those detailed in Table 5, Table 6 or Table 7;

f) whether any special scanning coverage, equipment or couplant is required in addition to that detailed in Clauses 7 and 12;

g) the scanning technique to be used if not manual (see Clause 1);

h) the sizing techniques to be used for extended discontinuities (see Clause 15);

i) the technique(s) to be used for setting sensitivity (see Clause 11);

j) whether the test shall be conducted in the presence of the purchaser or his representative;

k) whether a written procedure shall be submitted for approval by the purchaser (see Clause 5);

l) whether testing by angle-beam probes is required (see 11.3);

m) the remaining test requirements for complex forgings (type 4) (see 12.2).

5 Test procedure

5.1 General

Ultrasonic testing shall be performed in accordance with a written test procedure. Where specified in the enquiry or order, the written test procedure shall be submitted to the purchaser for approval prior to the test.

5.2 Form

The written test procedure shall be one of the following:

a) a product specification;

b) a test procedure written specifically for the application;

c) this part of EN 10228 may be used if it is accompanied by examination details specific to the application.

Documents
Document Sharing Hub
Full document details: BS EN 10228-4:2016

5.3 Content

The written test procedure shall contain the following details as minimum requirements:

a) description of the forgings to be tested;

b) reference documents;

c) qualification of testing operator;

d) stage of manufacture at which the test is carried out;

e) testing zones specified in terms of the applicable quality classes;

f) preparation of scanning surfaces;

g) couplant;

h) description of the test equipment;

i) calibration and checking of the test equipment;

j) scanning plan;

k) description and sequence of testing operations;

l) recording levels;

m) characterization of discontinuities;

n) acceptance criteria;

o) test report.

6 Personnel qualification

Personnel shall be qualified in accordance with the requirements detailed in EN ISO 9712.

7 Equipment and accessories

7.1 Instrument

The ultrasonic instrument shall feature A-scan presentation and shall conform to EN 12668-1.

7.2 Probes

7.2.1 General

Probes used for the initial detection of discontinuities shall conform to EN 12668-2. Where supplementary probes are used for purposes other than the initial detection of discontinuities, they need not conform to EN 12668-2.

Documents
Document Sharing Hub
Full document details: BS EN 10228-4:2016