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Material data sheets for structural steel

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Foreword

NORSOK M-120:2021 was adopted as NORSOK Standard and published 2021-10-06.

NORSOK M-120:2021 supersedes NORSOK M-120 Ed. 5, November 2008.

NORSOK is an acronym for the competitive position of the Norwegian continental shelf and comprise petroleum industry standards in Norway. The collaboration initiative in 1993 between the authorities and the petroleum industry initiated the development of NORSOK standards.

Reducing the project execution time and developing and operating cost for petroleum installations on the Norwegian shelf was the target.

The intention for the Petroleum industry is to develop and use standards providing good technical and cost effective solutions to ensure that the petroleum resources are exploited and managed in the best possible way by the industry and the authorities. The industry will actively contribute to the development and use of international standards in the global market.

The NORSOK standards shall:

- bridge the gap based on experiences from the Norwegian continental shelf where the international standards are unsatisfactorily;
- replace oil company specifications where possible;
- be available as references for the authorities' regulations;
- be cost effective; and
- promote the Norwegian sector as an attractive area for investments and activities.

Developing new NORSOK standards and regular maintenance of existing standards shall contribute to maintain the competitiveness both nationally and internationally for the Norwegian petroleum industry.

The NORSOK standards are developed by experts from the Norwegian petroleum industry and approved according to the consensus principles as laid down by the guidelines given in NORSOKA-001 N directive.

The NORSOK standards are owned by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed and published by Standards Norway.

Annex A is informative.

Introduction

The Material data sheets (MDSs) in this standard are based on the references given in Clause 2. Designation and associated technical requirements for the referenced grades are given in [NS-EN 10027-1/-2](#), except for [NS-EN 10225-1 /-2 /-3](#) and [/-4](#) which has its own designations.

The main changes from NORSOK M-120 Edition 5 (November 2008) to NORSOK M-120:2021 (Edition 6) are as follows:

The referenced material standards have been revised, hence the MDSs in this standard have been revised accordingly.

In addition, requirements for arctic conditions have been included. Prequalification and impact test requirement for arctic regions shall be in accordance with the [NS-EN 10225-1/-2 /-3](#) and [-4](#) and the applicable MDS in this NORSOK standard. When steel for arctic region is specified by the purchaser, a typical designation can be as follows:

MDS Y20 Arctic 1.

Finally, requirements for duplex structural steels have been included.

The bibliography lists standards, norms, laws, regulations and other literature that may be relevant to the use of this document.

Normative text contains the requirements of the standard. Informative text is only guidance to the reader. All text in foreword, introduction and notes is informative text. Note to entries in section 3 and annexes to the document may be either normative or informative.

Material data sheets for structural steel

1 Scope

This NORSOK standard includes a collection of material data sheets (MDS) applicable for selected material standards and grades for use in steel structures.

2 Normative references

The following referenced documents contain text which fully or in part is part of the requirements in the document. For dated references, only the edition cited applies. For undated references, the latest edition of the cited document applies (including amendments).

[NORSOK N-004](#), *Design of steel structures*

[NORSOK M-650](#), *Qualification of manufacturers of special materials*

[NS-EN 10025-1](#), *Hot rolled products of structural steels — Part 1: General technical delivery conditions*

[NS-EN 10025-2](#), *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

[NS-EN 10025-4](#), *Hot rolled products of structural steels — Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels*

[NS-EN 10027-1](#), *Designation systems for steels - Part 1: Steel names*

[NS-EN 10027-2](#), *Designation systems for steels - Part 2: Numerical system*

[NS-EN 10029](#), *Hot-rolled steel plates 3 mm thick or above — Tolerances on dimensions and shape*

[NS-EN 10149-1:2013](#), *Hot rolled flat products made of high yield strength steels for cold forming — Part 1: General technical delivery conditions*

[NS-EN 10149-2](#), *Hot rolled flat products made of high yield strength steels for cold forming — Part 2: Technical delivery conditions for thermomechanically rolled steels*

[NS-EN 10204](#), *Metallic products — Types of inspection documents*

[NS-EN 10210-1](#), *Hot finished structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*

[NS-EN 10210-2](#), *Hot finished structural hollow sections of non-alloy and fine grain steels — Part 2: Tolerances, dimensions and sectional properties*

[NS-EN 10219-1](#), *Cold formed welded structural hollow sections of non-alloy and fine grain steels — Part 1: Technical delivery conditions*

[NS-EN 10219-2](#), *Cold formed welded steel structural hollow sections — Part 2: Tolerances, dimensions and sectional properties*

[NS-EN 10225-1:2019](#), *Weldable structural steels for fixed offshore structures — Technical delivery conditions — Part 1: Plates*

[NS-EN 10225-2:2019](#), Weldable structural steels for fixed offshore structures — Technical delivery conditions — Part 2: Sections

[NS-EN 10225-3:2019](#), Weldable structural steels for fixed offshore structures — Technical delivery conditions — Part 3: Hot finished hollow sections

[NS-EN 10225-4:2019](#), Weldable structural steels for fixed offshore structures — Technical delivery conditions — Part 4: Cold formed welded hollow sections

[NS-EN 10056-2](#), Structural steel equal and unequal leg angles — Part 2: Tolerances on shape and dimensions

[NS-EN 10088-3](#), Stainless steels — Part 3: Technical delivery conditions for semi-finished products, bars, rods, wire, sections and bright products of corrosion resisting steels for general purposes

[NS-EN ISO 3183](#), Petroleum and natural gas industries — Steel pipe for pipeline transportation systems (ISO 3183)

[NS-EN ISO 5817](#), Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817)

[NS-EN ISO 8501-1](#), Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings (ISO 8501-1)

[NS-EN ISO 8501-3](#), Preparation of steel substrates before application of paints and related products — Visual assessment of surface cleanliness — Part 3: Preparation grades of welds, edges and other areas with surface imperfections (ISO 8501-3)

[NS-EN ISO 9001](#), Quality management systems — Requirements

[NS-EN ISO 9712](#), Non-destructive testing — Qualification and certification of NDT personnel

[NS-EN ISO 17781](#), Petroleum, petrochemical and natural gas industries — Test methods for quality control of microstructure of ferritic/austenitic (duplex) stainless steels (ISO 17781)

[NS-EN ISO 17782](#), Petroleum, petrochemical and natural gas industries — Scheme for conformity assessment of manufacturers of special materials (ISO 17782)

[NS-EN ISO 10893-2](#), Non-destructive testing of steel tubes — Part 2: Automated eddy current testing of seamless and welded (except submerged arc-welded) steel tubes for the detection of imperfections (ISO 10893-2)

[NS-EN ISO 10893-3](#), Non-destructive testing of steel tubes — Part 3: Automated full peripheral flux leakage testing of seamless and welded (except submerged arc-welded) ferromagnetic steel tubes for the detection of longitudinal and/or transverse imperfections (ISO 10893-3)

[NS-EN ISO 10893-5](#), Non-destructive testing of steel tubes — Part 5: Magnetic particle inspection of seamless and welded ferromagnetic steel tubes for the detection of surface imperfections (ISO 10893-5)

[NS-EN ISO 10893-11](#), Non-destructive testing of steel tubes — Part 11: Automated ultrasonic testing of the weld seam of welded steel tubes for the detection of longitudinal and/or transverse imperfections (ISO 10893-11)

ABS Steel Grades, EH36, DH36

API SPEC 2B, Specification for the Fabrication of Structural Steel Pipe

API SPEC 2H/2W/2Y, Offshore Construction Steel Plate

API SPEC 2MT1, *Specification for Carbon Manganese Steel Plate with Improved Toughness for Offshore Structures*

API SPEC 2MT2, *Rolled Shapes with Improved Notch Toughness*

API SPEC 5L, *Seamless & Welded Pipe*

ASME V:2017, *Boiler and Pressure Vessel Code, Section V: Nondestructive Examination*

ASME VIII:2019, *Rules for Construction of Pressure Vessels Division 1*

ASTM A6, *Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling*

ASTM A29, *Standard Specification for General Requirements for Steel Bars, Carbon and Alloy, Hot-Wrought*

ASTM A36, *Standard Specification for Carbon Structural Steel*

ASTM A106, *Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service*

ASTM A108, *Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished*

ASTM A131, *Standard Specification for Structural Steel for Ships*

ASTM A240, *Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications*

ASTM A276, *Standard Specification for Stainless Steel Bars and Shapes*

ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*

ASTM A484, *Standard Specification for General Requirements for Stainless Steel Bars, Billets, and Forgings*

ASTM A500, *Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes*

ASTM A516, *Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service*

ASTM A537, *Standard Specification for Pressure Vessel Plates, Heat-Treated, Carbon-Manganese-Silicon Steel*

ASTM A572, *Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel*

ASTM A633, *Standard Specification for Normalized High-Strength Low-Alloy Structural Steel Plates*

ASTM A709, *Standard Specification for Structural Steel for Bridges*

ASTM A992, *Standard Specification for Structural Steel Shapes*

ASTM A1011, *Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength*

ASTM E8, *Standard Test Methods for Tension Testing of Metallic Materials*

DNVGL-OS-B101, *Metallic materials*

JIS G3101, *SS400 Structural carbon steel plate specification*

JIS G3106, *Structural steel plate*

LR Steel Grades, *EH36*, *DH36*

3 Terms and definitions

In this document, the following terms and definitions apply.

3.1

shall (requirement)

expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed

Note 1 to entry: Requirements are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.2 Table 3.

3.2

should (recommendation)

expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others

Note 1 to entry: Recommendations are expressed using the verbal forms specified in ISO/IEC Directives, Part 2 clause 7.3 Table 4.

Note 2 to entry: In the negative form, a recommendation is the expression that a suggested possible choice or course of action is not preferred but it is not prohibited.

3.3

may (permission)

expression in the content of a document conveying consent or liberty (or opportunity) to do something

Note 1 to entry: Permissions are expressed using the verbal forms specified in ISO/IEC Directives Part 2 clause 7.4 Table 5

3.4

can (possibility and capability)

1: expression in the content of a document conveying expected or conceivable material, physical or causal outcome

2: expression in the content of a document conveying the ability, fitness, or quality necessary to do or achieve a specified thing

Note 1 to entry: Possibility and capability is expressed using the verbal forms specified in in ISO/IEC Directives, Part 2 clause 7.5 Table 6.

3.5

hollow sections

seamless or welded hollow long products

Note 1 to entry: Including rectangular hollow sections (RHS), square hollow sections (SHS) and circular hollow sections (CHS).

3.6

sections

hot rolled long products, including;

Note 1 to entry: H sections, I sections, T sections, U sections (channels), angles, bulb flats and flats with a width not over 150 mm.

3.7

bars

hot rolled long products having solid cross sections

EXAMPLE e.g. rounds, squares, hexagons and octagons.

3.8

plates

hot rolled flat products with a width of 600 mm or over, including wide flats with a width over 150 mm.

3.9

surface testing

techniques for detection of surface imperfections in metallic materials and welds

EXAMPLE magnetic particle testing or EMI (flux leakage) for magnetic materials and liquid penetrant testing and Eddy current

3.10

strip and coil

cold rolled flat product that immediately after final rolling pass, or after pickling or continuous annealing, is wound into a regular coil

3.11

arctic region

geographic region where the minimum design temperature is less than -10 °C

Note 1 to entry: -10 °C is the minimum temperature limit given in national and international standards.

3.12

arctic 1

geographic region where the minimum design temperature is between -10 °C and -20 °C

Note 1 to entry: It is operator's responsibility to define the design temperature.

3.13

arctic 2

geographic region where the minimum design temperature is between -20 °C and -30 °C

Note 1 to entry: It is operator's responsibility to define the design temperature.

3.14

arctic 3

geographic region where the minimum design temperature is between -30 °C and -40 °C

Note 1 to entry: It is operator's responsibility to define the design temperature.

4 Symbols and abbreviations

For this document, the following symbols and abbreviations apply.

AOD	Argon oxygen decarburization
AW	as welded
CVN	Charpy V notch
CTOD	crack tip opening displacement
CHS	circular hollow section

DC	design class
DFT	dry film thickness
EN	European standard
MDS	material data sheet
MPCR	manufacturer procedure conformity record
Pcm	critical metal parameter
PREN	pitting resistance equivalent number
PWHT	post weld heat treatment
QTR	qualification test record
RHS	rectangular hollow section
SHS	square hollow section
SQL	steel quality level
WT	wall thickness

5 Collection of material data sheets

The materials shall be delivered in accordance with the standard referred to in the MDS. In addition, the MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard, see also details in Introduction.

[Table 1](#) provides an overview of MDSs, associated standards, grades and steel quality levels (SQL). The relationship between SQL and design class (DC) is given in [NORSOK N-004](#).

Table 1 — Material data sheets for structural steel

MDS No.	Rev no.	Standard	Steel grade	Product type	Steel quality level
Y01	6	NS-EN 10025-2	S235JR	Plates, sections and bars	IV
		NS-EN 10210-1	S235JRH	Hot finished hollow sections	IV
		NS-EN 10219-1	S235JRH	Cold formed welded hollow sections	IV
Y04	3	NS-EN 10025-2	S355J0	Plates, sections and bars	IV
		NS-EN 10149-2	S355MC	Plates	IV
		NS-EN 10210-1	S355J0H	Hot finished hollow sections	IV
		NS-EN 10219-1	S355J0H	Cold formed welded hollow sections	IV
Y05	4	NS-EN 10025-2	S355J2 S355K2	Plates, sections and bars	III
		NS-EN 10149-2	S355MC	Plates	III
Y07	4	NS-EN 10210-1	S355NH	Hot finished hollow sections	III
Y08	4	NS-EN 10219-1	S355MLH	Cold formed welded hollow sections	III
Y15	4	NS-EN 10025-4	S420ML	Plates and sections	III
Y16	4	NS-EN 10219-1	S420MLH	Cold formed welded hollow sections	III
Y17	0	NS-EN 10210-1	S420NH	Hot finished hollow sections	III
Y20	6	NS-EN 10225-1	S355NLO S355MLO	Plates	I
Y21	6	NS-EN 10225-2	S355NL10 S355ML10	Sections	I
Y22	6	NS-EN 10225-3	S355NLHHO S355QLHHO	Seamless hollow sections	I
Y25	6	NS-EN 10225-1	S355NLO S355MLO	Plates	II
Y26	6	NS-EN 10225-2	S355NLO S355MLO	Sections	II
Y27	5	NS-EN 10225-3	S355NLHHO S355QLHHO	Seamless hollow sections	II

Table 1 — Material data sheets for structural steel (continued)

MDS No.	Rev no.	Standard	Steel grade	Product type	Steel quality level
Y28	4	NS-EN 10225-3	S355NLHHO	Welded hollow sections	II
Y30	6	NS-EN 10225-1	S420MLO S420QLO	Plates	I
Y31	6	NS-EN 10225-2	S420ML10	Sections	I
Y32	6	NS-EN 10225-3	S420QLHHO	Seamless hollow sections	I
Y35	5	NS-EN 10225-1	S420MLO S420QLO	Plates	II
Y36	6	NS-EN 10225-2	S420MLO	Sections	II
Y37	6	NS-EN 10225-3	S420QLHHO	Seamless hollow sections	II
Y40	6	NS-EN 10225-1	S460 MLO S460QLO	Plates	I
Y41	6	NS-EN 10225-2	S460ML10	Sections	I
Y42	6	NS-EN 10225-3	S460QLHHO	Seamless hollow sections	I
Y45	6	NS-EN 10225-1	S460MLO S460QLO	Plates	II
Y46	6	NS-EN 10225-2	S460MLO	Sections	II
Y47	6	NS-EN 10225-3	S460QLHHO	Seamless hollow sections	II
Y50	6	NS-EN 10225-1	S500MLO S500QLO	Plates	I
Y52	6	NS-EN 10225-3	S500QLHHO	Seamless hollow sections	I
Y55	6	NS-EN 10225-1	S500MLO S500QLO	Plates	II
Y57	6	NS-EN 10225-3	S500QLHHO	Seamless hollow sections	II
Y60	0	NS-EN 10225-1	S550QLO	Plates	I
YD35	0	ASTM A 240	UNS S32003 UNS S32304 UNS S82441	Plates, coil, and strip	II
YD36	0	ASTM A 276	UNS S32304	Sections	II
YD37	0	ASTM A240	UNS S32003 UNS S32304	Sections and hollow sections	II
YD38	0	ASTM A 240	UNS S31803 UNS S32205	Plates, coil, and strip	III
YD39	0	ASTM A 276	UNS S31803 UNS S32205	Sections	III

MATERIAL DATA SHEET MDS - Y01 Rev. 6 2021

MATERIAL DATA SHEET MDS - Y01 Rev. 6 2021

TYPE OF MATERIAL: Structural steel – SQL-IV			Page 1 of 1
PRODUCT	STANDARD	GRADE	ALTERNATIVE MATERIALS
Plates, sections and bars	NS-EN 10025-2	S235JR	See Appendix A
Hot finished hollow sections	NS-EN 10210-1	S235JRH	
Cold formed welded hollow sections	NS-EN 10219-1	S235JRH	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standards. These grades shall not be used for thicknesses above 25 mm. These materials are not intended for Arctic 2 and 3.		
STEEL GRADE			
PRE-QUALIFICATION			
HEAT TREATMENT/ DELIVERY CONDITION			
CHEMICAL COMPOSITION			
TENSILE TESTING			
IMPACT TESTING			
EXTENT OF TESTING			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.		
NON DESTRUCTIVE TESTING (NDT)			
SURFACE PROTECTION			
MARKING			
CERTIFICATE	NS-EN 10204 Type 2.2		

MATERIAL DATA SHEET MDS - Y04 Rev. 3 2021

MATERIAL DATA SHEET MDS - Y04 Rev. 3 2021

TYPE OF MATERIAL: Structural steel – SQL-IV			Page 1 of 1	
PRODUCT	STANDARD	GRADE	ALTERNATIVE MATERIALS	
Plates, sections and bars	NS-EN 10025-2	S355J0	See Appendix A	
Plates	NS-EN 10149-2	S355MC		
Hot finished hollow sections	NS-EN 10210-1	S355J0H		
Cold formed welded hollow sections	NS-EN 10219-1	S355J0H		
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. These grades shall not be used for thicknesses above 25 mm.			
STEEL GRADE				
QUALIFICATION				
HEAT TREATMENT/ DELIVERY CONDITION				
CHEMICAL COMPOSITION				
TENSILE TESTING				
IMPACT TESTING	CVN testing shall be performed at 0 °C			
	CVN impact test temperatures when Arctic region is specified ²⁾ :			
	Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)	Arctic 3 (°C)
	t ≤ 12	-20 ¹⁾	The grade shall not be used	The grade shall not be used
	12 < t ≤ 25	-20 ¹⁾	The grade shall not be used	The grade shall not be used
	25 < t ≤ 50	The grade shall not be used	The grade shall not be used	The grade shall not be used
	t > 50	The grade shall not be used	The grade shall not be used	The grade shall not be used
	1) Test temperature is in accordance with the material standard			
	2) CVN-notch energy requirement shall be minimum 27 J (average).			
EXTENT OF TESTING				
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.			
NON DESTRUCTIVE TESTING (NDT)				
SURFACE PROTECTION				

MATERIAL DATA SHEET MDS - Y04 Rev. 3 2021 *(continued)*

TYPE OF MATERIAL: Structural steel – SQL-IV		Page 1 of 1
MARKING		
CERTIFICATE	NS-EN 10204 Type 2.2. For modified impact test temperatures, NS-EN 10204 Type 3.1 applies	

MATERIAL DATA SHEET MDS - Y05 Rev. 4 2021

MATERIAL DATA SHEET MDS - Y05 Rev. 4 2021

TYPE OF MATERIAL: Structural steel – SQL-III			Page 1 of 1																
PRODUCT	STANDARD	GRADE	ALTERNATIVE MATERIALS																
Plates, sections and bars	NS-EN 10025-2	S355J2 S355K2	See Appendix A																
Plates	NS-EN10149-2	S355MC																	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. These grades shall not be used for thicknesses above 50 mm.																		
QUALIFICATIONS																			
HEAT TREATMENT/ DELIVERY CONDITION																			
CHEMICAL COMPOSITION	CEV max. 0,43 for all thicknesses. NS-EN 10025-2, C ≤ 0,18 %																		
TENSILE TESTING																			
IMPACT TESTING	CVN-notch energy requirement shall be minimum 40 J (average). For NS-EN 10149-2, S355MC, impact testing shall be carried out in accordance with NS-EN 10149-1 clause 11, option 5 a) for thicknesses ≥ 6mm. CVN impact test temperatures when Arctic regions are specified: <table><tr><td>Thickness (mm)</td><td>Arctic 1 (°C)</td><td>Arctic 2 (°C)</td><td>Arctic 3 (°C)</td></tr><tr><td>t ≤ 12</td><td>-20¹⁾</td><td>-20¹⁾</td><td>-30²⁾</td></tr><tr><td>12 < t ≤ 25</td><td>-20¹⁾</td><td>-20¹⁾</td><td>-30²⁾</td></tr><tr><td>25 < t ≤ 50</td><td>-30²⁾</td><td>-40²⁾</td><td>-50²⁾</td></tr></table> 1) Test temperature is in accordance with the material standard 2) Modified test temperature			Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)	Arctic 3 (°C)	t ≤ 12	-20 ¹⁾	-20 ¹⁾	-30 ²⁾	12 < t ≤ 25	-20 ¹⁾	-20 ¹⁾	-30 ²⁾	25 < t ≤ 50	-30 ²⁾	-40 ²⁾	-50 ²⁾
Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)	Arctic 3 (°C)																
t ≤ 12	-20 ¹⁾	-20 ¹⁾	-30 ²⁾																
12 < t ≤ 25	-20 ¹⁾	-20 ¹⁾	-30 ²⁾																
25 < t ≤ 50	-30 ²⁾	-40 ²⁾	-50 ²⁾																
EXTENT OF TESTING																			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.																		
NON DESTRUCTIVE TESTING (NDT)																			
SURFACE PROTECTION																			
MARKING																			
CERTIFICATE	NS-EN 10204 Type 3.1																		

MATERIAL DATA SHEET MDS - Y07 Rev.4 2021

MATERIAL DATA SHEET MDS - Y07 Rev.4 2021

TYPE OF MATERIAL: Structural steel - SQL-III			Page 1 of 1																
PRODUCT	STANDARD	GRADE																	
Hot finished hollow sections	NS-EN 10210-1	S355NH/ S355NLH																	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. These grades shall not be used for thicknesses above 40 mm.																		
PRE-QUALIFICATIONS																			
HEAT TREATMENT/ DELIVERY CONDITION																			
CHEMICAL COMPOSITION	C ≤ 0,18 % and CEV max. 0,43 for all thicknesses																		
TENSILE TESTING																			
IMPACT TESTING	CVN impact test temperatures when Arctic regions are specified: <table border="1"> <thead> <tr> <th>Thickness (mm)</th><th>Arctic 1 (°C)</th><th>Arctic 2 (°C)</th><th>Arctic 3 (°C)</th></tr> </thead> <tbody> <tr> <td>t ≤ 12</td><td>-20¹⁾</td><td>-20¹⁾</td><td>-30²⁾</td></tr> <tr> <td>12 < t ≤ 25</td><td>-20¹⁾</td><td>-20¹⁾</td><td>-30²⁾</td></tr> <tr> <td>25 < t ≤ 40</td><td>-30²⁾</td><td>-40²⁾</td><td>-50²⁾</td></tr> </tbody> </table> 1) Test temperature is in accordance with the material standard 2) Modified test temperature			Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)	Arctic 3 (°C)	t ≤ 12	-20 ¹⁾	-20 ¹⁾	-30 ²⁾	12 < t ≤ 25	-20 ¹⁾	-20 ¹⁾	-30 ²⁾	25 < t ≤ 40	-30 ²⁾	-40 ²⁾	-50 ²⁾
Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)	Arctic 3 (°C)																
t ≤ 12	-20 ¹⁾	-20 ¹⁾	-30 ²⁾																
12 < t ≤ 25	-20 ¹⁾	-20 ¹⁾	-30 ²⁾																
25 < t ≤ 40	-30 ²⁾	-40 ²⁾	-50 ²⁾																
EXTENT OF TESTING																			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.																		
NON DESTRUCTIVE TESTING (NDT)	For electric welded hollow sections, the following NDT shall be performed: <u>Volumetric testing</u> For nominal wall thicknesses of 12 mm and above, the weld seam shall be ultrasonic tested full length for longitudinal defects in accordance with NS-EN ISO 10893-11 to acceptance level U3. <u>Surface testing</u> For nominal wall thickness of 16 mm and above, the weld seam and adjacent base material minimum 10 mm on either side shall be tested for longitudinal surface defects in accordance with NS-EN ISO 10893-2, NS-EN ISO 10893-3 or NS-EN ISO 10893-5 to acceptance levels E3/E3H, F3 or M3 respectively. Extent of testing shall be minimum 10 % of the length for each hollow section. For hollow sections designated suspect, the extent of testing shall be increased to the full length.																		
SURFACE PROTECTION																			
MARKING																			

MATERIAL DATA SHEET MDS - Y07 Rev.4 2021 *(continued)*

TYPE OF MATERIAL: Structural steel - SQL-III		Page 1 of 1
CERTIFICATE	NS-EN 10204 Type 3.1	

MATERIAL DATA SHEET MDS - Y08 Rev. 4 2021

MATERIAL DATA SHEET MDS - Y08 Rev. 4 2021

TYPE OF MATERIAL: Structural steel - SQL-III			Page 1 of 1
PRODUCT	STANDARD	GRADE	
Cold formed welded hollow sections	NS-EN 10219-1	S355MLH	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. These grades shall not be used for thicknesses above 25 mm.		
QUALIFICATIONS			
HEAT TREATMENT/ DELIVERY CONDITION			
CHEMICAL COMPOSITION			
TENSILE TESTING			
IMPACT TESTING	CVN impact test temperatures when Arctic regions are specified:		
	Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)
	t ≤ 12	-50 ¹⁾	-50 ¹⁾
	12 < t ≤ 25	-50 ¹⁾	-50 ¹⁾
	1) Test temperature is in accordance with the material standard		
EXTENT OF TESTING			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.		
NON DESTRUCTIVE TESTING (NDT)	For electric welded hollow sections, the following NDT shall be performed: <u>Volumetric testing</u> For nominal wall thicknesses of 12 mm and above, the weld seam shall be ultrasonic tested full length for longitudinal defects in accordance with NS-EN ISO 10893-11 to acceptance level U3. <u>Surface testing</u> For nominal wall thickness of 16 mm and above, the weld seam and adjacent base material minimum 10 mm on either side shall be tested for longitudinal surface defects in accordance with NS-EN ISO 10893-2, NS-EN ISO 10893-3 or NS-EN ISO 10893-5 to acceptance levels E3/E3H, F3 or M3 respectively. Extent of testing shall be minimum 10 % of the length for each hollow section. For hollow sections designated suspect, the extent of testing shall be increased to the full length.		
SURFACE PROTECTION			
MARKING			
CERTIFICATE	NS-EN 10204 Type 3.1		

MATERIAL DATA SHEET MDS - Y15 Rev. 4 2021

MATERIAL DATA SHEET MDS - Y15 Rev. 4 2021

TYPE OF MATERIAL: Structural steel -SQL-III			Page 1 of 1
PRODUCT	STANDARD	GRADE	
Plates and sections	NS-EN 10025-4	S420ML	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. These grades shall not be used for thicknesses above 50 mm.		
QUALIFICATIONS			
HEAT TREATMENT/ DELIVERY CONDITION			
CHEMICAL COMPOSITION	Nb + V max. 0,12 %		
TENSILE TESTING			
IMPACT TESTING	CVN impact test temperatures when Arctic regions are specified:		
	Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)
	t ≤ 12	-50 ¹⁾	-50 ¹⁾
	12 < t ≤ 25	-50 ¹⁾	-50 ¹⁾
	25 < t ≤ 50	-50 ¹⁾	-50 ¹⁾
	1) Test temperature is in accordance with the material standard		
EXTENT OF TESTING			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.		
NON DESTRUCTIVE TESTING (NDT)			
SURFACE PROTECTION			
MARKING			
CERTIFICATE	NS-EN 10204 Type 3.1		

MATERIAL DATA SHEET MDS - Y16 Rev. 4 2021

MATERIAL DATA SHEET MDS - Y16 Rev. 4 2021

TYPE OF MATERIAL: Structural steel –SQL-III			Page 1 of 1
PRODUCT	STANDARD	GRADE	
Cold formed welded hollow sections	NS-EN 10219-1	S420MLH	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. These grades shall not be used for thicknesses above 16 mm.		
QUALIFICATIONS			
HEAT TREATMENT/ DELIVERY CONDITION			
CHEMICAL COMPOSITION	Option 1.2 Nb + V max 0,12 %		
TENSILE TESTING			
IMPACT TESTING	CVN impact test temperatures when Arctic regions are specified:		
	Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)
	t ≤ 16	-50 ¹⁾	-50 ¹⁾
	1) Test temperature is in accordance with the material standard		
EXTENT OF TESTING			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.		
NON DESTRUCTIVE TESTING (NDT)	For electric welded hollow sections, the following NDT shall be performed: <u>Volumetric testing</u> For nominal wall thicknesses of 12 mm and above, the weld seam shall be ultrasonic tested full length for longitudinal defects in accordance with NS-EN ISO 10893-11 to acceptance level U3. <u>Surface testing</u> For nominal wall thickness of 16 mm and above, the weld seam and adjacent base material minimum 10 mm on either side shall be tested for longitudinal surface defects in accordance with NS-EN ISO 10893-2, NS-EN ISO 10893-3 or NS-EN ISO 10893-5 to acceptance levels E3/E3H, F3 or M3 respectively. Extent of testing shall be minimum 10 % of the length for each hollow section. For hollow sections designated suspect, the extent of testing shall be increased to the full length.		
SURFACE PROTECTION			
MARKING			
CERTIFICATE	NS-EN 10204 Type 3.1		

MATERIAL DATA SHEET MDS – Y17 Rev. 0 2021

MATERIAL DATA SHEET MDS – Y17 Rev. 0 2021

TYPE OF MATERIAL: Structural steel - SQL-III			Page 1 of 1
PRODUCT	STANDARD	GRADE	
Hot finished hollow sections	NS-EN 10210-1	S420NH	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard. This grade shall not be used for thicknesses above 25 mm.		
PRE-QUALIFICATIONS			
HEAT TREATMENT/ DELIVERY CONDITION			
CHEMICAL COMPOSITION	C ≤ 0,18 % and CEV max. 0,43 for all thicknesses		
TENSILE TESTING			
IMPACT TESTING	CVN impact test temperatures when Arctic regions are specified:		
	Thickness (mm)	Arctic 1 (°C)	Arctic 2 (°C)
	t ≤ 12	-20 ¹⁾	-20 ¹⁾
	12 < t ≤ 25	-20 ¹⁾	-20 ¹⁾
	1) Test temperature is in accordance with the material standard		
	2) Modified test temperature		
EXTENT OF TESTING			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.		
NON DESTRUCTIVE TESTING (NDT)	For electric welded hollow sections, the following NDT shall be performed: <u>Volumetric testing</u> For nominal wall thicknesses of 12 mm and above, the weld seam shall be ultrasonic tested full length for longitudinal defects in accordance with NS-EN ISO 10893-11 to acceptance level U3. <u>Surface testing</u> For nominal wall thickness of 16 mm and above, the weld seam and adjacent base material minimum 10 mm on either side shall be tested for longitudinal surface defects in accordance with NS-EN ISO 10893-2, NS-EN ISO 10893-3 or NS-EN ISO 10893-5 to acceptance levels E3/E3H, F3 or M3 respectively. Extent of testing shall be minimum 10 % of the length for each hollow section. For hollow sections designated suspect, the extent of testing shall be increased to the full length.		
SURFACE PROTECTION			
MARKING			
CERTIFICATE	NS-EN 10204 Type 3.1		

MATERIAL DATA SHEET MDS - Y20 Rev. 6 2021

MATERIAL DATA SHEET MDS - Y20 Rev. 6 2021

TYPE OF MATERIAL: Structural steel with documented through thickness properties – SQL-I			Page 1 of 2
PRODUCT	STANDARD	GRADE	
Plates	NS-EN 10225-1	S355NLO/MLO	
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard.		
MANUFACTURING PROCESS	Options 2 & 3		
CHEMICAL COMPOSITION	Provided that the Pcm requirements are fulfilled, the following modifications of the chemical composition are acceptable: — Mn ≤ 2,0 % — Ni ≤ 1,0 % The following options apply: Option 7 Option 8: For carbon content ≤ 0,12 % (product analysis), Pcm shall be used.		
MECHANICAL PROPERTIES	Option 12		
PRE-QUALIFICATIONS	The following prequalification documentation shall be established and made available on request: <u>Steel manufacturing process</u> Option 1. <u>Base metal properties</u> Recent production data to demonstrate that mechanical properties are met in delivery and PWHT condition. Test results shall be representative of the thickness, processing route (steelmaking and rolling practice and delivery condition), manufacturer location and composition to be supplied. Option 15. — CVN impact energy shall meet the minimum requirements for the steel grade. <u>Weldability data</u> Option 17 weldability tests according to Annex B with additional requirements: — Weldability testing shall be performed for thicknesses greater than 25 mm — CTOD testing shall be included for thicknesses greater than 40 mm — CTOD values shall be minimum 0,25 mm in AW condition and minimum 0,20 mm in PWHT condition.		

MATERIAL DATA SHEET MDS - Y20 Rev. 6 2021 (continued)

TYPE OF MATERIAL: Structural steel with documented through thickness properties – SQL-I		Page 2 of 2		
PRE-QUALIFICATIONS	<u>Steels for arctic applications</u> Prequalification shall be carried out according to Annex F. This shall include base metal properties and weldability data as specified above. CVN impact test temperatures shall be in accordance with this MDS.			
	CTOD testing shall be performed for wall thicknesses as specified:			
	Temperature region	Arctic 1	Arctic 2	Arctic 3
	Wall thickness (mm)	> 40	> 30	> 20
		Page 2 of 2		
HEAT TREATMENT/				
DELIVERY				
CONDITION				
TENSILE TESTING				
IMPACT TESTING	CVN impact test temperatures when Arctic regions are specified :			
	Thickness (mm)	Arctic 1	Arctic 2	Arctic 3
		(°C)	(°C)	(°C)
	t ≤ 12	-40 ¹⁾	-40 ¹⁾	-40 ¹⁾
	12 < t ≤ 25	-40 ¹⁾	-40 ¹⁾	-50 ²⁾
	25 < t ≤ 50	-50 ²⁾	-60 ²⁾	-70 ²⁾
	t > 50	-50 ²⁾	-60 ²⁾	-70 ²⁾
	1) Test temperature is in accordance with the material standard			
2) Modified test temperature				
EXTENT OF TESTING	Option 25			
SURFACE CONDITION	The surface of the material shall comply to rust grade A or rust grade B in accordance with NS-EN ISO 8501-1.			
NON DESTRUCTIVE TESTING (NDT)	Option 18			
SURFACE PROTECTION	Optional requirement between purchaser and supplier. All surfaces shall receive a preliminary protective primer coat. Blast cleaning shall comply with NS-EN ISO 8501-3 Sa 2½ and the surface shall remain at Sa 2½ until application of the primer. The primer shall consist of 1 coat zinc ethyl silicate primer with a DFT of 15 ± 5 microns measured on a plane polished steel or glass test plate.			
CERTIFICATE	NS-EN 10204 Type 3.1			

MATERIAL DATA SHEET MDS - Y21 Rev. 6 2021

MATERIAL DATA SHEET MDS - Y21 Rev. 6 2021

TYPE OF MATERIAL: Structural steel with documented through thickness properties – SQL-I			Page 1 of 2												
PRODUCT	STANDARD	GRADE													
Sections	NS-EN 10225-2	S355NL10/ML10													
SCOPE	This MDS specifies the selected options in the referred standard and modified requirements which shall supersede the corresponding requirements in the referred standard.														
MANUFACTURING PROCESS	Options 2														
CHEMICAL COMPOSITION	Option 7 Option 8: For carbon content $\leq 0,12\%$ (product analysis), Pcm shall be used.														
MECHANICAL PROPERTIES	Option 12														
PRE-QUALIFICATIONS	The following prequalification documentation shall be established and made available on request: <u>Steel manufacturing process</u> Option 1. <u>Base metal properties</u> Recent production data to demonstrate that mechanical properties are met in delivery and PWHT condition. Test results shall be representative of the thickness, processing route (steelmaking and rolling practice and delivery condition), manufacturer location and composition to be supplied. <u>Weldability data</u> Option 17 weldability tests according to Annex B with additional requirements: — Weldability testing shall be performed for thicknesses greater than 40 mm — CTOD values shall be minimum 0,25 mm in AW condition and minimum 0,20 mm in PWHT condition. <u>Steels for arctic applications</u> Prequalification shall be carried out according to Annex C. This shall include base metal properties and weldability data as specified above. CVN impact test temperatures shall be in accordance with this MDS. <table border="1" style="width: 100%;"> <tr> <td colspan="4">CTOD testing shall be performed for wall thicknesses as specified:</td> </tr> <tr> <td>Temperature region</td> <td>Arctic 1</td> <td>Arctic 2</td> <td>Arctic 3</td> </tr> <tr> <td>Wall thickness (mm)</td> <td>> 40</td> <td>> 30</td> <td>> 20</td> </tr> </table>			CTOD testing shall be performed for wall thicknesses as specified:				Temperature region	Arctic 1	Arctic 2	Arctic 3	Wall thickness (mm)	> 40	> 30	> 20
CTOD testing shall be performed for wall thicknesses as specified:															
Temperature region	Arctic 1	Arctic 2	Arctic 3												
Wall thickness (mm)	> 40	> 30	> 20												
HEAT TREATMENT/															