Recommendation for selecting standards for steel bulk items (tentative recommended practice)
FOREWORD

DNV GL recommended practices contain sound engineering practice and guidance.

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Any comments may be sent by e-mail to rules@dnvgl.com

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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 structural steel materials
— Recommendation for selecting standards for electrical and instrumentation components.
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 tertiary structural items is to provide a uniform reference for design and construction of such items. 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. This RP was developed based on major international standards to comply with requirements of shelf regulations of the UK, US, Norway and Australia. Overall the requirements recommended in this RP will meet the majority of the specified regulatory requirements. Exemptions where regulatory requirements are not met in this RP are clearly stated.

1.4 Scope
The underpinning factors for determining the recommended requirements are to provide sufficient safety for people in combination with cost efficiency in implementing the requirements. This RP provides dimensions of items only. Requirements to clearances with other structures are not included.

Material selection is limited to references with more detailed information to be found in DNVGL RP B201 Recommended international standards for specification of structural steel.

The following tertiary structural items are covered by this RP:

— hand rails
— stairs
— vertical ladder
— grating.
1.5 References – informative

This RP is based on the international standards and regulations listed in Table 1-1. These standards are used for the majority of offshore installations.

Table 1-1 Informative standards and regulations

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DNVGL RP B201:2016</td>
<td>Recommended international standards for material selection specification of structural steel</td>
</tr>
<tr>
<td>NORSOK S-002</td>
<td>Working environment, Rev. 4, August 2004</td>
</tr>
<tr>
<td>NORSOK C-002</td>
<td>Architectural components and equipment, Edition 3, June 2006</td>
</tr>
<tr>
<td>Australian Standard 1657-2013, 2013</td>
<td></td>
</tr>
<tr>
<td>Norwegian Maritime Authority regulation</td>
<td></td>
</tr>
<tr>
<td>Petroleum Safety Authority Facilities regulation</td>
<td></td>
</tr>
<tr>
<td>Health and Safety Executive, OTO 2001-069</td>
<td></td>
</tr>
<tr>
<td>Occupational Safety And Health Administration 1910</td>
<td></td>
</tr>
<tr>
<td>National Offshore Petroleum Safety and Environmental Management Authority regulation</td>
<td></td>
</tr>
</tbody>
</table>

1.6 Definitions

1.6.1 Abbreviations

Table 1-2 Abbreviation

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full text</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS</td>
<td>Austrian Standard</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>ASSM</td>
<td>American Society of Safety Engineers</td>
</tr>
<tr>
<td>CS</td>
<td>Carbon steel</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>shall</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>should</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>may</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

Applicable standards and regulations identified for each item included in the scope of this RP are summarized in Table 2-1 and Table 2-2, respectively. The requirements and regulations listed in Table 2-1 and Table 2-2 cover the majority of standards and regulations applied in offshore projects. In general, ANSI is applied in the US, EN-ISO in the UK, NORSOK in Norway and AS in Australia. NORSOK requirements for tertiary structure refer to EN-ISO. However, there are some additional NORSOK specific requirements. The standards are generally not specifying detailed design requirements of tertiary structure.

Table 2-1 Identified standards

<table>
<thead>
<tr>
<th>Name</th>
<th>Handrail</th>
<th>Stair</th>
<th>Vertical ladder</th>
<th>Grating</th>
</tr>
</thead>
</table>

Table 2-2 Identified regulations

<table>
<thead>
<tr>
<th>Name</th>
<th>Handrail</th>
<th>Stair</th>
<th>Vertical ladder</th>
<th>Grating</th>
</tr>
</thead>
<tbody>
<tr>
<td>NMA</td>
<td>NMA 856/87 NMA 2318/86</td>
<td>NMA 856/87 NMA 2318/86</td>
<td>NMA 856/87</td>
<td>NMA 856/87</td>
</tr>
<tr>
<td>PSA</td>
<td>PSA Facilities</td>
<td>PSA Facilities</td>
<td>PSA Facilities</td>
<td>PSA Facilities</td>
</tr>
<tr>
<td>HSE</td>
<td>OTO 2001-069</td>
<td>OTO 2001-069</td>
<td>OTO 2001-069</td>
<td>OTO 2001-069</td>
</tr>
</tbody>
</table>

All relevant requirements of the relevant standards are listed in Appendix A.
2.2 Requirements for handrails

Table 2-3 shows a comparison of requirements for different parameters between standards and regulations for handrail. An empty cell in Table 2-3, Table 2-4, Table 2-5 and Table 2-6 means that there are no specific requirements in the standard/regulation towards that parameter. It can be seen that the requirements are very similar with some deviations such as “number of intermediate kneerails” and “toe plate horizontal clearance”.

### Table 2-3 Comparison of requirements of standards and regulations for handrail

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN ISO</td>
<td>ANSI</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td>Min. 1100 mm</td>
<td>Min 42” (1100 mm)</td>
</tr>
<tr>
<td><strong>Height on Stair</strong></td>
<td>900 – 1000 mm</td>
<td>34” – 38” (863-965 mm)</td>
</tr>
<tr>
<td><strong>Number of Intermediate kneerail</strong></td>
<td>Min. 1</td>
<td>Min. 1</td>
</tr>
<tr>
<td><strong>Vertical opening</strong></td>
<td>Max. 500 mm</td>
<td>Max. 21” (550 mm)</td>
</tr>
<tr>
<td><strong>Diameter</strong></td>
<td>25 – 50 mm</td>
<td>1.25” – 2” (32 – 51 mm)</td>
</tr>
<tr>
<td><strong>Distance btw stanchions</strong></td>
<td>Max. 1500 mm</td>
<td>Max. 8 ft (2440 mm)</td>
</tr>
<tr>
<td><strong>Height of toe plate</strong></td>
<td>Min. 100 mm</td>
<td>Min. 3.5” (89 mm)</td>
</tr>
<tr>
<td><strong>Toe plate vertical clearance above floor level</strong></td>
<td>Max. 10 mm</td>
<td>Max. 1/4” (6 mm)</td>
</tr>
<tr>
<td><strong>Toe plate horizontal clearance</strong></td>
<td>Max. 1” Continuous type</td>
<td>Continuous type</td>
</tr>
<tr>
<td><strong>Space between two segments</strong></td>
<td>75-120 mm</td>
<td>75-120 mm</td>
</tr>
<tr>
<td><strong>Sharp edges</strong></td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
2.3 Requirements for stairs

Table 2-4 shows a comparison of requirements for different parameters between standards and regulations for stairs. The "step overlap" requirement varies between the standards whereas the other requirements are very similar.

Table 2-4 Comparison of requirements of standards and regulations for stair

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN ISO</td>
<td>ANSI</td>
</tr>
<tr>
<td>Stairway slopes</td>
<td>30° - 38°</td>
<td>30° - 50°</td>
</tr>
<tr>
<td></td>
<td>Min. 600 mm (800 mm)</td>
<td>Min. 1000 mm (Traffic area)</td>
</tr>
<tr>
<td>Width</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step overlap (nosing)</td>
<td>Min. 10 mm</td>
<td>Max. 1.5&quot; (38 mm)</td>
</tr>
<tr>
<td>Climbing height per flight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of rise</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise height</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Going length</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Going (g) and rise (h)</td>
<td>600 ≤ g + 2h ≤ 660 mm</td>
<td>Going: min. 9.5&quot; (241 mm)</td>
</tr>
<tr>
<td>Toe plate on landing</td>
<td>100 mm</td>
<td>Reference to NORSOK</td>
</tr>
<tr>
<td>Parameter</td>
<td>Standard</td>
<td>Regulation</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td></td>
<td>EN ISO</td>
<td>ANSI</td>
</tr>
<tr>
<td>Level of uppermost step</td>
<td>Same level with the landing</td>
<td>Same level with the landing</td>
</tr>
<tr>
<td>Length of landing area</td>
<td>Min. 800 mm Stair width ≤ landing length (depth)</td>
<td>Min. 30&quot; (763 mm) Stair width ≤ landing length (depth)</td>
</tr>
</tbody>
</table>

2.4 Requirements for vertical ladders

Table 2-5 shows a comparison of requirements for different parameters between standards and regulations for vertical ladder. The main difference between the standards is related to the requirement for "Location of lowest part of safety cage".

Table 2-5 Comparison of requirements of standards and regulations for vertical ladder

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN ISO</td>
<td>ANSI</td>
</tr>
<tr>
<td>Spacing between successive rungs</td>
<td>225 – 300 mm</td>
<td>Max. 12&quot; (305 mm)</td>
</tr>
<tr>
<td>Spacing between rungs and the departure and arrival area</td>
<td>Max. 400 mm (225 – 300 mm)</td>
<td>Max. 14&quot; (356 mm)</td>
</tr>
<tr>
<td>Width</td>
<td>400 – 600 mm</td>
<td>Min. 16&quot; (406 mm)</td>
</tr>
<tr>
<td>Rung shape</td>
<td>Polygonal and U-shaped rungs</td>
<td>Polygonal and U-shaped rungs</td>
</tr>
<tr>
<td>Diameter of rungs</td>
<td>20 – 35 mm</td>
<td>20 – 50 mm</td>
</tr>
<tr>
<td>Cross-section profile of stiles (diameter)</td>
<td>Max. 80 mm</td>
<td>Max. 80 mm</td>
</tr>
<tr>
<td>Location of lowest part of safety cage</td>
<td>2200 – 3000 mm</td>
<td>7’ – 8’ (2134 – 2438 mm)</td>
</tr>
</tbody>
</table>
### 2.5 Requirements for gratings

Table 2-6 shows a comparison of requirements for different parameters between standards and regulations for grating. The comparison between the standards shows that AS allows a significantly wider opening in the grating compared to the other standards.

#### Table 2-6 Comparison of requirements of standards and regulations for grating

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Standard</th>
<th>Regulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>EN ISO</td>
<td>ANSI</td>
</tr>
<tr>
<td><strong>Opening diameter</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. 20 mm (max. 35 mm)</td>
<td>Max. 1&quot;</td>
<td></td>
</tr>
<tr>
<td><strong>Surface finish</strong></td>
<td>Non Slip</td>
<td>Non Slip</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 3 EVALUATION

3.1 General

Typical challenges building offshore installations in the yards are different definitions of material properties, shape of items and fabrication methods. Due to different requirements and insufficient definition of shape in the regulations and standards, manufacturers and vendors provide a wide range of structure types.

UK regulations are more challenging than other regulations due to a goal based regulatory regime and lack of reference to prescriptive standards. Handrails, stairs, vertical ladders and grating are procured and installed assumed to be in compliance with UK regulations but are in some cases not accepted by the owner, thus causing arguments between owner and yard. This can lead to significant rework and delays.

Different manufacturers provide many different types of tertiary structures. Different design and construction methods lead to inefficiency in construction, higher procurement and logistic cost and less possibility to reuse tertiary structures design and fabrication processes between projects.

Table 3-1 shows a distribution of standards applied for offshore projects in a shipyard in South Korea over a period of five years. The NORSOK standard is mostly applied only for Norway and its application will therefore strongly depend on the share of projects designed and built for the Norwegian continental shelf.

Table 3-1 Statistics on offshore standards applied in projects 2010 – 2015

<table>
<thead>
<tr>
<th>Applied standard</th>
<th>% of project in the last five years</th>
</tr>
</thead>
<tbody>
<tr>
<td>EN ISO standard</td>
<td>55%</td>
</tr>
<tr>
<td>American standard</td>
<td>10%</td>
</tr>
<tr>
<td>NORSOK Standard</td>
<td>25%</td>
</tr>
<tr>
<td>Australian Standard</td>
<td>10%</td>
</tr>
</tbody>
</table>

By taking into account occupational safety aspects, regulatory compliance as well as cost efficient design and construction, the EN ISO standard was identified as the most efficient basis for developing the recommended requirements for handrails, stairs, vertical ladders and grating. For some few parameters though the EN ISO standard is not aligned with stricter shelf state regulations. International standards were developed for the general industry including onshore industry and some of the requirements do not give sufficient dimension or limitation for safe work onboard offshore installations due to motion at sea and harsh environments.

NORSOK requirements can therefore in some cases provide better requirements for offshore safety since this standard was developed for offshore environments. As a result NORSOK standard requirements were in some cases identified and recommended to be included in this RP.

3.2 Handrails

In the identification of the preferred requirements to be selected for handrails, the main function of handrails to prevent fall from heights and dropped objects was used as the main criteria in addition to compliance with regulations and cost efficient design and construction. Table 3-2 shows the basis and criteria for the recommended requirement for handrails.
Table 3-2 Evaluation of requirements for handrails

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements in standards</th>
<th>Evaluation aspects</th>
<th>Recommended requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>EN ISO: min. 1100 mm</td>
<td>Sufficient height of handrails on platforms to prevent a fall from heights.</td>
<td>EN ISO, NORSOK, ANSI</td>
</tr>
<tr>
<td></td>
<td>ANSI: min 42&quot; (1100 mm)</td>
<td></td>
<td>Min. 1100 mm</td>
</tr>
<tr>
<td></td>
<td>NORSOK: min. 1100 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS: min. 900 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>NORSOK is an offshore standard as opposed to ANSI which is applied for</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>general industries.</td>
<td></td>
</tr>
<tr>
<td>Height on stair</td>
<td>EN ISO: 900 – 1000 mm</td>
<td>Sufficient height of handrails on stairways to prevent a fall from heights.</td>
<td>EN ISO, NORSOK</td>
</tr>
<tr>
<td></td>
<td>ANSI: 34&quot; – 38&quot; (863-965 mm)</td>
<td></td>
<td>Min. 1000 mm</td>
</tr>
<tr>
<td></td>
<td>NORSOK: min. 1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vertical opening</td>
<td>EN ISO: max. 500 mm</td>
<td>Sufficiently narrow space to prevent a fall from height between rails.</td>
<td>NORSOK</td>
</tr>
<tr>
<td></td>
<td>ANSI: max. 21&quot; (550 mm)</td>
<td></td>
<td>Max. 380 mm</td>
</tr>
<tr>
<td></td>
<td>NORSOK: max. 380 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS: max. 450 mm</td>
<td></td>
<td>(lowest course: 230 mm)</td>
</tr>
<tr>
<td>Number of Intermediate kneerail</td>
<td>EN ISO: min. 1</td>
<td>Sufficiently narrow space to prevent a fall from heights between rails.</td>
<td>NORSOK</td>
</tr>
<tr>
<td></td>
<td>ANSI: min. 1</td>
<td></td>
<td>Min. 2</td>
</tr>
<tr>
<td></td>
<td>NORSOK: min. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS: min. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>EN ISO: 25-50 mm</td>
<td>Ergonomic design for holding hand to handrail.</td>
<td>EN ISO, NORSOK, AS</td>
</tr>
<tr>
<td></td>
<td>ANSI: 1.25&quot; – 2&quot; (32 – 51 mm)</td>
<td></td>
<td>ANSI (partly)</td>
</tr>
<tr>
<td></td>
<td>NORSOK: 25-50 mm</td>
<td></td>
<td>25 – 50 mm</td>
</tr>
<tr>
<td></td>
<td>AS: max. 50 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distance between vertical</td>
<td>EN ISO: max. 1500 mm</td>
<td>Maximum distance between vertical stanchions should be limited based on</td>
<td>EN ISO, ANSI, NORSOK, NMA</td>
</tr>
<tr>
<td>stanchions</td>
<td>ANSI: max. 8' (2438 mm)</td>
<td>the stanchion anchoring strength and the fixing devices.</td>
<td>Max. 1500 mm</td>
</tr>
<tr>
<td></td>
<td>NORSOK: max. 1500 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height of toe plate</td>
<td>EN ISO: min. 100 mm</td>
<td>The solid toe plate at the bottom should be provided to prevent fall of minor</td>
<td>EN ISO, NORSOK, ANSI, AS</td>
</tr>
<tr>
<td></td>
<td>ANSI: min.3.5&quot; (89 mm)</td>
<td>objects.</td>
<td>Min. 100 mm</td>
</tr>
<tr>
<td></td>
<td>NORSOK: min. 100 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>AS: min. 100 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 3-3 Evaluation of requirements for stairs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements in standards</th>
<th>Evaluation aspects</th>
<th>Recommended requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stairway slopes ((\alpha))</strong></td>
<td>- EN ISO: 30° - 38°</td>
<td>Stairway slopes should be based on ergonomic principles.</td>
<td>- EN ISO, NORSOK, AS, OSHA</td>
</tr>
<tr>
<td></td>
<td>- ANSI: 30° - 50° (30° - 35° is preferred)</td>
<td></td>
<td>- ANSI (partly)</td>
</tr>
<tr>
<td></td>
<td>- NORSOK: max. 38°</td>
<td></td>
<td>- 30° - 40°</td>
</tr>
<tr>
<td></td>
<td>- AS: 20° - 45°</td>
<td></td>
<td>- (38° is recommended)</td>
</tr>
<tr>
<td><strong>Width ((W))</strong></td>
<td>- EN ISO: min. 600 mm (800 mm)</td>
<td>It should provide proper horizontal clearance of stairs for safe and easy access based on frequency, purpose of access and the number of personnel</td>
<td>- EN ISO, NORSOK, (AS)</td>
</tr>
<tr>
<td></td>
<td>mMin. 1000 mm (traffic area)</td>
<td></td>
<td>- Escape way: min. 1000 mm</td>
</tr>
<tr>
<td></td>
<td>- ANSI: min. 22&quot; (559 mm)</td>
<td></td>
<td>- Main access way: min. 800 mm</td>
</tr>
<tr>
<td></td>
<td>- NORSOK: min. 600 mm (800 mm)</td>
<td></td>
<td>- Other access way: min. 600 mm</td>
</tr>
<tr>
<td></td>
<td>Min. 1000 mm (traffic area)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- AS: min. 600 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.3 Stairs

The main function of stairs is to provide safe access between two different levels. The RP was developed to fulfil this safety requirement in addition to compliance with regulations and cost efficient design and construction. **Table 3-3** shows the basis for the recommended requirements for stairs.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements in standards</th>
<th>Evaluation aspects</th>
<th>Recommended requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step overlap ((r)) (nosing)</td>
<td>— EN ISO: min. 10 mm&lt;br&gt;— ANSI: max. 1.5” (38 mm)&lt;br&gt;— NORSOK: min. 20 mm&lt;br&gt;— AS: max. -30 mm</td>
<td>— For safe access, step overlap or nosing should be provided on all treads to prevent slipping.&lt;br&gt;— Overlap of 20mm in NORSOK considered overly conservative not providing any significant safety benefits compared to 10mm.</td>
<td>— EN ISO, ANSI, (NORSOK)&lt;br&gt;— Min. 10 mm&lt;br&gt;— Non-slip finish</td>
</tr>
<tr>
<td>Climbing height per flight ((H))</td>
<td>— EN ISO: max. 3000 mm&lt;br&gt;Max. 4000 mm (single flight)&lt;br&gt;— ANSI: 12’ – 15’ (3660 – 4500 mm)&lt;br&gt;— NORSOK: max. 3000 mm</td>
<td>— Maximum flight should be limited for safe access based on ergonomic design.</td>
<td>— EN ISO, NORSOK&lt;br&gt;— Max. 3000 mm for multi flight&lt;br&gt;— Max. 4000 mm for single flight</td>
</tr>
<tr>
<td>Number of rise</td>
<td>— NORSOK: max. 16</td>
<td>— The maximum number of rises should be limited based on ergonomic design.</td>
<td>— NORSOK&lt;br&gt;— Max. 16</td>
</tr>
<tr>
<td>Rise height ((h))</td>
<td>— NORSOK: max. 190 mm&lt;br&gt;— ANSI: max. 9.5” (241 mm)&lt;br&gt;— AS: 130 – 225 mm</td>
<td>— Height of stairs should be dimensioned based on ergonomic design.</td>
<td>— NORSOK&lt;br&gt;— Max. 190 mm</td>
</tr>
<tr>
<td>Going((g)) and rise((h))</td>
<td>— EN ISO: 600 ≤ g + 2h ≤ 660 mm&lt;br&gt;— ANSI: going: min. 9.5” (241 mm), rise: max. 9.5” (241 mm)&lt;br&gt;— NORSOK: GOING + TWICE THE RISE = 630 mm +/- 30 mm&lt;br&gt;— AS: 540 ≤ (2R + G) ≤700 mm</td>
<td>— General requirements for standards for stairs should be applied.</td>
<td>— EN ISO, NORSOK, AS&lt;br&gt;— 600 ≤ g + 2h ≤ 660 mm</td>
</tr>
<tr>
<td>Toe plate on landing</td>
<td>— NORSOK: 100 mm</td>
<td>— The solid toe plate at the bottom should be provided to prevent the fall of minor objects. However, the toe plate on the other stairs (requirement 50mm in NORSOK) is not recommended as the safety benefit of this requirement is considered disproportionate to the safety benefit.</td>
<td>— NORSOK&lt;br&gt;— Min 100 mm</td>
</tr>
<tr>
<td>Level of uppermost step</td>
<td>— EN ISO: uppermost step is level with landing</td>
<td>— The uppermost shall be level with the landing to prevent trip hazards.</td>
<td>— EN ISO, NORSOK</td>
</tr>
</tbody>
</table>

Recommendation for selecting standards for steel bulk items (tentative recommended practice)
### Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements in standards</th>
<th>Evaluation aspects</th>
<th>Recommended requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of landing area</td>
<td>— EN ISO: min. 800 mm, Stair width ≤ landing length (depth)</td>
<td>— The landing area should give proper space for easy and safe access.</td>
<td>— EN ISO, ANSI, NORSOK</td>
</tr>
<tr>
<td></td>
<td>— ANSI: min. 30&quot; (763mm), Stair width ≤ landing length (depth)</td>
<td>— Stretcher handling should be considered in the main access way.</td>
<td>— Min. 800 mm, stair width ≤ landing length (depth)</td>
</tr>
<tr>
<td></td>
<td>— NORSOK: stair width ≤ landing length (depth)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 3.4 Vertical ladders

The main function of vertical ladders is to provide safe access between two different levels and to prevent a fall from heights and dropped objects. The RP was developed to fulfil these safety requirements in addition to compliance with regulations and cost efficient design and construction. Table 3-4 shows the recommended requirements for vertical ladders.

**Table 3-4 Evaluation of requirements for vertical ladders**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements in standards</th>
<th>Selection criteria for guideline</th>
<th>Recommended requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacing between</td>
<td>— EN ISO: 225 – 300 mm</td>
<td>— The spacing between successive rungs should be constant and limited for easy and safe access based on ergonomic design.</td>
<td>— EN ISO, NORSOK, AS 225 – 300 mm</td>
</tr>
<tr>
<td>successive rungs</td>
<td>— ANSI: max. 12&quot; (304 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>— NORSOK: 225 – 300 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>— AS: 250 – 300 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spacing between rungs,</td>
<td>— EN ISO: max. 400 mm (225 – 300 mm)</td>
<td>— The spacing between rungs, departure and arrival area should be limited for easy and safe access based on ergonomic design.</td>
<td>— EN ISO, NORSOK, AS Max. 400 mm (225 – 300 mm)</td>
</tr>
<tr>
<td>departure and arrival</td>
<td>— ANSI: max. 14&quot; (356 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>area</td>
<td>— NORSOK: max. 400 mm (225 – 300 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>— AS: 225 – 300 mm (90–100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>— EN ISO: 400 – 600 mm</td>
<td>— The width should be properly dimensioned based on ergonomic principles.</td>
<td>— EN ISO, ANSI, NORSOK, AS 400 – 600 mm</td>
</tr>
<tr>
<td></td>
<td>— ANSI: min. 16&quot; (406 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>— NORSOK: 400 – 600 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>— AS: 375 – 525 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rung shape</td>
<td>— EN ISO: Polygonal and U-shaped rungs</td>
<td>— The rungs shape should be non-slip type.</td>
<td>— EN ISO, NORSOK</td>
</tr>
<tr>
<td></td>
<td>— NORSOK: Polygonal and U-shaped rungs</td>
<td>— The surface of the rungs shall not cause injuries, notably to hands, e. g. no sharp edges</td>
<td>— Diamond type</td>
</tr>
<tr>
<td>Diameter of rungs</td>
<td>— EN ISO: 20 – 35 mm</td>
<td>— The rungs should be dimensioned to easy grasp by hand.</td>
<td>— EN ISO, NORSOK</td>
</tr>
<tr>
<td></td>
<td>— NORSOK: 20 – 50 mm</td>
<td></td>
<td>— 20 – 50 mm</td>
</tr>
<tr>
<td></td>
<td>— AS: 20 – 50 mm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Requirements in standards</td>
<td>Selection criteria for guideline</td>
<td>Recommended requirements</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------------------</td>
<td>---------------------------------</td>
<td>--------------------------</td>
</tr>
</tbody>
</table>
| Cross-section profile of stiles (stringer) (diameter) | — EN ISO: max. 80 mm  
— NORSOK: max. 80 mm  
— AS: 40 – 80 mm | — The stiles should be dimensioned and shaped to easy grasp by hand. | — Recommended practice by operators  
— Plat bar  
Max. 80 mm (< 3 m – unsupported length) |
| Location of lowest part of safety cage | — EN ISO: 2200 – 3000 mm  
— ANSI: 7-8’ (2133 – 2438 mm)  
— NORSOK: 2200 – 3000 mm  
— AS: 2000 – 2200 mm | — The vertical clearance between lowest part of safety cage and floor level should be dimensioned for safe and easy access. | — EN ISO, ANSI, NORSOK, AS  
2200 – 3000 mm |
| Clear distances within safety cage hoop | — EN ISO: 650 – 800 mm  
— ANSI: 27”-30” (686-762 mm)  
— NORSOK: 650 – 800 mm  
— AS: 750 mm | — Distances within safety cage hoop should be dimensioned for easy and safe access. | — EN ISO, NORSOK, (AS)  
650 – 800 mm |
| Distance from the surrounding structure (safety cage) to stiles | — EN ISO: 325 – 400 mm  
— NORSOK: 325 – 400 mm | — The space between stiles (stringer) and safety cage hoop should be properly dimensioned to give sufficient space to grasp the stiles (stringer) by hand without interruption. | — EN ISO, NORSOK  
325 – 400 mm |
| Distance between two hoops of safety cage | — EN ISO: max. 1500 mm  
— NORSOK: max. 1500 mm  
— AS: max. 2000 mm | — Distance between two hoops is limited to prevent risk to fall from heights. | — EN ISO, NORSOK, AS  
Max. 1500 mm |
| Distance between two uprights of safety cage | — EN ISO: max. 300 mm  
— NORSOK: max. 300 mm  
— AS: max. 150 mm | — Distance between two uprights is minimised to prevent risk to fall from heights. | — EN ISO, NORSOK  
Max. 300 mm |
| No. of fixing support (Plat bar only) | — Recommended practice | — The number of fixing supports is to be decided based on strength and risk reduction. | — Recommended practice  
— Min. 2 (< 3 m)  
— Min. one support for every 3 m (> 3m) |
| Extension from arrival area | — EN ISO:  
— ANSI:  
— NORSOK:  
— AS: | — If there is no good handholds at the arrival area, top of the ladder should be extended for safe access and prevention of fall from heights.  
— At the arrival area the safety cage should be extended up to the height of the guard-rail of the arrival area to prevent a fall from heights. | — EN ISO, NORSOK  
— Min. 1125 mm (Min. 5 steps=225 x 5) for ladder  
— Min. 1100 mm for safety cage |
### Table 3-5 Evaluation of requirements for gratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirements in standards</th>
<th>Selection criteria for guide line</th>
<th>Recommended requirements</th>
</tr>
</thead>
</table>
| **Opening diameter** | — EN ISO: max. 20 mm (max. 35 mm)  
— ANSI: max. 1 " (2.54 mm)  
— NORSOK: max. 20 mm (max. 35 mm)  
— AS: max. 45 mm | — The opening diameter should be minimised to prevent the fall of minor objects through the opening.  
— Two opening size will be considered for work area and other area. | — EN ISO, NORSOK  
— Max. 20 mm (above areas where personnel can be present)  
— Max. 35 mm (above areas where people should normally not be present) |
| **Surface finish**  | — EN ISO: Non Slip  
— NORSOK: non-slip checkered plate | — The surface should be non-slip type to prevent slipping. | — EN ISO, NORSOK  
— Non slip: ex. punched type, Serrated type or equivalent |

#### 3.5 Gratings

The main function of gratings is to provide safe access and to prevent dropped objects. The RP was developed to fulfil these safety requirements in addition to compliance with regulations and cost efficient design and construction. **Table 3-5** shows the recommended requirements for gratings.
SECTION 4 RECOMMENDED REQUIREMENTS

4.1 Handrails

The main recommended dimensions for handrails are summarized in Table 4-1. The following requirements are recommended for plate and pipe material.

— Plate: SMYS 235 MPa according to DNVGL RP B201 MDS-CS001, material grade-CS235-R
— Pipe: SMYS 235 MPa according to DNVGL RP B201 MDS-CS201, material grade- CT235-R.

Table 4-1 Recommended dimensions for handrails

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommendation</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>— Min. 1100 mm</td>
<td></td>
</tr>
<tr>
<td>Height on stair</td>
<td>— Min. 1000 mm</td>
<td>Not in compliance with ANSI: min. 34” – max. 38” (863-965 mm).</td>
</tr>
<tr>
<td>Vertical opening</td>
<td>— Max. 380 mm</td>
<td>(lowest course: max. 230 mm)</td>
</tr>
<tr>
<td>Intermediate kneerail</td>
<td>— Min. 2 kneerails</td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>— Min.25 – max. 50 mm</td>
<td>Only partly in compliance with ANSI: 1.25” – 2” (32 – 51 mm).</td>
</tr>
<tr>
<td>Distance between vertical stanchions</td>
<td>— Max. 1500 mm</td>
<td></td>
</tr>
<tr>
<td>Height of toe plate</td>
<td>— Min. 100 mm</td>
<td></td>
</tr>
<tr>
<td>Vertical clearance between toe plate and floor level</td>
<td>— Max. 10 mm</td>
<td>Not in compliance with ANSI: max. 0.25” (6 mm).</td>
</tr>
<tr>
<td>Horizontal clearance between toe plates</td>
<td>Continuous type (or max. 10 mm)</td>
<td>NORSOK does not allow any gap.</td>
</tr>
<tr>
<td>Space between two segments</td>
<td>— Min.75 – max. 120 mm</td>
<td></td>
</tr>
<tr>
<td>Sharp edges</td>
<td>— Not allowed</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4-1 shows recommended dimensions for handrail on floors or platforms.
Figure 4-1 Recommended dimension for handrails

Figure 4-2 shows the recommended design to avoid sharp edge at the end of handrails. The end extension of the handrail should not exceed 600 mm to prevent occupational safety hazards. For interrupted handrails, the space between the two segments should be 75 – 120 mm as shown Figure 4-3 to prevent hand trap hazards.

Figure 4-2 Recommended end of handrail
4.2 Stairs

The recommended dimensions for stairs are summarized in Table 4-2. The following requirements are recommended for plate and section material:

— Plate: SMYS 235 MPa according to DNVGL RP B201 MDS-CS001, material grade-CS235-R
— Section: SMYS 235 MPa according to DNVGL RP B201 MDS-CS101, material grade-CS235-R.

Table 4-2 Recommended dimensions for stairs

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommendation</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stairway slopes (α)</td>
<td>— 30° - 40°</td>
<td>Recommendation is 38°.</td>
</tr>
<tr>
<td>Width (W)</td>
<td>— Escape way: min. 1000 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— Main access way: min. 800 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— Other access way: min. 600 mm</td>
<td></td>
</tr>
<tr>
<td>Step overlap (r) (Nosing)</td>
<td>— Min. 10 mm</td>
<td>Not in compliance with NORSOK: min. 20 mm.</td>
</tr>
<tr>
<td></td>
<td>— Nonslip finish</td>
<td></td>
</tr>
<tr>
<td>Climbing – Height per flight (H)</td>
<td>— Max. 3000 mm for multi flight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— Max. 4000 mm for single flight</td>
<td></td>
</tr>
<tr>
<td>Number of rises</td>
<td>— Max. 16 for multi flight</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— Max. 22 for single flight</td>
<td></td>
</tr>
<tr>
<td>Rise height (h)</td>
<td>— Max 190 mm</td>
<td></td>
</tr>
<tr>
<td>Going (g) and rise (h)</td>
<td>— $600 \leq g + 2h \leq 660$ mm</td>
<td>In the case where it is not possible to maintain the height of the rise between the level of departure and the first step, it may be reduced by a maximum of 15%.</td>
</tr>
</tbody>
</table>
### Parameter | Recommendation | Comments and limitations
--- | --- | ---
**Toe plate on landing** | — Min 100 mm | 50mm toe plate on other treads not recommended and hence not in compliance with NORSOK.
**Uppermost step** | — The uppermost step shall be level with the landing. |  
**Length of landing area** | — Min. 800 mm, Stair width ≤ landing length (depth)  
— Min. 1500 mm if stretcher handlings required and/or for escape ways. | Sufficient landing length should be conceded in the main access way and escape way for stretcher handling and safe escape.

*Figure 4-4 shows the recommended dimensions for stairs. The landing area should provide sufficient space as per the recommendation shown in Figure 4-5 when stretcher handling is required or the stair is used as escape way.*

![Figure 4-4 Recommended dimension for stairs](image-url)
4.3 Vertical ladders

The recommended dimensions for vertical ladders are summarized in Table 4-3. The following requirements are recommended for plate and section material.

— Plate: SMYS 235 MPa according to DNVGL RP B201 MDS-CS001, material grade-CS235-R
— Section: SMYS 235 MPa according to DNVGL RP B201 MDS-CS101, material grade-CS235-R.

Table 4-3 Recommended dimensions for vertical ladders

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommendation</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacing between successive rungs</td>
<td>— Min. 225 – max. 300 mm</td>
<td></td>
</tr>
<tr>
<td>Spacing between rung and the departure and arrival area</td>
<td>— Max. 400 mm</td>
<td>Recommendation is 225 – 300 mm.</td>
</tr>
<tr>
<td>Width of ladder</td>
<td>— Min. 400 – max. 600 mm</td>
<td>ANSI: min 16” (406.4 mm).</td>
</tr>
<tr>
<td>Rung shape</td>
<td>— Diamond type</td>
<td></td>
</tr>
<tr>
<td>Diameter of rungs</td>
<td>— Min. 20 – max. 50 mm</td>
<td></td>
</tr>
<tr>
<td>Cross-section profile of stiles (stringer) (diameter)</td>
<td>— Plat bar with max. 80 mm</td>
<td>Unsupported length is less than 3000 mm only.</td>
</tr>
<tr>
<td>Location of lowest part of safety cage</td>
<td>— Min. 2200 – max. 3000 mm</td>
<td>Not in compliance with ANSI: min. 7- max. 8’ (2133 – 2438 mm).</td>
</tr>
<tr>
<td>Clear distance within safety cage hoop</td>
<td>— Min. 650 – max. 800 mm</td>
<td></td>
</tr>
<tr>
<td>Distance from the surrounding structure (safety cage) to stiles</td>
<td>— Min. 325 – max. 400 mm</td>
<td></td>
</tr>
<tr>
<td>Parameter</td>
<td>Recommendation</td>
<td>Comments and limitations</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>----------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Distance between two hoops of safety cage</td>
<td>— Max. 1500 mm</td>
<td></td>
</tr>
<tr>
<td>Distance between two uprights of safety cage</td>
<td>— Max. 300 mm</td>
<td>AS: max. 150 mm when vertical opening is 2000 mm.</td>
</tr>
<tr>
<td>No. of fixing support (plat bar only)</td>
<td>— Min. 2 (&lt; 3m)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— Min. one additional support for every 3 m (&gt; 3 m)</td>
<td></td>
</tr>
<tr>
<td>Extension from arrival area</td>
<td>— Min. 1125 mm (min. 5 steps=225 x 5) for ladder</td>
<td>Extension is measured from arrival. Extension of ladder is required when no effective handholds are provided.</td>
</tr>
<tr>
<td></td>
<td>— Min 1100 mm for safety cage</td>
<td></td>
</tr>
<tr>
<td>Ladder height without rest platform (single flight)</td>
<td>— Max. 10000 mm</td>
<td></td>
</tr>
<tr>
<td>Ladder height with staggered flights</td>
<td>— Max. 6000 mm</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4-6 shows the recommended dimensions for vertical ladders. In the case of side access type, the ladder should be extended at least 5 steps as shown in the Figure 4-7.
Figure 4-6 Recommended dimensions for vertical ladders (through access type)
4.4 Grating

The recommended dimensions for gratings are shown in Table 4-4. The following requirements are recommended for plate and section material.

— Plate: SMYS 235 MPa according to DNVGL RP B201 MDS-CS001, material grade-CS235-R
— Section: SMYS 235 MPa according to DNVGL RP B201 MDS-CS101, material grade-CS235-R.

Table 4-4 Recommended dimensions for gratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Recommendation</th>
<th>Comments and limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opening diameter</td>
<td>— Max. 20 mm (above places where personnel can be present)</td>
<td>Not compliant with NMA: max. 15 mm.</td>
</tr>
<tr>
<td></td>
<td>— Max. 35 mm (other areas where people normally should not be present)</td>
<td></td>
</tr>
<tr>
<td>Surface finish</td>
<td>— Non slip: ex. punched type, Serrated type or equivalent</td>
<td>Low-density punched plate normally used.</td>
</tr>
</tbody>
</table>

Figure 6-8 shows the recommended dimensions for grating.
Figure 4-8 Recommended dimensions for gratings

The surface of the grating should be non-slip type such as punched, serrated or equivalent to prevent slipping hazard as shown in Figure 4-9.

Figure 4-9 Recommended surface finish for gratings
### APPENDIX A LIST OF STANDARDS AND REGULATIONS

<table>
<thead>
<tr>
<th>Items</th>
<th>Parameters</th>
<th>Regulations/standard</th>
<th>Clause</th>
<th>Requirement summary</th>
<th>Requirement full text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(1)</td>
<td>Vertical height: 42 inches</td>
<td>A standard railing shall consist of top rail, intermediate rail, and posts, and shall have a vertical height of 42 inches nominal from upper surface of top rail to floor, platform, runway, or ramp level. The top rail shall be smooth-surfaced throughout the length of the railing. The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp. The ends of the rails shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.</td>
</tr>
<tr>
<td>Handrail (stair railing)</td>
<td>Dimension</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(2)</td>
<td>Vertical height of railing &lt; 34 inches</td>
<td>A stair railing shall be of construction similar to a standard railing but the vertical height shall be not more than 34 inches nor less than 30 inches from upper surface of top rail to surface of tread in line with face of riser at forward edge of tread.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(3)(ii)</td>
<td>Diameter: min. 1 1/2 inches posts space: 8 feet</td>
<td>For pipe railings, posts and top and intermediate railings shall be at least 1 1/2 inches nominal diameter with posts spaced not more than 8 feet on centers.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(3)(iii)</td>
<td></td>
<td>For structural steel railings, posts and top and intermediate rails shall be of 2-inch by 2-inch by 3/8-inch angles or other metal shapes of equivalent bending strength with posts spaced not more than 8 feet on centers.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Material</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(3)(iv)</td>
<td>Min. 200 pounds</td>
<td>The anchoring of posts and framing of members for railings of all types shall be of such construction that the completed structure shall be capable of withstanding a load of at least 200 pounds applied in any direction at any point on the top rail.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Shape</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(3)(v)(a)</td>
<td>Smooth-surfaced top rail</td>
<td>A smooth-surfaced top rail at a height above floor, platform, runway, or ramp level of 42 inches nominal;</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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</tr>
<tr>
<td>Handrail</td>
<td>Material</td>
<td>OSHA 1910.23</td>
<td>1910.23(e) (3)(v)(b)</td>
<td>In. 200 pounds top rail pressure</td>
<td>A strength to withstand at least the minimum requirement of 200 pounds top rail pressure;</td>
</tr>
<tr>
<td>Handrail</td>
<td>Shape</td>
<td>OSHA 1910.23</td>
<td>1910.23(e) (3)(v)(c)</td>
<td>Intermediate rail</td>
<td>Protection between top rail and floor, platform, runway, ramp, or stair treads, equivalent at least to that afforded by a standard intermediate rail;</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(4)</td>
<td>Toeboard: 4 inches Max. 1/4-inch clearance above floor level</td>
<td>A standard toeboard shall be 4 inches nominal in vertical height from its top edge to the level of the floor, platform, runway, or ramp. It shall be securely fastened in place and with not more than 1/4-inch clearance above floor level. It may be made of any substantial material either solid or with openings not over 1 inch in greatest dimension. Where material is piled to such height that a standard toeboard does not provide protection, paneling from floor to intermediate rail, or to top rail shall be provided.</td>
</tr>
<tr>
<td>Handrail (stair railing)</td>
<td>Shape</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(5)(i)</td>
<td></td>
<td>A handrail shall consist of a lengthwise member mounted directly on a wall or partition by means of brackets attached to the lower side of the handrail so as to offer no obstruction to a smooth surface along the top and both sides of the handrail. The handrail shall be of rounded or other section that will furnish an adequate handhold for anyone grasping it to avoid falling. The ends of the handrail should be turned in to the supporting wall or otherwise arranged so as not to constitute a projection hazard.</td>
</tr>
<tr>
<td>Handrail (stair railing)</td>
<td>Dimension</td>
<td>OSHA 1910.23</td>
<td>1910.23(e)(5)(ii)</td>
<td>Height of handrails: min. 30 – max. 34 inches</td>
<td>The height of handrails shall be not more than 34 inches nor less than 30 inches from upper surface of handrail to surface of tread in line with face of riser or to surface of ramp.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>7.1.4</td>
<td>Height: min. 1100 mm</td>
<td>The minimum height of the guard-rail shall be 1100 mm.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
<td>Requirement full text</td>
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<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>7.1.5</td>
<td>Intermediate kneerail: min. one Space: max. 500 mm</td>
<td>The guard-rail shall include at least one intermediate kneerail or any other equivalent protection. The clear space between the handrail and the kneerail, as well as between the kneerail and the toe plate, shall not exceed 500 mm.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>7.1.6</td>
<td>Horizontal distance of vertical uprights: max. 180 mm</td>
<td>When vertical uprights are used instead of a kneerail the clear horizontal distance between those uprights shall be 180 mm maximum.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>7.1.7</td>
<td>Toe-plate: min. 100 mm Gap: max. 10 mm</td>
<td>A toe-plate with a minimum upstand of 100 mm shall be placed 10 mm maximum from the walking level and the edge of the platform</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>7.1.9</td>
<td>Space between two segments: 75–120 mm</td>
<td>In the case of an interrupted handrail, to prevent hand traps the clear space between the two segments should not be less than 75 mm and not greater than 120 mm (see Figure 5). If there is a larger opening, a self closing gate shall be used.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Shape</td>
<td>EN ISO 14122-3</td>
<td>7.1.11</td>
<td>Eliminate sharp edges</td>
<td>The ends of the handrail shall be designed in such a manner as to eliminate any risk of harm caused by sharp edges of the product or by catching of the user’s clothing.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>7.2.3</td>
<td>Vertical height: 900–1000 mm Diameter: 25–50 mm</td>
<td>The vertical height of the handrail on a stair shall be between 900 mm and 1 000 mm above the nosing on the step of the flight and be a minimum of 1100 mm above the walking level on the landing. The shape of the handrail should have a diameter between 25 mm to 50 mm or an equivalent section, to provide a good grip for the hand.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>5.4</td>
<td>Vertical height: min. 42&quot;</td>
<td>A railing system shall consist of top rail, intermediate rail or equivalent protection, and posts, and shall have a minimum vertical height of 42 inches (1.1m) from upper surface of top rail to floor, platform, runway, stair landing, or ramp level.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>E5.4</td>
<td>Height &gt; 42&quot;;</td>
<td>Additional horizontal intermediate rails</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>5.4</td>
<td>Smooth surfaced top rail</td>
<td>No projection hazard at end of handrails</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>5.8</td>
<td>Vertical height on stairs: 34&quot;–38&quot;</td>
<td></td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>5.7</td>
<td>Height of toeboard: min. 3.5&quot;</td>
<td></td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>E5.8</td>
<td>Diameter: 1.25&quot;–2&quot;</td>
<td></td>
</tr>
<tr>
<td>Handrail</td>
<td>Material</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>1,5 kN/m²</td>
<td></td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
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<tr>
<td>Handrail</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>Continuous handrail</td>
<td>The hand- and guardrail system consists typically of a continuous handrail at the top to be grasped by the hand, or just a continuous top-rail when hand support is not required, knee-rails placed parallel with the handrail to prevent accidental passage of a body, vertical stanchions for anchorage of the guardrail system, and a solid toe plate at the bottom to prevent the fall of minor objects.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>c/c distance: max 1500 mm</td>
<td>Handrail and guardrail supports shall normally be arranged at a maximum c/c distance of 1500 mm.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>Height: min. 1100 mm</td>
<td>The top of the handrail shall be minimum 1 100 mm above the finished floor or deck. Exempted is the top of handrails around the lowered helideck perimeter walkway, where the height shall be minimum 1 400 mm. The distance between stanchions shall in this case be maximum 750 mm.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>Vertical opening: max. 380 mm</td>
<td>Vertical openings between horizontal knee-rails, handrails and toe plates, shall not exceed 380 mm.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>Toe plate: min 100 mm</td>
<td>The toe plate shall have a minimum height of 100 mm, and a clearance of maximum 10 mm to the deck.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>Stanchion in each corner two stanchions before and after a corner</td>
<td>A stanchion shall be provided in each corner (change of direction), unless stanchions are provided on either side of the corner, at a maximum c/c distance of 350 mm from the corner. There shall always be at least two stanchions before and after a corner.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td>6.1</td>
<td>Sharp corners, rough edges, welds with burrs, etc. are not acceptable.</td>
<td>Hand- and guardrails shall not cause hindrance or injury to personnel. Sharp corners, rough edges, welds with burrs, etc., are not acceptable. Bolts, nuts and screws shall have a user-friendly design, which will not catch fingers or any part of a body in motion.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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</tr>
<tr>
<td>Handrail</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td>6.2</td>
<td>continuous, smooth handgrip, without any sharp angles, rough edges, obstructions, protruding brackets, or similar. No screws and bolts on handgrip area.</td>
<td>All handrails shall provide a continuous, smooth handgrip, without any sharp angles, rough edges, obstructions, protruding brackets, or similar. The handgrip area shall be without screws and bolts, unless they are completely recessed.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td>6.2</td>
<td>Distance to obstruction Internal LQ areas: 50 mm External LQ areas: 100 mm</td>
<td>The distance between the handrail and any obstruction shall be minimum 50 mm in internal LQ areas. In other areas the minimum distance shall be 100 mm.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Material</td>
<td>NORSOK C-002</td>
<td>6.2</td>
<td>Low maintenance finish</td>
<td>All handrails in LQ shall have a low maintenance finish, e.g. brushed stainless steel or suitable hardwood</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.2</td>
<td>Diameter: 25–50 mm</td>
<td>The outside diameter of the handrail shall be between 25 mm to 50 mm.</td>
</tr>
<tr>
<td>Handrail (stair railing)</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.2</td>
<td>Handrail: min. 1000 mm</td>
<td>All stairs shall have a handrail and guardrail on each side of every flight and every open intermediate landing. Handrails and guardrails shall be parallel to the pitch line of the stair flights and shall be level at open landings. Top of handrail shall be positioned minimum 1000 mm (measured vertically) above the tread pitch line, and minimum 1100 mm above landings and decks. The handrail shall be continuous from the top to the bottom of the stairway and shall be terminated in a safe manner at both ends.</td>
</tr>
<tr>
<td>Handrail (stair railing)</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>6.2</td>
<td>Distance between rails: 100 mm</td>
<td>Handrails on flights that are 180° to each other shall have a minimum of 100 mm clear distance between rails or between rails and supporting structures, to avoid the possibility of catching hands and fingers.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
<td>Requirement full text</td>
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</tr>
<tr>
<td>Self-closing gates</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td>6.5</td>
<td></td>
<td>Self-closing gates shall provide access through guardrails, as required. The gates shall have the same design and strength as the surrounding guardrails. It shall open towards a deck or platform, and have a firm outward stop, to prevent accidents. A safe and user-friendly opening/locking device shall be provided.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NMA Construction regulation</td>
<td>§ 17 1.2</td>
<td>Height: min. 1000 mm</td>
<td>The height of railings, handropes, etc. shall be at least 1 metre from deck to upper rail. There shall be two intermediate rails with a distance of maximum 380 mm. The opening below the lower rail in the railing shall not exceed 230 mm at the open part of the deck. The distance between stanchions shall be maximum 1.5 metres.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NMA Construction regulation</td>
<td>§ 17 1.2</td>
<td>Two intermediate rails Distance btw rails: max. 380 mm Lower distance: max. 230 mm</td>
<td>The height of railings, handropes, etc. shall be at least 1 metre from deck to upper rail. There shall be two intermediate rails with a distance of maximum 380 mm. The opening below the lower rail in the railing shall not exceed 230 mm at the open part of the deck. The distance between stanchions shall be maximum 1.5 metres.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>NMA Construction regulation</td>
<td>§ 17 1.2</td>
<td>stanchions Distance: max. 1500 mm</td>
<td>The height of railings, handropes, etc. shall be at least 1 metre from deck to upper rail. There shall be two intermediate rails with a distance of maximum 380 mm. The opening below the lower rail in the railing shall not exceed 230 mm at the open part of the deck. The distance between stanchions shall be maximum 1.5 metres.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>5.6.2</td>
<td>Height: 900–1100 mm</td>
<td>The height of a handrail, measured vertically above the floor, walkway surface or the nosing of a stair tread, shall be not less than 900 mm or greater than 1100 mm, as shown in Figure 5.3.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>5.6.6</td>
<td>Toeboard: min. 100 mm Gap: max. 10 mm</td>
<td>A toeboard complying with Clause 6.1.2 shall be installed where required by Clause 5.5 and shall be firmly attached to the posts or the floor. Any gap between the toeboard and the floor shall not exceed 10 mm. The top of the toeboard shall be not less than 100 mm above the floor.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>6.2.1</td>
<td>No sharp edges Intermediate kneerail: min. one Space: max. 450 mm Height: min. 900 mm</td>
<td>Any part of a guard railing that could come into contact with the user shall have no sharp edges or other attributes that could cause injury to the user. If mobility assistance is required and the guardrail does not provide this, a handrail shall also be provided. Where the guardrail is used as a handrail, it shall meet the requirements of Clause 5.6 and there shall be a minimum hand clearance of 50 mm between the handrail and any adjacent structure. The height of a guardrail measured vertically above the floor shall be not less than 900 mm. NOT...</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>C6.2.1.1</td>
<td>Where the fall height from a platform: min. 1000 mm</td>
<td>Where the fall height from a platform is significant or where persons on the platform may be subjected to wind forces, it is desirable to increase the height of the guardrail to at least 1000 mm to provide a greater sense of security to persons on the exposed platforms.</td>
</tr>
<tr>
<td>Handrail</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>6.2.1.2</td>
<td>No toeboard: space between the lowest rail and the floor: max. 560 mm</td>
<td>Where no toeboard is installed, the clear space between the lowest rail and the floor shall not exceed 560 mm.</td>
</tr>
<tr>
<td>Stair</td>
<td>Shape</td>
<td>EN ISO 14122-1</td>
<td>5.3.1.2</td>
<td>Angles: 30°-38°</td>
<td>stairs with an angle of pitch from a minimum of 30 ° to maximum of 38 ° (see 5.4.c))</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Stair</td>
<td>Shape</td>
<td>OSHA 1910.24</td>
<td>1910.24 (e)</td>
<td>Angles: 30°-50°</td>
<td>&quot;Angle of stairway rise.&quot; Fixed stairs shall be installed at angles to the horizontal of between 30 deg. and 50 deg. Any uniform combination of rise/tread dimensions may be used that will result in a stairway at an angle to the horizontal within the permissible range. Table D-1 gives rise/tread dimensions which will produce a stairway within the permissible range, stating the angle to the horizontal produced by each combination.</td>
</tr>
<tr>
<td>Stair</td>
<td>Shape</td>
<td>NMA P5 Ch.5</td>
<td>§15-1.3</td>
<td>Angles: max 45°</td>
<td></td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>EN ISO 14122-1</td>
<td>5.3.1.2</td>
<td>Width: min. 600 mm</td>
<td>Unless there are exceptional circumstances, the clear width of a stair shall be a minimum of 600 mm but preferably 800 mm. When the stairway is usually subject to the passage or crossing of several persons simultaneously, the width shall be increased to 1000 mm. The width of the stair, when designated as an escape way shall meet the requirements of appropriate regulations.</td>
</tr>
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<td>EN ISO 14122-3</td>
<td>5.7</td>
<td>Traffic area:</td>
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<td>min. 1000 mm</td>
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<td>Escape way:</td>
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<td>the requirements</td>
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<td>of appropriate</td>
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<td>regulations</td>
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<tr>
<td>Stair</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.24 (d)</td>
<td>Width: min. 22</td>
<td>&quot;Stair width.&quot; Fixed stairways shall have a minimum width of 22 inches.</td>
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<tr>
<td>Stair</td>
<td>Dimension</td>
<td>NMA P5 Ch.5</td>
<td>§15-1.3</td>
<td>Width: min. 800 mm</td>
<td></td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.24 (e)</td>
<td>Max. rise height:</td>
<td>the rise/tread combinations are not limited to those given in Table D-1.</td>
</tr>
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<td>6 1/2–9 1/2</td>
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</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>5.1</td>
<td>600 g + 2h 660</td>
<td>Going, g, and rise, h, shall meet the formula (1):</td>
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<td>Step overlap:</td>
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<td></td>
<td>min. 10 mm</td>
<td>The overlap, r, of the step shall be 10 mm and shall apply equally to landings and floors.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>5.2</td>
<td>Rise shall be</td>
<td>On the same flight, the rise shall be constant wherever possible. In the case where it is not possible to maintain the height of the rise between the level of departure and the lower step, it may be reduced by a maximum of 15%. If it is justified, it may be increased, for example in the case of certain mobile machines.</td>
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<td>constant. Different: max. 15%</td>
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<tr>
<td>Stair</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>5.3</td>
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<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
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<tr>
<td>Stair</td>
<td>Dimension</td>
<td>EN ISO 14122-3</td>
<td>5.8</td>
<td>Flights: max. 3000 mm Length of landing: min. 800 mm Length of landing &gt;= width</td>
<td>The climbing height $H$ of individual flights shall not exceed 3000 mm, otherwise a landing is deemed necessary before continuing on to another flight. The length of the landing, $L$, shall be at least 800 mm and in any case equal to or greater than the width of the stair. Only in the case of a single flight (see 3.1.2) shall the climbing height not exceed 4000 mm.</td>
</tr>
<tr>
<td>Stair</td>
<td>Material</td>
<td>EN ISO 14122-3</td>
<td>4.7</td>
<td>1.5 kN Up to 5 kN/m²</td>
<td>4.7.1 For the structure the unfactored loads used in the industrial field, may vary from 1,5 kN/m² for low density pedestrian traffic without load, up to 5 kN/m² for low density pedestrian traffic with load or for high density pedestrian traffic. 4.7.2 Steps shall resist the following unfactored loadings: if the width $w &lt; 1200$ mm, then 1,5 kN shall be distributed over an area of 100 mm x 100 mm where one boundary is the leading edge of the nosing applied at the middle of the stair width; if the width $w \geq 1200$ mm, then respectively 1,5 kN shall be distributed simultaneously over each of the 100 mm x 100 mm areas applied at the most unfavourable points spaced at intervals of 600 mm where one boundary is the leading edge of the nosing. The deflection between the structure and the steps under an unfactored load shall not exceed 1/300 th of the span or 6 mm whichever is the lesser.</td>
</tr>
<tr>
<td>Stair</td>
<td>Shape</td>
<td>EN ISO 14122-3</td>
<td>4.4</td>
<td>Non-slip surface</td>
<td>Steps and landings shall offer satisfactory slip resistance to avoid any risk of slipping.</td>
</tr>
<tr>
<td>Stair</td>
<td>Shape</td>
<td>EN ISO 14122-3</td>
<td>5.4</td>
<td>Uppermost step = landing level</td>
<td>The uppermost step shall be level with the landing.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
<td>Requirement full text</td>
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<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>E6.4</td>
<td>Slope: 30° - 50° (30° - 35° is preferred)</td>
<td>The preferred slope for a stairway is 30 to 35 degrees from the horizontal (see Figure 6.4). The International Building Code (IBC), and/or applicable building codes, regulations, standards or ordinances should also be considered.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>7.2.1</td>
<td>Side enclosed with one handrail: max. 44&quot; (1100 mm) or max. 88&quot; (2200 mm)</td>
<td>7.2.1 Stairways not exceeding 44 inches (1.1m) in width, having both sides enclosed, shall have at least one handrail preferably on the right side descending. 7.2.2 Stairways not exceeding 44 inches (1.1m) in width, having one side open, shall have at least one stair-railing system on the open side. 7.2.3 Stairways not exceeding 44 inches (1.1m) in width, and having both sides open, shall have one stair-railing system on each side. 7.2.4 Stairways of more than 44 inches (1.1m) in width, but not exceeding 88 inches (2.2m) in width, shall have one handrail on each enclosed side and one stair-railing system on each open side. 7.2.5 Stairways more than 88 inches (2.2m) in width, shall have one handrail on each enclosed side, one stair-railing system on each open side, and one intermediate stair-railing system located approximately midway of the width of the stairway.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>6.3</td>
<td>Width of stairs: min. 22&quot;</td>
<td>Fixed stairs shall have a minimum clear width of 22 inches (559mm).</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>6.5</td>
<td>Tread depth and riser height depend on slope Rise height: max. 9.5&quot;</td>
<td>Any uniform combination of tread-riser dimensions shall be used that results in a stairway at an angle to the horizontal within the permissible range; but minimum tread depth and maximum riser height shall be nine and one-half inches (241mm).</td>
</tr>
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<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>6.6</td>
<td>Nosings: max. 1.5&quot; (38 mm)</td>
<td>Nosings shall have an even leading edge and not extend more than one and one-half inches (38mm) beyond the face of the lower riser.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>E6.8</td>
<td>Variation of treads: 3.16&quot; Tolerance between treads:3.8&quot;</td>
<td>Variation in excess of 3/16 inches (4.8 mm) in the depth of adjacent treads or in the height of adjacent risers should be avoided. The tolerance between the largest and smallest riser or between the largest and smallest tread should not exceed 3/8 inches (9.5 mm) in any flight.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>ANSI A1264.1-2007</td>
<td>E6.9</td>
<td>Height of flights: 12ft–15ft (3660–4500 mm)</td>
<td>Flights (runs) of stairs are generally 12 feet (3.66m) vertical between landing, but not more than 15 feet (4.5m).</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.24(g)</td>
<td>Stairway platform: min 30 inches</td>
<td>&quot;Stairway platforms.&quot; Stairway platforms shall be no less than the width of a stairway and a minimum of 30 inches in length measured in the direction of travel.</td>
</tr>
<tr>
<td>Stair</td>
<td>Shape</td>
<td>OSHA 1910.24</td>
<td>1910.24(f)</td>
<td>Slip-resistant treads</td>
<td>&quot;Stair treads.&quot; All treads shall be reasonably slip-resistant and the nosings shall be of nonslip finish. Welded bar grating treads without nosings are acceptable providing the leading edge can be readily identified by personnel descending the stairway and provided the tread is serrated or is of definite nonslip design. Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.24(i)</td>
<td>Vertical clearance: min. 7 feet</td>
<td>&quot;Vertical clearance.&quot; Vertical clearance above any stair tread to an overhead obstruction shall be at least 7 feet measured from the leading edge of the tread.</td>
</tr>
<tr>
<td>Stair</td>
<td>Material</td>
<td>OSHA 1910.24</td>
<td>1910.24(C)</td>
<td>Load: min. 1000 pounds</td>
<td>&quot;Stair strength.&quot; Fixed stairways shall be designed and constructed to carry a load of five times the normal live load anticipated but never of less strength than to carry safely a moving concentrated load of 1,000 pounds.</td>
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<td>Items</td>
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<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Stair</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td></td>
<td></td>
<td>Stairways in escape routes shall be designed to allow for transportation of injured personnel by use of standard stretchers (length x width = 2 200 mm x 650 mm).</td>
</tr>
<tr>
<td>Stair</td>
<td>Shape</td>
<td>NORSOK C-002</td>
<td>5.3</td>
<td>Pitch: max. 38°</td>
<td>The maximum pitch of stairs shall not exceed 38°.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>5.3</td>
<td>Rise height: max. 190 mm</td>
<td>The maximum rise shall be 190 mm.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>5.3</td>
<td>Step overlap: min. 20 mm</td>
<td>Treads shall be evenly spaced. The maximum allowable deviation of the rise dimension in a single flight of stairs is +/-5 mm, including the first and last riser of every flight. Stairs for areas requiring installation contingency, may incorporate an adjustment facility. The projection of the treads shall overlap one another with minimum 20 mm.</td>
</tr>
<tr>
<td>Stair</td>
<td>Dimension</td>
<td>NORSOK C-002</td>
<td>5.5</td>
<td>Max. 16 rises</td>
<td>There shall be a maximum of 16 risers in any single stair flight. There shall be a minimum of two risers for any flight in a stair that has more than one flight. In long, straight stairways, after a maximum of 36 risers in consecutive flights, there shall be a change in direction of minimum 30°, or a landing of minimum 2 000 mm length.</td>
</tr>
<tr>
<td>Stair</td>
<td>Material</td>
<td>NORSOK C-002</td>
<td>5.6</td>
<td>2 000 N (200 kg)/100 mm x 100 mm</td>
<td>Treads shall withstand a foot load of 2 000 N (200 kg) on an area of 100 mm x 100 mm at any position without permanent deflection.</td>
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<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Stair</td>
<td>Material</td>
<td>AS1657-2013</td>
<td>7.1.1</td>
<td>Min. 1.5 kN/100 mm x 100 mm</td>
<td>Stairways and integral landings shall be designed for the dead load of the stairway structure plus a superimposed live loading of not less than 2.5 kPa uniformly distributed on each tread and landing. The maximum deflection shall be L/100 or 40 mm, whichever is the lesser, over the horizontal span (L) of the stairway between supports, including landings where provided. Where the stairs are likely to be loaded in excess of the above requirements, the loading shall be based on the requirements of AS/NZS 1170.1 for imposed actions. Treads shall be designed for a distributed loading of not less than 2.2 kN per linear metre of stair tread width or a concentrated loading of not less than 1.5 kN applied through a 100 mm x 100 mm steel pad, whichever loading produces the more adverse effect. The load shall be applied at the centre of the tread span. In all cases the design actions for stairways shall be determined using load factors and combination of actions according to AS/NZS 1170.0.</td>
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<td>AS/NZS 1170.0.</td>
</tr>
<tr>
<td>Stair</td>
<td>Material</td>
<td>AS1657-2013</td>
<td>7.2.1</td>
<td>Width: min. 600 mm Angles: 20°-45°</td>
<td>Stairways shall be not less than 600 mm wide, measured between the inside edges of the stiles. The clear space between handrails and midrails shall be not less than 550 mm. The angle of slope between the stiles and the horizontal shall be not less than 20° and not greater than 45° (see Figure 2.1).</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
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<tr>
<td>Stair</td>
<td>Material</td>
<td>AS1657-2013</td>
<td>7.2.3.2</td>
<td>Rise: 130–225 mm</td>
<td>All risers and all goings in the same flight of stairs shall be of uniform dimensions within a tolerance of ±5 mm.</td>
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<td>Going: 215–355 mm</td>
<td>NOTE: In some cases it may be necessary to modify the landing at the base of the stairway to achieve uniformity in the risers.</td>
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<td>Tread gap: max. 30 mm ≤ (2R + G) ≤700</td>
<td>A riser (R) shall be not less than 130 mm and not greater than 225 mm. The going (G) shall be not less than 215 mm and not greater than 355 mm. The going shall not be greater than the tread depth (TD) plus a maximum gap of 30 mm between the rear edge of one tread and the nosing of the tread above.</td>
</tr>
<tr>
<td>Ladder</td>
<td>Material</td>
<td>EN ISO 14122-4</td>
<td>4.2.1.1</td>
<td>Maximum deflection: 50 mm</td>
<td>The ladder elements are considered to fulfil the requirements mentioned in 4.2.1 when they meet the requirements of EN 131-2. The maximum deflection as indicated in 5.1 shall not exceed 50 mm.</td>
</tr>
<tr>
<td>Ladder</td>
<td>Material</td>
<td>EN ISO 14122-4</td>
<td>4.2.2.2</td>
<td>3000 N per stile</td>
<td>The anchoring points and connections to them shall be capable of supporting 3000 N per stile. Up to four anchorages may be considered to contribute to this support. See 5.5 for the test method.</td>
</tr>
<tr>
<td>Ladder</td>
<td>Shape</td>
<td>EN ISO 14122-4</td>
<td>4.3.1</td>
<td>Fall protection device:</td>
<td>The ladder shall be fitted with a fall protection device when: a) height of the ladder flight is more than 3000 mm; b) height of the ladder is 3000 mm or less, but at the departure area there is the risk of falling an additional distance. In this case, the total distance of fall from the upper level of the ladder could be more than 3000 mm.</td>
</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>EN ISO 14122-4</td>
<td>4.4.1.1</td>
<td>Spacing between the rungs: 225–300 mm</td>
<td>The spacing between successive rungs shall be constant and shall be between 225 mm and 300 mm.</td>
</tr>
<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
<td>Requirement summary</td>
<td>Requirement full text</td>
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</tbody>
</table>
| Ladder   | Dimension  | EN ISO 14122-4       | 4.4.1.2 | Spacing between rungs and the departure and arrival area.                              | - Departure: 225–300 mm  
- Arrival: max. 400 mm  
- Gap between the walking surface and the ladder: max. 75 mm  

The distance between the walking surface of the departure area and the first rung shall not exceed the spacing between two consecutive rungs.  

NOTE) In case of mobile machinery to be used on uneven ground, the distance between the walking surface of the departure area and the first rung may be 400 mm max.  

The top rung shall be positioned at the same level as the walking surface of the arrival area (see Figure 6a). If the gap between the walking surface and the ladder is greater than 75 mm, a floor extension shall be provided at the arrival area to reduce this gap. |
<p>| Ladder   | Shape      | EN ISO 14122-4       | 4.4.2.1 | Polygonal and U-shaped rungs                                                          | Polygonal and U-shaped rungs shall be positioned so that the tread walking surface is horizontal (see Figure 6.b, 6.c and 6.d).                                                                                     |
| Ladder   | Dimension  | EN ISO 14122-4       | 4.4.2.2 | Clear width between the two stiles: 400–600 mm                                        | The clear width between the two stiles shall be between 400 mm and 600 mm (see Figure 4). However, a shorter length between 300 mm and 400 mm is permissible, in cases where the immediate environment makes it impossible to use 400 mm. Before a shorter length is considered a check should be carried out to see if it is possible to find a more favourable position for the ladder allowing a clear width of 400 mm or more. |
| Ladder   | Dimension  | EN ISO 14122-4       | 4.4.2.2 | Rungs of fixed ladders with one stile                                                 | The clear width between the stile and the protective device against slipping-off shall be between 150 mm and 250 mm and the thickness of the stile shall not be more than 80 mm (see Figure 5).                                    |
| Ladder   | Dimension  | OSHA 1910.24         | 1910.27(a) (1)(i) | Load: 200 pounds                                                              | The minimum design live load shall be a single concentrated load of 200 pounds.                                                                                                                                  |</p>
<table>
<thead>
<tr>
<th>Items</th>
<th>Parameters</th>
<th>Regulations/standard</th>
<th>Clause</th>
<th>Requirement summary</th>
<th>Requirement full text</th>
<th>Relevant references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(b)(1)(i)</td>
<td>Rung diameter: 3–4 inches</td>
<td>All rungs shall have a minimum diameter of three-fourths inch for metal ladders, except as covered in paragraph (b)(7)(i) of this section and a minimum diameter of 1 1/8 inches for wood ladders.</td>
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</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(b)(1)(ii)</td>
<td>Between rungs: max. 12 inches</td>
<td>The distance between rungs, cleats, and steps shall not exceed 12 inches and shall be uniform throughout the length of the ladder.</td>
<td></td>
</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(b)(1)(iii)</td>
<td>Length of rung: min. 16 inches</td>
<td>The minimum clear length of rungs or cleats shall be 16 inches.</td>
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</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(c)(4)</td>
<td>Clearance in back of ladder: min. 7 inches</td>
<td>&quot;Clearance in back of ladder.&quot; The distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than 7 inches, except that when unavoidable obstructions are encountered, minimum clearances as shown in figure D-3 shall be provided.</td>
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</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(c)(5)</td>
<td>Clearance in back of grab bar: min. 4 inches</td>
<td>&quot;Clearance in back of grab bar.&quot; The distance from the centerline of the grab bar to the nearest permanent object in back of the grab bars shall not be less than 4 inches. Grab bars shall not protrude on the climbing side beyond the rungs of the ladder which they serve.</td>
<td></td>
</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(d)(3)</td>
<td>Ladder extensions</td>
<td>&quot;Ladder extensions.&quot; The side rails of through or side-step ladder extensions shall extend 3 1/2 feet above parapets and landings. For through ladder extensions, the rungs shall be omitted from the extension and shall have not less than 18 nor more than 24 inches clearance between rails. For side-step or offset fixed ladder sections, at landings, the side rails and rungs shall be carried to the next regular rung beyond or above the 3 1/2 feet minimum (fig. D-10).</td>
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<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
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<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>OSHA 1910.27</td>
<td>1910.27(d)(2)</td>
<td>Max height of fixed ladder: 30 feet</td>
<td>&quot;Landing platforms.&quot; When ladders are used to ascend to heights exceeding 20 feet (except on chimneys), landing platforms shall be provided for each 30 feet of height or fraction thereof, except that, where no cage, well, or ladder safety device is provided, landing platforms shall be provided for each 20 feet of height or fraction thereof. Each ladder section shall be offset from adjacent sections. Where installation conditions (even for a short, unbroken length) require that adjacent sections be offset, landing platforms shall be provided at each offset.</td>
<td></td>
</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>ANSI A14.3</td>
<td>5.1.2</td>
<td>length of rung: min. 16 inches</td>
<td>Width. The minimum inside clear width of step surface for steps and rungs shall be 16 inches, and this width shall be uniform in the same length of climb (see Fig. 6).</td>
<td></td>
</tr>
<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>ANSI A14.3</td>
<td>5.1.1</td>
<td>Between rungs: max. 12 inches</td>
<td>Steps and rungs shall not exceed 12 inches on centers, and this spacing shall be uniform in the same length of climb (see Fig. 6)</td>
<td></td>
</tr>
<tr>
<td>Safety cage</td>
<td>Material</td>
<td>EN ISO 14122-4</td>
<td>4.2.1.2</td>
<td>Deformation: max 10 mm</td>
<td>The safety cage is considered to meet these requirements if the permanent deformation as the result of a vertical load of 1000 N is not more than 10 mm and as the result of a horizontal load of 500 N is not more than 10 mm.</td>
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<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
<td>Clause</td>
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<tr>
<td>Safety cage</td>
<td>Shape</td>
<td>EN ISO 14122-4</td>
<td>4.3.2</td>
<td>Two main alternatives: safety cages or fall arresters</td>
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<td>Two main alternatives for protection of the users of fixed ladders against falls from a height are safety cages or fall arresters:</td>
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<td>— The cage shall be the required choice, as it is a means which is always present and the actual safety function is independent of the operator's actions,</td>
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<td>— Where it is not possible to use a cage, individual protective equipment shall be provided. The fall arrester is only effective if the user chooses to use it. If a harness with an incompatible sliding system is used with a guided type fall arrester, there will be a risk (requirements for information for use see Clause 6).</td>
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<td>A fall arrester shall be designed only for low frequency and specialised access (e.g. maintenance).</td>
<td></td>
</tr>
<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>EN ISO 14122-4</td>
<td>4.5</td>
<td>lowest part of safety cage: 2200–3000 mm</td>
<td></td>
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<td>The lowest part of safety cage, e.g. the lowest hoop shall start at a height of between 2200 mm and 3000 mm above the departure area.</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>EN ISO 14122-4</td>
<td>4.5</td>
<td>Clear distances within the hoop: 650–800 mm  Distance from the surrounding structure: 325–400 mm</td>
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<td>The clear distances within the hoop of the safety cage shall be between 650 mm and 800 mm (see Figure 4.c). This applies equally to non-circular as well as circular safety cages. The distance from the rung to the safety cage shall be between 650 mm and 800 mm (see Figure 4.d). With regard to the ladder axis, the distance from the surrounding structure in the absence of a safety cage shall be between 325 mm and 400 mm (see Figure 4.d).</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>EN ISO 14122-4</td>
<td>4.5</td>
<td>Clearance within the cage: 500–700 mm (rungs between the inside face of the cage)</td>
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<td>The clearance within the cage at the arrival area, measured along the transverse axis of the ladder rungs between the inside face of the cage shall be between 500 mm and 700 mm (see Figure 4.c).</td>
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<td>Items</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>EN ISO 14122-4</td>
<td>4.5</td>
<td>Distance between two hoops: max. 1500 mm Distance between two uprights: max. 300 mm</td>
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<td>The distance between two hoops shall not exceed 1500 mm and the distance between two uprights on the cage shall not exceed 300 mm. The hoops shall be placed at right angles to the uprights on the cage. The safety cage uprights shall be fixed to the inside of the hoop and be equally spaced.</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>EN ISO 14122-4</td>
<td>4.5</td>
<td>Spacing of safety cage: max. 0.4 m²</td>
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<td>The spacing of safety cage components shall be designed so that the empty spaces are in any case not more than 0.4 m².</td>
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<tr>
<td>Safety cage</td>
<td>Shape</td>
<td>EN ISO 14122-4</td>
<td>4.7.1.2</td>
<td>If the horizontal distance to the guard-rail of the raised departure area is not more than 1500 mm, the guard-rail shall be fitted with an extension or the structure of the cage shall be extended down to the guard-rail (see Figure 8).</td>
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<td>The top of the extension shall at least meet the following requirements:</td>
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<td>— no dimension between the cage and the extension shall exceed 400 mm, or</td>
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<td>— it shall have an angle, formed by the vertical and a straight line linking the upper section of the extension to the nearest part of the safety cage of 45 degrees or more.</td>
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<td>The components shall be positioned so that:</td>
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<td>— horizontal width of any space is not more than 300 mm and,</td>
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<td>— area of a free space is ≤ 0.4 m².</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(d)(1)(ii)</td>
<td>Cages height: 20 feet – 30 feet</td>
<td>Cages or wells (except as provided in subparagraph (5) of this paragraph) conforming to the dimensions shown in figures D-7, D-8, and D-9 shall be provided on ladders of more than 20 feet to a maximum unbroken length of 30 feet.</td>
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<td>Regulations/standard</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(d) (1)(iii)</td>
<td>Cages extending to up: min. 42 inches</td>
<td>Cages shall extend a minimum of 42 inches above the top of landing, unless other acceptable protection is provided.</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.27(d) (1)(iv)</td>
<td>Cages extending to down: 7–8 feet</td>
<td>Cages shall extend down the ladder to a point not less than 7 feet nor more than 8 feet above the base of the ladder, with bottom flared not less than 4 inches, or portion of cage opposite ladder shall be carried to the base.</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>ANSI A14.3</td>
<td>4.1.3</td>
<td>Cages height: 24 feet – 50 feet</td>
<td>A cage, well, or ladder safety device shall be provided where a single length of climb is greater than 24 feet but does not exceed 50 feet (see Fig. 4).</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>ANSI A14.3</td>
<td>5.3.2.1</td>
<td>Cages extending to up: min. 42 inches (3 feet 6 inches)</td>
<td>The side rails of through or side-stepladders shall extend 3 feet 6 inches above the top of the access/egress level or landing platform served by the ladder (see Fig. 8,9, and 10). For a parapet ladder, the access legress level shall be the roof if the parapet is cut to permit passage through the parapet; if the parapet is continuous, the access/egress level shall be the top of the parapet (see Fig. 9)</td>
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<tr>
<td>Safety cage</td>
<td>Dimension</td>
<td>ANSI A14.3</td>
<td>6.1.2.4</td>
<td>Cages extending to down: 7–8 feet</td>
<td>The bottom of the cage shall be at a level not less than 7 feet or more than 8 feet above the point of access/egress to the bottom of the ladder. The bottom of the cage shall be flared not less than 4 inches all around within the distance between the bottom horizontal band and the next higher band (see Fig. 16). were practical difficulties are encountered, cages may start at 10 feet above the point of access/egress. of 3 feet 6 inches above the top of the platform, or the point of access/egress at the top of the ladder, with provision for access/egress to the platform or point of access/egress (see Fig. 16).</td>
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<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>7.4.2.1</td>
<td>Clear width between the two stiles: 375–525 mm</td>
<td>The clear width between stiles shall be not less than 375 mm and not greater than 525 mm.</td>
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<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>7.4.2.2</td>
<td>Cross-section: 40-80 mm</td>
<td>The cross-section profile of the stile may be of any shape, provided it fits within a circle not greater than 80 mm and not less than 40 mm diameter.</td>
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<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>7.4.3.1</td>
<td>Diameter of rung: min. 20 mm</td>
<td>The surface of rungs shall be slip resistant (e.g. corrugated, serrated, knurled, dimpled or coated with a slip-resistant material). Rungs shall be securely connected to the stiles and shall not rotate. Rungs shall be not less than 20 mm diameter and not greater than 50 mm diameter</td>
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<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>7.4.3.2</td>
<td>Spacing between rungs: 250–300 mm</td>
<td>Rungs shall be spaced as follows: (a) For ladders having a length greater than 1 m, a rung spacing of not less than 250 mm, or greater than 300 mm. (b) For ladders having a length less than or equal to 1 m, rungs shall be evenly spaced but not greater than 300 mm apart.</td>
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<tr>
<td>Ladder</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>7.4.3.4</td>
<td>Distance between bottom rung/tread and bottom landing: 90%–100% of space btw rungs</td>
<td>The distance between the bottom rung/tread and the bottom landing shall be not less than 90% and not greater than 100% of the rung/tread spacing (see Figure 7.5).</td>
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| Safety cage   | Dimension  | AS1657-2013          | 7.4.3.7| Opening: max. 150 mm| (a) The inside of the cage shall be free from projections. 
(b) The ladder cage shall be constructed so that any opening does not permit a 150 mm sphere to pass through it. 
(c) The cage shall extend not less than 1000 mm or to the height of the guardrail (if provided) above the top of the platform landing. 
(d) The bottom of the cage shall terminate not less than 2000 mm or more than 2200 mm above the base of the ladder. 
(e) Where the bottom of the ladder terminates at a platform fitted with guardrailing that is less than 900 mm horizontally from the front of the ladder, the area between the cage and the top of the guardrailing shall be guarded to provide sufficient edge protection. |
<p>| Safety cage   | Dimension  | AS1657-2013          | 7.4.3.7| Sectional dimensions of cage: 750 mm| (g) The rear half of the cage shall be approximately semicircular. The sectional dimensions of the cage shall provide an internal width of 700 mm and a clearance of 750 mm between the back of the cage and the front of the rungs, measured at 90° to the slope of the ladder. |
| Grating       | Dimension  | EN ISO 14122-2       | 4.2.4.4| Diameter Manned area: 20 mm Un manned area: 35 mm| The flooring of a working platform or walkway shall only have such maximum openings that a ball with a diameter of 35 mm cannot fall through; floorings above a place where people are working, as opposed to occasional passage, shall have such maximum openings that a ball with a diameter of 20 mm cannot fall through unless the same safety is guaranteed by other suitable means. |
| Grating       | Shape      | EN ISO 14122-2       | 4.2.4.6| Non Slip| Floorings shall have a surface finish which is designed to reduce the risk of slipping. Whilst waiting for the European standards on enhanced slip resistance, see informative annex A. |</p>
<table>
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<th>Items</th>
<th>Parameters</th>
<th>Regulations/standard</th>
<th>Clause</th>
<th>Requirement summary</th>
<th>Requirement full text</th>
<th>Relevant references</th>
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</thead>
<tbody>
<tr>
<td>Grating</td>
<td>Dimension</td>
<td>NORSOK C-002, Edition 3, June 2006</td>
<td>5.6</td>
<td>Diameter</td>
<td>Grating openings shall not allow a 20 mm diameter ball to pass through at any point. This applies above places where personnel are likely to be present. Otherwise 35 mm diameter is acceptable. Low-density punched plate shall be used for treads and landings in external areas where open grating is not suitable. Maximum openings in the plate shall be as above.</td>
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<tr>
<td>Grating</td>
<td>Shape</td>
<td>NMA Construction regulation</td>
<td>§14 3.8</td>
<td>Diameter: 15 mm</td>
<td>The openings of the grating shall be so small that a ball of 15 mm diameter will not fall through.</td>
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<tr>
<td>Grating</td>
<td>Material</td>
<td>NORSOK C-002, Edition 3, June 2006</td>
<td>5.6</td>
<td>Withstand a foot load of 2 000 N (200 kg)</td>
<td>Treads shall withstand a foot load of 2 000 N (200 kg) on an area of 100 mm x 100 mm at any position without permanent deflection.</td>
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<tr>
<td>Grating</td>
<td>Shape</td>
<td>NORSOK C-002, Edition 3, June 2006</td>
<td>5.6</td>
<td>Non-slip checkered plate</td>
<td>Non-slip checkered plate</td>
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<tr>
<td>Grating</td>
<td>Material</td>
<td>EN ISO 14122-2</td>
<td>4.2.5</td>
<td>2 kN/m²</td>
<td>2 kN/m² under distributed load for the structure; 1,5 kN concentrated load applied in the most unfavourable position over a concentrated load area of 200 mm x 200 mm for the flooring. When loaded with the design load, the deflection of the flooring shall not exceed 1/200th of the span and the difference between the loaded and a neighbouring unloaded flooring shall not exceed 4 mm in height.</td>
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<tr>
<td>Grating</td>
<td>Dimension</td>
<td>NORSOK S-002, Rev. 4, August 2004</td>
<td>Annex B</td>
<td>Diameter</td>
<td>Maximum opening in grating: Ø 20 mm Grating shall not allow a ball with greater diameter to fall through. Applies above places with presence of persons, otherwise Ø 35 mm.</td>
<td>NORSOK C-002</td>
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<tr>
<td>Items</td>
<td>Parameters</td>
<td>Regulations/standard</td>
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<tr>
<td>Grating</td>
<td>Dimension</td>
<td>OSHA 1910.24</td>
<td>1910.23(a)(9)</td>
<td>Diameter: 1 inch</td>
<td>Every floor hole into which persons cannot accidentally walk (on account of fixed machinery, equipment, or walls) shall be protected by a cover that leaves no openings more than 1 inch wide. The cover shall be securely held in place to prevent tools or materials from falling through.</td>
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<tr>
<td>Grating</td>
<td>Dimension</td>
<td>AS1657-2013</td>
<td>3.2.3.4</td>
<td>Opening diameter: max. 45 mm (max. 5000 mm²) Gap: max. 10 mm</td>
<td>For grating and expanded metal flooring, the smallest dimension of any opening shall not exceed 45 mm and the area of any opening shall not exceed 5000 mm². Any gap between adjacent made-up sections of grated floor shall not exceed 10 mm. The gap may be of any length. Where straightedge bars are not fitted, the size of any opening at the joint between adjacent panels shall not exceed the requirements for openings in the grating, as given in Figure 3.1.</td>
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</table>
CHANGES - HISTORIC

There are currently no historical changes for this document.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16 000 professionals are dedicated to helping our customers make the world safer, smarter and greener.