GUIDANCE NOTES ON

RECOMMENDED SPECIFICATIONS OF JUNCTION BOX AND CABLE TRAY FOR OFFSHORE APPLICATION

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Foreword

These Guidance Notes provide ABS recommendations for the design and construction of cable trays and junction boxes. These Guidance Notes are applicable to fixed and floating offshore structures as well as drilling units.

These Guidance Notes provide recommendations and best practices for standard specifications of certain electrical and instrumentation components thus improving cost efficiency (i.e., design man-hours, operation and maintenance costs), and increasing predictability of operation without compromising quality and safety in offshore structures and units. The recommendations in these Guidance Notes are based on industrial experiences, project experience, shipyard practices, manufacturer's data sheets, national regulations, international standards, and ABS Rules.

These Guidance Notes become effective on the first day of the month of publication.

Users are advised to check periodically on the ABS website www.eagle.org to verify that this version of these Guidance Notes is the most current.

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SECTION 1 General

1 Background

These Guidance Notes have been developed to provide shipyards, designers, owners and operators with practical guidance on the design and construction of specific electrical and instrumentation (E&I) components used in offshore structures and units that are not covered by Class Rules. The main purpose of these Guidance Notes is to provide recommendations and promote standardization for the material, design and manufacturers' requirements.

Basic requirements for some aspects of the E&I components (e.g., cable tray and junction box) can be found in the ABS *Rules for Building and Classing Mobile Offshore Drilling Units (MODU Rules)*, as well as the ABS *Guide for Classification of Drilling Systems (CDS Guide)*. However, it is recommended in these Guidance Notes that some requirements additionally be based on international standards, such as IEC, IEEE, NEC, API, and NEMA.

3 Scope and Application

These Guidance Notes are applicable to fixed and floating offshore structures as well as drilling units (without any geographical limitations) including topside installations. These Guidance Notes are not applicable to E&I components already covered by Class Rules. The recommendations in these Guidance Notes do not override any Rules or statutory requirements that may exist.

The design standard for junction boxes and cable trays in the offshore projects is based on applicable industry standards, regulations, and classification requirements. An effort is made to compare the safety standards considering OSHA, NEC, NEMA, NFPA, API and IEC Standards.

5 Instrument Junction Box

Junction boxes are an integral part of every electrical, control and instrumentation installation. For control and instrumentation, it is an enclosure used for interconnection between field devices (i.e., instruments) in the process/production areas and control/monitoring equipment typically located in the control room. The junction box is typically used for terminating multiple field devices of common systems in a general area. Instrument junction boxes should be designed to suit the environmental conditions of the intended locations. It should have certification to demonstrate proper ingress protection (IP) and hazardous area protection.

The specifications for instrument junction boxes covered in these Guidance Notes address the following items:

- Materials
- Degree of protection
- Type of terminal
- Cable entry direction and devices
- Earthing
- Temperature class and gas group
- Breather/drain plug
- Enclosure size

- Labels
- Terminal block back plate
- Doors
- Ambient temperature

Instrument junction boxes are required for many systems and can be in a variety of work locations (e.g., in wet or dry conditions and safe or hazardous areas) onboard offshore structures and units. Generally, instrument junction boxes should be maintained at safe and efficient conditions. Because typically many junction boxes are required on offshore structures and units, it is recommended that the requirements and specifications be standardized.

7 Metal Cable Tray

Cable trays are a part of a planned cable management system to support, route, protect, and provide a pathway for cable systems. All offshore structures and units require numerous electrical cables with cable tray systems for installations. Although cable trays are available in various shapes, straight type cable trays are the most common and are discussed in these Guidance Notes.

Most offshore structures and unit use the ladder type cable trays (i.e., the cables are supported by a traverse bar, similar to the rungs of a ladder, at regular intervals) due to their desirable characteristics, such as:

- They permit the maximum free flow of air across the cables, thus dissipating heat.
- They consume less space and require less labor for installation compared to other types
- The rungs provide a strong anchor position
- The rail flanges provide protection to the cables
- Faulty cables can easily be located/identified and replaced/repaired

Perforated trays (i.e., punch type cable trays with holes) are another type of cable tray support system It is usually used for small bundles of cables for short distances and generally is used for cable branching.

The standard specification of straight type metal cable trays in these Guidance Notes are addressing the following items:

- Materials
- Dimensions
- Classification
- Testing
- Finishing material

9 Abbreviations

API	American Petroleum Institute
AS/NZ	Australian/New Zealand Standard
ASTM	American Society of Testing and Materials
ATEX	ATmosphères EXplosibles
BS	British Standards
CDS	Classification of Drilling Standards
E&I	Electrical and Instrumentation
EN	European Standards

Ex e	Increased Safety equipment as per IEC 60079-7
GRP	Glass Reinforced Polymer
HDG	Hot Dip Galvanized
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electro-technical Commission
IECEx	Global certification scheme for equipment suitable for hazardous areas based on IEC standards
IP	Ingress Protection
NEMA	National Electrical Manufacturers Association
NORSOK	Norsk Sokkels Konkuranseposisjon, Standards by Norwegian Technology Centre
NEC	National Electrical Code
NFPA	National Fire Protection Association's Standard
MODU	Mobile Offshore Drilling Unit
OSHA	Occupational Safety and Health Association
PVC	Poly Vinyl Chloride
UL	Underwriters Laboratories Inc.
SS	Stainless Steel
TAMB	Temperature Ambient
VPI	Vapor Protection Inhibitor

SECTION 2 Instrument Junction Box

1 Scope

This Section provides recommendations for the specification of instrument junction box as per API, IEC, ABS Class Rules and NEMA.

3 Material and Grades

3.1 Material

It is noted that the majority of instrument junction boxes on offshore structures and units are manufactured using stainless steel. Stainless steel junction boxes are manufactured using 316L grade stainless steel (SS316L) for maximum environmental protection. Type 316 stainless steel is usually preferred because Type 303 and 304 are more subject to pitting-type corrosion (API RP 14F and API 14FZ). Additionally, the robust design provides a high degree of safety for offshore applications. SS316L (API 14FZ) is capable of achieving ingress protection enabling these instrument junction boxes to be suitable for use in hazardous areas and be certificated under the ATEX Directive and the IECEx certification schemes.

For outdoor areas that are exposed to changing environmental conditions, the use of materials with good corrosion resistance, high yield, tolerance to high ambient temperatures and high creep strength, is important. Considering these conditions, Glass Fiber Reinforced Polyester (GFRP) material may be used for instrument junction boxes construction, due to its high resistance to contamination from oils and its excellent mechanical properties (e.g., strength) and life expectancy.

In general, SS316L and GFRP is recommended for use in both indoor and outdoor instrument junction boxes.

3.3 Installation in Hazardous Zone

The enclosure should be suitable for both the area classification and the environment. Hazardous areas are classified in terms of zones on the basis of the frequency and duration of the occurrence of an explosive atmosphere with gas vapor and mist (API14F and API14F RP).

The ATEX directive consists of European Union (EU) directives describing the equipment and work environment with an explosive atmosphere. More specifically, the equipment directive covers equipment and protective systems intended for use in potentially explosive atmospheres. ATEX Certification is not accepted by US Flag.

Whereas the IECEx is based on the international standards IEC 60079-series. The IECEx Certificate is the Certificate of Conformity covering Ex Equipment for use in Explosive Atmospheres. IECEx certification is accepted by US flag.

In addition to ATEX and IECEx certification(s), the junction box should undergo various test and type approval procedures requirements. It is recommended that the junction boxes are certified as per the ATEX or IECEx certification schemes because it provides an increased level of safety. All cable entries to the instrument junction boxes should be fitted for certified sub-components and with the appropriate IP rating.

Ex d “flameproof” and Ex e “increased safety” are the most commonly used for junction boxes in offshore. The pressurized enclosures should comply with NFPA 496 or IEC standards as shown in Section 2, Table 1.

TABLE 1
Installation in Hazardous Zone (API 14FZ)

Type of Protection Method	*Equipment Code*	*Description*	*Area Classification (Zone)*	*International Standard*
Intended to prevent potential ignition arising	Ex e	Increased safety	1, 2	IEC 60079-7
	Ex nA	Non-Sparking	2	IEC 60079-15
Intended to limit the ignition energy of the equipment	Ex ia	Intrinsic ia	0	IEC 60079-11
	Ex ib	Intrinsic ib	1	IEC 60079-11
	Ex ic	Intrinsic ic	2	IEC 60079-11
	Ex nL	Energy Limited – Limit the energy of sparks and surface temperatures	2	IEC 60079-15
Intended to prevent the explosive atmosphere contacting the ignition source	Ex p	Purge/pressurized protection	1	IEC 60079-2
	Ex px	Purge/pressurized protection ‘px’	1	IEC 60079-2
	Ex py	Purge/pressurized protection ‘py’	1	IEC 60079-2
	Ex pz	Purge/pressurized protection “pz’	2c	IEC 60079-18
	Ex m	Encapsulation		IEC 60079-18
	Ex ma	Encapsulation	0, 1, 2	IEC 60079-18
	Ex mb	Encapsulation	1,2	IEC 60079-18
	Ex 0	Oil immersion	1, 2	IEC 60079-18
	Ex nR	Restricted breathing enclosure	2	IEC 60079-15
Intended to prevent an ignition from escaping outside the equipment	Ex d	Flameproof protection	1,2	IEC 60079-1
	Ex q	Flameproof protection	1,2	IEC 60079-5
	Ex nC	Flameproof protection	2	IEC 60079-15
Special	Ex s	Special Protection	Zone depending on manufacturer certification	IEC 60079-0

3.5 Ingress Protection Rating

Enclosures ingress protection (IP) rating provides protection of equipment against certain external influences (e.g., intrusions, dust, accidental contact, and water) and, in any direction, protection against direct contact is well defined as the IP rating in IEC 60529 The IP rating is based on different locations that are divided into four categories: A, B, C and D. The IP rating for indoor is defined with low severity levels like IP21 and IP44. The outdoor IP rating is IP56, which can withstand severe conditions as shown in Section 2, Table 2.

TABLE 2
IP Ratings for Junction Box

Category	*Indoor Location*	*Ingress Protection*
A	Indoor with HVAC	IP 21
B	Indoor machinery space	IP 44
C	Indoor with water mist	IP54
D	Outdoor	IP56

5 Type of Terminal

In general, there are two types of terminals used on offshore structures and units: screw and pin/spring cage. The screw type connection is time consuming and the screw mechanism limits the minimum physical size of a terminal, making screw terminals less useful where a large number of connections are required. Spring cage-type or pin-type terminals are most commonly used. These types provide a vibration proof connection, high strength, easy installation, and good electrical conductivity according to IEC 60947. For these reasons, the pin/spring cage type is recommended for use in terminal boxes.

7 Cable Entry Directions

Sufficient cable entries on Ex e certified instrument junction boxes should be at the bottom and sides which should maintain the certification and IP rating of the enclosure. Unused entries in the enclosure should be sealed by blanking elements that comply with EN 60079-0 and can maintain the degree of ingress protection and the Ex rating.

9 Cable Entry Device

A gland plate is used as the cable entry device. The material used for gland plate fabrication is SS316L. The SS316L contains molybdenum (Mo), which provides excellent corrosion resistance especially against chlorides. Nickel plated brass is most commonly used for the cable glands. Cable glands should also conform to the requirements for threaded joints.

It is recommended to use SS316L material for gland plates for the instrument junction box entry device with nickel plated brass for cable glands complying with IEC 60423 and IEC 62444.

11 Earthing

All instrument junction boxes should be provided with M6~M10 internal/external SS316L earth studs. Earth studs should be welded to the enclosure wall to maintain integrity of the IP rating complying with NORSOK E001 Sec.10.5 and IEC 60529.

13 Temperature Class and Gas Group

A temperature class for junction boxes is used to designate the maximum operating temperatures on the surface of the equipment, which should be less than the ignition temperature of the surrounding, potentially hazardous (flammable) atmosphere. The junction box located in the field should be suitable for hazardous areas with Gas Group II and temperature class of T3 as a minimum, complying with IEC60079-10.

15 Drain or Breather Plug

All external instrument junction boxes should be provided with breather/drain plugs to enable any condensation or moisture to drain and allow air from the enclosure to vent into the surrounding atmosphere to minimize moisture build up. All breather/drain assemblies are SS316/SS316L type and should have an IP rating equal to the associated junction box.

17 Junction Box Size

Human factors engineering principles should be considered and applied during the early design stage of the junction box where the size can have a critical impact on maintainability, accessibility as well as the safety and health of the user. The factors influencing junction box size selection are based on current industry practices and ease of handling and installation considering the health, safety and environment (HSE) and the IIF (incident and injury free) guidelines.

It is recommended that junction boxes have a width and height in the range of 200~500 mm and a depth of as per manufacturer's recommendation, as shown in Section 2, Table 3 below.

TABLE 3
Instrument Junction Box Dimensions

Dimension	*Size mm (in.)*
Width	200 ~500mm (7.87~19.69)
Height	200 ~500mm (7.87~19.69)

19 Terminal Block Back plate

The terminal block back plate is suggested for installation of terminal block inside the junction box. The purpose of this back plate is to maintain the IP rating of junction box. It is recommended to use normal steel or SS316/SS316L material for the back plate inside the instrument junction box.

21 Labels

All equipment should be labeled with the level of protection, gas group, applied standard, temperature class, and the number of the certificate. Labels and signs should use words and abbreviations familiar to personnel. Labels should be made from materials and manufactured by a process that will be suitable for all expected conditions in the operating environment. The material should also be compatible with the surface on which it is attached and be resistant to ultra-violet (UV) damage, if exposed to sunlight. It is recommended that the material used for labelling be SS316 or SS316L. Separate label brackets, if used, should be made of SS316 or 316L.

For fixing the label into place, it is recommended that rivet-type and spot welding be used as per industry practice.

23 Door

The indoor GRP junction box should be wall mounted type and door should be removable type with four (4) stainless steel screws fastening. The outdoor junction boxes most commonly use a hinged lift-off door. A removable stainless steel gland plate completed with gasket should be provided. The junction box should be wall mounted type and door should be hinged type. The function of the hinge is to support the door when opened and allow easy removal of the door, as required. It is recommended to use hinged type and lift off doors.

25 Ambient Temperature

All equipment used within hazardous areas has an operational temperature range often referred to as the "Tamb". It defines the upper and lower ambient temperatures of which the equipment is approved for use as defined in IEC 60079-0. Those standard limits are –20°C to +55°C. It is recommended that the junction boxes comply with these limits.

27 Safety and Risk for Junction Box

Risk factors, safety issues, and their mitigation factors for the junction box are described in Section 2, Table 4 below.

TABLE 4
Risk Assessment, Consequence and Mitigation for Junction Box

Risk Issue	*Standard*	*Consequence*	*Mitigation*
Corrosion	NEMA 4X	Corrosion due to dust, rain, splashing water, humidity, and salt laden atmosphere, which can damage the junction box	It is recommended to use SS316 material for indoor and outdoor junction boxes. SS316 is primarily intended for outdoor use and offers a superior level of protection from corrosion and extreme environments. In order to protect the components from corrosion inside the enclosure, VPI (Vapor Protection Inhibitor) are recommended to be used.
Explosion	NORSOK S001 NEMA 250 EN 60079-7.	Explosion occurs due to: Potential ignition source Explosion proof design problems Fire and shocks The explosion leads to damage of the junction box.	Explosion proof certificates should be acquired by the manufacturer. Junction boxes used in hazardous areas should be ATEX or IECEx certified, and should undergo various testing as per UL guidelines and type approval procedures as recommended.
Stagnating water	NEMA 250 IEC60529	Stagnating water leads to corrosion, explosions, water accumulation, and sparking	IP ratings are developed by IEC in which junction boxes are tested against stringent test procedures given by UL.
Improper electrical connections due to mishandling	NEC AS 3000	Improper connection leads to loose connection and affects the operation instrument drastically	Tooth gears or shake proof washers are recommended in order to maintain electrical connection. Double compression glands are also recommended as they provide compression to the cable armor as well as the inner sheath, thus, providing better support and sealing.
Condensation	IECEx ATEX UL Mark	Condensation may lead to sparks, short-circuits, corrosion, and premature ageing of components	Drain/Breather plugs are used to drain moisture due to temperature variation between the inside and outside of the junction box. This can purify the inside air of the equipment. It is recommended to use drain/breather plugs to minimize moisture and vent air. They should have an IP rating the equal to that of the associated junction box.
Overheating	IEC 60423	Overheating leads to shocks and explosion	It is recommended that a junction box located in the field be suitable for hazardous areas with Gas Group II and a temperature class of T3, as minimum.

SECTION 3 Metal (Straight) Cable Tray

1 Scope

Many industrial and commercial electrical cabling systems have high initial capital costs and require excessive maintenance. The procurement process for the components can be extensive and challenging for all parties, as a wide range of components are available with differing construction standards to comply with various regulations. Based on current industry practice, the straight type cable trays are more commonly used in offshore structures and units, so this section addresses the standard specifications of straight type cable trays. Straight type cable trays are divided into two categories: ladder type and perforated type.

Based on current industrial practice for offshore project it is noted that the NEMA VE 1, NEC 300.22(C) and NEC 392 standards are most widely used for the construction and the design of cable trays.

3 Material

All applicable NEMA, IEC, NEC, API and British standards require cable trays to be made of corrosion-resistant metal with a corrosion-resistant finish. Recommended materials for cable trays include copper-free aluminum, stainless steel, and fiberglass (API 14F). Other materials such as plastic (Thermoplastic and Thermosetting plastic materials with or without reinforcement, such as PVC and fiber reinforced plastics – FRP) are also acceptable provided they comply with ABS Rules or other standard recognized by ABS.

Hot-dipped galvanized (HDG) steel and structural steel are recommended for metal cable trays. Aluminum cable trays have lightweight properties but have sparking tendency (due to their conductivity, cooling and heating properties) and are difficult to maintain. The current industry practice is the use of SS316L and HDG cable trays as per the NEMA VE1 standard. It is recommended that for indoor installations HDG material is used and for outdoor installations SS316L material is used.

All fittings for the cable trays should be of the same material as the cable tray.

3.1 Stainless Steel SS316L

Stainless steel offers high yield strength, high creep strength and tolerance to high ambient temperatures. Roll formed SS316L is especially suitable because it possesses high corrosion resistance due to its high level of chromium and nickel. Molybdenum in SS316 increases temperature strength and improves anti-corrosion strength, in accordance to IEC 61537, ASTM A240.

3.3 Hot-Dip Galvanized (HDG) Steel SS400

HDG is manufactured when the tray is immersed in a bath of molten zinc, resulting in the coating of all surfaces. Hot dip galvanizing after fabrication creates a much thicker coating than the pre-galvanized process, according to ASTM A123 Grade 65 and BS EN 61537.

5 Dimensions

The length of cable tray is a crucial dimension for selection as it is based on several criteria such as strength, load, span, and ease of handling and installation.

The commonly used cable tray standard NEMA VE1, lists typical lengths (not including connectors) as follows:

- 3000 mm (10 ft)
- 3660 mm (12 ft)
- 6000 mm (20 ft)
- 7320 mm (24 ft)

In general, longer lengths [≥ 6000 mm (20 ft)] are impractical and difficult to load test. Specifically, it is impractical to manufacture lighter systems in the longer lengths or heavier systems in the shorter lengths. A 3000 mm (10 ft) long cable tray is considered an appropriate length and is typically easier to maneuver during installation. It is recommended that the rung spacing of open-type trays not exceed 300 mm (12 in.) (API14F, NEMA VE 1) as shown in Section 3, Figure 1.

7 Classification

The NEMA VE1 Classifications for cable trays were established to simplify and standardize the specification of cable trays most commonly used for offshore cable trays**.** The classification of NEMA VE1 defines the distance between the supports on which a cable tray is installed, commonly referred to as the support span, and the working load to be used for the ladder type cable tray. The selection of span/load class designation is in accordance to NEMA VE 1.

The selection of 10C NEMA Class cable tray is based on ease of handling and the thickness of the cable tray, which plays an important role in selecting the desired classification. The 10C NEMA VE1 Classification with 3 m (10 ft) span and 97 Kg/m (65 lb/ft) load should be used to design the ladder type cable tray in compliance with NEMA VE1.

The NEMA classification is not available for perforated cable trays.

9 Testing

Several types of mechanical and electrical tests are required by NEMA VE1 and IEC 61537 standards.

An electrical continuity of connections test is considered pivotal as per NEMA VE1. It confirms the cable tray electrical connections from one cable tray to another.

11 Finishing Material

Most cable trays on offshore structures and units are powder coated. The powder coating is a polyester type applied by using electrostatic spray with a pre-treatment of zinc phosphate.

The main purpose of the finishing material is corrosion resistance. There are additional benefits as listed below:

- Resistance to weather
- Resistance to physical damage
- Protects the tray from falling welding slug
- Resistance to scratching or finger marking
- To give a clean, aesthetically pleasing appearance

Powder coating is most commonly used for all the outdoor cable trays and is recommended.

13 Recommended Design of Ladder and Perforated Cable Tray

Section 3, Figures 1 and 2 give the recommended cable tray design as per the standard specifications.

FIGURE 1
Ladder Type Cable Tray

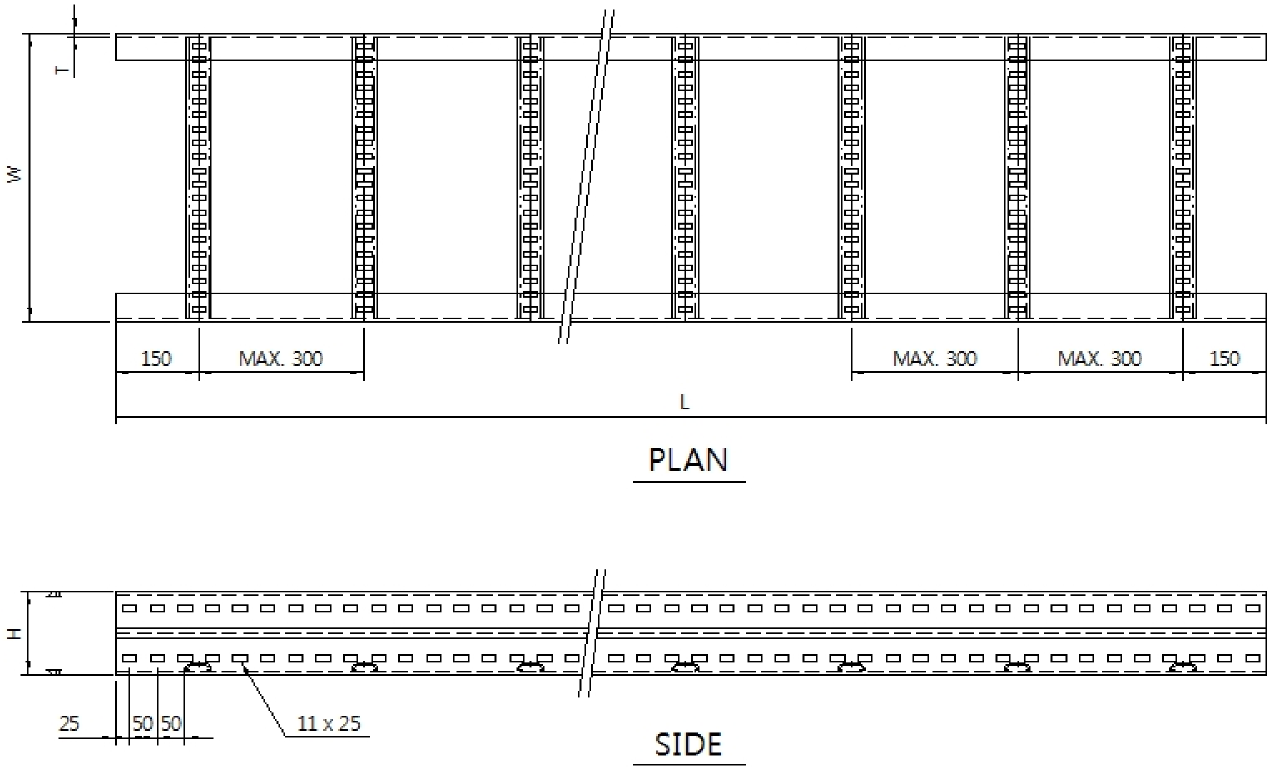
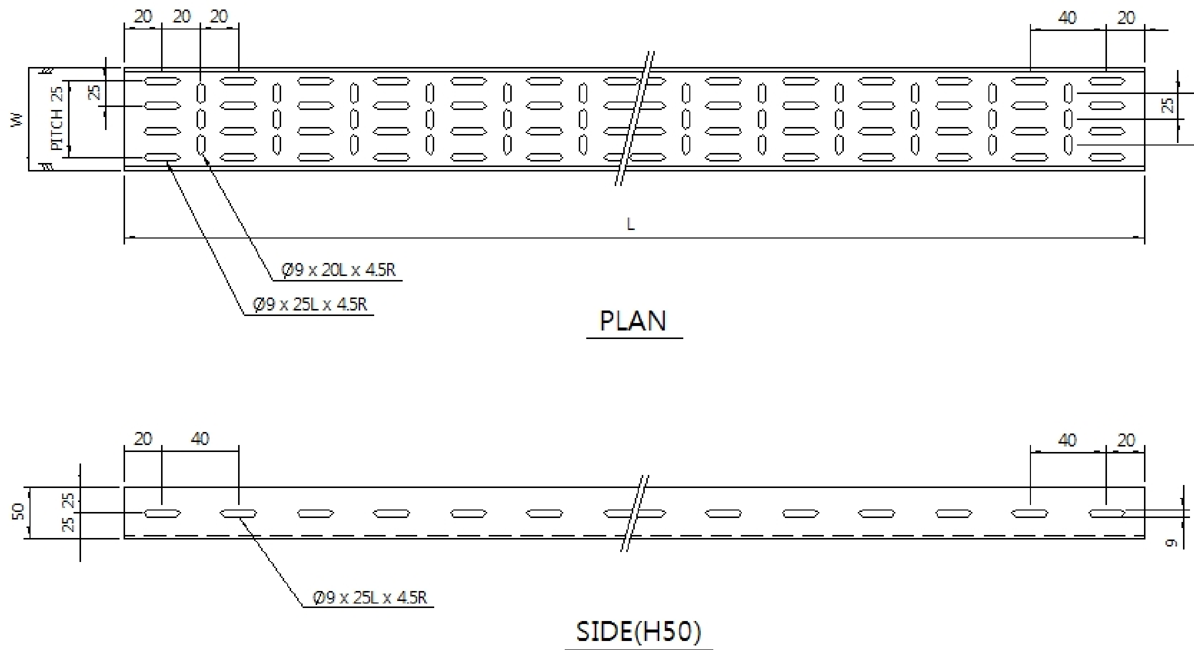


FIGURE 2
Perforated Type Cable Tray



15 Risk and Safety for Cable Tray

The safety and risk factors related to cable tray system design and installation are discussed in Section 3, Table 1.

TABLE 1
Risk Assessment, Consequences and Mitigation for Cable Trays

Issue	*Standard*	*Consequences*	*Mitigation*
Corrosion	NEMA VE1 4.2.1 IEC 61537 Table 7	Corrosion due to the environment can damage the cable tray	It is recommended that outdoor cable trays are powder coated or painted.
Improper Ventilation	NEMA VE1 6.1 NEC 2005	Improper ventilation leads to: a) Overheating and damage to electrical cable insulations b) Drooping of the cables	The standard specification recommends that straight ladder type cable trays for indoors and outdoors are used as it can easily dissipate the heat generated by the cables. Ventilation through cable trays, such as perforated cable trays, is recommended when extend for short distances for small bundles of cables.
Overloading	NEMA VE 1 Sec. 5 IEC 61537 Sec.8	Overloading of cable trays can cause breakdown of the tray, its connecting points, and supports. This may lead to injuries to personnel: potential for electric shock and arc/flashing events from the cables that are no longer supported	Proposed standardization recommends a length of 3 m (10 ft.), which suits the typical support spans and makes load testing easier. The testing of cable trays should be carried out according to NEMA VE1 Sec 5 and mechanical strength testing according to IEC 61537 Sec 8.
Overfilling	Section 4-3-3/5.9.3 and 5.11.1 of the *MODU Rules*	Overfilling leads to potential for overheating	The Cable Tray Institute (CTI) of Raleigh, NC suggests that cable trays should not be filled in excess of 40-50% of the inside area of the tray or of the maximum weight based on the cable tray specifications.
Thermal expansion	NEMA VE2, Section 4.3.2, NEC® Section 300.7(B)	Overheating, shocks	Raceways should be provided with expansion joints where necessary to compensate for thermal expansion or contraction.

APPENDIX 1 References

ABS *Rules for Building and Classing Mobile Offshore Drilling Units*

AISI Type 316L stainless steel, Standard Specification of Stainless Steel SS316L

ANSI IEC 60529 Degrees of protection provided by enclosures

API 14RP and 14F Design, Installation, and Maintenance of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class 1, Division 1 and Division 2 Locations. AS/NZ 3000 Electrical Installation (Australia/ New Zealand Wiring Rules)

ASTM A 123 Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.

AS/NZS 60079.10.1:2009 Explosive atmospheres - Classification of areas explosive gas atmospheres

ASTM B633-13 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel

BS EN 61537, IEC 61537 - Cable tray systems and cable ladder system for cable management.

EN 10088-1, Stainless steels. List of stainless steels

EN 10326 Continuously hot-dip coated strip and sheet of structural steels – Technical delivery conditions

EN 10327 Continuously hot-dip coated strip and sheet of low carbon steels for cold forming - Technical delivery conditions

IEC 60092-350 Electrical Installations in ships: Part 350 Shipboard power cables, General construction and test requirements.

IEC 60079-0 Equipment- General Requirements

IEC 60079-7 Equipment Protection by Increased Safety ‘e’

IEC 60079-11 Explosive Atmosphere

IEC 60079-14 Electrical Installations design, selection and erection.

IEC 61892 Mobile & Fixed Offshore Units: Electrical Installations

IEC 60204: International Electro technical Contractors Standard for Safety of Machinery/Electrical Equipment with Machinery

IEC 61892 Mobile and Fixed Offshore Units: Electrical Installations

IEC 61537: International Electro technical Contractors Standard for Cable Tray Systems and Cable Ladder Systems for Cable Management second

IEC 60204-1 International Electro technical Contractors Standard for Safety of Machinery/Electrical Equipment with Machinery

IEEE Std 1202, Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies

ISO 14713, Protection against corrosion of iron and steel in structures – Zinc and aluminum coatings – Guidelines

National Electrical Code® 500 (NEC® Handbook)

National Electrical Code® Article 317 and Article 318

National Electrical Code® Article 392 (NEC® Handbook)

NEMA VE1: National Electrical Manufacturers Association (partnered with CSA) Standard for Metal Cable Tray Systems

NEMA VE2: National Electrical Manufacturers Association Standard for Cable Tray Installation Guidelines NECA/NEMA 105 Recommended Practice for Installing Cable Trays

NFPA 70: National Fire Protection Association's Standard; equivalent to NEC

NFPA-78 Electrical Standards for Industrial machinery

NORSOK E001, Electrical, Instrumentation and Telecommunication Installation

OSHA Fact Sheet - Electrical Safety Hazards of Overloading Standard Cable Trays & 29 CFR 1910.305(a)(3)

UL 50 Enclosures for Electrical Equipment, Non-Environmental Considerations