

Contents

Page

European foreword	5
1 Scope.....	6
2 Normative references.....	6
3 Terms and definitions	8
4 Classification and designation	10
4.1 Classification.....	10
4.2 Designation	10
5 Information to be supplied by the purchaser.....	11
5.1 Mandatory information	11
5.2 Options.....	11
5.3 Examples of an order	11
6 Manufacturing process	12
6.1 Steel manufacturing process	12
6.2 Condition of feedstock material	12
6.3 Structural hollow section manufacturing process.....	12
6.4 Qualification of personnel for NDT-activities.....	12
6.5 Delivery condition	13
7 Requirements.....	13
7.1 General.....	13
7.2 Chemical composition	13
7.2.1 Heat analysis.....	13
7.2.2 Product analysis.....	13
7.2.3 Carbon equivalent values (CEV) and P_{cm}	13
7.3 Mechanical properties	14
7.3.1 General.....	14
7.3.2 Post weld heat treatment (PWHT)	14
7.3.3 Through thickness testing	14
7.3.4 Flattening or bend test.....	14
7.3.5 Prequalification for arctic areas.....	14
7.4 Weldability data	14
7.5 Internal soundness and non-destructive testing	15
7.5.1 Non-destructive testing of the weld seam of hollow sections.....	15
7.5.2 Laminar discontinuities of hollow sections	15
7.6 Surface quality	15
7.7 Dimensions, tolerances, mass	16
7.7.1 Dimensions and tolerances on dimensions and shape	16
7.7.2 Mass of steel.....	16
8 Inspection	16
8.1 General.....	16
8.2 Types of inspection documents	16
8.3 Summary of inspections	18
8.4 Intermediary supply	23
9 Frequency of testing and preparation of samples and test pieces.....	23

9.1	Frequency of test.....	23
9.1.1	Chemical analysis	23
9.1.2	Tensile test and impact test.....	23
9.1.3	Testing of the weld seam.....	24
9.1.4	Testing of the corner regions for square or rectangular HFW hollow sections.....	24
9.2	Selection and preparation of samples for product analysis.....	24
9.3	Location of samples and orientation of tensile test pieces.....	24
9.4	Location of samples and orientation of impact test pieces	24
9.5	Preparation of test pieces for mechanical tests.....	25
9.5.1	General	25
9.5.2	Preparation of tensile test pieces	25
9.5.3	Preparation of impact test pieces	25
9.5.4	Test pieces for flattening and bend tests	26
10	Test methods.....	26
10.1	Chemical analysis	26
10.2	Mechanical tests.....	26
10.2.1	Test temperatures.....	26
10.2.2	Tensile test.....	26
10.2.3	Impact test.....	26
10.2.4	Flattening test.....	27
10.2.5	Weld bend test.....	27
10.3	Visual inspection and dimensional check.....	27
10.4	Non-destructive tests	27
10.4.1	General	27
10.4.2	NDT for the weld seam of HFW hollow sections.....	28
10.4.3	NDT for the weld seam of submerged arc welded hollow sections	28
10.4.4	Ultrasonic testing for laminar imperfections.....	28
10.4.5	NDT for surface quality.....	28
10.5	Retests, sorting and reprocessing	28
11	Marking and bundling.....	28
11.1	Die stamping and paint marking.....	28
11.2	Bundling.....	29
12	Options	29
Annex A (normative when Option 1 is specified by the purchaser) Further details of steel manufacturing procedures to be supplied by the manufacturer		40
Annex B (normative when Option 17 is specified by the purchaser) Weldability testing and mechanical testing of butt welds.....		41
B.1	General requirements.....	41
B.2	Welding processes and procedure	41
B.3	Butt-weld requirements.....	42
B.3.1	General	42
B.3.2	Test piece dimensions.....	42
B.3.3	Bevel detail	43
B.3.4	Welding processes.....	44
B.3.5	Nominal heat input.....	44

B.3.6	Heat treatment of S355NLHCO, S355MLHCO, S420MLHCO, S460MLHCO, S500MLHCO, S550MLHCO, S600 MLHCO, S650 MLHCO and S700MLHCO grades	44
B.3.7	Dehydrogenation of test pieces	45
B.4	Mechanical testing.....	45
B.4.1	General.....	45
B.4.2	Charpy-V-notch impact tests.....	46
B.4.3	Fracture mechanic test	47
B.4.4	Macrohardness	48
B.4.5	Cross-weld tensile test.....	49
Annex C	(normative when Option 17 is specified by the purchaser) Weldability testing - Bead-on-strip.....	54
C.1	General.....	54
C.2	Test material dimension	54
C.3	Welding method	54
C.4	Test condition	54
C.5	Specific test requirements: Macrosection and hardness tests	55
Annex D	(normative when Option 17 is specified by the purchaser) Weldability testing - Controlled thermal severity tests (CTS)	57
D.1	General.....	57
D.2	Test block dimensions	57
D.3	General welding details	57
D.3.1	Anchor welds	57
D.3.2	Test welds.....	57
D.4	Evaluation of the test welds	58
D.5	Hardness testing.....	58
Annex E	(informative) Helical submerged arc welded (SAWH) hollow sections.....	64
E.1	General.....	64
E.2	Additional weld geometry tolerances	64
Annex F	(informative) High strength square and rectangular cold formed HFW hollow sections.....	65
Annex G	(informative) Prequalification of steels for offshore structures operating in arctic areas	68
Bibliography		69

European foreword

This document (EN 10225-4:2019) has been prepared by Technical Committee CEN/TC 459 “ECISS - European Committee for Iron and Steel Standardization”¹, 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 November 2019, and conflicting national standards shall be withdrawn at the latest by November 2019.

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

This document, together with EN 10225-1:2019, EN 10225-2:2019, and EN 10225-3:2019, supersedes EN 10225:2009.

This European Standard consists of the following parts, under the general title ‘*Weldable structural steels for fixed offshore structures – Technical delivery conditions*’:

- Part 1: Plates
- Part 2: Sections
- Part 3: Hot finished hollow sections
- Part 4: Cold formed welded hollow sections

In comparison to the previous edition following technical changes were made:

- welded cold formed hollow sections were only implicitly mentioned in the previous version. Because of the split of the standard into four parts now a separate part with full requirements to cold formed hollow sections for offshore structures is written;
- the steel names were adapted to EN 10027-1;
- former grades of group 3 are no longer listed, new options with the same enhanced properties have been introduced (**Options 2 and 3**);
- there is an Annex E concerning SAWH hollow sections and an Annex F concerning high strength square and rectangular HFW hollow sections, since the application of these hollow sections needs more practical experience;
- an informative Annex G was added for the prequalification of steels for fixed offshore structures in arctic areas.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

¹ Through its subcommittee SC 3 “Structural steels other than reinforcements” (secretariat: DIN)

1 Scope

This document specifies requirements for submerged arc welded (SAW) and high frequency welded (HFW) cold formed hollow sections to be used in the fabrication of fixed offshore structures.

The thickness limit for SAWL circular hollow sections is up to and including 50,8 mm, for HFW circular hollow sections up to and including 25,4 mm and for HFW square and rectangular hollow sections up to and including 12,5 mm.

Greater thicknesses for SAWL hollow sections can be agreed provided the technical requirements of this European Standard are maintained.

NOTE 1 This document has an Annex E for SAWH round hollow sections with a thickness limit of 30,0 mm, and an Annex F for high strength square and rectangular HFW hollow sections made of steel grades S500 to S700.

This European Standard is applicable to steels for offshore structures designed to operate in the offshore sector but not to steels supplied for the fabrication of subsea pipelines, risers, process equipment, process piping and other utilities. It is primarily applicable to the North Sea Sector, but may also be applicable in other areas provided that due consideration is given to local conditions e.g. design temperature.

NOTE 2 This document has an informative Annex G on the prequalification of steels for fixed offshore structures in arctic areas.

Minimum yield strengths up to 700 MPa are specified together with impact properties at temperatures down to -40 °C.

NOTE 3 A range of material grades is specified in this standard and the user can select the grade most appropriate to the intended use and its service condition.

2 Normative references

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

EN 1011-1, *Welding — Recommendations for welding of metallic materials — Part 1: General guidance for arc welding*

EN 10020, *Definition and classification of grades of steel*

EN 10021, *General technical delivery conditions for steel products*

EN 10027-1, *Designation systems for steels — Part 1: Steel names*

EN 10027-2, *Designation systems for steels — Part 2: Numerical system*

EN 10079, *Definition of steel products*

EN 10160, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*

EN 10164, *Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions*

EN 10168, *Steel products — Inspection documents — List of information and description*