

Architectural components and equipment

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Foreword

The NORSOK standards are developed by the Norwegian petroleum industry to ensure adequate safety, value adding and cost effectiveness for petroleum industry developments and operations. Furthermore, NORSOK standards are, as far as possible, intended to replace oil company specifications and serve as references in the authorities' regulations.

The NORSOK standards are normally based on recognised international standards, adding the provisions deemed necessary to fill the broad needs of the Norwegian petroleum industry. Where relevant, NORSOK standards will be used to provide the Norwegian petroleum industry input to the international standardisation process. Subject to development and publication of international standards, the relevant NORSOK standard will be withdrawn.

The NORSOK standards are developed according to the consensus principle generally applicable for most standards work and according to established procedures defined in NORSOK A-001N.

The NORSOK standards are prepared and published with support by the Norwegian Oil and Gas Association, The Federation of Norwegian Industries, Norwegian Shipowners' Association and The Petroleum Safety Authority Norway.

NORSOK standards are administered and published by Standards Norway.

This NORSOK standard has been written and revised by the NORSOK committee EG C.

Main changes from the third edition to the fourth edition are in summary:

- inclusion of new operational experience feedback from recent projects;
- revision of the clause related to normative and informative references;
- revision of the clause related to common requirements, including certification, penetrations and tagging;
- revision of structural requirements related to hand- and guardrails;
- revision of the clause related to doors, including hinged doors, sliding doors, threshold heights, external doors, watertight doors and doors to HVDC converter modules;
- revision of the clause related to windows, including fire rating, thermal insulation, acoustic requirements, HTCC windows and wheel house windows;
- revision of the clause related to insulation, including insulation types, protective cover, fire insulation and acoustic cassettes;
- revision of the clause related to prefabricated wall systems, including structural reinforcement and louvered panels;
- revision of the clause related to floating floors, including water resistance and installation;
- revision of the clause related to floor finishes, including carpets, PVC, synthetic shock absorbent deck covering, and electrical insulation mats;
- revision of the clause related to raised access floor, including airflow panels and floor finishes/skirting;
- revision of the clause related to prefabricated bathrooms, including sanitary fixture, accessories, electrical and service shaft;
- revision of the clause related to provision stores, including general requirements, floors, walls and ceilings, shelves and refrigeration system;
- revision of the clause related to kitchen, catering and laundry equipment, including design and fabrication (plinth height) and plumbing requirements;
- revision of the clause related to furniture, equipment and accessories, including cabin furniture, shoe drying cabinets, curtains, production laboratory furniture and miscellaneous equipment/accessories;
- revision of the clause related signs, including general requirements, sign related to general information and orientation, platform ID signs;
- Annex A (normative): Revised data sheets;

Introduction

This NORSOK standard is based on current technology and practical experiences accumulated from the offshore petroleum industry. The standard sets the framework for the design, engineering, fabrication and installation of architectural materials, components and equipment to be used offshore.

1 Scope

This NORSOK standard defines the minimum functional requirements for design and construction of architectural components and equipment to be installed and used on offshore installations in the petroleum industry.

This NORSOK standard is primarily applicable to permanent offshore installations. The standard may also be used for mobile installations for which, however, other requirements may be applicable.

2 Normative and informative references

The following standards include provisions and guidelines, which through reference in this text, constitute provisions and guidelines of this NORSOK standard. Latest issue of the references shall be used unless otherwise agreed. Other recognized standards may be used provided it can be shown that they meet the requirements of the referenced standards.

2.1 Normative references

EN 1993, Eurocode 3: *Design of steel structures*
 EN 1999, Eurocode 9: *Design of aluminium structures*
 EN 10025-1, *Hot rolled products of structural steels – Part 1: General technical delivery conditions*
 EN 10025-3, *Hot rolled products of structural steel – Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*
 EN 12600, *Glass in building – Pendulum test – Impact test method and classification for flat glass*
 EN 13501-1, *Fire classification of construction products and building elements – Classification using test data from reaction to fire tests*
 ISO 62, *Plastics – Determination of water absorption*
 ISO 354, *Acoustics – Measurement of sound absorption in reverberation room*
 ISO 717-1, *Acoustics – Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation*
 ISO 10140-1, *Acoustics – Laboratory measurement of sound insulation of building elements – Part 1: Application rules for specific products*
 ISO 14122 (all parts), *Safety of machinery – Permanent means of access to machinery*
 ISO 15138, *Petroleum and natural gas industries - Offshore production installations - Heating, ventilation and air-conditioning*
 ISO 16283-1, *Acoustics – Field measurement of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation*
 IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*
 IEC 61511 (all parts), *Functional safety – Safety instrumented system for the process industry sector*
 EU Marine equipment Directive (MED), *“Wheelmark” certification of products used on board ships*
 IMO FTP Code, *International code for application of fire test procedures (2010 FTP Code)*
 NORSOK C-001, *Living quarters area*
 NORSOK C-004, *Helicopter deck on offshore installations*
 NORSOK H-003, *Heating, ventilation and air conditioning (HVAC) and sanitary systems*
 NORSOK M-101, *Structural steel fabrication*
 NORSOK M-102, *Structural aluminium fabrication*
 NORSOK M-120, *Material data sheets for structural steel*
 NORSOK M-121, *Aluminium structural material*
 NORSOK M-501, *Surface preparation and protective coating*
 NORSOK R-002, *Lifting equipment*
 NORSOK R-004, *Piping and equipment insulation*
 NORSOK S-001, *Technical safety*
 NORSOK S-002, *Working environment*
 DNV-RP-C205 *Environmental conditions and environmental loads*
 NMA, *Regulations for mobile offshore units, No. 878 concerning stability, watertight subdivisions and watertight/weather tight closing means on mobile offshore units*
 PSA, *Guidelines regarding the facilities regulations*
 SOLAS, *International convention for the safety of life at sea*

2.2 Informative references

None.

3 Terms, definitions and abbreviations

For the purposes of this NORSOK standard, the following terms, definitions and abbreviations apply.

3.1 Terms and definitions

3.1.1

can

verbal form used for statements of possibility and capability, whether material, physical or casual

3.1.2

cassette wall system

prefabricated cassette wall system, comprising louvered and plated (explosion relief or fixed) panels in various combinations, with vertical or horizontal supports, internal drainage system, sound attenuators, built-in frames, reinforcements, penetrations, flashings, trims, lifting lugs, fixings and all other materials and work required for a successful installation on the specified location

3.1.3

ceiling system

modularised ceiling system, compatible with the wall system, and being either suspended or self-supporting, with all necessary reinforcements, frames, insulation and installation aids

3.1.4

clear opening height

net vertical distance between threshold/floor/deck finish and inside of frame

3.1.5

clear opening width

net horizontal distance between insides of frame

3.1.6

clear width

unobstructed horizontal distance between two opposing surfaces or physical objects

3.1.7

conductive flooring

floor covering with the ability to conduct electric current, equal to the reciprocal of the resistance of the material, measured in 10^4 to 10^5 Ohms resistance.

3.1.8

dry fix insulation

certified, incombustible insulating material which is supplied in a dry, stable and ready-to-use state from the manufacturer without requiring any further preparation or treatment before application, as opposed to spray-on insulation

3.1.9

external prefabricated wall

external, prefabricated, structurally self-supporting wall system, with built-in penetrations, trims, braces, cut-outs, lifting lugs, supports, equipment, elements, insulation, materials, installation aids, etc., complete and ready for installation on specified external location

3.1.10

flight

sequence of steps between two landings

3.1.11**going**

horizontal distance between the edges of two consecutive nosings

3.1.12**heat shield panels**

prefabricated heat shield panel system comprising stainless steel ladder type frame construction with either stainless steel wire mesh facing sheets, perforated stainless steel plates, or stainless steel expanded metal panels to provide project specific radiant heat flux reduction

3.1.13**internal panel wall system**

internal, prefabricated, structurally self-supporting wall system, with a flat surface, having built-in penetrations, trims, braces, cut-outs, supports, equipment, elements, insulation, materials, installation aids, etc., complete and ready for installation on specified internal location

3.1.14**left and right handed doors**

door leaf location at open position, when viewed from door leaf side of wall/ bulkhead

3.1.15**may**

verbal form used to indicate a course of action permissible within the limits of this NORSOK standard

3.1.16**non-conductive flooring**

floor covering with very low ability to conduct electric current, equal to the reciprocal of the resistance of the material, measured in 10^9 to 10^{11} Ohms resistance

3.1.17**nosing**

top edge at the front of the step

3.1.18**partition system**

modularised wall system, solid skin or double skin cavity system, with all necessary reinforcements, bracings, frames, insulation and installation aids

3.1.19**penetration dossier**

project specific document containing standardised detailing and description of electrical, piping and HVAC penetrations through fire rated and non-fire rated divisions such as walls, decks, roofs, etc., that are part of a physical module

3.1.20**pitch**

angle between the pitch line and its projection on the horizontal surface

3.1.21**pitch line**

straight line touching the top of tread nosings

3.1.22**primary stairways**

stairs which are part of major personnel traffic routes and main emergency escape ways

3.1.23**rise**

height between two consecutive tread surfaces

3.1.24**secondary stairways**

all types of stairs, which are not part of major personnel traffic routes and main emergency escape ways, and which do not provide access to machinery and equipment skid

3.1.25**semi-conductive flooring**

floor covering with some ability to conduct electric current, equal to the reciprocal of the resistance of the material, measured in 10^6 to 10^8 Ohms resistance.

3.1.26**shall**

verbal form used to indicate requirements strictly to be followed in order to conform to this NORSOK standard and from which no deviation is permitted

3.1.27**should**

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

3.1.28**spray-on insulation**

certified, incombustible insulating material which is supplied as a semi-wet substance, requiring further preparation, treatment and curing time after application

3.1.29**stringer**

flanking framework element supporting the steps

3.1.30**tread**

horizontal surface on which the foot is placed

NOTE Same as step.

3.1.31**wind shield panels**

a prefabricated windshield panel system, with flat or corrugated trapezoidal shaped profiles, penetrations, flashings, trims, lifting lugs, fixings and all other materials and work required for a successful installation on the specified location

3.2**Abbreviations**

AISI	American Iron and Steel Institute
CAP	critical action panel
CE	Conformité Européenne
EDS	electric driven system
EMC	electromagnetic compatibility
FAT	fabrication acceptance test
HTCC	helicopter traffic control centre
HVAC	heating, ventilation and air conditioning
HVDC	high-voltage direct current
ID	identity

IGBT	insulated-gate bipolar transistor
IP	ingress protection
LCI	life cycle information
LQ	living quarters (accommodation)
MCT	multi cable transit
NCS	natural colour system
PC	personal computer
PSA	Petroleum Safety Authority
PSV	pressure safety valve
PVC	polyvinyl chloride
NMA	Norwegian Maritime Authority
RAL	colour coding system (Reichausschuss für Lieferbedingungen)
SOLAS	safety of life at sea
TV	television
UHF	ultra high frequency
VHF	very high frequency
ULS	ultimate limit state
UV	ultraviolet

4 Common requirements

4.1 General

This NORSOK standard specifies minimum requirements. Data sheets and schedules shall contain detailed and specific requirements, e.g. type, brand, quantity, capacity, dimensions, etc. The user group shall participate in the selection process, in accordance with operator/company requirements. The equipment lists contained in this NORSOK standard are of a typical/general nature. Project specific data sheets shall be established at an early date by the individual project, as a basis for pricing and further development.

The amount of generated documents in the supply chain should be on an “information-to-need” level to secure correct quality, supply, execution and timely completion within the given budget. Irrelevant documentation should be avoided.

Achieving a fit for purpose level of functionality and safety within the different areas shall be a governing requirement, preferably based on proven record of accomplishment. Minor, necessary details shall be allowed for, even though unspecified in this NORSOK standard or data sheets.

Standard products shall be used, unless a purpose made solution is required. The selection of all furniture, equipment and accessories shall be co-ordinated and standardised on the entire installation, or group of installations within a larger field development, as required.

All architectural supplies described in this NORSOK standard shall be installed as complete and finished units, comprising all the work and materials required for a successful installation and intended use. All components, equipment and elements shall be set plumb and level. The installed work shall be true, clean and free from any faults, marks and damage. It shall withstand severe abuse.

Life cycle costs, design life expectancy and minimal environmental impact shall be given governing attention in selection of components and their detailing.

Suppliers may propose, and correspondingly justify, alternative solutions in order to reduce life cycle costs, provided the level of functionality and safety are maintained.

The work shall always be performed by qualified personnel, and in accordance with the manufacturer's written procedures and instructions.

All supplies shall be properly protected and preserved throughout all project phases. Necessary cleaning shall be performed in accordance with manufacturers' guidelines prior to preservation. Preservation shall be applied in a manner that does not leave tape marks or stains, and shall be easy to remove. The preservation shall not be removed before mechanical completion.

Data sheets and schedules are attached to certain clauses in this NORSOK standard. They shall be used to specify all requirements related to that clause, complete with all accessories and systems. The data sheets and schedules shall be continuously updated throughout the various project phases, until all required information is available before the start of procurement and fabrication activities.

Preliminary and final weight data of equipment and products are required for input to weight reports.

Prototypes and/or preassemblies of purpose made items shall be available for visual inspection and verification prior to delivery. This shall upon request from operator/company, include the following items as a minimum, including any requested FAT:

- cabin(s) including shower/bathroom;
- kitchen purpose made consoles;
- cold table and cold storage room(s);
- standard office arrangement;
- doors;
- coffee bar unit;
- reception unit;
- central control room operator desk and emergency response room operations table;
- laboratory fume cabinets and workstation;
- crane cabin;
- drillers cabin.

The inspections shall be at an early stage to allow for necessary adjustments within the stipulated production schedule.

Structural reinforcement of walls, floors and ceiling constructions shall be included as required.

4.2 Certification

All materials, components and equipment shall have necessary data sheets, test reports and certificates from relevant recognised authorities, confirming compliance with project and regulatory requirements. These certificates shall be compiled in a certification dossier, which shall be handed to operator/company prior to start of fabrication.

Materials used shall in general have low flame spread ability and produce little heat, smoke and toxic substances. The determination of the technical fire qualities of materials shall be based on section 12 in the guidelines to the PSA Facilities Regulations, applicable sections in IMO FTP Code and relevant requirements in NORSOK S-001.

Documentation of acoustic properties shall be in accordance with ISO 16283-1, ISO 10140-1, ISO 354 and ISO 717-1. Applicable clauses in NORSOK S-002 shall be used for noise and vibration control.

4.3 Penetrations

A penetration dossier shall be developed and include penetrations for all areas on the installation.

Penetrations, including field run penetrations shall be of standardised types as far as practical, and located in areas of lowest fire-rating/fire-load. Penetrations shall not reduce the requirements to strength, fire, blast, acoustics, gas and water tightness integrity of the divisions in which they are installed.

All penetrations, including multiple penetrations, shall have valid fire certificates from a recognised authority that document compliance with governing body regulations. Where certificates are not available, test reports from a recognised authority is required, justifying the detailed solution. The penetration dossier shall refer to the certificates compiled in the certification dossier.

Pipe penetrations shall be tested and installed as described in NORSOK R-004.

3D modelling shall include penetrations, where the actual penetration cut out sizes shall be shown.

Penetrations exposed to weather, or are subject to mechanical damage, shall be provided with a suitable cover. Mechanical protection at exposed areas (e.g. transport routes) shall be able to withstand heavy abuse.

Penetrations located in divisions exposed to moisture, weather or frequent hose-down, shall have detailing that will prevent the passage of moisture to the protected side. Special attention is required for cable penetrations through roofs to avoid leakages through MCTs, e.g. by installing MCT frames vertically.

Penetrations located in divisions that act as a barrier between differential design pressures for HVAC, fire and gas systems, etc., shall be sealed to retain the designed over/under pressure.

Any requirements for supplementary insulation or coatings (in addition to the penetration seal) that are necessary to provide certified fire, thermal or acoustic penetration solutions, shall be clearly indicated in the penetration dossier. Where the provision and installation of these additional materials requires preparation during engineering, the detailing of such requirements shall be included on relevant discipline's drawings, (e.g. surface protection, passive fire protection, pinning, etc.).

Multi cable transit penetrations shall have fire insulation at flanges where required to comply with the applicable fire certificate. The detailing shall allow for effective maintenance and re-pulling access of cables. The arrangement shall permit maintenance access without having to remove or replace large sections of lining and insulation.

Penetration types for cables, piping and ducting shall be co-ordinated with the relevant disciplines.

Penetrations that are likely to be exposed to excessive movement and vibrations (e.g. those located close to rotating type pumps, emergency generators, etc., or for piping systems where "hammering" effects are likely to occur during commissioning or operation) shall withstand the vibration without functional deterioration. Minimum service clearance to sleeves shall allow for vibrational, mechanical and thermal movement. Mastic type penetration seals shall have the applicable sleeve and pipe surfaces degreased as required, to achieve permanent adhesion.

Dedicated openings for temporary routing of cables adjacent to doors in the construction phase may be considered. Details of these openings, including methods of sealing after use, shall be included in the penetration dossier. Locations shall be agreed with the construction group.

Penetrations in walls located below raised access floors should be grouped together in yard sacrificial plate areas.

In order to avoid hot work, sand blasting and touch-up during later phases, additional penetrations shall be provided for future services in accordance with respective discipline spare capacity requirements.

4.4 Master lock and key suiting system

For new installations, a master lock and key suiting system shall be developed and delivered for the entire installation in accordance with operator/company requirements. For modification projects, any new locking arrangement shall be agreed with operator/company, to match existing lock suiting system on the installation.

A practical key cabinet for storage of keys and spare keys shall be part of the supply. The name of the installation, operator/owner, room name and number shall be inscribed on the key holders, or as agreed with operator/company. Certain key holders shall have the lifeboat station number included, if applicable.

Three coded and labelled keys per lock shall be issued directly to the operator/owner.

The key cylinders and locks shall be adjusted to allow for a smooth locking function. Keys shall have a smooth fit in their cylinders to reduce breakage.

Rooms and areas within the LQ, inclusive cabin doors and external doors, shall be temporary lockable in the final construction phase to prevent unauthorized access. This principle is also applicable to other rooms and areas on the installation. All details shall be clarified with operator/company.

See clause 7 for further requirements to door locks.

4.5 Materials

All materials shall be resistant to corrosion in a saline environment. The materials, components and equipment shall be as light as possible, without adversely affecting compliance with relevant functional and safety requirements. Alternative materials may be used for all supplies, providing they comply with relevant requirements.

Drilling through fire-rated deck head plates or floating floors is not acceptable as a fixing method for materials and equipment.

Components specified with brushed stainless steel finish should have a grit of 180–220 to ease cleaning.

Materials and processes shall not emit dust, fumes or other contaminants or toxic substances, which may impair health. A list of chemicals applicable to each supply is required. The list shall include adhesives, finishes, filler material and required cleaning and maintenance agents. Selection and documentation of hazardous chemicals shall satisfy the requirements of NORSOK S-002.

4.6 Static electricity

Objects that may collect an electrical charge shall be earthed or bonded.
Reference also NORSOK S-001.

4.7 Identification

Each major component, furniture and equipment item shall be provided with a discreetly placed and securely fixed nameplate showing the manufacturer's name, equipment type, model, serial number, fire rating, etc., as appropriate. Doors and windows with B-rating or stricter, shall have the relevant fire certificate number included on the identification plate. Rated penetrations shall have identification of applicable fire rating with reference to relevant certificate number.

Equipment with environmental declaration marking shall be selected, where applicable.

4.8 CE marking

CE marking and provision of documentation shall be in accordance with regulatory requirements.

4.9 Tagging

Tagging and codes are required for the following items, unless specified otherwise by operator/company:

- doors (all doors with the exception of lightweight B type doors that are not connected to a system);
- control cabinets;
- air reservoirs;
- kitchen and laundry equipment connected to various systems;
- equipment permanently connected to power supply;
- items connected to instrument air supply;
- medical oxygen systems (permanent, installed type);
- refrigeration systems;
- laboratory gas test system;
- other equipment requiring regular maintenance/documentation for the operational phase.

4.10 Life cycle information

LCI documentation shall be developed, stored and transferred in accordance with operator/company systems and instructions. The information shall be available for engineering, preparations for operations, start-up, maintenance, repair, modifications and decommissioning of equipment and systems.

Most of the LCI is to be submitted to operator/company, while some information is to be retained by the supplier on behalf of operator/company.

All LCI shall be transferable in digital format.

The final LCI shall reflect the as-built status at take-over by the operator/company.

4.11 Installation, operation and maintenance manual

An installation manual shall be included with all supplies as a minimum. Additional operation manual and inspection/maintenance manual shall be included for all components and equipment to be in regular use, or requiring inspection and maintenance.

4.12 Function testing

All installed equipment and systems shall be formally function tested to verify compliance with functional requirements as part of mechanical completion/commissioning activities. Damaged equipment or equipment that does not perform as required, shall be identified in accordance with project procedures, and rectified or replaced immediately. Certain items, as specified by operator/company, shall be factory tested prior to delivery and retested after installation on board.

4.13 Equipment follow up

Each supply shall include a quantity of appropriate paint and/or foil, to allow minor repairs during the installation phase.

4.14 Architectural finishes schedule

A detailed architectural finishes schedule shall be developed for all internal areas, specifying materials, colours, etc. The schedule shall specify the manufacturer coding and colour reference for each proprietary architectural element. The schedule shall also include the colour references for all internal painted surfaces.

Physical sample boards in A3 size shall be provided for the LQ interior, illustrating the proposed materials, finishes and colour scheme for acceptance by the operator/company. Sample boards may also be required in other areas outside the LQ, if specified by operator/company.

Sample boards in digital format with back up of true material samples are acceptable if approved by operator/company.

4.15 Architectural colour coding schedule

4.15.1 General

A detailed architectural colour coding schedule shall be developed for all external areas on the entire installation, and include graphic illustration(s) of the overall view. The schedule may also include parts of the installation that are below water level.

Colours shall be selected to enhance perception of the installation as a coherent whole, emphasise orientation and escape/access routes, and allow for standardisation of topcoat types throughout the installation. Application method shall be part of colour selection criteria.

Stainless steel, metallized carbon steel and aluminium surfaces shall not be painted, unless specified otherwise by the operator/project.

Manufacturers' standard colours shall generally be used for bulk components and equipment packages, where changes will result in a cost increase. A repair/ maintenance procedure shall be supplied for acceptance by the project, where manufacturers' standard topcoats are used.

Topcoats shall be denoted by RAL or NCS coding. The surface shall in general have a minimum reflectance factor of 70 %, except where non-slip surfaces are required, or in areas where low reflectance factors are required, e.g. in control rooms, inside of crane cabins, etc.

Topcoat application shall be in accordance with NORSOK M-501.

Topcoats used in normally non-visible areas such as inside shafts, voids and behind insulation, should have a standardised colour as far as practical throughout the installation. The colour should be white/off-white.

The architectural colour-coding schedule does not cover piping and ductwork systems coding.

Samples of the main topcoat colours shall be provided on request.

4.15.2 Identification and safety colours

Identification and safety colour coding requirements shall take precedence.

Escape routes outside “clean” areas with applied floor finishes shall be marked with traffic yellow RAL 1023.

A uniform approach shall be adopted for safety marking of stairs in external and unmanned area escape routes.

Fire equipment cabinets, firefighters’ equipment containers, firewater equipment cabinets, etc., shall be traffic red RAL 3020. Exempted are firewater cabinets inside the LQ, which may be painted white/off-white with red lettering, to match the interior overall colour scheme better.

First aid cabinets shall be leaf green RAL 6002.

4.16 Company specified items

Operator/company specific requirements deviating from the requirements stated herein should be included as an addendum to this NORSOK standard in the contract documentation. Otherwise, they shall be established during the project by cooperation between the project and the operator/company.

As a minimum, the following items from this clause require specification by the operator/company:

- master lock and key suiting system;
- required prototypes and/or preassemblies of purpose made items;
- tagging of doors;
- user group participation in the selection process for elements and equipment.

5 Stairs

5.1 General requirements

All stairs on a field installation except those providing means of access to machinery or equipment skids shall comply with these requirements.

Other stairs, stepladders and ladders that provide access to machinery or equipment skids shall comply with the requirements of ISO 14122 (all parts).

Stairs shall be provided in daily frequented areas where there is a height difference between levels of more than 350 mm, and where a ramp cannot maintain the functional requirements. A ramp solution shall be used for height differences of less than 350 mm.

Main internal stairways and all emergency stairways are defined as primary stairways. Primary stairways shall be designed to allow for transportation of injured personnel by use of standard stretchers (length x width = 2 200 mm x 650 mm).

Secondary stairways, including spiral stairs and inclined and vertical ladders, may be used for access to isolated areas or areas with little personnel traffic. Inclined ladders shall be used in preference to vertical ladders where space permits.

Selection of materials and construction for internal stairways shall be given due attention to ease cleaning/maintenance, reduce noise impact and provide acceptable reverberation time in the stairwell.

Stairways in areas that may be exposed to hydrocarbon fire shall be in steel.

5.2 Stair width

The minimum clear width of a stairway shall be 1 000 mm measured between the inside of handrails. A width of less than 1 000 mm may be acceptable for secondary stairs with limited traffic, based on individual project justification.

Primary stairways shall have a minimum clear width of 1 200 mm, measured between inside of handrails.

Continuous stairways with access to more than two levels shall be minimum 1 200 mm wide, measured between the inside of handrails.

Stairways to be used by more than 50 persons in an emergency shall be minimum 1 500 mm wide, measured between the inside of handrails.

Wider stairways may be required if specified by the project.

5.3 Stair pitch and proportion

The maximum pitch of stairs shall not exceed 38°. The pitch shall be the same for all flights in a continuous stairway, as far as practically possible.

The following formula is applicable for determining the stair proportion:

GOING + TWICE THE RISE = 630 mm +/- 30 mm

The maximum rise shall not exceed 190 mm.

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.

5.4 Nosing

All nosings shall have a non-slip surface with secure and permanent fixing on top of the flooring material, unless the selected material itself has a built-in nosing. Internal stairs shall have nosings that allow efficient cleaning.

5.5 Flight

There shall be a maximum of 16 risers in any single stair flight.

A minimum of two risers shall be provided for any flight in a stair that has more than one flight.

A change in direction of minimum 30°, or a landing of minimum 2 000 mm length, shall be provided for long straight stairways after a maximum of 36 risers in consecutive flights.

5.6 Treads and landings

Each stairway shall have a landing at the top and bottom of every flight. There shall be an intermediate landing when two or more flights converge between deck levels. The depth of the landing shall not be less than the width of the stair.

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.

Treads and landings for internal stairs shall be constructed in a material suitable for the stair's function and location, e.g. flat plate, flat plate for application of screed and floor finishes, checkered plate, low-density punched hole plate or open grating. The grating shall not allow a 20 mm diameter ball to pass through. Flat plate for application of screed and floor finishes shall be provided for main internal stairways in the LQ.

For external stairs, treads and landings should be made of open grating, complying with the same 20 mm ball restriction as for internal stairs.

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.

Grating types and detailing of stairs shall be coordinated with the method of escape-way marking/painting of the stairs.

Where external stair treads and landings form part of a fire rated deck, all walking surfaces shall be made of non-slip checkered plate. Treads and landing surfaces shall be sloped for drainage as necessary.

All treads shall have a toe plate of minimum 50 mm height. All landings shall have a toe plate of minimum 100 mm height. Openings between toe plate and decks or gratings shall not exceed 10 mm.

The floor finish for internal stairways may cover the sidewalls (stringer) and be finished with a U-shaped profile at the top. Painting of the stringers is also acceptable, unless constructed in aluminium or stainless steel.

5.7 Headroom

Clear headroom (free height) of minimum 2 300 mm shall be maintained in all stairs, measured vertically above the pitch line of the stair.

5.8 Company specified items

Operator/company specific requirements deviating from the requirements stated herein should be included as an addendum to this NORSOK standard in the contract documentation. Otherwise, they shall be established during the project by cooperation between the project and the operator/company.

6 Handrails, guardrails and barriers

6.1 General requirements

This section applies to handrails, guardrails and barriers that are not part of a machine or equipment skid. For handrails, guardrails and barriers that are part of a machine or equipment skid, see ISO 14122 (all parts).

All handrails and guardrails shall be solid for personnel protection, and shall resist the accidental impact of a falling person, in any direction and at any point.

NOTE The scenario may be a person falling down a stairway flight, hitting the hand- and guardrail on the landing with considerable force.

Hand and guardrails shall comply with structural requirements in subclause 6.2. Support of equipment on the hand and guardrails should be avoided. Minor equipment such as light fittings (not floodlights), signs, cable trays and similar, may be accepted, based on justification in each case. Loads and forces shall be verified by structural calculations, where structural members shall be dimensioned accordingly.

The hand- and guardrail system consists typically of:

- continuous handrail at the top to be grasped by the hand, or just a continuous top-rail when hand support is not needed;
- knee-rails placed parallel with the handrail to prevent accidental passage of a body;
- vertical stanchions for anchorage of the guardrail system;
- solid toe plate at the bottom to prevent the fall of minor objects.

Decks, gangways and platforms higher than 500 mm shall be equipped with hand- and guardrails.

Handrail and guardrail supports shall normally be arranged at a maximum c/c distance of 1 500 mm. Handrail fixings to internal partition systems shall be reinforced for permanent stability.

The top of the handrail shall be minimum 1 100 mm above the finished floor or deck, and minimum 1 400 mm for handrails around the lowered helideck perimeter walkway. The distance between stanchions shall in this case be maximum 750 mm.

Vertical openings between horizontal knee-rails, handrails and toe plates, shall not exceed 380 mm. For external guardrails on open decks, the opening below the lowest course of the guardrails shall not exceed 230 mm.

The toe plate shall have a minimum height of 100 mm, and a clearance of maximum 10 mm to the deck.

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.

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.

The multi-barrier safety principle shall apply for the complete hand- and guardrail system, where a single fault shall not cause a system failure. Any weaknesses or faults developed over time shall be detectable by visual inspection.

The complete hand- and guardrail system, with all its parts and fixing details, shall be of a solid non-corrosive material that is practically maintenance free.

Handrails on floating installations, (e.g. in corridors, etc.), shall be in accordance with applicable maritime regulations.

6.2 Structural requirements

Handrails and guardrails shall be designed for the following ultimate limit state (ULS) actions:

- a horizontal line action of 1,5 kN/m acting on the handrail;
- a point action of 1,0 kN acting in worst location and worst direction (horizontal or vertical). The point action does not act together with the horizontal line action;
- actions from possible attachments shall be established for each case;
- actions on guardrails and flexible barriers in areas with cargo handling should be determined with due attention to relevant operational conditions.

A load factor of 1,3 shall be applied to the above ULS actions.

Hand and guardrails exposed to actions from wind should be designed without risk of Vortex Induced Vibrations (VIV). DNV-RP-C205 provides guidelines on how to avoid wind induced vortex shedding.

6.3 Material requirements

Handrails and guardrails in aluminium should be in accordance with EN 1999 (Eurocode 9). Material selection shall be in accordance with NORSOK M-121. Fabrication and inspection shall be in accordance with NORSOK M-102.

Handrails and guardrails in steel should be in accordance with EN 1993 (Eurocode 3). Material selection shall be in accordance with NORSOK M-120. Fabrication and inspection shall be in accordance with NORSOK M-101. Inspection Category D and steel quality level (SQL) IV may be used for handrails and guardrails. Surface protection shall be in accordance with NORSOK M-501.

Hand- and guardrails in areas that may be exposed to hydrocarbon fire shall be in steel.

6.4 Handrails

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.

The clear distance between the handrail and any obstruction shall be minimum 50 mm in internal LQ areas, and 100 mm in all other areas.

All handrails in LQ shall have a low maintenance finish, e.g. suitable hardwood or brushed stainless steel.

The outside diameter of the handrail shall be between 25 mm to 50 mm.

6.5 Prefabricated handrails and guardrails

Prefabricated hand- and guardrail systems shall be of a robust, non-corrosive type. All connections between the elements shall be securely fixed by lock nuts and through bolts, or self-tapping screws. Setscrew type connections are not acceptable as a permanent fixing method. The fixed connections shall not loosen or weaken by normal use, wind and platform vibrations.

The width of the guardrail shall be as small as reasonably possible without impairing function and safety.

The hand- and guardrail system shall be installed in accordance with the manufacturer's written instructions and procedure. Only personnel with necessary theoretical and practical training shall be involved in the installation work.

Hand and guardrails shall satisfy all relevant requirements before put into use. Assembly correctness, fixing details and correct torque are of primary importance. Any demounted and remounted hand- and guardrails shall be rechecked before put into use. Areas with unfinished hand and guardrails shall be temporary closed for passage.

6.6 Handrails and guardrails in stairs

All stairs shall have a handrail and guardrail on each side of every open flight and 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 1 000 mm (measured vertically) above the tread pitch line, and minimum 1 100 mm above landings and decks.

The handrail shall be continuous from top to bottom of the stairway with a safe termination at both ends. A securely fixed handrail is sufficient where a wall surrounds the stairway.

Open stairways shall have intermediate knee-rails parallel with the handrail, or other barrier of sufficient strength.

Handrails on flights that are 180° to each other shall have a minimum of 150 mm clear distance between rails or between rails and supporting structures, to avoid the possibility of catching hands and fingers.

6.7 Gates

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.

6.8 Flexible barriers

A "heavy duty" type flexible barrier with adequate elastic properties shall be provided around material handling and truck operating areas and landing decks in compliance with NORSOK R-002, subclause B.3.2. The strength and exposure to loads and forces shall be assessed in each case. The barrier shall be constructed in a solid non-corrosive material, which can withstand mechanical impact from containers and trucks. The system shall allow for easy replacement of any damaged element. A container guiding system shall be provided where required.

The barriers shall be bolted to welded foundations to avoid leakages and penetrations through fire rated decks or bulkheads.

Ordinary handrails and guardrails shall be avoided in areas where they may be subjected to mechanical damage from material handling.

6.9 Company specified items

Operator/company specific requirements deviating from the requirements stated herein should be included as an addendum to this NORSOK standard in the contract documentation. Otherwise, they shall be established during the project by cooperation between the project and the operator/company.

7 Doors

7.1 General requirements

Doors, with associated equipment and hardware, shall be of a safe and ergonomic design to prevent injury to personnel. The door arrangement shall allow for optimal functionality and easy operation in an emergency.

Doors shall have a clear opening of at least 750 mm width x 2 050 mm height from floor finish/deck. Doors to cabin bathrooms, toilets, and doors that are not part of escape routes for more than one person may have a width of less than 750 mm. On mobile installations, other requirements to dimensions of doors may apply. See also clause 17 for doors to prefabricated bathroom units.

A preliminary door schedule shall be developed at an early design stage. The schedule shall be updated continuously in the following design phases, until all required information is included per door prior to placement of order.

With the exception of B15 type lightweight doors and special doors (e.g. watertight doors and doors to provision stores, etc.) the same supplier should be selected for all doors on the installation, unless instructed otherwise by operator/company. This should also apply for doors to mechanical packages to the extent possible.

Panic bars are required on doors in areas where there is a risk of congestion or panic.

Automatic opening devices are required for doors in areas with frequent personnel traffic and material handling as described in subclause 7.10.

Bulletproof external doors and use of "pirate locks" on hinges may be considered for relevant geographical locations in cooperation with operator/company.

All doors shall be suitably preserved and protected against damages in the transportation, storage and construction phase. The preservation shall be of a heavy-duty type, resistant to weld spatter, angle grinding grit and potential damage from other construction activities, and shall be in place immediately following installation. The door surface finish shall be stain resistant and require minimum maintenance after preservation removal. A procedure for stain removal (without dismantling the door) shall be part of the supply for doors that are not to be painted/coated.

7.2 Opening force

The opening force (i.e. the initial force required to open a door) as measured with a dynamometer or similar device, shall not exceed the following limits for doors in frequent use (i.e. doors in major traffic and escape routes and doors likely to be used at least 10 times a day) when these doors are in a level position:

Hinged doors	:	65 N
Sliding doors	:	50 N

For all other doors, the following limits shall not be exceeded:

Hinged doors	:	130 N
Sliding doors	:	105 N

The maximum acceptable opening force in an accidental situation shall never exceed 250 N for doors in main escape routes.

The above maximum opening forces shall be verified by the supplier prior to purchase and by the project as part of the mechanical completion activity.

On floating/mobile installations, the maximum acceptable opening forces under accidental heeling conditions shall be evaluated and resolved on a project-by-project basis at an early stage.

Unless specified otherwise by the project, all escape route doors and fire sectioning doors on floating/mobile installations, shall be self-closing for a static heel of 3,5 degrees in accordance with SOLAS regulation. For installations having stricter requirements to the heeling condition, the project shall specify the static heeling requirement for doors in escape routes.

The design shall optimise the use of materials and construction methods to provide doors that are as light as possible.

7.3 Fire rating and fire test requirements

Fire rated doors shall be certified to have the same fire rating as the divisions in which they are installed. Any additional components that are required to comply with the fire rating (e.g. exposed frame insulation covering and associated flashing) shall be part of the supply.

7.4 Acoustic requirements

Doors with acoustic requirements, shall as a minimum have the same sound reduction requirement as the divisions in which they are installed. A lower sound reduction value for the door may be accepted if it can be documented that the overall door/wall assembly meets the required sound reduction value ($R'w$) for the division.

7.5 Materials

The material thickness of frames and door leaf plates shall be sufficient to provide robust and rattle free doors, suitable for the location and intended use. Heavy abuse from mechanical and natural forces and requirements to minimum repair and maintenance shall be given due attention.

Carbon steel doors shall be in accordance with EN 10025-1 and 3, S235 JRG2 or equivalent, and of sufficient thickness to allow sandblasting.

Stainless steel shall be type AISI 316L, or alternatively AISI 316 with a maximum carbon content of 0,05 %. The stainless steel material shall be of the white pickled and passivated condition.

Aluminium shall be of seawater resistant type.

Alternative materials (e.g. composite, etc.), may be used as long as such materials comply with all relevant requirements.

Pop rivets should be avoided, unless accepted by operator/company on a case-by-case basis.

All door leaves, with the exception of doors in un-insulated prefabricated cassette walls and V-doors, shall be of a double plate, sandwich type construction and fully insulated without any air pockets. Insulation fibres shall be sealed to prevent any fibres being released to the environment. Insulation within door-leaves shall not sag following continuous use.

Gasket seals shall permanently maintain the specified integrity of the door throughout the door's specified design lifetime. Gaskets shall be glued or mechanically fixed in such a way that they can be easily replaced. Gaskets shall be of a design that maintains elasticity and allows for latching and full perimeter sealing of door-leaves during continuous heavy use, without requiring excessive force or slamming. Special attention shall be paid to the gasket sealing of external LQ doors, to applicable doors at zone 1 classified areas and to doors that shall maintain an air pressure differential.

7.6 Painting

Carbon steel surfaces shall be sandblasted, prepared, primed and painted with a coating system in accordance with project requirements. Sandblasting is not, however, required for internal carbon steel doors with front leaves less than 1,5 mm thickness, (type L1 and L2).

Stainless steel surfaces shall not be painted, unless specified otherwise in the door schedule. Aluminium doors shall be anodised. B-rated type doors and internal doors may be delivered with baked-on electrostatic powdered epoxy/polyester coating or PVC foil, as specified.

The internal face of unpainted external door leaves and frames to recreation rooms and other accommodation areas shall be painted to match the internal colour scheme.

7.7 Hinged doors

All hinged doors and the active leaf of all hinged double doors shall be self-closing and self-latching, unless specified otherwise in the door schedule. Small passive door blades of double doors may be fitted with sliding bolts at top and bottom to secure correct self-latching when closing.

Doors shall be provided with at least three hinges, and doors higher than 2 500 mm shall be provided with at least four hinges. A continuous piano hinge may also be used. The hinge design shall facilitate easy removal of the door. There shall be a lubrication nipple on each hinge, unless guaranteed maintenance free.

Each hinge shall be fixed to the door leaf with a minimum of three screws. The hinge design and the fixing method to the frame and door leaf shall ensure that no buckling of the leaf or frame occurs during continuous normal use throughout the design life of the door. Thin plate doors (with faceplates of less than 2 mm thickness) shall have additional reinforcement inside the door leaf on the hinge side to satisfy this requirement. Hinges welded to door leaf are not acceptable.

The meeting edge of double door leaves shall have a continuous seal and overlap that satisfies all integrity requirements for the double door, without gaps at gasket joints.

The door leaf or the gasket shall be easily adjustable after the door has been installed to ensure proper closure and compression of all seals when closed.

See clause 3 for definition of left and right handed doors.

7.8 Sliding doors

All "A" and "H" rated sliding doors shall be self-closing with an adjustable speed reduction brake to stop the door from closing or opening (on floating installations) too quickly. In addition, doors on floating or mobile installations shall be self-latching. They shall have fail-safe protection against falling down from their tracks and guides, and overturning. Sliding door connected to magnet holders in an open position shall close automatically when the fire and gas alarm is activated, (see subclause 7.9).

The sliding doors shall be provided with a track housing, which protects and encloses the top, front, back and ends of the track mechanism. The housing shall be of the same material as the doorframe. The front panel of the track housing shall be hinged and have a fail-safe hold open device, allowing for easy inspection and maintenance of the mechanism. For H-rated doors the front panel of the track housing may be bolted, if required, for compliance with fire regulations. The panels shall not open unintentionally. The track housing on external doors shall provide maximum weather protection to the sliding mechanism. Track housings located in areas with suspended ceilings shall have the front panel hinges located below the level of the ceiling, to allow easy access to the mechanism without dismantling the ceiling panels.

Handles on sliding doors shall have an ergonomically correct grip for easy manual opening of the doors by personnel wearing gloves. Handgrips at frame side shall be designed to avoid accidental crushing of fingers.

Suspension track, rollers, top and bottom roller guides, latch, handles, etc. shall be in stainless steel. All doors shall be easily removable from their tracks.

Doors with counterweights shall be of a chain and cogwheel construction.

Recesses in the floor that may collect moisture or dirt shall not be used.

7.9 Hardware and accessories

Generally, all hardware (inclusive hinges) shall be in stainless steel, unless specified otherwise in the door schedule. Visible surfaces shall have a brushed finish.

Door handles shall be of brushed stainless steel AISI 316 and shall be of a consistent type and design for the whole installation.

Door handles shall be solid with a minimum 8 mm spindle. Lock screws in spindles shall be of a type that does not need periodical re-tightening. Lever handles shall be secured on the backside of the escutcheon plate to stop side movement. The escutcheon plate shall encompass the lock cylinder (where applicable), and shall be properly secured, with local reinforcement in the door leaf, to prevent any movement, deflection or other weaknesses. Handles with roller bearing mountings may be required in areas of continuous heavy use.

The inactive leaf of B-rated double doors shall have flush bolts at top and bottom, adjustable to give a rattle free closing. The inactive leaf of all other double-hinged doors shall have a heavy duty stretching latch, which is operated by a single lever handle and locks the leaf into the frame at the top and at the threshold at

the bottom. The inactive leaf in escape-way doors shall have automatic release flush bolt and door leaf coordinator.

Doors shall normally be supplied with a single mortise latch and locking mechanism provided they meet the specified performance requirements. All latch systems shall be removable and replaceable without any alteration to the door leaf. For doors in LQs, the latching mechanism shall be recessed into the door leaf.

All striker plates shall be adjustable to ensure proper latching.

Doorstops shall be provided for all doors to prevent damage to adjacent surfaces.

Panic devices shall be suitable for the specified door type and shall override the door lock (stainless steel rim latch with cross bar or similar).

Kick plates (300 mm height) and trolley protection plates (800 mm height) in brushed stainless steel shall be provided for hinged doors in relevant traffic areas. Trolley protection plates shall be provided to both sides of doors in kitchen area, scullery, provision stores and laundry.

Kick plates and trolley protection plates shall be mechanically fixed with flush fixings. There shall be no sharp or protruding edges.

It shall be possible to fit all doors with a temporary "hold open device" for use in the construction phase. Temporary "hold open devices" may be an integral part of the door closer system or a purpose made device. The temporary "hold open devices" shall be removed prior to commissioning. Certain doors (e.g. all cabin doors) shall be fitted with permanent "hold open devices", unless specified otherwise by operator/company. The type shall be compatible with the safety philosophy, to ease cleaning in the operational phase.

Electro-magnetic door holders, connected to the fire and gas system, shall be provided for certain doors, (e.g. doors in corridors), that are to be kept open in normal use, all in accordance with operator/company requirements. The door holders shall have a manual release button. Door leaves and wall systems shall be suitably reinforced for fixing of door holders where required.

Door leaves shall be properly reinforced at hinges, locks, handles, closer devices and any other places where hardware is to be attached to the door.

Doors in transport routes where frequent movements of heavy pallets and goods are anticipated (e.g. to main internal storage areas and to kitchen storage from lay-down decks) shall have leaves and frames reinforced as necessary.

The frames and door leaves for all cabin doors shall be delivered with pre-drilled holes for fixing of door closers. This should also apply to other relevant doors.

7.10 Automatic opening devices

Doors that do not meet the specified opening force stated earlier in this clause, or are frequently in use by personnel, truck and trolley traffic, shall be equipped with automatic opening devices as deemed necessary by the project. Details shall be included in the door schedule at an early stage.

The opening device shall be activated by a door handle or by a large red wall mounted push button. The handles and the push buttons shall be located on both sides of the door, approximately 900 mm above the floor level on the door opening side. Sensors, which are safe in a fire may also be used, when appropriate.

Certain doors may be fitted with a pull-wire opening device on both side of the door. Such devices shall be carefully positioned for convenient use in accordance with user requirements, e.g. forklift truck operators.

Automatic sliding doors shall be fitted with red push buttons or pull-wires as described above. Additional door handles are required on each side for manual use in a power failure situation. The handle on the doorframe side shall be recessed in the door leaf. A transparent breakable/removable plastic plate shall cover the handle, and a safety sign shall be attached adjacent to it with the text "NØDÅPNER / EMERGENCY OPENER". An additional warning sign shall be conspicuously placed on the doorframe side with the text "KLEMFARE / RISK OF INJURY" to warn against accidental crushing of fingers, ref. Appendix A, CDS-209.

Automatic doors shall be fitted with a reliable safety device to prevent the danger of accidental crushing. The system shall cause doors to stop and reopen immediately upon meeting any resistance while closing. "Resistance" in this context shall mean any part of the human body in motion through the door".

Doors with opening devices shall not "self-open" under the action of fire.

The system shall incorporate a time laps mechanism to close the doors slowly, easily adjustable from 10 s to 2 min 30 s.

Care is required to avoid structure borne and airborne noise emission from the automatic opening devices.

Manual override devices or emergency release valves shall be located approximately 1 750 mm above the floor, and have a self-explanatory arrangement for use.

Doors with inset personnel doors shall not be operable if the personnel door is not properly closed.

Pneumatic assisted doors shall have system components sized to suit the design pressure as specified for each project. The doors shall have moisture extractors fitted in air supply lines, and shall not be supplied with pressure safety valves unless specified otherwise by the project. Control cabinets shall have permanent signs or labels for identification. Instrument fittings and tubing shall be carefully coordinated with the project standard at an early stage prior to selection of supplier.

Unless otherwise specified by the project, pneumatic doors in escape routes shall be fitted with emergency air reservoirs to enable four complete activations (opening and closing) of the doors in the event of plant air failure. Each air reservoir shall have a maximum capacity of 20 litres.

Pneumatic cylinders will be sensitive to contamination when air supply is disconnected. Consequently, the cylinder arrangement shall allow for simple disconnection from the door-leaf when the air supply stops for any period. Screw sealing plugs of same material as pneumatic supply lines shall be part of the pneumatic assembly supply. Plugs on a safety chain should be provided near the fitting.

Pneumatic system tubing and components in exposed weather conditions and in naturally ventilated areas shall be aligned with the material qualities of the instrument air system on the installation. However, the minimum requirement is stainless steel AISI 316L. This includes components inside and outside of the pneumatic control cabinets. Pneumatic tubing and fittings in SS 6Mo may be specified in severe corrosive environments or if operating temperatures will be above + 60 °C.

Electrical opening devices may be used if zone 1 classified area requirements and IP ratings are satisfied.

All doors with automatic opening devices shall have appropriate CE marking.

7.11 Thresholds

All required thresholds shall be dimensionally as low as possible, without impairing function with regard to fire rating, noise reduction and ability to stop ingress of water. See clause 17 for cabin bathroom doors.

The maximum height between the top of threshold and adjacent floor finish shall not be more than 25 mm for lightweight doors and internal medium duty doors in the LQ area. The maximum height between the top of threshold and adjacent steel deck shall not exceed 35 mm for medium and heavy-duty doors outside LQ. Threshold heights up to 65 mm (deck to top threshold) is acceptable for H-rated doors, but is subject to confirmation by operator/company in each case.

Doors requiring thresholds shall have the thresholds arranged to provide absolute minimum obstructions where regular passage of trolleys or forklift trucks are required. This may be achieved by using thresholds with integral inclined edges, or by using deck levelling screed and associated floor material to create a local inclined plane for threshold height reduction. Door thresholds in forklift transport routes shall have detailing to withstand passage of the truck with its forks in the lowered position.

The threshold height shall be specified for each door type in the door schedule, together with adjacent floor finish arrangement.

Thresholds shall be of stainless steel. Doors that have painted or coated frames shall have either a brushed stainless steel threshold or a brushed stainless steel cover plate, minimum 1 mm thick, for the entire length, and down to the floor on both sides, leaving no gaps and sharp edges.

Fixing of thresholds shall not be by bolting through the fire rated deck below, and shall maintain the project standard of corrosion protection. For all sliding doors, large double-hinged doors and doors in areas with uneven deck plates, the threshold shall be fixed to doubling plates that are welded to the deck by the fabricator.

7.12 Frames

Doorframes shall be installed and fixed, as appropriate, by either bolting through airtight isolation gaskets or by a continuous fillet weld all round. Frames shall be reinforced at hinges, locks and closer device positions. Detailing shall minimise galvanic corrosion.

To reduce transmission of forces from the bulkhead into the doorframe, which may affect proper alignment and operation of doors, the maximum plate buckling at the perimeter of the cut out shall be 5 mm along a straight edge. Where buckling is in excess of this, or where required for structural reasons, the cut out shall be terminated at a welded angle profile into which the doorframe may be welded or bolted.

7.13 Door locks

Doors shall be provided with locks in accordance with operator/company requirements. Non-lockable doors shall be fitted with "blind" escutcheon plates or blind cylinders. Lockable doors requiring key cylinder only on one side, shall have a wing shaped thumb-turn on the other side (normally inside), which overrides the lock mechanism. Certain doors shall be supplied with a "break-glass" unit to house a key or a thumb-turn.

Doors to cabins shall normally be unlocked in the operational phase for safety reasons. The locks shall be fitted with "blind" escutcheon plate or blind cylinder, unless the key cylinders are required by operator/company, e.g. for locking of unused cabins in a low manning situation.

None of the doors in escape routes shall be lockable in the operational phase. Requirements for temporary locking of doors during the construction phase shall be agreed between the project and the operator/company.

All bathroom cubicle doors, solarium doors and doors to toilets and shower rooms, etc. shall be fitted with inside thumb-turn and outside indicator.

Doors to high voltage electrical rooms shall be lockable. They shall open outwards from the room. They shall be equipped with a manual panic device, e.g. a vertical panic bar or push-button operated device that is operable from inside the room by the use of the knee, elbow or other part of the body, also by a person who is crawling, all in accordance with governing authority requirements.

High voltage rooms and certain local equipment rooms may require "break-glass" units for emergency access, if indicated in the door schedule. Such units shall be located adjacent to the door.

7.14 Vision panels

Vision panels shall be installed as required for orientation or safety reasons, and always in pendulum doors and doors in corridors and doors to stairway lobbies. Exempted are doors with electro-magnetic door holders.

The vision panels shall be positioned to ensure good line-of-sight through the panel whilst operating the door. This may require the vision panel to be positioned off-centre in the door leaf.

The vision panels shall be an integral part of the certified door. The glazed area shall be approximately 200 mm x 500 mm (width x height) or 400 mm x 400 mm (width x height), and consist of tempered security glass. The vision panels shall not impair the function of the sliding door sealing. The vision panel for watertight doors may be down sized to 100 x 200 mm (width x height), or 200 x 100 mm (width x height) if stiffener spacing makes the first alternative difficult.

7.15 Tolerances

All parts shall be supplied free from distortion. Face sheets shall be flat and shall not vary by more than 2 mm. Doors and frames shall be fabricated within tolerances on overall dimensions of 2 mm.

7.16 Tagging, marking and coding

Doors and component parts, (pneumatic control boxes, air reservoirs, push buttons, safety valves, etc.), shall be tagged, marked and coded in accordance with operator/company requirements. A tag plate shall be discreetly fixed to the door assembly, providing as a minimum, manufacturer's name and address, fire rating, sound insulation rating, project tag number and door number as listed in the door schedule. For all doors, the tag plates shall be fixed to an easily accessible but mechanically protected location.

7.17 Internal doors

The B-rated doors shall be fully compatible with the relevant proprietary B-rated partition systems. B-rated folding doors are part of the partition supply covered in clause 10.

Internal A, B and non-rated doors requiring large glazed surfaces shall be included in the door schedule. The glazed area shall consist of laminated or tempered security glass divided into at least two panes separated by horizontal window bar(s). The glazing shall be an integral part of the certified door.

Doors being an integral part of an internal glazed partition system are covered in clause 8, and are part of the glazed partition supply. The doors shall nevertheless comply with this clause.

7.18 External doors

7.18.1 General

All external doors shall be robust stainless steel or aluminium sliding doors. Hinged doors may be used in recessed and sheltered entrances.

The door leaf shall be a sealed unit, totally impervious to moisture. Sliding doors shall be mounted on the outside of the walls. The doors shall withstand the extreme environmental design conditions on the specified field location. The relative humidity shall be calculated at 100 %.

Detailing shall stop any pools of water on external decks to pass through the door construction.

Weather tight doors on permanent ship type installations should be equipped with a centralized locking system to avoid operating several locking dogs manually.

7.18.2 Weather tight doors (for hose testing)

Weather tight doors shall have weather tight seals. Hose testing from the outside after installation shall verify the weather tightness. The water pressure shall be at least 0,2 MPa (2 bar), and the nozzle shall be held at a distance of maximum 1,5 m from the door. No leakage is accepted.

7.18.3 Weather tight doors (for strength verification)

On floating production units, drill-ships, semi-submersibles, etc., weather tight doors may be required below, on or above freeboard decks. In addition to the sealing requirement stated above, these doors shall be designed for a strength equivalent to that required for the structure in which they are positioned. The strength shall be verified by calculations.

7.19 "Gas-tight" doors

"Gas-tight" doors are normally located in the perimeter of areas where an air pressure differential shall be maintained, or where specified in the door schedule.

"Gas-tight" doors shall maintain a pressure differential between adjacent areas, where the allowable leakage rate shall not exceed 0,5 m³/m² h at 50 Pa (5×10^{-4} bar) over-pressure, following prolonged use, or as specified by the project. A satisfactory test certificate shall be provided with each door type.

A pressure relief port and/or air lock is required for hinged doors separating areas of high differential pressure. It shall not reduce the door's specified fire rating and sound reduction properties.

7.20 Blast resistant doors

Certain doors shall be designed to withstand blast over-pressures. The magnitude of the static and dynamic design pressure (in bar), including impulse duration, shall be in accordance with project requirements.

The door shall be reinforced as required to maintain the given fire rating, integrity and operability (for escape), after the expected blast. Satisfactory laboratory test results (certificates) from a recognised laboratory shall be supplied with all blast resistant doors. The doors shall have been subjected to a full blast test followed by a fire test.

7.21 Explosion relief doors

Explosion relief doors are normally installed in external walls containing explosion relief panels. The doors shall have explosion relief panels, which open at an over-pressure of 0,005 kPa (0,05 bar), built into the door leaves. It shall be possible to open the door leaf up to a minimum of 60 % after an internal explosion. The panels and parts of the door shall not cause flying debris during the explosion.

The door frame, stiles and rails shall withstand an explosion over-pressure of minimum 0,01 MPa (0,1 bar) and remain in place.

7.22 Louvered doors

Louvered doors are normally installed in louvered walls providing natural ventilation to interior areas. The louvered doors shall be designed to maximise the passage of air through the louvers, whilst minimising the penetration of water to the interior.

7.23 Inset personnel doors

Inset personnel doors are doors set within larger hinged or sliding door leaves, as an integral part of the total door assembly. These doors shall be self-closing and self-latching.

7.24 Watertight doors (in watertight bulkheads)

Doors or hatches within watertight bulkheads shall be certified to meet the applicable design pressure requirements in compliance with the NMA regulations.

The doors' fire rating shall be the same as the wall in which they are installed.

Doors in frequent use by personnel may be fitted with a vision panel (ref. subclause 7.14) if approved by operator/company in each case. The vision panel shall satisfy the same fire and water pressure requirements as the door.

Hydraulically operated watertight doors shall be in accordance with current SOLAS regulation and the NMA regulation No. 878. In addition to the requirements stated therein, it is strongly recommended that these doors are equipped with a safety device that will prevent accidental crushing injuries to personnel. The system shall be tested with respect to functional safety and reliability in remote closing operation and personnel safety in local door operation. A certificate or test report shall confirm compliance with principles in IEC 61508 and IEC 61511 for active systems. Supplier/manufacturer shall document that failure or other circumstances related to the anti-crushing system never can open a closed door.

From this follows that the control console in the control room should have two control switches, (normally part of CAP under the heading "Watertight doors") with the following modes:

Switch one - All doors closed with safety device active:

- "local control" position shall allow any door to be locally opened and locally closed after use without automatic closure, (i.e. each door's movement and position is controlled locally by the door handle on both sides);
- "door closed" position shall allow automatic closure of any door that is open with the safety device active, (i.e. the door can be operated locally by the door handle, but will immediately start closing when the hand is removed from the door handle). The safety device shall cause the door to stop and reopen immediately should a person passing through the door be in danger of accidental crushing.

Switch two – Master mode switch safety override:

- "local control" position shall allow any door to be locally opened and locally closed after use without automatic closure, (as for switch one);
- "safety device override" position shall allow automatic closure of any door that is open, but now with the safety device deactivated, (i.e. the door can be operated locally by the door handle, but will immediately start closing when the hand is removed from the door handle). The danger of crushing is in this case imminent, and passage requires utmost attention.

The two switches shall have parallel closing functions. It is then sufficient that one of the switches are in "door closed" mode, with or without the safety device active.

NOTE Any proposed deviation to the above recommendation should be evaluated on a case-by-case basis with operator/company.

Arrangement of the remote operation and the local operation of doors shall be according to SOLAS regulation 13.7.8.1 and NMA regulation No. 878 chapter XI. It shall not be possible to open any door from the remote control, see SOLAS regulation 15.8.3.

The degree of protection for the electrical components shall be according to SOLAS regulation 13.7.6. Electrical systems shall be according to SOLAS Regulation, 13.7.7 and 13.7.8.

Closing of doors shall be fail-safe, where doors close automatically in the event of loss of control power. A mechanical locking device shall prevent unintentional opening in an emergency.

The doors' operational system shall be connected to both the main and the emergency power systems.

Alarm and visual indication in the control room shall be according to SOLAS and NMA regulation.

A red flashing warning light shall be activated on each side of the door when the door is operated in the "door closed" mode. Control, alarm and visual indication locally at each door shall be according to SOLAS regulation.

Each door shall have an accumulator power unit with the capacity to operate the closing means at least three times (closed-open-closed) for a period of minimum 12 hours after a power failure.

The door threshold height shall be maximum 20 mm without recess. Hinged plates shall not be used. Detailing of thresholds for doors in material handling routes shall be carefully coordinated with material handling requirements, in order to achieve a functional threshold that is as low and obstruction free as possible.

On board testing intervals shall be according to SOLAS chapter II-1, regulation 21.

Only qualified personnel shall perform commissioning and servicing of watertight doors.

Door operating instructions shall be located on, or adjacent, to each door on both sides. A warning sign shall be located on both sides of the door with the text "KLEMFARE / RISK OF INJURY", ref. Appendix A, CDS-210.

7.25 Doors to HVDC converter modules

Doors to HVDC converter modules shall be designed to ensure EMC shielding throughout their lifetime.

All doors to IGBT and reactor areas shall have EMC gaskets and earthing strips in accordance with operator/company requirements. The doors shall be equipped with locks suited to a key interlocking system in order to prevent access when the EDS system is energized, all in accordance with operator/company requirements.

7.26 Emergency escape hatches

Emergency escape hatches shall be easy to open by a single individual from both sides, and shall have a minimum clear opening of 800 mm x 800 mm on fixed installations. On mobile installations, other requirements may apply. All emergency escape hatches shall be hinged.

Emergency escape hatches shall be of the same construction and quality as personnel doors, and shall be listed in the door schedule. Emergency doors are, however, the preferred solution wherever feasible.

7.27 Inspection hatches

Horizontally arranged inspection hatches on top of decks shall be splash proof and detailed to be flush with the deck, with no protruding appurtenances likely to be a tripping hazard. They shall have fail-safe sealing detailing.

All inspection hatches shall be hinged wherever possible. Hatches in insulated bulkheads or decks shall be detailed to allow opening without causing damage to the adjacent insulation.

See clause 10 for inspection access panels in lightweight partition systems.

7.28 Function testing / commissioning of doors

All doors shall be function tested as part of the mechanical completion activities. Full perimeter gasket sealing, latching and compliance with specified opening pressure limits shall be formally verified. All adjustments shall have been completed, to ensure the fire and smoke barrier properties are maintained.

Doors and hatches shall have recommended lubricants applied to hinges, mechanisms and gaskets as required at mechanical completion, in accordance with manufacturers' maintenance procedures.

Automatic opening devices shall be fully adjusted to comply with specified operational requirements. Instrument quality air shall be provided if necessary, to allow for adjustment. Following adjustment, pneumatic cylinders shall be disconnected until air supply is permanently available. Air supply shall be checked for moisture content and contamination prior to permanent reconnection. Disconnected pneumatic tubing shall be sealed with screwed metal plugs of the same material as the tubing.

Qualified/certified personnel shall perform the function testing.

7.29 Door schedule

The door schedule shall be based on the attached data sheet in annex A, specifying all requirements for each door. All hardware, accessories and systems to be part of each door supply shall be included.

7.30 Door selection

It is of utmost importance that correct fit-for-purpose door types are selected, e.g. thin plate domestic/LQ category doors shall not be selected for use in medium or heavy-duty areas and vice versa. Table 1 to Table 3 shall be used to establish suitable door and escape hatch types for the respective areas of the installation. The door type codes shall be included in the door schedule in data sheet CDS-201, see Annex A. Special doors, or doors that are part of equipment packages (e.g. provision stores), are not covered by Table 1 to Table 3.