International Association of Oil & Gas Producers

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S-737

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Specification for Deluge Skids

JIP33
JOINT INDUSTRY PROGRAMME

Revision history

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1.0	October 2021	Issued for Use

Acknowledgements

This IOGP Specification was prepared by a Joint Industry Programme 33 Standardization of Equipment Specifications for Procurement organized by IOGP with support by the World Economic Forum (WEF).

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Foreword

This specification was prepared under Joint Industry Programme 33 (JIP33) "Standardization of Equipment Specifications for Procurement" organized by the International Oil & Gas Producers Association (IOGP) with the support from the World Economic Forum (WEF). Companies from the IOGP membership participated in developing this specification to leverage and improve industry level standardization globally in the oil and gas sector. The work has developed a minimized set of supplementary requirements for procurement, with life cycle cost in mind, resulting in a common and jointly agreed specification, building on recognized industry and international standards.

Recent trends in oil and gas projects have demonstrated substantial budget and schedule overruns. The Oil and Gas Community within the World Economic Forum (WEF) has implemented a Capital Project Complexity (CPC) initiative which seeks to drive a structural reduction in upstream project costs with a focus on industry-wide, non-competitive collaboration and standardization. The CPC vision is to standardize specifications for global procurement for equipment and packages. JIP33 provides the oil and gas sector with the opportunity to move from internally to externally focused standardization initiatives and provide step change benefits in the sector's capital projects performance.

This specification has been developed in consultation with a broad user and supplier base to realize benefits from standardization and achieve significant project and schedule cost reductions.

The JIP33 work groups performed their activities in accordance with IOGP's Competition Law Guidelines (November 2020).

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Introduction

The purpose of this specification is to define a minimum common set of requirements for the procurement of deluge skids for application in the petroleum and natural gas industries.

This specification follows a common document structure comprising the four documents as shown below, which together with the purchase order define the overall technical specification for procurement.

JIP33 Specification for Procurement Documents
Technical Specification

This specification is to be applied in conjunction with the supporting procurement data sheet, information requirements specification (IRS) and quality requirements specification (QRS) as follows.

IOGP S-737: Specification for Deluge Skids

This specification defines the technical requirements for the supply of the equipment.

IOGP S-737D: Procurement Data Sheet for Deluge Skids

The procurement data sheet defines application specific requirements, attributes and options specified by the purchaser for the supply of equipment to the technical specification. The procurement data sheet may also include fields for supplier provided information attributes subject to purchaser's technical evaluation. Additional purchaser supplied documents may also be incorporated or referenced in the procurement data sheet to define scope and technical requirements for enquiry and purchase of the equipment.

IOGP S-737L: Information Requirements for Deluge Skids

The IRS defines the information requirements, including contents, format, timing and purpose to be provided by the supplier. It may also define specific conditions which invoke information requirements.

IOGP S-737Q: Quality Requirements for Deluge Skids

The QRS defines quality management system requirements and the proposed extent of purchaser conformity assessment activities for the scope of supply. Purchaser conformity assessment activities are defined through the selection of one of four generic conformity assessment system (CAS) levels on the basis of evaluation of the associated service and supply chain risks. The applicable CAS level is specified by the purchaser in the data sheet or in the purchase order.

The terminology used within this specification and the supporting procurement data sheet, IRS and QRS is in accordance with ISO/IEC Directives, Part 2.

The procurement data sheet and IRS are published as editable documents for the purchaser to specify application specific requirements. The specification and QRS are fixed documents.

The order of precedence (highest authority listed first) of the documents shall be:

a) regulatory requirements;

b) contract documentation (e.g. purchase order);

c) purchaser defined requirements (procurement data sheet, IRS, QRS);

d) this specification.

1 Scope

This specification covers the design, manufacture, inspection and testing requirements of deluge skids for onshore and offshore oil and gas applications. This specification is limited to deluge type packages, with or without foam. This specification includes equipment and components from inlet flange to outlet flange of a deluge skid.

Deluge skids may be part of a larger system comprising other firefighting equipment units (e.g. sprinkler systems, spray systems and monitors). Deluge skids may be built as a single skid or as a multivalve skid where two or more deluge valves are located. Deluge skids may be built with or without an enclosure.

The following systems and applications are not covered by this specification:

— firewater pumps;

— water supply piping or pilot piping outside boundaries of skid piping;

— nozzles, sprinklers and other discharge devices downstream of the deluge valve;

— fire and gas detection.

2 Normative references

The following publications are referred to in this document, the procurement data sheet (S-737D) or the IRS (S-737L) in such a way that some or all of their content constitutes requirements of this specification. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Recommended Practice 14F, *Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1, and Division 2 Locations*

API Recommended Practice 14FZ, *Recommended Practice for Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1, and Zone 2 Locations*

API Recommended Practice 686, *Recommended Practice for Machinery Installation and Installation Design*

ASME *BPVC*, Section IX, *Welding, Brazing, and Fusing Qualifications*

ASME B16.5, *Pipe Flanges and Flanged Fittings,* NPS ½ Through NPS 24 Metric/Inch Standard

ASME B36.10M, *Welded and Seamless Wrought Steel Pipe*

ASME B36.19M, *Stainless Steel Pipe*

AWS D1.1, *Structural welding - Steel*

EN 50288-7, *Multi-element metallic cables used in analogue and digital communication and control - Part 7: Sectional specification for instrumentation and control cables*

IEC 60092-350, *Electrical installations in ships – Part 350: Shipboard power cables – General construction and test requirements*

IEC 60092-360, *Electrical installations in ships – Part 360: Insulating and sheathing materials for shipboard and offshore units, power, control, instrumentation and telecommunication cables*

IEC 60092-376, *Electrical installations in ships – Part 376: Cables for control and instrumentation circuits 150/250 V (300 V)*

IEC 60331 (all parts), *Tests for electrical cables under fire conditions*

IEC 60332 (all parts), *Tests on electrical and optical fibre cables under fire conditions*

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60364-4-44, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

IEC 60364-5-54, *Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61537, *Cable management – Cable tray systems and cable ladder systems*

IEC 61892-4, *Mobile and fixed offshore units – Electrical Installations – Part 4: Cables*

IEEE 1580, *Recommended Practice for Marine Cable for Use on Shipboard and Fixed or Floating Facilities*

IOGP S-715, *Supplementary Specification to NORSOK M-501 Coating and Painting for Offshore, Marine Coastal and Subsea Environments*

IOGP S-716, *Specification for Small Bore Tubing and Fitting*

ISO 3864 (all parts), *Graphical symbols — Safety colours and safety signs*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 9606 (all parts), *Qualification testing of welders — Fusion welding*

ISO 12944-4, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 4: Types of surface and surface preparation*

ISO 12944-7, *Paints and varnishes — Corrosion protection of steel structures by protective paint systems — Part 7: Execution and supervision of paint work*

ISO 14732, *Welding personnel — Qualification testing of welding operators and weld setters for mechanized and automatic welding of metallic materials*

ISO 15614 (all parts), *Specification and qualification of welding procedures for metallic materials - Welding procedure test*

ISO 21457, *Petroleum, petrochemical and natural gas industries —Materials selection and corrosion control for oil and gas production systems*

NEMA VE 1, *Metal Cable Tray Systems*

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*

NFPA 70, *National Electrical Code*

NFPA 170, *Standard for Fire Safety and Emergency Symbols*

UL 1309, *Standard for Safety Marine Shipboard Cable*

UL 1569, *Standard for Safety Metal-Clad Cables*

UL 1598, *Standard for Safety Luminaires*

UL 2196, *Standard for Safety Tests for Fire Resistive Cables*

UL 2225, *Standard for Safety Cables and Cable-Fittings For Use In Hazardous (Classified) Locations*

UL 2556, *Standard for Safety Wire and Cable Test Methods*

3 Terms, definitions, acronyms and abbreviations

3.1 Terms and definitions

For the purpose of this document, the following terms and definitions apply.

3.1.1
published information
technical product documentation
comprehensive and structured technical documents covering all the information required for the definition of a component

Note 1 to entry: This includes design, operating range, materials, construction, assembly, performance data, properties, configuration limitation, instructions, safety, health and environmental information.

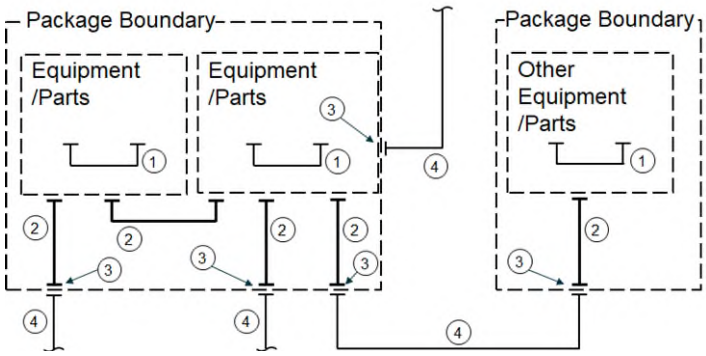
3.1.2
winterization
measures implemented to reduce the effects of cold temperatures on piping and equipment

Note 1 to entry: Winterization can be achieved by addition of insulation, trace heating, electric motors designed for arctic duty and ingress protection for electrical equipment.

3.1.3
fire department connection
interface through which the fire department (brigade) can pump supplemental water into the sprinkler system, standpipe, or other water-based fire protection systems, furnishing water for fire extinguishment to supplement existing water supplies

3.1.4
package piping
assemblies of piping components used to convey or distribute fluid flows between package parts and up to the package boundary

Note to entry: See Figure 1.



Key
1) Piping associated with individual package components: covered by individual component design codes.
2) Package piping covered by specification.
3) Package piping connections to external piping covered by specification.
4) External piping: not covered by specification

Figure 1 — Package boundary

3.2 Acronyms and abbreviations

DN diameter nominal

LED	light emitting diode
LV	low voltage
NPS	nominal pipe size
RMS	root mean square value
SIL	safety instrumented level
UV	ultraviolet

4 General requirements

4.1 General

4.1.1

Deluge skid materials and components shall be installed and tested in accordance with the manufacturer's published information.

4.1.2

If piping materials are not specified, the material selection shall comply with ISO 21457.

4.1.3

Mechanical handling solutions shall allow the removal of equipment or components without disturbance to the rest of the package.

4.2 Design objectives

The deluge valve skid shall automatically and/or manually supply water or a foam-water solution to the fire protection system.

4.3 Service life

Deluge skids shall be designed for a service life of 20 years.

4.4 Deluge skid interfaces

4.4.1

Cables within deluge skids shall be terminated in a junction box at the skid edge.

4.4.2

If a deluge skid is enclosed, the junction box shall be at the edge external to the enclosure.

4.4.3

Hydraulic and pneumatic tubing shall be terminated at the skid edge with bulkhead male or female connectors or unions.

4.4.4

Piping shall be terminated at the skid edge with a flange.

4.5 Ingress protection for equipment

Equipment shall have a minimum degree of ingress protection as specified.

4.6 Winterization

Deluge skids or valves shall be enclosed when winterization is required.

4.7 Labelling, tagging and name plate

4.7.1

Deluge skids and deluge valves shall include a name plate.

4.7.2

Components with an assigned tag number shall include the purchaser's tag number on the name plate or a separate tag plate.

4.7.3

Name plates and tag plates shall be affixed with stainless steel 316L rivets or screws.

4.7.4

Name plates and tag plates shall be located and orientated for accurate reading from grade or platform.

4.7.5

Tag plates shall be 316L stainless steel or traffolyte.

4.7.6

Name plates shall be 316L stainless steel.

4.7.7

The following information shall be stamped or engraved on the skid name plate:

a) skid manufacturer;

b) weight (operating/dry);

c) year of manufacture;

d) purchaser’s tag number;

e) purchaser’s order number.

4.7.8

The following information shall be stamped or engraved on the deluge system name plate:

a) service description (e.g. water-deluge, foam-water);

b) minimum operating pressure;

c) design flow;

d) deluge valve tag number;

e) protected area.

4.7.9

Graphical symbols, safety colours and safety signs shall be in accordance with ISO 7010, ISO 3864 or NFPA 170.

4.7.10

Text-only warning labels shall have white characters on a red background.

4.7.11

Warning labels shall be in English and in the local language.

4.7.12

Non-warning labels shall have black characters on a white background.

4.7.13

Instrument junction boxes and electrical junction boxes shall have tag plates installed on the outer surface of the access cover.

4.8 Safety integrity level (SIL)

Devices specified to be SIL capable shall be provided with a certificate and a safety manual from an independent assessment body to establish conformance to IEC 61508.

5 System components

5.1 Valves

5.1.1 General

5.1.1.1

Valve material shall be compatible with the foam concentrate, the foam solution and the type of water used.

5.1.1.2

When provided, the automatic valve for foam concentrate shall be compatible with the type of foam concentrate to be used.

5.1.2 Deluge valves

5.1.2.1

Deluge valves shall be pilot operated.

5.1.2.2

Design of deluge valves and trim shall prevent the automatic return of valves to the closed position.

5.1.2.3

The design of deluge valves shall not require disassembling valves to return to service after operation.

5.1.3 Isolation valves

5.1.3.1

Isolation valves shall have an indicator showing the valve "open" and "closed" positions.

5.1.3.2

Isolation valves shall be capable of being secured in the intended position.

5.1.3.3

Isolation valves operating at maximum speed shall not fully open or fully close in less than five seconds.

5.2 Piping and pipe fittings

Piping and fitting materials shall be compatible with the foam concentrate, the foam solution and the type of water used.

5.3 Tubing and fittings

Small bore tubing and fittings shall be in accordance with IOGP S-716.

5.4 Electrical and instrumentation design and installation

5.4.1 General

5.4.1.1

For projects using IEC standards, the mobile and fixed offshore unit electrical installations shall be in accordance with IEC 61892-4.

5.4.1.2

For projects using IEC standards, electrical installations on ships shall be in accordance with IEC 60092.

5.4.1.3

For projects using North American standards, the electrical system design and installations for fixed and floating offshore petroleum facilities shall be in accordance with API Recommended Practice 14F or API Recommended Practice 14FZ.

5.4.1.4

For onshore projects using IEC standards, the low-voltage electrical system selection and installation shall be in accordance with IEC 60364-1, IEC 60364-4 and IEC 60364-5.

5.4.1.5

For projects using North American standards, electrical installations shall be in accordance with NFPA 70 (NEC 500/NEC 505).

5.4.2 Lighting

5.4.2.1

Luminaires, when provided, shall be LED type with integral electronic drivers.

5.4.2.2

For projects using IEC standards, luminaires shall be in accordance with IEC 60598.

5.4.2.3

For projects using North American standards, luminaires shall be in accordance with UL 1598.

5.4.3 Cables

5.4.3.1 General

5.4.3.1.1

The minimum cable bending radius shall comply with the manufacturer's recommendations.

5.4.3.1.2

Cable ends shall be provided with a cable tag.

5.4.3.1.3

Instrument, power and control cables not mechanically protected shall be armoured.

5.4.3.1.4

For projects using IEC standards, cable insulation material shall be flame resistant and low smoke in accordance with IEC 60332.

5.4.3.1.5

For projects using IEC standards, cables requiring a fire resistance rating shall be in accordance with IEC 60331.

5.4.3.1.6

For projects using North American standards, cables requiring a fire resistance rating shall be in accordance with UL 2196.

5.4.3.1.7

For projects using North American standards, cable outer sheaths shall be UV light stabilized in accordance with UL 2556.

5.4.3.1.8

For projects using North American standards, electrical cables in hazardous (classified) areas shall be in accordance with UL 2225.

5.4.3.2 Power and control cables

5.4.3.2.1

For offshore projects using IEC standards, cables shall be in accordance with IEC 61892-4.

5.4.3.2.2

For offshore projects using North American standards, cables shall be in accordance with UL 1309 and IEEE 1580.

5.4.3.2.3

For projects using North American standards, power and control wiring in cable trays shall be Type MC or TC rated cable in accordance with NFPA 70.

5.4.3.2.4

For three-phase, four-wire systems of electrical power, the neutral conductor shall equal the phase conductor specification and size.

5.4.3.2.5

Power cables and wiring shall be installed in continuous, uncut lengths without splices.

5.4.3.3 Instrumentation cables

5.4.3.3.1

For offshore projects using IEC standards, instrument cables shall be in accordance with IEC 61892-4, IEC 60092-350, IEC 60092-360 and IEC 60092-376.

5.4.3.3.2

For offshore projects using North American standards, instrument cables shall be in accordance with UL 1569.

5.4.3.3.3

For onshore projects using IEC standards, instrument cables shall be in accordance with EN 50288-7.

5.4.4 Cable glands

5.4.4.1

Cable gland material shall be compatible with the cable type.

5.4.4.2

Adaptors and reducers shall be made of the same material as the gland.

5.4.5 Cable support systems

5.4.5.1

Cables shall be routed using conduit, channel, cable trays and cable ladders.

5.4.5.2

For projects using IEC standards, cable trays and cable ladders shall be in accordance with IEC 61537.

5.4.5.3

For projects using North American standards, cable trays and cable ladders shall be in accordance with NEMA VE 1.

5.4.6 Junction boxes

5.4.6.1

Electrical junction boxes shall be segregated to LV power junction box and control junction box.

5.4.6.2

Junction boxes shall be fitted with internal or external earth, or ground studs.

5.4.6.3

The cable entry of junction boxes shall be from the bottom, except for lighting junction boxes.

5.4.6.4

Terminal blocks and individual terminals shall be permanently numbered.

5.4.6.5

Power terminals shall be raising screw clamp type.

5.4.6.6

Where conductor inter-connections are needed, metal links shall be used.

5.4.7 Cable transits

5.4.7.1

Cables shall penetrate enclosures through cable transits.

5.4.7.2

Spare ways in transit frames shall be filled with blank filling blocks.

5.4.7.3

10 % spare filler blocks with a minimum of one filler block of each type shall be provided in the transit frames.

5.4.7.4

Transits shall be identified by labels located on either side of the penetrations.

5.4.7.5

Cable insert blocks shall be non-flammable intumescent elastomeric polymer.

5.4.7.6

Separate multi-cable transit frames shall be provided for instrument and electrical cables.

5.4.8 Earthing and bonding

5.4.8.1

The package base frame shall have two earthing bosses as a minimum, at diagonally opposed locations, with a lug, stud, washer and nut.

5.4.8.2

Non-current carrying metallic equipment and enclosures shall be bonded to the package steelwork.

5.4.8.3

The instrument cable screen shall be tied back and insulated at the instrument side without terminating the screen at the field end.

5.4.8.4

Intrinsically safe earthing or grounding shall have an earthing point that is fully independent of instrument earth bonding.

5.4.9 Terminations

Spare cores shall be numbered and identified.

5.5 Structural steel base frame / enclosure / piping and valve support

5.5.1 Structural skid base frame

5.5.1.1 General

5.5.1.1.1

For offshore applications, base frames shall be designed with a maximum of four support points and analyzed with pinned boundary conditions.

5.5.1.1.2

Piping and tubing systems shall be designed to withstand stress due to vibration, thermal variation or the movement of attached equipment.

5.5.1.1.3

For piping and tubing component vibration, limits shall not exceed 12,70 mm/s (0,5 in/s) RMS measured in any direction.

5.5.1.1.4

Base frame welding shall be continuous welds.

5.5.1.1.5

Base frames shall be supplied with engineered tie-down points for use in any of the temporary phases that the package might encounter from engineering works to the installation site.

5.5.1.1.6

Areas on base frames inaccessible for coating or inspection shall be boxed in and seal welded.

5.5.1.1.7

Base frames shall be designed to prevent rainwater from pooling and becoming trapped in the frame.

5.5.1.2 Equipment > 1 000 kg (2 200 lb)

5.5.1.2.1

For packages and equipment weighting 1 000 kg (2 200 lb) or more, base frame support points shall be bolted to a support plate as detailed in Figure 2, Figure 3 and Figure 4.

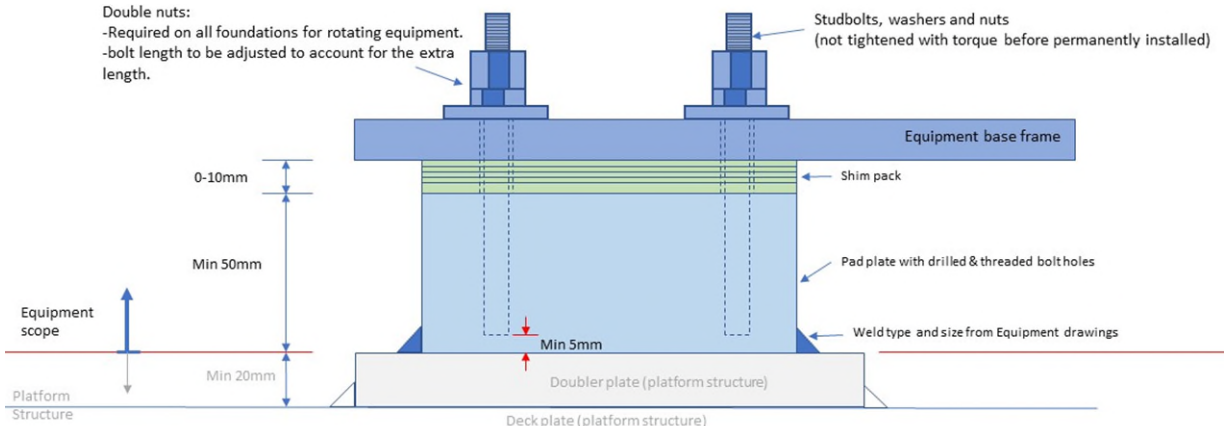


Figure 2 — Foundation for equipment ≥ 1 000 kg (2 200 lb) operational weight, interface design and responsibilities, double securing nut

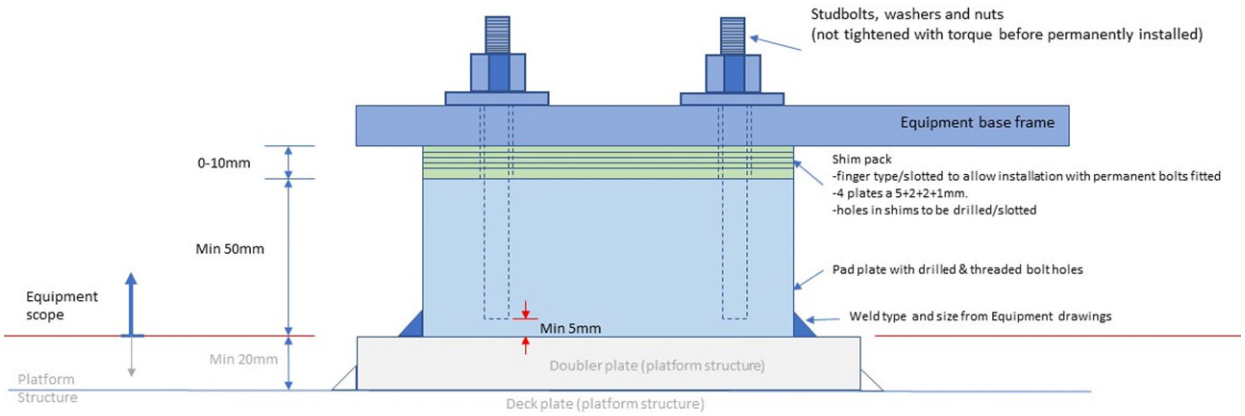


Figure 3 — Foundation for equipment ≥ 1 000 kg (2 200 lb) operational weight, interface design and responsibilities, single securing nut

5.5.1.2.2

Foundation bolts at support points shall be located on the outside face of the package skid.

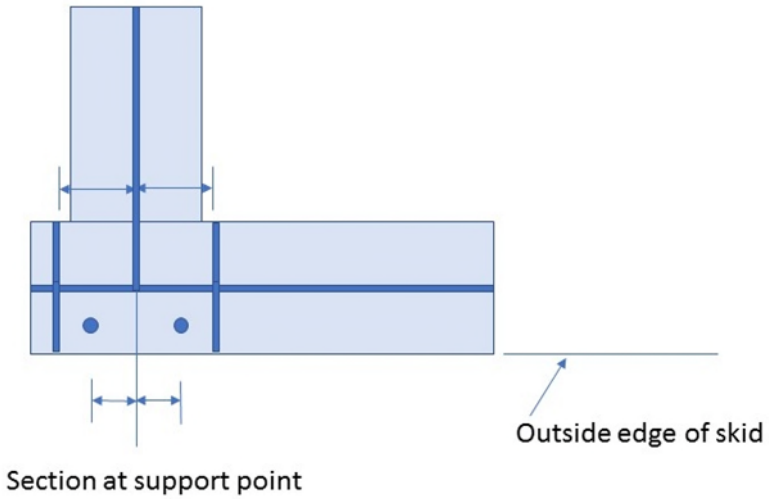


Figure 4 — Foundation for equipment ≥ 1 000 kg (2 200 lb) operational weight, section at support point showing bolt positions at support

5.5.1.2.3

Baseplate design, fabrication and mounting details for attachment to concrete foundations shall be in accordance with API Recommended Practice 686.

5.5.2 Enclosures

5.5.2.1

Ventilation shall prevent enclosure temperature exceeding the maximum ambient temperature.

5.5.2.2

Heating shall prevent the temperature inside enclosures falling below 4 °C (40 °F).

5.6 Main pipeline strainer

5.6.1 General

5.6.1.1

The main pipeline strainer shall permit the removal of the filter for replacement or repairs without removing the strainer from the line.

5.6.1.2

Perforations in the main pipeline strainer shall be sized to trap solids larger than the specified spray nozzle / sprinkler orifice.

5.6.1.3

The main pipeline strainer shall have a flushing outlet.

5.6.2 Flushing outlet connection

5.6.2.1

The outlet shall be sized to maintain a water flow velocity of minimum 1,8 m/s (6,0 ft/s) in the supply pipe when 345 kPa (50 psi) pressure is maintained at the inlet connection to the strainer and there is no flow through the strainer.

5.6.2.2

The main pipeline strainer flushing outlet shall be provided with a manual shut-off valve and a hose connection for disposal of the water.

5.7 Foam concentrate proportioning equipment

The foam proportioner equipment shall be certified for use with the foam concentrate.

5.8 Foam concentrate tank

5.8.1

Foam concentrate tanks shall comply with NFPA 16:2019, 6.6.

5.8.2

Foam concentrate tanks shall have a drain valve.

5.8.3

Foam concentrate tanks shall have a DN 600 (NPS 24) access hatch at the top of the tank.

5.8.4

If a foam concentrate tank is too small to permit a DN 600 (NPS 24) access hatch, the tank shall have an inspection hatch.

5.8.5

A filling connection shall be provided at the top of the tank.

5.8.6

Foam concentrate tanks shall have a pressure vacuum device and an expansion dome.

5.8.7

Foam concentrate tanks shall have a foam outlet connection.

5.8.8

The foam concentrate tank configuration shall include features to minimize foam evaporation.

5.9 Foam concentrate pump

The design and materials of construction for foam concentrate pumps shall be in accordance with NFPA 20.

5.10 Pressure gauge

Pressure gauges shall have an upper limit not less than twice the normal working pressure.

6 System configuration

6.1 Bypass line

6.1.1

If provided, the bypass line shall have a flow capacity equal to the flow capacity of the deluge.

6.1.2

If provided, the bypass line shall be located upstream of the foam proportioner.

6.2 Piping installation

6.2.1 Isolation valves

6.2.1.1

An isolation valve shall be located upstream of each deluge valve.

6.2.1.2

An isolation valve shall be provided on the bypass line.

6.2.1.3

Where a bypass line is specified, an isolation valve shall be provided between the deluge valve and connection of the bypass line downstream of the deluge valve.

6.2.1.4

An isolation valve shall be provided at the flushing outlet from the main pipeline strainer.

6.2.2 Draining

6.2.2.1

Pipe and fittings downstream of the deluge valve shall be sloped at no less than 25 mm per 3 m (1 in per 10 ft) to permit draining through the deluge valve drain.

6.2.2.2

Any pipe configuration that results in trapped sections shall be provided with a drain.

6.2.2.3

Drains shall be sized in accordance with NFPA 15:2017, 6.3.3.8.2.

6.2.2.4

Trapped sections over 190 litres (50 US gal) of water shall be provided with the capability to be drained to a safe area.

6.2.2.5

Means shall be provided to verify water flow through the drain.

6.2.3 Piping and layout

6.2.3.1 Piping specifications

6.2.3.1.1

Package piping shall be selected from the sizes listed in ASME B36.10M and ASME B36.19M.

6.2.3.1.2

Package piping shall be equal to or greater than DN 15 (NPS ½).

6.2.3.1.3

Package piping connections to external piping shall use flanges in accordance with ASME B16.5.

6.2.3.1.4

Gaskets and sealing rings of package piping flanges opened or dismantled prior to delivery shall be replaced with new ones.

6.2.3.1.5

Hydraulic hoses, expansion joints and flexible couplings shall not be used in package piping.

6.2.3.2 Piping valves

Valve stems shall not be mounted below the horizontal, except for gate valves in a pressure relief system.

6.2.3.3 Piping bolting

Bolting and nuts for flanges in package piping shall be in accordance with the recommendations in ASME B16.5, including minimum bolt length requirements.

6.2.3.4 Piping design and layout

6.2.3.4.1

Package components shall not overhang the package baseframe.

6.2.3.4.2

Mechanical joints shall be located wherever package piping components need to be separated to facilitate expected maintenance or replacement of parts.

6.2.3.5 Piping and valve supports

6.2.3.5.1

Pipe stands shall be anchored to the skid.

6.2.3.5.2

Support components welded to piping shall be the same or equivalent material grade as the pipe.

6.2.3.5.3

Piping and supports constructed from dissimilar metals shall be separated by an insulating barrier.

6.2.3.5.4

After welding, hollow piping support sections shall have their ends sealed with closure plates and vent holes sealed.

6.2.4 Test line

6.2.4.1

Test lines shall be located downstream of the deluge valve and the foam proportioner.

6.2.4.2

The test line, provided for deluge valve capacity testing, shall be routed to the skid edge.

6.2.4.3

An isolation valve shall be provided at the test line connection.

6.2.5 Pneumatic and hydraulic pilot line

6.2.5.1

The pilot line for the deluge valve shall be hydraulic or a combination of pneumatic and hydraulic.

6.2.5.2

A double check valve shall be provided in the pneumatic supply line.

6.2.5.3

Pneumatic supply lines shall have an isolation valve on the supply side of the double check valve.

6.2.5.4

The pilot line shall have a releasing solenoid.

6.2.5.5

The pilot line shall be provided with a valve for manual deluge release.

6.2.5.6

When a pressure-regulating type deluge valve is provided, the minimum downstream operating pressure shall be the pressure-regulating set point.

6.2.5.7

When a solenoid is provided, pilot line piping shall be configured to release deluge as energized to trip.

6.2.5.8

If sea water is used in the pilot line, there shall be no contact between the solenoid and the sea water.

6.3 Deluge skid attachments

6.3.1 Instrumentation

6.3.1.1

A transmitter for indication of low pressure shall be provided downstream of the double check valves on the pneumatic supply.

6.3.1.2

For heated enclosures, a temperature device shall be provided to detect when the indoor enclosure temperature is below 4 °C (40 °F).

6.3.1.3

Instrumentation shall be provided to detect water flow when the system is activated.

6.3.2 Fire department connection

6.3.2.1

The fire department connection piping shall be without isolation valves.

6.3.2.2

A check valve shall be installed in each fire department connection.

6.3.2.3

Piping between the check valve and the fire department connection termination point on the skid shall be equipped with an automatic drain valve.

6.3.2.4

For foam water type deluge skids, the fire department connection shall be configured to provide water to the supply side of the foam proportioner.

6.3.3 Gauges

6.3.3.1

A pressure gauge shall be installed upstream of non-pressure-regulating deluge valves.

6.3.3.2

Pressure gauges shall be installed upstream and downstream of pressure-regulating deluge valves.

6.3.3.3

Pressure gauges shall be installed on the pneumatic or hydraulic supply to the pilot line.

6.3.3.4

Pressure gauges and transmitters shall be equipped with a block and bleed valve.

6.3.4 Main pipeline strainer

6.3.4.1

When provided, the main pipeline strainer shall be installed upstream of the deluge valve.

6.3.4.2

The flushing outlet connection shall be routed to the skid edge.

6.3.4.3

The main pipeline strainer shall be accessible for flushing and cleaning.

6.4 Foam

6.4.1

The method of foam proportioning shall comply with NFPA 16:2017, 6.4.

6.4.2

The foam proportioning unit shall maintain a constant ratio of foam concentrate to the deluge and foam distribution piping.

6.4.3

Where the foam proportioner method requires the foam inlet pressure to be higher than the fire water pressure, the pressure difference shall be at least 100 kPa (14,5 psi).

6.4.4

Local manual activation via foam release valve shall be provided.

6.4.5

Remote activation with local reset shall be provided.

6.4.6

Back flow of firewater into the foam concentrate tank or foam concentrate distribution line shall be prevented.

6.4.7

The foam proportioning unit shall be installed between flanges in the firewater line.

6.4.8

Foam concentrate storage tanks shall be mounted on the skid base frame.

6.4.9

Foam concentrate tanks shall be provided with local visual indication of the foam level.

6.4.10

The foam concentrate hydraulic activation tube shall be configured to be constantly pressurized.

7 Welding

7.1 Welding management requirements

Welding shall be performed under a weld quality management system in compliance with the specified construction code and welding code or specification.

7.2 Welding procedure specifications

7.2.1

Welding for piping, pressure containing equipment and attachments welded thereto shall be in accordance with the specification indicated in the procurement data sheet.

7.2.2

Welding procedures for structures shall be qualified by a PQR in accordance with the applicable code and AWS D1.1 or the applicable parts of ISO 15614.

7.3 Welder and welding operator qualification

7.3.1

Welders and tack welders shall be qualified in accordance with applicable parts of ISO 9606, ASME *BPVC,* Section IX or the applicable design and fabrication code.

7.3.2

Welding operators shall be qualified in accordance with ISO 14732, ASME *BPVC,* Section IX or the applicable design and fabrication code.

8 Protective coating, painting and insulation

8.1 Protective coatings

8.1.1

Surface preparation for steel structures shall be in accordance with ISO 12944-4.

8.1.2

Execution and supervision of the coating application shall be in accordance with ISO 12944-7 and the qualified coating system procedure specification.

8.2 Piping and instrument insulation

8.2.1

When provided, insulation shall be removable.

8.2.2

Insulated surfaces shall be coated in accordance with IOGP S-715.

8.2.3

Perforated guards or screens shall be provided for surface temperatures over 60 °C (140 °F).

9 Special tools

9.1

Special tools shall be identified and supplied for assembly and maintenance of the equipment in the deluge skid.

9.2

Special tools shall be marked or tagged to indicate their intended use.

10 Testing

10.1 General

10.1.1

The deluge skid shall be tested for the full range of design conditions.

10.1.2

Deluge valves shall be tested for full flow at maximum supply pressure conditions.

10.1.3

The test line shall demonstrate functional performance of the deluge valve operation including pressure regulation if specified.

10.1.4

The bypass line shall be tested for full flow at maximum supply pressure.

10.2 Hydrostatic pressure test

10.2.1

Piping and appurtenances, including foam concentrate lines where provided, shall be tested at 344 kPa (50 psi) higher pressure than the maximum working pressure or 1380 kPa (200 psi), whichever is greater.

10.2.2

The gauge pressure shall not deviate more than ± 34 kPa (5 psi) for a minimum of two hours with no visual leakage.

10.2.3

Bladder tanks and atmospheric tanks shall not be pressure tested.

11 Preparation for shipment

Open gland entries shall be fitted with temporary blanking plugs to maintain the ingress protection rating during transportation and storage.

12 Lifting arrangements

12.1

Lifting equipment shall be certified.

12.2

Lifting equipment and rigging arrangements shall be designed such that a single point lift can be performed safely, keeping the package horizontal.

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