Recommendation for selecting standards for structural steel materials (tentative recommended practice)
FOREWORD

DNV GL recommended practices contain sound engineering practice and guidance.

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CHANGES – CURRENT

This is a new document.

This is a tentative edition of a DNV GL recommended practice. Tentative editions apply to new service documents to which DNV GL reserves the right to make adjustments during a period of time to obtain the intended purpose.
Acknowledgement

This recommended practice is one of a series resulting from a Joint Industry Project (JIP) led by DNV GL to reduce cost and increase predictability without compromising quality and safety in international offshore development projects by recommending standardized parameter for selected items. The partners of the JIP were Hyundai Heavy Industries (HHI), Daewoo Shipbuilding and Marine Engineering Company (DSME), Samsung Heavy Industries (SHI), Korea Offshore and Shipbuilding Association (KOSHIPA) and the Korea Marine Equipment Research Institute (KOMERI).

The present series of recommended practices also include:

— Recommendation for selecting standards for piping components
— Recommendation for selecting standards for electrical and instrumentation components
— Recommendation for selecting standards for steel bulk items.
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SECTION 1 INTRODUCTION

1.1 General
The joint industry effort followed an aligned development approach, which consisted of three distinguished and iterative process steps as follows:
— define items to be included in the scope
— identify relevant standards and regulations
— define requirements and formulate recommendations.

The first step defined potential standardization areas in more detail, e.g. intended function of the item, its operational context and possible parameters to be standardized. In the second step the relevant international standards and regulations for the selected items were identified and structured. Differences between standards and regulations were identified as a basis for defining standardized requirements and developing recommendations.

This recommended practice (RP) is the direct outcome of the third and last step defining requirements and formulating recommendations. It aims to reduce the number and variations in requirements to the minimum necessary to reflect a common and global best practice based upon the standards and regulations identified in second step. A risk based approach has been used when defining the proposed requirements and recommendations.

1.2 Objective
The objective of this RP for selection of standards for structural steel materials is to standardize the specification of standards and plate, section and tubular steel materials for use in special, primary, secondary and tertiary structural elements. This standardization in the selection and use of standards is expected to result in significant cost and schedule savings.

1.3 Applicability
This RP covers offshore oil and gas projects involving topsides equipment on any type of production installation, fixed or floating, or drilling unit. The RP should not be applied for systems covered by class rules. No geographical limitations apply.

1.4 Scope
This RP enables efficient and economical selection of materials independent of the location of shipyards and suppliers during concept, engineering and construction phases. The RP is based on API, ASTM, DNVGL, EN, JIS and NORSOK. These standards are widely used for offshore projects.

The requirements and classification of standards were grouped by parameters such as strength and quality level. There are different requirements with regards to material properties for different material grades in the different standards applied such as API, ASTM, DNVGL, EN, JIS and NORSOK. This main purpose of this RP is to address those differences in requirements between the standards. Pre-qualification requirements were developed separately as presented in Sec.4. Pre-qualification requirements are common for plates, sections and tubular items.

The following items are covered by this RP:
— Special, primary and secondary plates
— Primary, secondary and tertiary sections (H-beam, angle, channel, bars)
— Primary, secondary and tertiary tubular (seamless or welded).
1.5 References – informative

National standards within Europe are now being superseded by EN. The global steel market for offshore projects is based on API, ASTM, DNVGL, EN, JIS and NORSOK standards. This RP is based on the following international standards:

Table 1-1 Standards

<table>
<thead>
<tr>
<th>Standard</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>API 2W</td>
<td>Material standards for steel</td>
</tr>
<tr>
<td>ASTM</td>
<td>Material standards for steel</td>
</tr>
<tr>
<td>DNVGL-OS-B101:2015</td>
<td>Metallic materials</td>
</tr>
<tr>
<td>EN 10025: 2004</td>
<td>Hot rolled products of structural steels</td>
</tr>
<tr>
<td>EN 10210: 2006</td>
<td>Hot finished structural hollow sections of non-alloy and fine grain steels</td>
</tr>
<tr>
<td>EN 10219: 2006</td>
<td>Cold formed welded structural hollow sections of non-alloy and fine grain steels</td>
</tr>
<tr>
<td>EN 10225: 2001</td>
<td>Weldable structural steels for fixed offshore structures – Technical delivery conditions</td>
</tr>
<tr>
<td>JIS G3101: 1995</td>
<td>Rolled steels for general structure</td>
</tr>
<tr>
<td>NORSOK M-120</td>
<td>Material data sheets for structural steel, Edition 5</td>
</tr>
</tbody>
</table>

1.6 Definitions

1.6.1 Abbreviations

Table 1-2 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full text</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASTM</td>
<td>American Society for Testing and Materials</td>
</tr>
<tr>
<td>API</td>
<td>American Petroleum Institute</td>
</tr>
<tr>
<td>ALARP</td>
<td>As low as reasonably practicable</td>
</tr>
<tr>
<td>BOP</td>
<td>Bead-on-plate</td>
</tr>
<tr>
<td>CP</td>
<td>Carbon, C-Mn steel plate</td>
</tr>
<tr>
<td>CS</td>
<td>Carbon, C-Mn steel section</td>
</tr>
<tr>
<td>CT</td>
<td>Carbon, C-Mn steel tubular</td>
</tr>
<tr>
<td>CTOD</td>
<td>Crack tip opening displacement</td>
</tr>
<tr>
<td>EN</td>
<td>European Standards</td>
</tr>
<tr>
<td>GCHAZ</td>
<td>Grain-coarsened heat affected zone</td>
</tr>
<tr>
<td>ICHAZ</td>
<td>Intercritical heat affected zone</td>
</tr>
<tr>
<td>JIS</td>
<td>Japanese Industrial Standards</td>
</tr>
<tr>
<td>MDS</td>
<td>Material data sheet</td>
</tr>
</tbody>
</table>
1.6.2 Verbal forms

Table 1-3 Verbal forms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>shall</strong></td>
<td>verbal form used to indicate requirements strictly to be followed in order to conform to the standard and from which no deviation is permitted, unless accepted by all involved parties</td>
</tr>
<tr>
<td><strong>should</strong></td>
<td>verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required</td>
</tr>
<tr>
<td><strong>may</strong></td>
<td>verbal form used to indicate a course of action permissible within the limits of the standard</td>
</tr>
</tbody>
</table>
SECTION 2 SUMMARY OF STANDARDS, KEY PARAMETERS AND REQUIREMENTS

2.1 General

Standards of industry steel materials for special, primary, secondary and tertiary structure were identified and the material grades were grouped according to material properties and purpose. In this section, requirements of API, ASTM, DNVGL, EN, JIS and NORSOK standards are sorted and grouped according to material grade and parameters like quality level, impact test temperature, yield pressure and average minimum impact.

2.2 Material tables for plates

Materials quality levels for plates were identified based upon the following informative standards:
— ASTM
— DNVGL-OS-B101
— EN 10225
— EN 10025
— JIS G3101
— NORSOK M-120.

Table 2-1 shows a complete summary of the different material quality levels for the above mentioned informative standards.

### Table 2-1 Material quality levels for plates based on informative reference standards

<table>
<thead>
<tr>
<th>Category</th>
<th>Strength</th>
<th>Quality level</th>
<th>Impact test temp. (°C)</th>
<th>Reference Material grades</th>
<th>Y.P Min. (MPa)</th>
<th>Impact Avg. Min. (J)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(L: Long., T: Trans.)</td>
</tr>
<tr>
<td>Secondary</td>
<td>235</td>
<td>IV</td>
<td>+20</td>
<td>S235JR VL A</td>
<td>235 all thickness</td>
<td>27(L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>JIS SS400 A36</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>0</td>
<td>S235J0 VL B A36</td>
<td>235 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td>Secondary</td>
<td>275</td>
<td>IV</td>
<td>+20</td>
<td>S275JR</td>
<td>275 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>0</td>
<td>S275J0</td>
<td></td>
<td>27 (L)</td>
</tr>
<tr>
<td>Secondary</td>
<td>355</td>
<td>IV</td>
<td>0</td>
<td>S355J0</td>
<td>t≤16: 355 16≤t≤40: 345</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>III</td>
<td>-20</td>
<td>S355J2 S355K2</td>
<td>t≤16: 355 16&lt;t≤40: 345 40&lt;t: 335</td>
<td>27 (L) 40 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>III</td>
<td>-20</td>
<td>VL D36</td>
<td>355 all thickness</td>
<td>t≤50: 34 (L) or 24 (T) 50&lt;t≤70: 41 (L) or 27 (T)</td>
</tr>
<tr>
<td>Category</td>
<td>Strength</td>
<td>Quality level</td>
<td>Impact test temp. (°C)</td>
<td>Reference Material grades</td>
<td>Y.P Min. (MPa)</td>
<td>Impact Avg. Min. (J)</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L: Long., T: Trans.</td>
</tr>
<tr>
<td>Primary/ special</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-40</td>
<td>API 2W 50</td>
<td>345</td>
<td>41 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-40</td>
<td>VL E36</td>
<td>355 all thickness</td>
<td>t≤50: 34 (L) or 24 (T) 50&lt;t≤70: 41 (L) or 27 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-40</td>
<td>S355G9+M/N S355G10+M/N</td>
<td>t16: 355 16&lt;t≤40: 345 40&lt;t: 335</td>
<td>50 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-46</td>
<td>API 2W 50</td>
<td>345</td>
<td>31 (7.5x10) (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-62</td>
<td>API 2W 50</td>
<td>345</td>
<td>20 (5 x10) (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-60</td>
<td>VL F36</td>
<td>355 all thickness</td>
<td>t≤50: 34 (L) or 24 (T) 50&lt;t≤70: 41 (L) or 27 (T)</td>
<td></td>
</tr>
<tr>
<td>Primary/ special</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-40</td>
<td>S420G2+M/Q NV E420</td>
<td>420 ~540</td>
<td>60 (T)</td>
<td>28 (T)</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-40</td>
<td>API 2W 60</td>
<td>414 ~ 586</td>
<td>48 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-46</td>
<td>API 2W 60</td>
<td>414 ~ 586</td>
<td>35 (7.5x10) (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-62</td>
<td>API 2W 60</td>
<td>414 ~ 586</td>
<td>24 (5x10) (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-60</td>
<td>VL F420</td>
<td>420 all thickness</td>
<td>28 (T)</td>
<td></td>
</tr>
<tr>
<td>Primary/ special</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>-40</td>
<td>S460G2+M/Q VL E460</td>
<td>460 ~580</td>
<td>60 (T)</td>
<td>31 (T)</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-60</td>
<td>VL F460</td>
<td>460 all thickness</td>
<td>31 (T)</td>
<td></td>
</tr>
<tr>
<td>Primary/ special</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-40</td>
<td>VL E500</td>
<td>500 all thickness</td>
<td>33 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-60</td>
<td>VL F500</td>
<td>500 all thickness</td>
<td>33 (T)</td>
<td></td>
</tr>
<tr>
<td>Primary/ special</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-40</td>
<td>VL E550</td>
<td>550 all thickness</td>
<td>37 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-60</td>
<td>VL F550</td>
<td>550 all thickness</td>
<td>37 (T)</td>
<td></td>
</tr>
<tr>
<td>Primary/ special</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-40</td>
<td>VL E690</td>
<td>690 all thickness</td>
<td>46 (T)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>-60</td>
<td>VL F690</td>
<td>690 all thickness</td>
<td>46 (T)</td>
<td></td>
</tr>
</tbody>
</table>
2.3 Material tables for sections

Material quality levels for sections, i.e. H-beam, angle, channel, bars, were identified and grouped based on the following informative standards.

— ASTM A36
— DNVGL OS B101
— EN 10025
— JIS
— NORSOK M-120.

Table 2-2 shows a complete summary of the different material quality levels for the above mentioned informative standards.

Table 2-2 Material quality levels for sections based on informative reference standards

<table>
<thead>
<tr>
<th>Category</th>
<th>Strength</th>
<th>Quality level</th>
<th>Impact test temp. (°C)</th>
<th>Reference Material grades</th>
<th>Y.P Min. (MPa)</th>
<th>Impact Avg. Min. (J)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tertiary</td>
<td>235</td>
<td>IV</td>
<td>+20</td>
<td>S235JR VL A</td>
<td>235 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>JIS SS400 A36</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>0</td>
<td>S235J0 VL B</td>
<td>235 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td>Secondary/tertiary</td>
<td>275</td>
<td>IV</td>
<td>+20</td>
<td>S275JR</td>
<td>275 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>0</td>
<td>S275J0</td>
<td>275 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td>Secondary</td>
<td>355</td>
<td>IV</td>
<td>+20</td>
<td>S355JR</td>
<td>t≤16: 355 16≤t≤40: 345</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>JIS SM490YB</td>
<td>t≤16: 365 16&lt;t: 355</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>S355J0</td>
<td>t≤16: 355 16≤t≤40: 345</td>
<td>27 (L)</td>
</tr>
<tr>
<td>Secondary</td>
<td>355</td>
<td>IV</td>
<td>0</td>
<td>VL A36</td>
<td>355 all thickness</td>
<td>t≤50: 34 (L) 50&lt;t≤70: 41 (L)</td>
</tr>
<tr>
<td>Primary/secondary</td>
<td>355</td>
<td>III</td>
<td>-20</td>
<td>VL D36</td>
<td>355</td>
<td>41 (T)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-20</td>
<td>S355J2</td>
<td>355</td>
<td>t≤50: 34 (L) 50&lt;t≤70: 41 (L)</td>
</tr>
<tr>
<td>Primary</td>
<td>355</td>
<td>II</td>
<td>-40</td>
<td>S355G12</td>
<td>t≤16: 355 16≤t≤40: 345</td>
<td>50 (T)</td>
</tr>
<tr>
<td>Primary/secondary</td>
<td>460</td>
<td>III</td>
<td>-20</td>
<td>S460G2+M</td>
<td>460</td>
<td>36 (T)</td>
</tr>
</tbody>
</table>
### 2.4 Material tables for tubular

Material quality levels for tubular, seamless or welded, were grouped and identified based upon the following informative standards:

- API 5L
- ASTM A106, A53, A672
- DNVGL OS B101
- EN 10210, EN 10219
- JIS.

Table 2-3 shows a complete summary of the different material quality levels for the above mentioned informative standards.

#### Table 2-3 Material quality levels for tubular based on informative reference standards

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>0</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.B EN S235JRH</td>
<td>235, all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td>Tertiary/secondary</td>
<td>275</td>
<td>IV</td>
<td>+20</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X42 EN S275JRH</td>
<td>275, all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IV</td>
<td>0</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X42 EN S275J0H</td>
<td>27 (L)</td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>355</td>
<td>IV</td>
<td>+20</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X52</td>
<td>t≤16: 355 16≤t≤40: 345</td>
<td>27 (L)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>III</td>
<td>-20</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X52 EN S355J0H</td>
<td>355 all thickness</td>
<td>27 (L)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>355</td>
<td>III</td>
<td>-20</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X52 EN S355G1+N EN S355K2H</td>
<td>355</td>
<td>41 (T)</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
<td>---------------</td>
<td>------------------------</td>
<td>--------------</td>
<td>-------------------------------------------</td>
<td>----------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>355</td>
<td>II</td>
<td>-40</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X52 EN S355NH EN S355G15+Q/N EN S355G14+Q/N</td>
<td>t≤16: 355 16&lt;t≤40: 345</td>
<td>50 (T)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>420</td>
<td>III</td>
<td>-20</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X65 EN S460G6+Q</td>
<td>460</td>
<td>50 (T)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>420</td>
<td>II</td>
<td>-40</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X65 EN S460G6+Q</td>
<td>460</td>
<td>60 (T)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>460</td>
<td>II</td>
<td>-40</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X65 EN S460G6+Q</td>
<td>460</td>
<td>50 (T)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>460</td>
<td>II</td>
<td>-40</td>
<td>Hot finished or Cold formed</td>
<td>API 5L Gr.X65 EN S460G6+Q</td>
<td>460</td>
<td>60 (T)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>550</td>
<td>II</td>
<td>-40</td>
<td>Hot finished</td>
<td>DNVGL VL E550</td>
<td>550</td>
<td>41 (T)</td>
</tr>
<tr>
<td>Secondary/primary</td>
<td>690</td>
<td>II</td>
<td>-40</td>
<td>Hot finished</td>
<td>DNVGL VL E690 DNVGL VL F690</td>
<td>690</td>
<td>46 (T)</td>
</tr>
</tbody>
</table>
SECTION 3 EVALUATION

It is a general issue that standards do not contain the same properties. Therefore, this RP includes recommendations in respect of a complete set of required properties.

An example of the described challenge pertaining to lack of common properties across standards is that carbon, silicon and manganese composition are not specified in the JIS standard for SS400. This material is frequently used for tertiary structural items. However, the actual composition of this JIS material normally still complies with requirements to other equivalent grades.

In general, if there is a deviation between standards related to strength and toughness, then this RP recommends using the higher strength or toughness value. When chemical allowance is too wide to maintain weldability and required strength levels, e.g. chemical composition for carbon, phosphor and sulphur, more strict requirements are recommended. The main rationale for this is to ensure the required quality for the material selection. It should be noted that this is expected to have insignificant consequence for weight and cost.

Another key factor emphasized in this RP is to simplify the required strength levels between the standards regardless of thickness. This will simplify the engineering strength calculations and will again have insignificant consequence for weight and cost. Manufacturers may in some cases be required to adjust their manufacturing process as a result of a higher required strength, but this will be a limited temporary change for the industry.

There are several differences in pre-qualification requirements between API and EN. Those are proposed to be addressed by choosing the stricter pre-qualification requirements of the two standards. This will remove the need for additional pre-qualification tests when EN is used for a project where API is specified and vice versa. As a result, manufacturing and preparation time will be reduced in addition to manufacturing cost savings.

In addition to the described evaluation and rationale for the recommendations above there will be significant general standardization savings from application of this RP as there are many challenges related to unnecessary time spent as a direct result of large variations in material selection requirements leading to misunderstanding, different interpretations of standards and re-qualification of materials. Those challenges are also often causing delays during engineering, procurement and construction.
SECTION 4 RECOMMENDED REQUIREMENTS

4.1 General
The recommended material grades for plates, sections and tubulars are based on the evaluation and criteria described in Sec.2 and Sec.3.
Material data sheets (MDS) for each material grade are exhibited in Appendix B.

4.2 Plates
The recommended material grades for plates listed in Table 4-1 are developed to cover the requirements of API, ASTM, DNVGL OS B101, EN 10225, EN 10025, JIS G3101, and NORSOK M-120. In cases where pre-qualification is required the material grade shall be fully tested according to the requirements of prequalification as described in section [4.4].

Table 4-1 Recommended material grade for plates

<table>
<thead>
<tr>
<th>Standard MDS no.</th>
<th>Material Grade</th>
<th>Category</th>
<th>Quality level</th>
<th>Thickness (mm)</th>
<th>Min. Yield strength (MPa)</th>
<th>Impact test temp. (°C)</th>
<th>Impact value (Transverse)</th>
<th>Prequalification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS001</td>
<td>CP235-R</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS002</td>
<td>CP235-0</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS003</td>
<td>CP275-R</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS004</td>
<td>CP275-0</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS005</td>
<td>CP355-0</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS006</td>
<td>CP355-20</td>
<td>Primary</td>
<td>III</td>
<td>Up to 50</td>
<td>355</td>
<td>-20</td>
<td>40</td>
<td>None</td>
</tr>
<tr>
<td>CS007</td>
<td>CP355-40</td>
<td>Primary/special</td>
<td>II</td>
<td>Up to 100</td>
<td>355</td>
<td>-40</td>
<td>41</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS008</td>
<td>CP355-46</td>
<td>Primary/special</td>
<td>II</td>
<td>Up to 100</td>
<td>355</td>
<td>-46</td>
<td>31</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS009</td>
<td>CP355-60</td>
<td>Primary/special</td>
<td>II</td>
<td>Up to 100</td>
<td>355</td>
<td>-60</td>
<td>41</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS010</td>
<td>CP420-20</td>
<td>Primary/special</td>
<td>II</td>
<td>Up to 100</td>
<td>420</td>
<td>-20</td>
<td>28</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS011</td>
<td>CP420-40</td>
<td>Primary/special</td>
<td>I</td>
<td>Up to 100</td>
<td>420</td>
<td>-40</td>
<td>60</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS012</td>
<td>CP420-46</td>
<td>Primary/special</td>
<td>I</td>
<td>Up to 100</td>
<td>420</td>
<td>-46</td>
<td>42</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS013</td>
<td>CP420-60</td>
<td>Primary/special</td>
<td>I</td>
<td>Up to 100</td>
<td>420</td>
<td>-60</td>
<td>42</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS014</td>
<td>CP460-20</td>
<td>Primary/special</td>
<td>II</td>
<td>Up to 100</td>
<td>460</td>
<td>-20</td>
<td>31</td>
<td>See requirements for prequalification</td>
</tr>
</tbody>
</table>
### Standard MDS no. | Material Grade | Category | Quality level | Thickness (mm) | Min. Yield strength (MPa) | Impact test temp. (°C) | Impact value (Transverse) | Prequalification
---|---|---|---|---|---|---|---|---
CS015 | CP460-40 | Primary/special | I | Up to 100 | 460 | -40 | 60 | See requirements for prequalification
CS016 | CP460-60 | Primary/special | I | Up to 100 | 460 | -60 | 31 | See requirements for prequalification
CS017 | CP500-40 | Primary/special | I | Up to 100 | 500 | -40 | 33 | See requirements for prequalification
CS018 | CP500-60 | Primary/special | I | Up to 100 | 500 | -60 | 33 | See requirements for prequalification
CS019 | CP550-40 | Primary/special | I | Up to 100 | 550 | -40 | 55 | See requirements for prequalification
CS020 | CP550-60 | Primary/special | I | Up to 100 | 550 | -60 | 37 | See requirements for prequalification
CS021 | CP690-40 | Primary/special | I | Up to 100 | 690 | -40 | 46 | See requirements for prequalification
CS022 | CP690-60 | Primary/special | I | Up to 100 | 690 | -60 | 69 | See requirements for prequalification

The recommended material grades for plates with reference to standards are presented in Appendix A. MDSs for each material grade are exhibited in Appendix B.

### 4.3 Sections

The recommended material grades for sections, i.e. H-beam, angle, channel and bars, listed in Table 4-2 are developed to cover the requirements of ASTM, EN and JIS. In cases where pre-qualification is required the material grade shall be fully tested according to pre-qualification requirements described in section [4.4].

#### Table 4-2 Recommended material grade for sections

<table>
<thead>
<tr>
<th>Standard MDS no.</th>
<th>Material Grade</th>
<th>Category</th>
<th>Quality level</th>
<th>Thickness (mm)</th>
<th>Min. Yield strength (MPa)</th>
<th>Impact test temp. (°C)</th>
<th>Impact value (Transverse)</th>
<th>Prequalification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS101</td>
<td>CS235-R</td>
<td>Tertiary</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS102</td>
<td>CS235-0</td>
<td>Tertiary</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS103</td>
<td>CS275-R</td>
<td>Tertiary/secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS104</td>
<td>CS275-0</td>
<td>Tertiary/secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS105</td>
<td>CS355-R</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS106</td>
<td>CS355-0</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS107</td>
<td>CS355-0H</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>0</td>
<td>40</td>
<td>None</td>
</tr>
</tbody>
</table>
### 4.4 Tubular

The recommended material grades for tubulars, seamless or welded, listed in Table 4-3 are developed to cover the requirements of API, ASTM, EN and JIS. In cases where pre-qualification is required the material grade shall be fully tested according to the pre-qualification requirements described in section [4.4].

#### Table 4-3 Recommended material grade for tubulars

<table>
<thead>
<tr>
<th>Standard MDS no.</th>
<th>Material Grade</th>
<th>Category</th>
<th>Quality level</th>
<th>Thickness (mm)</th>
<th>Min. Yield strength (MPa)</th>
<th>Impact test temp. (°C)</th>
<th>Impact value (Transverse)</th>
<th>Prequalification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS201</td>
<td>CT235-R</td>
<td>Tertiary</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS202</td>
<td>CT235-0</td>
<td>Tertiary</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS203</td>
<td>CT275-R</td>
<td>Tertiary/secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS204</td>
<td>CT275-0</td>
<td>Tertiary/secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS205</td>
<td>CT355-R</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS206</td>
<td>CT355-0</td>
<td>Secondary</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>0</td>
<td>34</td>
<td>None</td>
</tr>
<tr>
<td>CS207</td>
<td>CT355-20</td>
<td>Secondary/primary</td>
<td>III</td>
<td>Up to 40</td>
<td>355</td>
<td>-20</td>
<td>41</td>
<td>None</td>
</tr>
<tr>
<td>CS208</td>
<td>CT355-40</td>
<td>Secondary/primary</td>
<td>II</td>
<td>Up to 40</td>
<td>355</td>
<td>-40</td>
<td>50</td>
<td>Required for primary: See requirements for prequalification</td>
</tr>
</tbody>
</table>

The recommended material grades for sections with reference to standards are presented in Appendix C. MDSs for each material grade are exhibited in Appendix D.
The recommended material grades for tubulars with reference to standards are presented in Appendix E. MDSs for each material grade are exhibited in Appendix F.

### 4.5 Requirements for pre-qualification

Pre-qualification requirements presented in this RP cover quality level I and II steels for structural purpose. The referenced informative standards are listed in Table 4-4. Pre-qualification includes third party witnessing, monitoring and/or reviewing.

**Table 4-4 Informative reference standards for pre-qualification**

<table>
<thead>
<tr>
<th>Standards</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>API 2W, Dec. 2006</td>
<td>Specification for steel plates for offshore structures, Produced by Thermo-Mechanical Control Processing (TMCP)</td>
</tr>
<tr>
<td>API RP 22, Sep. 2005</td>
<td>Recommended Practice for preproduction qualification for steel plates for offshore structures</td>
</tr>
<tr>
<td>EN 10225, Sep. 2009</td>
<td>Weldable structural steels for fixed offshore structures, Technical delivery conditions</td>
</tr>
<tr>
<td>ISO 12135 Dec. 2002</td>
<td>Metallic materials — Unified method of test for the determination of quasistatic fracture toughness</td>
</tr>
</tbody>
</table>
The material quality levels requiring pre-qualification shall be carried out according to the pre-qualification procedure described in Appendix G.

<table>
<thead>
<tr>
<th>Standards</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORSOK M-101, Oct. 2011</td>
<td>Structural steel fabrication</td>
</tr>
<tr>
<td>NORSOK M-120, Nov. 2008</td>
<td>Material data sheets for structural steel</td>
</tr>
</tbody>
</table>
### APPENDIX A MATERIAL TABLE FOR PLATES

Informative reference standard: ASTM, DNVGL OS B101, EN 10025, EN 10225, JIS G3101, NORSOK M-120.

<table>
<thead>
<tr>
<th>MDS No.</th>
<th>Material grade</th>
<th>Category</th>
<th>Strength</th>
<th>Quality level</th>
<th>Thickness (mm)</th>
<th>Min. Yield strength (MPa)</th>
<th>Impact test temp. (°C)</th>
<th>Impact value (Transverse)</th>
<th>Pre-qualification</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS001</td>
<td>CP235-R</td>
<td>Secondary</td>
<td>235</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS002</td>
<td>CP235-0</td>
<td>Secondary</td>
<td>235</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS003</td>
<td>CP275-R</td>
<td>Secondary</td>
<td>275</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>+20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS004</td>
<td>CP275-0</td>
<td>Secondary</td>
<td>275</td>
<td>IV</td>
<td>Up to 40</td>
<td>275</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS005</td>
<td>CP355-0</td>
<td>Secondary</td>
<td>355</td>
<td>IV</td>
<td>Up to 40</td>
<td>355</td>
<td>0</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS006</td>
<td>CP355-20</td>
<td>Primary</td>
<td>355</td>
<td>III</td>
<td>Up to 50</td>
<td>355</td>
<td>-20</td>
<td>27</td>
<td>None</td>
</tr>
<tr>
<td>CS007</td>
<td>CP355-40</td>
<td>Primary/special</td>
<td>355</td>
<td>II</td>
<td>Up to 100</td>
<td>355</td>
<td>-40</td>
<td>41</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS008</td>
<td>CP355-46</td>
<td>Primary/special</td>
<td>355</td>
<td>II</td>
<td>Up to 100</td>
<td>355</td>
<td>-46</td>
<td>31</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS009</td>
<td>CP355-60</td>
<td>Primary/special</td>
<td>355</td>
<td>II</td>
<td>Up to 100</td>
<td>355</td>
<td>-60</td>
<td>41</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS010</td>
<td>CP420-20</td>
<td>Primary/special</td>
<td>420</td>
<td>II</td>
<td>Up to 100</td>
<td>420</td>
<td>-20</td>
<td>28</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS011</td>
<td>CP420-40</td>
<td>Primary/special</td>
<td>420</td>
<td>I</td>
<td>Up to 100</td>
<td>420</td>
<td>-40</td>
<td>60</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS012</td>
<td>CP420-46</td>
<td>Primary/special</td>
<td>420</td>
<td>I</td>
<td>Up to 100</td>
<td>420</td>
<td>-46</td>
<td>42</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS013</td>
<td>CP420-60</td>
<td>Primary/special</td>
<td>420</td>
<td>I</td>
<td>Up to 100</td>
<td>420</td>
<td>-60</td>
<td>42</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS014</td>
<td>CP460-20</td>
<td>Primary/special</td>
<td>460</td>
<td>II</td>
<td>Up to 100</td>
<td>460</td>
<td>-20</td>
<td>31</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>MDS No.</td>
<td>Material grade</td>
<td>Category</td>
<td>Strength</td>
<td>Quality level</td>
<td>Thickness (mm)</td>
<td>Min. Yield strength MPa</td>
<td>Impact test temp. (°C)</td>
<td>Impact value (Trans-verse)</td>
<td>Pre-qualification</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
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<td>------------------------</td>
<td>----------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>CS015</td>
<td>CP460-40</td>
<td>Primary/special</td>
<td>460</td>
<td>I</td>
<td>Up to 100</td>
<td>460</td>
<td>-40</td>
<td>60</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS016</td>
<td>CP460-60</td>
<td>Primary/special</td>
<td>460</td>
<td>I</td>
<td>Up to 100</td>
<td>460</td>
<td>-60</td>
<td>31</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS017</td>
<td>CP500-40</td>
<td>Primary/special</td>
<td>500</td>
<td>I</td>
<td>Up to 100</td>
<td>500</td>
<td>-40</td>
<td>33</td>
<td>See requirements for prequalification</td>
</tr>
<tr>
<td>CS018</td>
<td>CP500-60</td>
<td>Primary/special</td>
<td>500</td>
<td>I</td>
<td>Up to 100</td>
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<td>-60</td>
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APPENDIX B MDS FOR PLATES

<table>
<thead>
<tr>
<th>MATERIAL DATA SHEET</th>
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<tr>
<td>Steel quality: IV</td>
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<tr>
<td>Material gr.: CP235-R</td>
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Material purpose and product type: Structural steel/plate

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<tr>
<th>Informative reference standard and grade</th>
<th>EN 10025 S235JR</th>
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<tr>
<td></td>
<td>JIS G3101 SS400</td>
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<tr>
<td></td>
<td>ASTM A36</td>
</tr>
<tr>
<td></td>
<td>DNVGL-OS-B101 VL A</td>
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1) **Scope:**
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
AR, NR or TM

3) **Chemical composition (wt. %):**
C: max.0.17, Si: max.0.50, Mn: min.2.5xC, P:max.0.035, S:max.0.035, Ceq.:max.0.43

4) **Mechanical property:**
Tensile strength (MPa): 360 ~ 510
Yield strength (MPa): min. 235
Elongation (% gauge length of 5.65√So): min. 22
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
Impact: Otherwise additional requirement, not required up to 25mm, t<25mm. min. avg. 27J, ind. 19J at +20#,

5) **Extent of testing (test unit):**
1 tensile + 1 set impact per heat

6) **Surface condition:**
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

7) **Dimension and shape:**
Dimensions and shapes tolerances shall be met to ISO 7452

8) **Identification:**
Heat number, plate ID number
Other number as per purchaser’s request

9) **Type of certificate:**
EN 10204 Type 3.1
**MATERIAL DATA SHEET**

<table>
<thead>
<tr>
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**Material purpose and product type:** Structural steel/plate

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1) **Scope:**
   This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   AR, NR or TM

3) **Chemical composition (wt. %):**
   C: max.0.17, Si: max.0.50, Mn: max.1.4, P: max.0.035, S: max.0.035, Ceq.:max.0.35

4) **Mechanical property:**
   Tensile strength (MPa): 360 ~ 510
   Yield strength (MPa): min. 235
   Elongation (%: gauge length of 5.65√So): min. 24
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   Impact 2-v: at 0 °C, min. avg.27J, ind. 19J

5) **Extent of testing (test unit):**
   1 tensile + 1 set impact per heat

6) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

7) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

8) **Identification:**
   Heat number, plate ID number
   Other number as purchaser’s request

9) **Type of certificate:**
   EN 10204 Type 3.1
MATERIAL DATA SHEET

MDS-CS003 Rev.0
Steel quality: IV
Material gr.: CP275-R

Material purpose and product type: Structural steel/plate

Informative reference standard and grade
EN 10025 S275JR

1) Scope:
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) Delivery condition:
AR, NR, or TM

3) Chemical composition (wt. %):
C: max.0.21, Si: max.0.50, Mn:max.1.5, P: max.0.030, S: max.0.030, Ceq.: max.0.41

4) Mechanical property:
Tensile strength (MPa): 430 ~ 580
Yield strength (MPa): min. 275
Elongation (% gauge length of 5.65√So): min. 23
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
Impact 2-v: at +20#, min. avg. 27J, ind. 19J

5) Extent of testing (test unit):
1 tensile + 1 set impact per heat

6) Surface condition:
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

7) Dimension and shape:
Dimensions and shapes tolerances shall be met to ISO 7452

8) Identification:
Heat number, plate ID number
Other number as purchaser’s request

9) Type of certificate:
EN 10204 Type 3.1
### MATERIAL DATA SHEET

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#### Material purpose and product type: Structural steel/plate

#### Informative reference standard and grade

| EN 10025 S275J0 |

1) **Scope:**
   - This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   - In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   - AR, NR or TM

3) **Chemical composition (wt. %):**
   - C: max.0.18, Si: max.0.50, Mn: max.1.6, P: max.0.030, S: max.0.030, Ceq.:max.0.40

4) **Mechanical property:**
   - Tensile strength (MPa): 410 ~ 560
   - Yield strength (MPa): Min. 275.
   - Elongation (% gauge length of 5.65√So): min. 23
   - When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Impact 2-v: at 0°C, min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact per heat

6) **Surface condition:**
   - Surface is to be inspected and pitting is not allowed.
   - For surface soundness EN 10163-2 Class A may be applied.

7) **Dimension and shape:**
   - Dimensions and shapes tolerances shall be met to ISO 7452

8) **Identification:**
   - Heat number, plate ID number
   - Other number as purchaser’s request

9) **Type of certificate:**
   - EN 10204 Type 3.1
### MATERIAL DATA SHEET

| MDS- CS005 Rev.0 | Steel quality: IV  
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</table>

**Material purpose and product type:** Structural steel/plate

**Informative reference standard and grade**

| EN 10025 S355J0 | JIS 3106 SM490YB |

1) **Scope:**  
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**  
AR, NR or TM

3) **Chemical composition (wt. %):**  
C: max.0.18, Si: max 0.50, Mn: max 1.6, P: max 0.030, S: max 0.030, Ceq.: max 0.45

4) **Mechanical property:**  
Tensile strength (MPa): 470 ~ 630  
Yield strength (MPa): Min. 355  
Elongation (% gauge length of 5.65√So): min. 23  
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.  
Impact 2-v: at 0°C, min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**  
1 tensile + 1 set impact per heat

6) **Surface condition:**  
Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied.

7) **Dimension and shape:**  
Dimensions and shapes tolerances shall be met to ISO 7452

8) **Identification:**  
Heat number, plate ID number  
Other number as purchaser’s request

9) **Type of certificate:**  
EN 10204 Type 3.1
MATERIAL DATA SHEET

<table>
<thead>
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<tbody>
<tr>
<td>Informative reference standard and grade</td>
</tr>
<tr>
<td>EN 10025 S355J2</td>
</tr>
<tr>
<td>EN 10025 S355K2</td>
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</table>

1) **Scope:**
   This MDS specifies material requirements for steel quality III for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 50 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   NR or TM

3) **Chemical composition (wt. %):**
   C: max.0.18, Si: max.0.50, Mn: max.1.6, P: max.0.025, S: max.0.025, Ceq.:max.0.40

4) **Mechanical property:**
   Tensile strength (MPa): 510 ~ 680
   Yield strength (MPa): Min. 355
   Elongation (% gauge length of 5.65√So): min. 20
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   Impact 2-v: transverse direction, at -20°C, min. avg. 40J, ind. 28J

5) **Extent of testing (test unit):**
   1 tensile + 1 set impact per 40 tonnes

6) **Non-destructive test:**
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

7) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

8) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

9) **Identification:**
   Heat number, plate ID number
   Other number as purchaser’s request

10) **Type of certificate:**
    EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS007 Rev.0
Steel quality: II
Material gr.: CP355-40

Material purpose and product type: Structural steel/plate

Informative reference standard and grade
EN 10025 S355J2
EN 10025 S355K2

1) Scope:
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) Pre-qualification:
Base material information shall be submitted prior to delivery.
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
Prequalification is to be carried out with independent 3rd party witness.

3) Delivery condition:
NR or TM

4) Chemical composition (wt. %):
C: max. 0.16, Si: 0.05 ~ 0.50, Mn: max.1.65, P: max. 0.015, S: max. 0.008
Ceq.: max.0.41 (above 75mm, max.0.42) Pcm; max.0.21 (above 75mm, 0.22)
The individual elements shall be within the range which is stated in EN 10225 Option 18, or API RP 2Z based on prequalification test result.

5) Mechanical property:
Tensile strength (MPa): 470 ~ 630
Yield strength (MPa): min. 355
YS/TS ratio: max.0.87 for NR, max.0.93 for TM
Elongation (% gauge length of 5.65√So): min. 23
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
Upon agree between purchaser and manufacturer, through thickness properties (%): min. avg. 35, ind. 25
Impact 2-v: transverse direction, at -40°C, min. avg. 41J, ind. 29J

6) Extent of testing (test unit):
1 tensile + 1 set impact each 40 tonnes

7) Non-destructive test:
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) Surface condition:
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

9) Dimension and shape:
Dimensions and shapes tolerances shall be met to ISO 7452

10) Identification:
Heat number, plate ID number
Other number as purchaser’s request

11) Type of certificate:
EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS008 Rev.0
Steel quality: II
Material gr.: CP355-46

Material purpose and product type: Structural steel/plate

Informative reference standard and grade
API 2W GR.50

1) **Scope:**
   This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 150 mm.

   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   Base material information shall be submitted prior to delivery.
   And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
   Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   TM

4) **Chemical composition (wt. %):**
   C: max.0.16, Si: 0.05~ 0.50, Mn: max.1.60, P: max. 0.030, S: max. 0.010
   Ceq.:max.0.39 (40<t≤90mm, 0.41, t>90mm, 0.43)
   Pcm: max.0.22 (40<t≤90mm, 0.23, t>90mm, 0.24)

   The individual elements shall be within the range which is stated in API RP 2Z based on prequalification test result.

5) **Mechanical property:**
   Tensile strength (MPa): Min. 448
   Yield strength (MPa): min. 355~517
   Elongation (%), gauge length of 5.65√So: min. 23
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   Through thickness properties (%): min. avg. 35, ind. 25
   Impact 2-v: transverse direction, at -46°C, min. avg. 31J, ind. 26J

6) **Extent of testing (test unit):**
   1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
    Heat number, plate ID number
    Other number as purchaser’s request

11) **Type of certificate:**
    EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS009 Rev.0
Steel quality: II
Material gr.: CP355-60

Material purpose and product type: Structural steel/plate

Informative reference standard and grade
API 2W GR.50
DNVGL-OS-B101 VL F36

1) Scope:
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) Pre-qualification:
Base material information shall be submitted prior to delivery.
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
Prequalification is to be carried out with independent 3rd party witness.

3) Delivery condition:

4) Chemical composition (wt. %):
C: max. 0.16, Si: 0.05 ~ 0.50, Mn: max.1.65, P: max. 0.015, S: max. 0.008

Ceq.: max.0.41 (above 75mm, max.0.42) Pcm: max.0.21 (above 75mm, 0.22)
The individual elements shall be within the range which is stated in EN 10225 Option 18, or API RP 2Z based on prequalification test result.

5) Mechanical property:
Tensile strength (MPa): 470 ~ 630
Yield strength (MPa): min. 355
YS/TS ratio: max. 0.87 for NR, max. 0.93 for TM
Elongation (% , gauge length of 5.65√So): min. 23
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
Through thickness properties (%): min. avg. 35, ind. 25
Impact 2-v: transverse direction, at -60°C, min. avg. 41J, ind. 29J

6) Extent of testing (test unit):
1 tensile + 1 set impact each 40 tonnes

7) Non-destructive test:
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) Surface condition:
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

9) Dimension and shape:
Dimensions and shapes tolerances shall be met to ISO 7452

10) Identification:
Heat number, plate ID number
Other number as purchaser’s request

11) Type of certificate:
EN 10204 Type 3.2
**MATERIAL DATA SHEET**

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**Material purpose and product type:** Structural steel/plate

**Informative reference standard and grade**

| DNVGL-OS-B101 VL D420 |

1) **Scope:**
   - This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.
   - In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   - Base material information shall be submitted prior to delivery.
   - And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
   - Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   - NR or TM

4) **Chemical composition (wt. %):**
   - C: max.0.20, Si: 0.50, Mn: max.1.65, P: max. 0.015, S: max. 0.008
   - Ceq.:max.0.42, Pcm: max.0.22 (t15mm, 0.23)
   - The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   - Tensile strength (MPa): 530 ~ 680
   - Yield strength (MPa): min. 420
   - YS/TS ratio: t16mm max. 0.93, t>16mm 0.90
   - Elongation (%), gauge length of 5.65√So): min. 18
   - When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Through thickness properties (%): min. avg. 35, ind. 25
   - Impact 2-v: transverse direction, at -20°C, min. Avg. 42 J, ind. 29J

6) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**
   - Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**
   - Surface is to be inspected and pitting is not allowed.
   - For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   - Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
    - Heat number, plate ID number
    - Other number as request

11) **Type of certificate:**
    - EN 10204 Type 3.2
### MATERIAL DATA SHEET

**MDS- CS011 Rev.0**  
**Steel quality:** I  
**Material gr.:** CP420-40

**Material purpose and product type:** Structural steel/plate

| Informative reference standard and grade | EN 10225 S420G2+M/QT  
|                                         | API2W GR.60  
|                                         | DNVGL-OS-B101 VL E420 |

1) **Scope:**  
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 150 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**  
Base material information shall be submitted prior to delivery.  
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".  
Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**  
TM or QT

4) **Chemical composition (wt. %):**  
C: max.0.14 (0.15, t<15mm), Si:0.15~ 0.55, Mn:max.1.65, P: max. 0.020, S: max. 0.007  
Ceq.:max.0.42, Pcm: max.0.22 (t< 15mm, 0.23)  
The individual elements shall be within the range which is stated in EN 10225 Option 18, or API RP 2Z based on prequalification test result.

5) **Mechanical property:**  
Tensile strength (MPa): 500~660 (t≤40mm, 480~640)  
Yield strength (MPa): min.420  
YS/TS ratio: max. 0.93, (t>16mm, max.0.90)  
Elongation (% gauge length of 5.65√So): min. 19  
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.  
Through thickness properties (%): min. avg.35, ind. 25  
Impact 2-v: transverse direction, at -40°C, min. avg. 60J, ind. 42J

6) **Extent of testing (test unit):**  
1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**  
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**  
Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**  
Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**  
Heat number, plate ID number  
Other number as purchaser's request

11) **Type of certificate:**  
EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS012 Rev.0
Steel quality: I
Material gr.: CP420-46

Material purpose and product type: Structural steel/plate

Informative reference standard and grade: API 2W 60

1) **Scope:**
   This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.

   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   Base material information shall be submitted prior to delivery.

   And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".

   Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   TM

4) **Chemical composition (wt. %):**
   C: max. 0.12, Si: 0.50, Mn: max.1.65, P: max. 0.020, S: max. 0.008
   Ceq.:max.0.42 Pcm: max.0.22

   The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   Tensile strength (MPa): 530 ~ 680
   Yield strength (MPa): min. 420
   YS/TS ratio: max. 0.93
   Elongation (%), gauge length of 5.65√So: min. 20

   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.

   Through thickness properties (%): min. avg. 35, ind. 25

   Impact 2-v: transverse, at -46°C, min. avg. 50 J, ind. 35J

6) **Extent of testing (test unit):**
   1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.

   For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
    Heat number, plate ID number

    Other number as purchaser’s request

11) **Type of certificate:**
    EN 10204 Type 3.2
**MATERIAL DATA SHEET**

<table>
<thead>
<tr>
<th>MDS- CS013 Rev.0</th>
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<td>Steel quality: I</td>
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<td>Material gr.: CP420-60</td>
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**Material purpose and product type:** Structural steel/plate

**Informative reference standard and grade:** DNVGL-OS-B101 VL F420

1) **Scope:**
   This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   Base material information shall be submitted prior to delivery.
   And prequalification is to be carried out according to “REQUIREMENTS FOR PREQUALIFICATION”.
   Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   NR or TM

4) **Chemical composition (wt. %):**
   
   - C: max. 0.18, Si: max. 0.50, Mn: max.1.65, P: max. 0.010, S: max. 0.008
   - Ceq.: max.0.42, Pcm: max. 0.22 (for t15mm, 0.23)
   
   The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   
   - Tensile strength (MPa): 530 ~ 680
   - Yield strength (MPa): min. 420
   - YS/TS ratio: t16mm max. 0.93, t>16mm 0.90
   - Elongation (% gauge length of 5.65√Sо): min. 18
   - When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Through thickness properties (%): min. avg. 35, ind. 25
   - Impact 2-v: transverse direction, at -60°C, min. avg. 28J, ind. 20J

6) **Extent of testing (test unit):**
   1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S1/E1 or ASTM A 578 Level C.

8) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
    - Heat number, plate ID number
    - Other number as purchaser’s request

11) **Type of certificate:**
    EN 10204 Type 3.2
### MATERIAL DATA SHEET

**MDS- CS014 Rev.0**  
Steel quality: II  
Material gr.: CP460-20  

**Material purpose and product type:** Structural steel/plate

**Informative reference standard and grade**  
DNVGL-OS-B101 VL D460

1) **Scope:**  
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**  
Base material information shall be submitted prior to delivery.  
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".  
Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**  
TM or QT

4) **Chemical composition (wt. %):**  
C: max. 0.21, Si: max. 0.10~0.55, Mn: min. 0.60, P: max. 0.035, S: max. 0.035.  
Ceq.: max.0.42, Pcm: max. 0.22 (for t15mm, 0.23)  
The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**  
Tensile strength (MPa): 570~720  
Yield strength (MPa): min. 460  
Elongation (% gauge length of 5.65√So): min. 17  
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.  
Through thickness properties (%): min. avg. 35, ind. 25  
Impact 2-v: transverse direction, at -20°C min. avg. 31J, ind. 22J

6) **Extent of testing (test unit):**  
1 tensile + 1 set impact each 40 tonnes (when QT, each plate)

7) **Non-destructive test:**  
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**  
Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**  
Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**  
Heat number, plate ID number  
Other number as purchaser’s request

11) **Type of certificate:**  
EN 10204 Type 3.2
### MATERIAL DATA SHEET

**MDS- CS015 Rev.0**  
**Steel quality:** I  
**Material gr.:** CP460-40

**Material purpose and product type:** Structural steel/plate

| Informative reference standard and grade | EN 10225 S460 G2+M/QT  
DNVGL-OS-B101 VL F460 |

1) **Scope:**  
This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**  
Base material information shall be submitted prior to delivery.  
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".  
Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**  
TM or QT

4) **Chemical composition (wt. %):**  
C: max. 0.12, Si: Max. 0.50, Mn: max.1.65, P: max. 0.010, S: max. 0.008  
Ceq.: max.0.43 Pcm.: max. 0.22 (for t<sub>15</sub>mm, 0.23)  
The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**  
Tensile strength (MPa): 540 ~ 700  
Yield strength (MPa): min. 460  
YS/TS ratio: max. 0.93  
Elongation (% gauge length of 5.65√So): min. 19  
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.  
Through thickness properties (%): min. avg. 35, ind. 25%  
Impact 2-v: transverse direction, at -60°C, Min. avg. 60 J ind. 42J.

6) **Extent of testing (test unit):**  
1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**  
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S1/E1 or ASTM A 578 Level C.

8) **Surface condition:**  
Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**  
Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**  
Heat number, plate ID number  
Other number as purchaser’s request

11) **Type of certificate:**  
EN 10204 Type 3.2
Recommendation for selecting standards for structural steel materials (tentative recommended practice)

MATERIAL DATA SHEET

MATERIAL DATA SHEET

Material purpose and product type: Structural steel/plate

Informative reference standard and grade

DNVGL-OS-B101 VL F460

1) **Scope:**
   
   This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.

   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   
   Base material information shall be submitted prior to delivery.

   And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".

   Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   
   NR, or TM

4) **Chemical composition (wt. %):**
   
   C: max. 0.18, Si: max. 0.50, Mn: max.1.65, P: max. 0.010, S: max. 0.008

   Ceq.:max.0.43 Pcm: max.0.22 (for t15mm, 0.23)

   The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   
   Tensile strength (MPa): 570 ~ 720

   Yield strength (MPa): min. 460

   YS/TS ratio: t16mm max. 0.93, t>16mm 0.90

   Elongation (% , gauge length of 5.65√So): min. 17

   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.

   Through thickness properties (%): min. avg. 35, ind. 25

   Impact 2-v: transverse direction, at -60°C, min. avg. 46J, ind. 32J

6) **Extent of testing (test unit):**
   
   1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**
   
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S1/E1 or ASTM A 578 Level C.

8) **Surface condition:**
   
   Surface is to be inspected and pitting is not allowed.

   For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   
   Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
   
   Heat number, plate ID number

   Other number as purchaser’s request

11) **Type of certificate:**
   
   EN 10204 Type 3.2
MATERIAL DATA SHEET

Material purpose and product type: Structural steel/plate

Informative reference standard and grade

DNVGL-OS-B101 VL E500

1) **Scope:**
   This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   Base material information shall be submitted prior to delivery.
   And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
   Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   TM or QT

4) **Chemical composition (wt. %):**
   - C: max.0.18, Si: max.0.50, Mn: max.1.80, P: max.0.020, S: max. 0.008
   - Ceq.:max.0.45, Pcm: max.0.22
   The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   - Tensile strength (MPa): 610~770
   - Yield strength (MPa): min.500
   - Elongation (% gauge length of 5.65√So): min. 18
   - When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Through thickness properties (%): min. avg.35, ind.25
   - Impact 2-v: transverse direction, at -40°C, avg. min.60J, ind.42J

6) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact each 40 tonnes

7) **Non-destructive test:**
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
    - Heat number, plate ID number
    - Other number as purchaser’s request

11) **Type of certificate:**
    - EN 10204 Type 3.2
# MATERIAL DATA SHEET

**Material purpose and product type:** Structural steel/plate

**Informative reference standard and grade:** DNVGL-OS-B101 VL F500

| 1) **Scope:** |  
| --- | --- |
| This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm. In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected. |  |

| 2) **Pre-qualification:** |  
| --- | --- |
| Base material information shall be submitted prior to delivery. And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness. |  |

| 3) **Delivery condition:** |  
| --- | --- |
| TM or QT |  |

| 4) **Chemical composition (wt. %):** |  
| --- | --- |
| C: max.0.18, Si: max.0.50, Mn: max.1.80, P: max. 0.020, S: max. 0.008 | Ceq.:max.0.45, Pcm: max.0.22 |
| The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result. |  |

| 5) **Mechanical property:** |  
| --- | --- |
| Tensile strength (MPa): 610 ~ 770 | Yield strength (MPa): min. 500 |
| Elongation (% gauge length of 5.65√So): min. 18% | When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1. |
| Through thickness properties (%): min. avg. 35, ind. 25 | Impact 2-v: transverse direction, at -60°C, avg. Min. 60J, ind. 42J |

| 6) **Extent of testing (test unit):** |  
| --- | --- |
| 1 tensile + 1 set impact each 40 tonnes |  |

| 7) **Non-destructive test:** |  
| --- | --- |
| Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C. |  |

| 8) **Surface condition:** |  
| --- | --- |
| Surface is to be inspected and pitting is not allowed. For surface soundness EN 10163-2 Class A may be applied. |  |

| 9) **Dimension and shape:** |  
| --- | --- |
| Dimensions and shapes tolerances shall be met to ISO 7452 |  |

| 10) **Identification:** |  
| --- | --- |
| Heat number, plate ID number | Other number as purchaser’s request |

<p>| 11) <strong>Type of certificate:</strong> |<br />
| --- | --- |
| EN 10204 Type 3.2 |  |</p>
<table>
<thead>
<tr>
<th><strong>MATERIAL DATA SHEET</strong></th>
<th><strong>MDS- CS019 Rev.0</strong></th>
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<tbody>
<tr>
<td>Steel quality: I</td>
<td>Steel gr.: CP550-40</td>
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</table>

**Material purpose and product type:** Structural steel/plate

**Informative reference standard and grade:** DNVGL-OS-B101 VL E550

1) **Scope:**
This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 150 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
Base material information shall be submitted prior to delivery.
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
QT

4) **Chemical composition (wt. %):**
- C: max. 0.18, Si: max. 0.50, Mn: max. 1.60, P: max. 0.010, S: max. 0.008
- Pcm: max. 0.27
Other limits may be accepted based on pre-qualification test result.
The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
- Tensile strength (MPa): 670 ~ 830
- Yield strength (MPa): min. 550
- Elongation (% gauge length of 5.65√So): min. 16
- When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
- Through thickness properties (%): min. avg. 35, ind. 25
- Impact 2-v: transverse direction, at -40°C, min. avg. 55J, ind. 39J

6) **Extent of testing (test unit):**
- 1 tensile + 1 set impact each plate

7) **Non-destructive test:**
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
- Heat number, plate ID number
- Other number as purchaser’s request

11) **Type of certificate:**
EN 10204 Type 3.2
### MATERIAL DATA SHEET

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<tbody>
<tr>
<td>Informative reference standard and grade: DNVGL-OS-B101 VL F550</td>
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</table>

#### 1) Scope:

This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 150 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

#### 2) Pre-qualification:

- Base material information shall be submitted prior to delivery.
- Prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
- Prequalification is to be carried out with independent 3rd party witness.

#### 3) Delivery condition:

- QT

#### 4) Chemical composition (wt. %):

- C: max. 0.18, Si: max. 0.50, Mn: max. 1.60, P: max. 0.010, S: max. 0.008
- Pcm: max.0.27

Other limits may be accepted based on pre-qualification test result.

The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

#### 5) Mechanical property:

- Tensile strength (MPa): 670 ~ 830
- Yield strength (MPa): min. 550
- Elongation (%), gauge length of 5.65√So): min. 16
- When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
- Through thickness properties (%): min. avg. 35, ind. 25
- Impact 2-v: transverse, at -60°C, min. avg. 55J, ind. 39J.

#### 6) Extent of testing (test unit):

- 1 tensile + 1 set impact per plate

#### 7) Non-destructive test:

- Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

#### 8) Surface condition:

- Surface is to be inspected and pitting is not allowed.
- For surface soundness EN 10163-2 Class A may be applied.

#### 9) Dimension and shape:

- Dimensions and shapes tolerances shall be met to ISO 7452

#### 10) Identification:

- Heat number, plate ID number
- Other number as purchaser’s request

#### 11) Type of certificate:

- EN 10204 Type 3.2
| **MATERIAL DATA SHEET** | **MDS- CS021 Rev.0**  
Steel quality: I  
Material gr.: CP690-40 |
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</tr>
<tr>
<td><strong>Informative reference standard and grade</strong></td>
<td><strong>DNVGL-OS-B101 VL E690</strong></td>
</tr>
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</table>

1) **Scope:**  
This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 210 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**  
Base material information shall be submitted prior to delivery.  
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".  
Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**  
QT

4) **Chemical composition (wt. %):**  
- C: max.0.18, Si: max. 0.50, Mn: max.1.60, P: max. 0.010, S: max. 0.008  
- Pcm: max.0.35  
Other limits may be accepted based on pre-qualification test result.  
The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**  
- Tensile strength (MPa): 770 ~ 940  
- Yield strength (MPa): min. 690  
- YS/TS ratio: max. 0.95  
- Elongation (% gauge length of 5.65√So): min.14  
  When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.  
  Impact 2-v: transverse direction, at -40°C, avg. min.46J, ind. 32J

6) **Extent of testing (test unit):**  
1 tensile + 1 set impact each plate

7) **Non- destructive test:**  
Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**  
Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**  
Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**  
Heat number, plate ID number  
Other number as purchaser’s request

11) **Type of certificate:**  
EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS022 Rev.0
Steel quality: I
Material gr.: CP690-60

Material purpose and product type: Structural steel/plate

Informative reference standard and grade
DNVGL-OS-B101 VL F690

1) **Scope:**
   This MDS specifies material requirements for steel quality I for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 210 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   Base material information shall be submitted prior to delivery.
   And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
   Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   QT

4) **Chemical composition (wt. %):**
   C: max. 0.18, Si: max. 0.50, Mn: max. 1.60, P: max. 0.010, S: max. 0.008
   Pcm: max. 0.30
   Other limits may be accepted based on pre-qualification test result.
   The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   Tensile strength (MPa): 770 ~ 940
   Yield strength (MPa): min. 690
   Elongation (%gauge length of 5.65√So): min. 14
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   Impact 2-v: transverse direction, at -60°C, avg. min. 46J, ind. 32J

6) **Extent of testing (test unit):**
   1 tensile + 1 set impact each plate

7) **Non- destructive test:**
   Internal soundness is to be tested with UT according to agreed procedure or EN 10160 Level S3/E4 or ASTM A 578 Level C.

8) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

9) **Dimension and shape:**
   Dimensions and shapes tolerances shall be met to ISO 7452

10) **Identification:**
    Heat number, plate ID number
    Other number as purchaser’s request

11) **Type of certificate:**
    EN 10204 Type 3.2
### APPENDIX C MATERIAL TABLE FOR SECTIONS

Reference standard: ASTM, EN and JIS

<table>
<thead>
<tr>
<th>MDS No.</th>
<th>Material grade</th>
<th>Category</th>
<th>Strength</th>
<th>Quality level</th>
<th>Thickness (mm)</th>
<th>Min. Yield strength MPa</th>
<th>Impact test temp. (°C)</th>
<th>Impact value (Transverse)</th>
<th>Pre-qualification</th>
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<tbody>
<tr>
<td>CS101</td>
<td>CS235-R</td>
<td>Tertiary</td>
<td>235</td>
<td>IV</td>
<td>Up to 40</td>
<td>235</td>
<td>+20</td>
<td>27</td>
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<td>CS235-0</td>
<td>Tertiary</td>
<td>235</td>
<td>IV</td>
<td>Up to 40</td>
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<td>CS275-R</td>
<td>Tertiary/secondary</td>
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<td>CS275-0</td>
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<td>III</td>
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<td>-20</td>
<td>41</td>
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<td>355</td>
<td>II</td>
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<td>-40</td>
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<td>See Requirements for Prequalification</td>
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<td>III</td>
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<td>36</td>
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</table>
APPENDIX D MDS FOR SECTIONS

MATERIAL DATA SHEET

MDS- CS101 Rev.0
Steel quality: IV
Material gr.: CS235-R

Material purpose and product type: Section/structural steel

Informative reference standard and grade

EN 10025 S235JR
JIS G3101 SS400
ASTM A36
DNVGL-OS-B101 VL A

1) **Scope:**
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
AR or NR

3) **Chemical composition (wt. %):**
C: max. 0.18
Si: max. 0.50
Mn: min. 2.5
P: max. 0.035
S: max. 0.035
Ceq.: max.0.43

4) **Mechanical property:**
Tensile strength (MPa): min. 400
Yield strength (MPa): min. 235
Elongation (%): min. 21

When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.

Impact: Not required up to t<25mm min. 27J at +20#, otherwise additional requirement.

5) **Extent of testing (test unit):**
1 tensile + (1 set impact, when required) per heat

6) **Surface condition:**
All surfaces shall be visual inspected and pitting is not allowed.

For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7) **Dimension and shape:**
Dimensions and shapes tolerances are met to ISO 657

8) **Identification:**
Heat number, plate ID number
Other number as purchaser’s request

9) **Type of certificate:**
EN 10204 Type 3.1
### MATERIAL DATA SHEET

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<thead>
<tr>
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<tr>
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**Material purpose and product type:** Section/structural steel

**Informative reference standard and grade**

<table>
<thead>
<tr>
<th>EN 10025 S235J0</th>
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<tbody>
<tr>
<td>DNVGL-OS-B101 VL B</td>
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</table>

1. **Scope:**
   This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2. **Delivery condition:**
   AR or NR

3. **Chemical composition (wt. %):**
   C: max. 0.18 Si: max. 0.50 Mn: min. 0.8 P: max. 0.030 S: max. 0.030 Ceq.:max.0.43

4. **Mechanical property:**
   - Tensile strength (MPa): min 400
   - Yield strength (MPa): min. 235
   - Elongation (%) (\(L_0=5.65\sqrt{S_0}\)): min. 23
     When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Impact: at 0°C, min. avg. 27J, ind. 19J

5. **Extent of testing (test unit):**
   1 tensile + 1 set impact per heat

6. **Surface condition:**
   All surfaces shall be visual inspected and pitting is not allowed.
   For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7. **Dimension and shape:**
   Dimensions and shapes tolerances are met to ISO 657

8. **Identification:**
   - Heat number, plate ID number
   - Other number as purchaser’s request

9. **Type of certificate:**
   EN 10204 Type 3.1
### MATERIAL DATA SHEET

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**Material purpose and product type:** Section/structural steel

**Informative reference standard and grade**

| EN 10025 S275JR |

1) **Scope:**
   - This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   - In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   - AR, NR, or TM

3) **Chemical composition (wt. %):**
   - C: max. 0.18 Si: max. 0.50 Mn: min. 2.5xC P: max. 0.030 S: max. 0.030 Ceq.:max.0.43

4) **Mechanical property:**
   - Tensile strength (MPa): 410 ~ 560
   - Yield strength (MPa): min. 275
   - Elongation (%) (Lo=5.65√So): min. 23
   - When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Impact: at +20°C, Min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact per heat

6) **Surface condition:**
   - All surfaces shall be visual inspected and pitting is not allowed.
   - For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7) **Dimension and shape:**
   - Dimensions and shapes tolerances are met to ISO 657

8) **Identification:**
   - Heat number, plate ID number
   - Other number as request

9) **Type of certificate:**
   - EN 10204 Type 3.1
Material purpose and product type: Section/structural steel

Informative reference standard and grade

EN 10025 S275J0

1) Scope:
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) Delivery condition:
AR, NR, or TM

3) Chemical composition (wt. %):
C: max. 0.18 Si: max. 0.50 Mn: min. 2.5xC P: max. 0.030 S: max. 0.030 Ceq.: max. 0.43

4) Mechanical property:
Tensile strength (MPa): 410 ~ 560
Yield strength (MPa): min. 275
Elongation (%) (Lo=5.65√So): min. 23
When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
Impact: at +20°C, Min. avg. 27J, ind. 19J

5) Extent of testing (test unit):
1 tensile + 1 set impact per heat

6) Surface condition:
All surfaces shall be visual inspected and pitting is not allowed.
For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7) Dimension and shape:
Dimensions and shapes tolerances are met to ISO 657

8) Identification:
Heat number, plate ID number
Other number as request

9) Type of certificate:
EN 10204 Type 3.1
MATERIAL DATA SHEET

MDS- CS105 Rev.0
Steel quality: IV
Material gr.: CS355-R

Material purpose and product type: Section/structural steel

Informative reference standard and grade

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<td>JIS 3106 SM490Y</td>
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1) **Scope:**
   This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   AR, NR, or TM

3) **Chemical composition (wt. %):**
   C: max. 0.20 Si: max. 0.55 Mn: max.1.60 P: max. 0.015 S: max. 0.015 Ceq.:max.0.43

4) **Mechanical property:**
   Tensile strength (MPa): 470 ~ 630
   Yield strength (MPa): min. 355
   Elongation (%): min. 23
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   Impact: at +20°C, min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**
   1 tensile + 1 set impact per heat (same chemistry and same rolling)

6) **Surface condition:**
   All surfaces shall be visual inspected and pitting is not allowed.
   For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7) **Dimension and shape:**
   Dimensions and shapes tolerances are met to ISO 657

8) **Identification:**
   Heat number, plate ID number
   Other number as purchaser’s request

9) **Type of certificate:**
   EN 10204 Type 3.2
**MATERIAL DATA SHEET**

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**Material purpose and product type:** Section/structural steel

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<tr>
<td>EN 10025 S355JO</td>
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<td>JIS 3106 SM490YB</td>
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1) **Scope:**
   This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   AR, NR, or TM

3) **Chemical composition (wt. %):**
   C: max. 0.20 Si: max. 0.55 Mn: max. 1.60 P: max. 0.015 S: max. 0.015
   Ceq.:max.0.43

4) **Mechanical property:**
   Tensile strength (MPa): 470 ~ 630
   Yield strength (MPa): min. 355
   Elongation (%): min. 23
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   Impact: at 0°C, min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**
   1 tensile + 1 set impact per heat (same chemistry and same rolling)

6) **Surface condition:**
   All surfaces shall be visual inspected and pitting is not allowed.
   For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7) **Dimension and shape:**
   Dimensions and shapes tolerances are met to ISO 657

8) **Identification:**
   Heat number, plate ID number
   Other number as purchaser’s request

9) **Type of certificate:**
   EN 10204 Type 3.2
**MATERIAL DATA SHEET**

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**Material purpose and product type:** Section/structural steel

**Informative reference standard and grade**

| DNVGL-OS-B101 VL A36 |

---

1) **Scope:**

This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**

AR, NR or TM

3) **Chemical composition (wt. %):**

C: max. 0.18  Si: max. 0.50  Mn: max.1.65  P: max. 0.035  S: max. 0.035

Ceq.:max.0.41  Pcm:max.0.22

4) **Mechanical property:**

Tensile strength (MPa): 490 ~ 620

Yield strength (MPa): t16mm min. 355, 16< t ≤40mm min. 335.

Elongation (%): min. 21

When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.

Impact: at 0°C, Min. avg. 34J, ind. 24J

5) **Extent of testing (test unit):**

1 tensile + 1 set impact per 40 tonnes

6) **Surface condition:**

Surface is to be visual inspected and pitting is not allowed.

For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

7) **Dimension and shape:**

Dimensions and shapes tolerances are met to ISO 657

8) **Identification:**

Heat number, plate ID number

Other number as purchaser’s request

9) **Type of certificate:**

EN 10204 Type 3.1
**MATERIAL DATA SHEET**

**Material purpose and product type:** Section/structural steel

| Informative reference standard and grade | EN 10025 S355J2  
| DNVGL-OS-B101 VL D36 |

1) **Scope:**
This MDS specifies material requirements for steel quality III for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
Base material information shall be submitted prior to delivery.

Prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".

Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
NR or TM

4) **Chemical composition (wt. %):**
- C: max. 0.14
- Si: max. 0.55
- Mn: max. 1.65
- P: max. 0.015
- S: max. 0.006

Ceq.: max. 0.42 Pcm: max. 0.22

The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
- Tensile strength (MPa): 460 ~ 620
- Yield strength (MPa): min. 355
- YS/TS ratio: max. 0.87 for NR, max. 0.90 for TM
- Elongation (%): min. 22

When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.

Impact: at -20°C, min. avg. 50J, ind. 35J

6) **Extent of testing (test unit):**
1 tensile + 1 set impact per 40tonnes

7) **Internal soundness:**
Rolled sections with web thickness is greater than 12mm shall be subject to UT of webs and flanges when specified by the purchaser.

8) **Surface condition:**
Surface is to be visual inspected and pitting is not allowed.

For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

9) **Identification:**
- Heat number, plate ID number
- Other number as purchaser’s request

10) **Type of certificate:**
EN 10204 Type 3.2
| MATERIAL DATA SHEET | MDS- CS109 Rev.0  
| Steel quality: II  
| Material gr.: CS355-40  |

**Material purpose and product type:** Section/structural steel

| Informative reference standard and grade | EN 10225 S355G12  |

1) **Scope:**
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
Base material information shall be submitted prior to delivery.

And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".

Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
NR or TM

4) **Chemical composition (wt. %):**
C: max. 0.14  
Si: max. 0.55  
Mn: max. 1.65  
P: max. 0.015  
S: max. 0.006  
Ceq.: max. 0.41  
Pcm: max. 0.22

The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
Tensile strength (MPa): 460 ~ 620  
Yield strength (MPa): min. 355  
YS/TS ratio: max. 0.87 for NR, max. 0.90 for TM  
Elongation (%): min. 22

When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.

Impact: at -40°C, Min. avg. 50J, ind. 35J

6) **Extent of testing (test unit):**
1 tensile + 1 set impact per 40tonnes

7) **Internal soundness:**
Rolled sections with web thickness is greater than 12mm shall be subject to UT of webs and flanges when specified by the purchaser.

8) **Surface condition:**
Surface is to be visual inspected and pitting is not allowed.

For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

9) **Dimension and shape:**
Dimensions and shapes tolerances are met to ISO 657

10) **Identification:**
Heat number, plate ID number  
Other number as purchaser’s request

11) **Type of certificate:**
EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS110 Rev.0
Steel quality: III
Material gr.: CS460-20

Material purpose and product type: Section/structural steel

Informative reference standard and grade

EN 10225 S460G2

1) **Scope:**
This MDS specifies material requirements for steel quality III for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
Base material information shall be submitted prior to delivery.
And prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION".
Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   
4) **Chemical composition (wt. %):**
   - C: max. 0.14
   - Si: max. 0.55
   - Mn: max. 1.65
   - P: max. 0.015
   - S: max. 0.006
   - Ceq.: max. 0.43
   - Pcm: max. 0.22
   The individual elements shall be within the range which is stated in EN 10225 Option 18, based on prequalification test result.

5) **Mechanical property:**
   - Tensile strength (MPa): 530 ~ 690
   - Yield strength (MPa): min. 460
   - YS/TS ratio: max. 0.93
   - Elongation (%): min. 17
   When other gauge lengths are used, the minimum required value shall be converted according to ISO 2566-1.
   - Impact: at -20°C, min. avg. 60J, ind. 42J

6) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact per 40 tonnes

7) **Internal soundness:**
   - Rolled sections with web thickness is greater than 12mm shall be subject to UT of webs and flanges when specified by the purchaser.

8) **Surface condition:**
   - All surfaces shall be visual inspected and pitting is not allowed.
   - For surface soundness EN 10163-3 Class D sub-class 2 may be applied.

9) **Dimension and shape:**
   - Dimensions and shapes tolerances are met to ISO 657

10) **Identification:**
    - Heat number, plate ID number
    - Other number as purchaser’s request

11) **Type of certificate:**
    - EN 10204 Type 3.2
APPENDIX E MATERIAL TABLE FOR TUBULARS
Informative reference standard: API, ASTM, EN and JIS.

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<th>Category</th>
<th>Strength</th>
<th>Quality level</th>
<th>Thickness (mm)</th>
<th>Min. Yield strength MPa</th>
<th>Impact test temp. (°C)</th>
<th>Impact value (Transverse)</th>
<th>Prequalification</th>
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<tbody>
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<td>CT235-R</td>
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<td>235</td>
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<td>CT235-0</td>
<td>Tertiary</td>
<td>235</td>
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<td>CT275-R</td>
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APPENDIX F MDS FOR TUBULARS

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</tbody>
</table>

Material purpose and product type: Structural steel/tubular (seamless or welded)

Informative reference standard and grade

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>API 5L Gr.B</td>
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<tr>
<td>ASTM A106 Gr.B</td>
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<td>ASTM A53 Gr.B</td>
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<tr>
<td>ASTM A672 Gr.CC60, 70 CL.12/22</td>
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<tr>
<td>EN 10210 S235JRH</td>
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<tr>
<td>EN 10219 S235JRH</td>
<td></td>
</tr>
<tr>
<td>JIS G3454 STPG370</td>
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</table>

1) **Scope:**
   This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   ERW process may be permitted for Hand rail and post.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   Cold formed or Hot finished

3) **Chemical composition (wt. %):**
   C: max. 0.17 Si: max. 0.50 Mn: max.1.20 P: max. 0.030 S: max. 0.030
   Ceq.: max.0.35

4) **Mechanical property:**
   Yield strength (MPa): min. 235
   Tensile strength (MPa): min. 360
   Elongation (%) (Lo=5.65√So): min. 24
   Impact: Not required up to t<25mm min. 27J at +20#, otherwise additional requirement.
   No need Hydrostatic test.

5) **Extent of testing (test unit):**
   1 tensile + 1 set impact(when required), per heat

6) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

7) **Identification:**
   Heat number, Material grade and other number as request

8) **Type of certificate:**
   EN 10204 Type 3.1
| **MATERIAL DATA SHEET** | **MDS- CS202 Rev.0**  
**Steel quality:** IV  
**Material gr.:** CT235-0 |
<table>
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<tr>
<td><strong>Material purpose and product type:</strong> Structural steel/tubular (seamless or welded)</td>
<td></td>
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</table>
| **Informative reference standard and grade** | **API 5L Gr.B**  
**ASTM A333 Gr.6**  
**ASTM A672 Gr.CC60, 70 CL.12/22**  
**EN 10210 S235J0H**  
**EN 10219 S235JR** |
| **1) Scope:** | This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected. |
| **2) Delivery condition:** | Cold formed or Hot finished |
| **3) Chemical composition (wt. %):** | C: max. 0.17  
Si: max. 0.50  
Mn: max.1.20  
P: max. 0.030  
S: max. 0.030  
Ceq.:max.0.35 |
| **4) Mechanical property:** | Yield strength (MPa): min. 235  
Tensile strength (MPa): min. 360  
Elongation (%) (Lo=5.65√So): min. 24  
Impact: Not required up to t<25mm min. 27J at 0°C, otherwise additional requirement.  
No need Hydrostatic test. |
| **5) Extent of testing (test unit):** | 1 tensile + 1 set impact(when required), per heat |
| **6) Surface condition:** | Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied. |
| **7) Identification:** | Heat number, Material grade and other number as request |
| **8) Type of certificate:** | EN 10204 Type 3.1 |
**MATERIAL DATA SHEET**

<table>
<thead>
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<th>Material purpose and product type: Structural steel/tubular (seamless or welded)</th>
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<table>
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<th>Informative reference standard and grade</th>
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<tbody>
<tr>
<td>API 5L Gr. X42</td>
</tr>
<tr>
<td>EN 10210 S275JRH</td>
</tr>
<tr>
<td>EN 10219 S275JRH</td>
</tr>
</tbody>
</table>

1) **Scope:**
   - This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   - In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   - Cold formed or Hot finished

3) **Chemical composition (wt. %):**
   - C: max. 0.20 Si: max. 0.50 Mn: max. 1.50 P: max. 0.025 S: max. 0.025
   - Ceq.: max. 0.40

4) **Mechanical property:**
   - Yield strength (MPa): min. 275
   - Tensile strength (MPa): min. 430
   - Elongation (%) (in 50.8mm): min. 20
   - Impact: Not required up to t<25mm min. 27J at +20#, otherwise additional requirement.
   - No need Hydrostatic test.

5) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact (when required), per heat

6) **Surface condition:**
   - Surface is to be inspected and pitting is not allowed.
   - For surface soundness EN 10163-2 Class A may be applied.

7) **Identification:**
   - Heat number, Material grade and other number as request

8) **Type of certificate:**
   - EN 10204 Type 3.1
MATERIAL DATA SHEET

MDS- CS204 Rev.0
Steel quality: IV
Material gr.: CT275-0

Material purpose and product type: Structural steel/tubular (seamless or welded)

Informative reference standard and grade

API 5L Gr. X42
EN 10219 S275J0H

1) **Scope:**
   This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
   Cold formed or Hot finished

3) **Chemical composition (wt. %):**
   C: max. 0.20 Si: max. 0.50 Mn: max. 1.50 P: max. 0.025 S: max. 0.025
   Ceq.: max. 0.40

4) **Mechanical property:**
   Yield strength (MPa): min. 275
   Tensile strength (MPa): min. 430
   Elongation (%): min. 20
   Impact: at +0°C, Min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**
   1 tensile + 1 set impact per heat

6) **Non-destructive test (NDT):**
   Surface soundness is to be inspected according to ISO 10893.

7) **Dimension:**
   Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

8) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

9) **Identification:**
   Heat number, Material grade and other number as request

10) **Type of certificate:**
    EN 10204 Type 3.1
**MATERIAL DATA SHEET**

**MDS- CS205 Rev.0**  
Steel quality: IV  
Material gr.: CT355-R

**Material purpose and product type:** Structural steel/tubular (seamless or welded)

**Informative reference standard and grade**  
API 5L X52

1) **Scope:**  
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**  
Cold formed or Hot finished

3) **Chemical composition (wt. %):**  
   - C: max. 0.22  
   - Si: max. 0.55  
   - Mn: min. 1.60  
   - P: max. 0.030  
   - S: max. 0.030  
   - Ceq: max. 0.45

   For seamless tubular with t>25.0mm, the chemical composition may be agreed.

4) **Mechanical property:**  
   - Yield strength (MPa): min. 355  
   - Tensile strength (MPa): min. 470  
   - Elongation (%): min. 20  
   - Impact: at +20°C, min. avg. 27J, ind. 19J

5) **Extent of testing (test unit):**  
   1 tensile + 1 set impact per heat

6) **Non-destructive test (NDT):**  
Surface soundness is to be inspected according to ISO 10893.

7) **Dimension:**  
   Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

8) **Surface condition:**  
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

9) **Identification:**  
   Heat number, Material grade and other number as request

10) **Type of certificate:**  
   EN 10204 Type 3.1
MATERIAL DATA SHEET

MDS- CS206 Rev.0
Steel quality: IV
Material gr.: CT355-0

Material purpose and product type: Structural steel/tubular (seamless or welded)

Informative reference standard and grade

API 5L X52
EN 10219 S355J0H

1) Scope:
This MDS specifies material requirements for steel quality IV for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) Delivery condition:
Cold formed or Hot finished

3) Chemical composition (wt. %):
C: max.0.22 Si: max.0.55 Mn: max.1.60 P: max. 0.025 S: max. 0.015
Ceq = max. 0.45
For seamless tubular with t>25.0mm, the chemical composition may be agreed.

4) Mechanical property:
Yield strength (MPa): 355
Tensile strength (MPa): 470
Elongation (%): min. 20
Impact: at +0°C, min. avg. 27J, ind. 20J

5) Extent of testing (test unit):
1 tensile + 1 set impact per heat

6) Non-destructive test (NDT):
Surface soundness is to be inspected according to ISO 10893.

7) Dimension:
Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

8) Surface condition:
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

9) Identification:
Heat number, Material grade and other number as request

10) Type of certificate:
EN 10204 Type 3.1
MATERIAL DATA SHEET

MDS- CS207 Rev.0
Steel quality: III
Material gr.: CT355-20

Material purpose and product type: Structural steel/tubular (seamless or welded)

Informative reference standard and grade

<table>
<thead>
<tr>
<th>API 5L Gr. X52 PSL2</th>
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<tbody>
<tr>
<td>EN 10210 S355K2H, S355J2H</td>
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<tr>
<td>EN 10219 S355K2H, S355J2H</td>
</tr>
<tr>
<td>EN 10225 S355G1+N</td>
</tr>
</tbody>
</table>

1) **Scope:**
This MDS specifies material requirements for steel quality III for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Delivery condition:**
Cold formed or Hot finished

3) **Chemical composition (wt. %):**
C: max.0.22 Si: max.0.55 Mn: max.1.60 P: max. 0.025 S: max. 0.015

Ceq = max. 0.45
For seamless tubular with t>25.0mm, the chemical composition may be agreed.

4) **Mechanical property:**
Yield strength (MPa): min. 355
Tensile strength (MPa): min. 470
Elongation (%): min. 20
Impact value: at -20#, avg. 41J, Ind. 29J

5) **Extent of testing (test unit):**
1 tensile + 1 set impact per heat

6) **Non-destructive test (NDT):**
Seamless: none
Welded product: UT 100%

7) **Dimension:**
Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

8) **Surface condition:**
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

9) **Identification:**
Heat number, Material grade and other number as request

10) **Type of certificate:**
EN 10204 Type 3.2
**MATERIAL DATA SHEET**

**MDS- CS208 Rev.0**  
Steel quality: II  
Material gr.: CT355-40

**Material purpose and product type:** Structural steel/tubular (seamless or welded)

**Informative reference standard and grade**
- API 5L Gr.X52
- EN 10219 S355NH/NHN
- EN 10225 S355G13+N
- EN 10225 S355G14+Q/N

1) **Scope:**  
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 65 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**  
When this material is used to primary structure, pre-qualification test is required.  
Base material information shall be submitted prior to delivery and prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**  
Cold formed or Hot finished

4) **Chemical composition (wt. %):**  
C: max.0.18, Si: max.0.50, Mn: max. 1.60, P: max.0.025, S: max.0.025, Ceq: 0.45

5) **Mechanical property:**  
Yield strength (MPa): min. 355  
Tensile strength (MPa): min. 470  
Elongation (%): min. 22  
Impact value: at -40#, avg. 50J

6) **Extent of testing (test unit):**  
1 tensile + 1 set impact per heat

7) **Non-destructive test (NDT):**  
Welded product: UT 100%

8) **Dimension:**  
Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**  
Surface is to be inspected and pitting is not allowed.  
For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**  
Heat number, Material grade and other number as request

11) **Type of certificate:**  
EN 10204 Type 3.2
MATERIAL DATA SHEET

MDS- CS209 Rev.0
Steel quality: III
Material gr.: CT420-20

Material purpose and product type: Structural steel/tubular (seamless or welded)

Informative reference standard and grade
EN 10210 S420NH/NLH
EN 10219 S420MH/MLH

1) **Scope:**
This MDS specifies material requirements for steel quality III for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 65 mm.
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
When this material is used to primary structure, pre-qualification test is required.
Base material information shall be submitted prior to delivery and prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
Cold formed or Hot finished

4) **Chemical composition (wt. %):**
C: max.0.18, Si: max.0.50, Mn: max. 1.70, P: max.0.025, S: max.0.025, Ceq: 0.55

5) **Mechanical property:**
Yield strength (MPa): min. 420
Tensile strength (MPa): min. 520
Elongation (%): min. 17
Impact value: at -20#, avg. 50J

6) **Extent of testing (test unit):**
1 tensile + 1 set impact per heat

7) **Non-destructive test (NDT):**
Welded product: UT 100%

8) **Dimension:**
Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**
Surface is to be inspected and pitting is not allowed.
For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**
Heat number, Material grade and other number as request

11) **Type of certificate:**
EN 10204 Type 3.2
### MATERIAL DATA SHEET

**MDS- CS210 Rev.0**  
Steel quality: II  
Material gr.: CT420-40

**Material purpose and product type:** Structural steel/tubular (seamless or welded)

**Informative reference standard and grade**  
- EN 10210 S420NH  
- EN 10219 S420MH

1) **Scope:**  
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 65 mm.  
In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**  
When this material is used to primary structure, pre-qualification test is required.  
Base material information shall be submitted prior to delivery and prequalification is to be carried out according to “REQUIREMENTS FOR PREQUALIFICATION”. Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**  
- Cold formed or Hot finished

4) **Chemical composition (wt. %):**  
- C: max. 0.18  
- Si: max. 0.45  
- Mn: max. 1.70  
- P: max. 0.025  
- S: max. 0.015  
- Ceq.: max. 0.52

5) **Mechanical property:**  
- Yield strength (MPa): min. 420  
- Tensile strength (MPa): min. 520  
- Elongation (%): min. 19  
- Impact: 50J at -40#  
- No need Hydrostatic test.

6) **Extent of testing (test unit):**  
- 1 tensile + 1 set impact test per heat

7) **Non-destructive test (NDT):**  
- Welded product: UT 100%

8) **Dimension:**  
- Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**  
- Surface is to be inspected and pitting is not allowed.  
- For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**  
- Heat number, Material grade and other number as request

11) **Type of certificate:**  
- EN 10204 Type 3.2
### MATERIAL DATA SHEET

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<th>Material purpose and product type: Structural steel/tubular (seamless or welded)</th>
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</table>

<table>
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<th>Informative reference standard and grade</th>
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<tbody>
<tr>
<td></td>
<td>EN 10219 S420MH/MLH</td>
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</tbody>
</table>

1) **Scope:**
   This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   When this material is used to primary structure, pre-qualification test is required.
   Base material information shall be submitted prior to delivery and prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   Cold formed or Hot finished

4) **Chemical composition (wt. %):**
   C: max.0.18, Si: max.0.50, Mn: max. 1.70, P: max.0.025, S: max.0.025, Ceq: 0.55

5) **Mechanical property:**
   Yield strength (MPa): min. 460
   Tensile strength (MPa): min. 540
   Elongation (%): min. 17
   Impact value: at -20#, avg. 50J

6) **Extent of testing (test unit):**
   1 tensile + 1 set impact test per heat

7) **Non-destructive test (NDT):**
   Welded product: UT 100%

8) **Dimension:**
   Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**
    Heat number, Material grade and other number as request

11) **Type of certificate:**
    EN 10204 Type 3.2
### MATERIAL DATA SHEET

MDS- CS212 Rev.0
Steel quality: II
Material gr.: CT460-40

**Material purpose and product type:** Structural steel/tubular (seamless or welded)

<table>
<thead>
<tr>
<th>Informativ reference standard and grade</th>
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</thead>
<tbody>
<tr>
<td>EN 10210 S420NH/NLH</td>
</tr>
<tr>
<td>EN 10219 S420MH/MLH</td>
</tr>
</tbody>
</table>

1) **Scope:**
This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 100 mm.

In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Prequalification:**
When this material is used to primary structure, pre-qualification test is required.

Base material information shall be submitted prior to delivery and prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
- Cold formed or Hot finished

4) **Chemical composition (wt. %):**
- C: max.0.18, Si: max.0.50, Mn: max. 1.70, P: max.0.025, S: max.0.025, Ceq: 0.55

5) **Mechanical property:**
- Yield strength (MPa): min. 460
- Tensile strength (MPa): min. 540
- Elongation (%): min. 17
- Impact value: at -40°, avg. 50J

6) **Extent of testing (test unit):**
- 1 tensile + 1 set impact test per heat

7) **Non-destructive test (NDT):**
- Welded product: UT 100%

8) **Dimension:**
- Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**
- Surface is to be inspected and pitting is not allowed.
- For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**
- Heat number, Material grade and other number as request

11) **Type of certificate:**
- EN 10204 Type 3.2
| MATERIAL DATA SHEET | MDS- CS213 Rev.0  
| Steel quality: II  
| Material gr.: CT690-40  

Material purpose and product type: Structural steel/tubular (seamless or welded)

Informative reference standard and grade: DNVGL-OS-B101 VL E690

1) **Scope:**
   This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   When this material is used to primary structure, pre-qualification test is required.
   Base material information shall be submitted prior to delivery and prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   Cold formed or Hot finished

4) **Chemical composition (wt. %):**
   - C: max.0.18
   - Si: max.0.50
   - Mn: max. 1.70
   - P: max.0.025
   - S: max.0.025
   - Ceq: 0.55

5) **Mechanical property:**
   - Yield strength (MPa): min. 690
   - Tensile strength (MPa): min. 770
   - Tensile strength (MPa): max. 940
   - Elongation (%): min. 17
   - Impact value: at -40#, avg. 46J

6) **Extent of testing (test unit):**
   1 tensile + 1 set impact test per heat

7) **Non-destructive test (NDT):**
   Welded product: UT 100%

8) **Dimension:**
   Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**
   Surface is to be inspected and pitting is not allowed.
   For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**
    Heat number, Material grade and other number as request

11) **Type of certificate:**
    EN 10204 Type 3.2
### MATERIAL DATA SHEET

<table>
<thead>
<tr>
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<tr>
<td>Material gr.: CT690-40</td>
</tr>
</tbody>
</table>

**Material purpose and product type:** Structural steel/tubular (seamless or welded)

**Informative reference standard and grade:** DNVGL-OS-B101 VL F690

1) **Scope:**
   - This MDS specifies material requirements for steel quality II for structural purpose. Basic requirements are given below, but if deemed necessary additional project specific requirements with reference to the referred informative standards can be applied. This grade shall not be used for thicknesses above 40 mm.
   - In addition to compliance with the below requirements, a grade which is listed in an informative reference standard may be selected.

2) **Pre-qualification:**
   - When this material is used to primary structure, pre-qualification test is required.
   - Base material information shall be submitted prior to delivery and prequalification is to be carried out according to "REQUIREMENTS FOR PREQUALIFICATION". Prequalification is to be carried out with independent 3rd party witness.

3) **Delivery condition:**
   - Cold formed or Hot finished

4) **Chemical composition (wt. %):**
   - C: max.0.18, Si: max.0.50, Mn: max. 1.70, P: max.0.025, S: max.0.025, Ceq: 0.55

5) **Mechanical property:**
   - Yield strength (MPa): min. 690
   - Tensile strength (MPa): min. 770
   - Tensile strength (MPa): max. 940
   - Elongation (%): min. 17
   - Impact value: at -60#, avg. 46J

6) **Extent of testing (test unit):**
   - 1 tensile + 1 set impact test per heat

7) **Non-destructive test (NDT):**
   - Welded product: UT 100%

8) **Dimension:**
   - Otherwise agreed between purchaser and manufacturer, EN 10219-2 is to be applied.

9) **Surface condition:**
   - Surface is to be inspected and pitting is not allowed.
   - For surface soundness EN 10163-2 Class A may be applied.

10) **Identification:**
    - Heat number, Material grade and other number as request

11) **Type of certificate:**
    - EN 10204 Type 3.2
APPENDIX G PRE-QUALIFICATION PROCEDURE

Pre-qualification requirements presented in this RP covers quality level I and II steels for structural purpose. The referenced informative standards are listed in Table G-1. Pre-qualification includes third party witnessing, monitoring and/or reviewing.

Table G-1 Informative reference standards for pre-qualification

<table>
<thead>
<tr>
<th>Standards</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN 10225, Sep. 2009</td>
<td>Weldable structural steels for fixed offshore structures, technical delivery conditions</td>
</tr>
<tr>
<td>API 2W, Dec. 2006</td>
<td>Specification for Steel Plates for Offshore Structures, Produced by Thermo-Mechanical Control Processing (TMCP)</td>
</tr>
<tr>
<td>API RP 2Z, Sep. 2005</td>
<td>Recommended Practice for Preproduction Qualification for Steel Plates for Offshore Structures</td>
</tr>
<tr>
<td>NORSOK M-120, Nov. 2008</td>
<td>Material data sheets for structural steel</td>
</tr>
<tr>
<td>NORSOK M-101, Oct. 2011</td>
<td>Structural steel fabrication</td>
</tr>
<tr>
<td>ISO 12135 Dec. 2002</td>
<td>Metallic materials — Unified method of test for the determination of quasistatic fracture toughness</td>
</tr>
</tbody>
</table>

The following general pre-qualification requirements are recommended:

— Material requirements and other criteria covered by the project specification shall meet or exceed the pre-qualification requirements specified in this section.
— Any pre-qualification test is to be progressed with independent 3rd party’s witness with metallurgical background. When the manufacturer has qualification documents for equivalent grades, a review of manufacturing process documents may be sufficient with no witnessing required. This will have to be decided by the engaged third party.
— The supplier shall submit pre-qualification test procedure for review and approval to 3rd party and/or purchaser before starting the pre-qualification test.
— Planned chemical composition, rolling conditions, e.g. rolling starting temperature, rolling finishing temperature, cooling starting temperature, cooling finishing temperature, cooling rate, etc. are to be reviewed.
— For chemical composition tolerance, any refining elements specified in EN 10225 option 18, are to be specified and analysis result is to be reported.
— Pre-qualification test report shall be submitted to purchaser prior to delivery.

The material quality levels requiring pre-qualification shall be carried out according to the required tests in Table G-2.
### Table G-2 Qualification test items

<table>
<thead>
<tr>
<th>Thickness range (mm)</th>
<th>Chemical composition</th>
<th>Parent metal</th>
<th>Weldability 0.7kJ/mm, 3.0kJ/mm and 5.0kJ/mm (or lowest and highest heat input of yard practice may be taken instead of 0.7kJ/mm and 5.0kJ/mm, resp.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ladle analysis and Product analysis</td>
<td>As delivered condition</td>
<td>As-weld</td>
</tr>
<tr>
<td></td>
<td>T.S, Y.P, E.L, Impact</td>
<td>CTOD at -10 °C Min. 0.25mm</td>
<td>T.S, Impact (FL, FL+1 ~ 2, FL+3 ~5)</td>
</tr>
<tr>
<td>25 &lt; t ≤ 40</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>40 &lt; t ≤ 63</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>63 &lt; t ≤ 100</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
<tr>
<td>100 &lt; t ≤ 150</td>
<td>v</td>
<td>v</td>
<td>v</td>
</tr>
</tbody>
</table>

Notes:
- "v" indicates a required test.
- Pre-qualification of base material shall cover both "As-delivered condition" and "Post weld heat treatment (PWHT) condition".
- Strain aging tests are to be conducted at least at 5% strain rate. However, when the test is carried out at a higher rate, it is to be reported for reference. When 5% strain is accepted according to this RP, it means that a manufacturer can assure that the strain ageing property is lower than 5% forming degree.
- The thickest material in the range shall be tested, i.e. thinner thickness can be covered by tested thickness.
- Chemical composition; A steel shall be considered for the same type if it is within the range of product analysis of this RP and manufactured using the same alloying system. The individual elements shall be within given EN 10225 Option 18.
- Yield strength shall be measured by 0.2% off-set from the stress-strain curve.
- Impact test shall be carried out at specified test temperature or lower temperature of the material specification in the MDS.
- Crack tip opening displacement (CTOD) test shall be carried out according to ISO 12135 at -10 °C or lower temperature depending on project requirements.
- Welding is to be carried out at three different heat input conditions; 0.7±0.2 kJ/mm, 3.0±0.2 kJ/mm and 5.0±0.2 kJ/mm.
- Heat input may be calculated by IIW equation.
- Each of the 3 valid test result are to be obtained at GCHAZ and at base metal before delivery, but CTOD test at weld is to be carried out at a yard separately according to approved WPS or pWPS.
- Macro and hardness test (Hv10) shall be carried out.
- Micro structure test result (at near surface, 1/4t and 1/2t) shall be reported.
- Bead-on-plate (BOP) test is to be carried out. (refer EN 10225 Annex F)
- Through thickness tensile test (Z-quality) is required.
- Ceq and Pcm shall be calculated according to IIW equation.
- Ceq. = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15
— \( P_{cm} = C + \frac{Si}{30} + \frac{(Mn+Cu+Cr)}{20} + \frac{Ni}{60} + \frac{Mo}{15} + \frac{V}{10} + 5B \)
— Min. thickness reduction ratio is 3:1, but thickness reduction ratio may not be necessarily required, if required mechanical properties are fulfilled according to this RP.
CHANGES - HISTORIC

There are currently no historical changes for this document.
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