कोचीन शिपयार्ड लिमिटेड / COCHIN SHIPYARD LIMITED
कोच्ची / COCHIN - 682 015

पोत निर्माण प्रभाग / SHIP BUILDING DIVISION

आउटसिर्सिंग विभाग
OUTSOURCING DEPARTMENT

निविदा दस्तावेज़ / TENDER DOCUMENT

TENDER NO. SB-OSD/TSHD/928/2025 Dtd: 19-02-2025

ELECTRICAL OUTFIT WORKS – ELECTRICAL CABLE LAYING WORKS IN TRAILING SUCTION HOPPER DREDGER (SH.37)

FEBRUARY - 2025

विषय - सूची / CONTENTS

15	जहाज की सामान्य व्यवस्था (जीए) **GENERAL ARRANGEMENT (GA) OF VESSEL**	अनुबंध	**APPENDIX G**
16	आईएचसी गुणवत्ता मैनुअल **IHC QUALITY MANUAL**	अनुबंध	**APPENDIX H**
17	सीएसएल विद्युत आउटफिटिंग मानक **CSL ELECTRICAL OUTFITTING STANDARDS**	अनुबंध	**APPENDIX I**
18	एमसीटी इंस्टालेशन चेकलिस्ट **MCT INSTALLATION CHECKLIST**	अनुबंध	**APPENDIX J**
19	ईएमसी प्रबंधन नियंत्रण दस्तावेज़ **EMC MANAGEMENT CONTROL DOCUMENT**	अनुबंध	**APPENDIX K**
20	हीट ट्रेसिंग सिस्टम की स्थापना का विवरण **INSTALLATION DETAILS OF HEAT TRACING SYSTEM**	अनुबंध	**APPENDIX L**

निविदा सूचना / TENDER NOTICE
कोचीन शिपयार्ड लिमिटेड / COCHIN SHIPYARD LIMITED

पोत निर्माण प्रभाग / SHIP BUILDING DIVISION
आउटसिर्सिंग विभाग/ OUTSOURCING DEPARTMENT

SB-OSD/TSHD/928/2025 **19th February - 2025**

निविदा सूचना / TENDER NOTICE

संक्षिप्त विवरण / BRIEF DETAILS:

निविदा जांच संख्या और तारीख **Tender enquiry No. and date**	**SB-OSD/TSHD/928/2025 Dtd 19-02-2025**
कार्य का नाम **Name of work**	**ELECTRICAL OUTFIT WORKS – Electrical Cable Laying Works in Trailing Suction Hopper Dredger**
निविदाएं प्राप्त करने की अंतिम तिथि और समय **Last date & time of receipt of Tenders** (भाग/Part I – तकनीकी-वाणिज्यिक बोली और भाग - II मूल्य बोली/ **Techno-Commercial Bid & Part II-Price Bid)**	**12th March - 2025at 15.00 Hrs IST**
पूर्व बोली बैठक की तारीख **Date of Pre bid meeting**	**28th February - 2025at 11.00 Hrs IST**
भाग I (तकनीकी–वाणिज्यिक) बोली खोलने की तिथि और समय **Date & time of opening of Part I (Techno – Commercial) Bid**	**12th March – 2025at 15.30 Hrs IST**
संपर्क व्यक्ति **Contact Person**	***For Commercial queries:*** Mr. Adarsh S, AM (Outsourcing), Mob No: 87146 30926. ***For Technical queries:*** Mr. Muhammed Faizy C E, AGM (EOF), Mob. No: 9895705126.

नोट: इस निविदा के खिलाफ उद्धृत करने से पहले, संभावित बोलीदाता से अनुरोध है कि वे निविदा जांच दस्तावेज़ (और अनुलग्नक, यदि कोई हो) को पूरी तरह से और सावधानी से पढ़ लें। निविदा के नियमों और शर्तों में विचलन अत्यधिक हतोत्साहित किया जाता है। इसलिए, निर्धारित किसी भी नियम और शर्तों, योग्यता मानदंड, ईएमडी जमा करने से छूट के लिए पात्रता, दस्तावेज़ीकरण/प्रक्रियात्मक आवश्यकताओं आदि के संबंध में स्पष्टीकरण, यदि कोई हो, के संबंध में उत्पन्न होने वाले किसी भी संदेह को संभावित बोलीदाता द्वारा बोली जमा करने से पहले निरपवाद रूप से उपरोक्त सूचित व्यक्तियों के माध्यम से अनिवार्य रूप से स्पष्ट किया जाएगा।

Note: Before quoting against this Tender, the prospective bidder is requested to go through the Tender Enquiry document (& Annexes, if any) thoroughly & carefully. Deviations to the Terms & Conditions of the Tender are highly discouraged. Therefore, any doubts arising in respect of any of the Terms & Conditions stipulated, Qualification Criteria, Eligibility for exemption from submission of EMD, clarification if any w.r.t. Documentation / Procedural requirements, etc. shall get clarified by the prospective bidder through above noted contact persons invariably before the submission of the Bid.

1. कोचीन शिपयार्ड लिमिटेड, एक प्रमुख पोत निर्माण और पोत मरम्मत उद्योग और वैश्विक पोत निर्माण के मोर्चे पर विख्यात, इच्छुक, प्रतिष्ठित, संसाधन संपन्न और वित्तीय रूप से सक्षम कंपनियों/ठेकेदारों को एकल चरण दो भाग बोलियों को प्रस्तुत करने हेतु आमंत्रित करता है।
   Cochin shipyard Limited, a leading Ship Building & ship repair industry and also well known player on the global ship building front, invites interested, reputed, resourceful and financially solvent firms/contractors to submit **single stage two part bids.**
2. निर्धारित प्रपत्र में मुहरबंद प्रतिस्पर्धी निविदाएं निविदा जांच के अनुलग्नक में उल्लिखित नियम और शर्तों के अनुसार होनी चाहिए।
   The Sealed competitive tenders in the prescribed form should be as per the terms and conditions as mentioned in the annexure to tender enquiry.
3. निविदा के कार्यक्षेत्र के विस्तार पर चर्चा करने के लिए निविदा पूर्व बैठक दिनांक **28.02.2025** को सीएसएल के योजना सम्मेलन कक्ष में पूर्वाह्न **11.00** बजे से आयोजित की जाएगी। पूर्व निविदा बैठक में भाग लेने के इच्छुक ठेकेदारों को अपने पूर्व निविदा प्रश्नों (यदि कोई हो) को दिनांक **27.02.2025** तक सकारात्मक रूप से सूचित और अग्रेषित करना चाहिए।
   The pre-bid meeting will be held on **28.02.2025** at CSL from **11.00 Hrs** to discuss the detail scope of work and other tender conditions. The Firms / Contractors interested to participate in Pre-bid meeting should inform and forward their Pre-bid queries (if any) by **27.02.2025** positively.

4. पूर्व निविदा बैठक में भाग लेने के लिए सूचना और पूछताछ, यदि कोई हो, तो निम्नलिखित मेल आईडी ashtal.antony@cochinshipyard.in & adarsh.s@cochinshipyard.in पर समय पर अग्रेषित की जानी चाहिए।

   Information to participate in pre-bid meeting and queries, if any should be forwarded in time to following mail ID: ashtal.antony@cochinshipyard.in & adarsh.s@cochinshipyard.in

5. निविदाएं दो बोली प्रणाली में प्रस्तुत की जानी हैं; भाग I: तकनीकी वाणिज्यिक बोली और भाग II: सॉफ्ट कॉपी के रूप में मूल्य बोली और निर्धारित तिथि और समय पर या उससे पहले अधोहस्ताक्षरी के पास पहुंच जानी चाहिए:

   The tenders are to be submitted in two bid system; **Part I : Techno Commercial Bid** and **Part II : Price Bid** as Soft copy and should reach the undersigned on or before the date and time as stipulated:

6. **MODE OF SUBMISSION OF BIDS**

   a. निविदा केवल ई-मेल के माध्यम से सॉफ्ट कॉपी में प्रस्तुत की जानी चाहिए। सीएसएल किसी अन्य प्रकार की निविदा स्वीकार नहीं करेगा।

   Tender should be submitted in soft copy via E-mail only. CSL will not accept any other mode of tender.

   b. ई-मेल के विषय में स्पष्ट रूप से निविदा पूछताछ संख्या और जमा करने की देय तिथि का उल्लेख होना चाहिए। मूल्य बोलियों को पासवर्ड से सुरक्षित किया जाना चाहिए और जब तक मांगा नहीं जाता तब तक पासवर्ड अग्रेषित नहीं किया जाना चाहिए।

   The subject of the E mail should clearly state the tender enquiry number and due date of submission. **Price Bids are to be password protected separately and password is not to be forwarded unless asked for.**

   c. निविदा दस्तावेज़ पीडीएफ प्रारूप में प्रस्तुत किया जाना चाहिए और पीडीएफ प्रारूप से सीधे खोला जा सकता है। उपरोक्त का अनुपालन न करने वाले प्रस्तावों को बिना किसी सूचना के सरसरी तौर पर खारिज कर दिया जाएगा।

   Tender Documents should be submitted in PDF Format and Directly openable from the PDF format. Offers not complying with the above shall be summarily rejected without further intimation.

   d. निविदाएं, तकनीकी - वाणिज्यिक बोली (भाग-I) और मूल्य बोली (भाग-II) अलग से ई-मेल के माध्यम से **"SB-OSD/TSHD/928/2025"** विषय के साथ प्रस्तुत की जाएगी।

   Tenders, Techno- commercial bid (Part-I) and Price bid(Part -II) shall be submitted separately via email , with subject as " **SB-OSD/TSHD/928/2025"** to:

   (i) ashtal.antony@cochinshipyard.in

   (ii) adarsh.s@cochinshipyard.in

प्रतिलिपि / Copy to:

(ii) **madhu.pk@cochinshipyard.in**

(iii) **philip.thomas@cochinshipyard.in**

7. बोलियां दिनांक 12 मार्च –2025 को अपराह्न 15.00 बजे या उससे पहले कोचीन शिपयार्ड लिमिटेड में प्राप्त की जाएंगी और भाग I तकनीकी – वाणिज्यिक बोली उसी दिन अपराह्न 15.30 बजे खोली जाएगी।

   The Bids shall be received at Cochin Shipyard Ltd on or before 15.00 Hrs on 12th March - 2025 and Part I Techno-Commercial Bid will be opened at 15.30 Hrs on the same day.

8. देर से आनेवाली निविदाएं/शर्तों वाली निविदाएं सरसरी तौर पर खारिज कर दी जाएंगी।

   Late tenders / tenders with conditions will be summarily rejected.

9. सीएसएल ई-मेल द्वारा भेजी गई निविदाओं के विलंब, खो जाने या प्राप्त न होने की कोई ज़िम्मेदारी नहीं लेगा।

   CSL takes no responsibility for delay, loss or non-receipt of tenders sent by e-mail.

10. मूल्य बोली खोलने के लिए केवल तकनीकी रूप से योग्य बोलियों पर विचार किया जाएगा। तकनीकी पहलुओं और वाणिज्यिक शर्तों दोनों के लिए बोलियों का मूल्यांकन करने के बाद, तकनीकी-व्यावसायिक रूप से योग्य बोलीदाताओं को भाग-II

    Only technically qualified bids will be considered for price bid opening. After evaluating the bids for both technical aspects and commercial terms, the techno-commercially qualified bidders will be intimated regarding the date and time of opening of Part II - Price Bid.

11. केवल तकनीकी - वाणिज्यिक बोली खोलने को अनुबंध देने के लिए प्रस्ताव की स्वीकृति के रूप में नहीं माना जा सकता है।

    Merely opening of Techno-Commercial Bid cannot be construed as acceptance of offer for awarding of contract.

12. भाग I (तकनीकी-वाणिज्यिक) बोली के साथ निम्नलिखित प्रस्तुत किया जाएगा:

The following shall be submitted along with Part I (Techno-commercial) Bid:-

i. अनुलग्नक **I, II, III, IV, V,VI,VII** और परिशिष्ट – A, B, C, D,E,F,G,H,I ,J,K & L में रखे गए पूछताछ के नियम और शर्तें, समान्य शर्तें, तकनीकी विनिर्देश और आरेखण सहित सभी पृष्ठों पर विधिवत हस्ताक्षरित मूल निविदा दस्तावेज़।

Original tender document duly signed on all pages - including Terms & conditions of enquiry, general conditions, technical specification and drawings placed at Annexure I, II, III, IV, V,VI,VII & Appendix- A, B, C, D,E,F,G,H,I ,J,K & L

ii. अनुलग्नक **IV** में तकनीकी वाणिज्यिक जांच सूची पूरी तरह से भरी हुई है और विधिवत हस्ताक्षरित है । विधिवत भरी हुई तकनीकी वाणिज्यिक जांच सूची प्रस्तुत न करने पर बोलियों को अस्वीकार कर दिया जाएगा।

The techno commercial Check List at Annexure IV filled up completely and duly signed. **The non submission of duly filled techno commercial checklist will lead to the rejection of the bids.**

iii. गैर-मूल्य बोली प्रारूप की प्रतिलिपि (कीमत/अंकों के बिना मूल्य बोली)।

Copy of un-priced bid format (price bid WITHOUT prices/numerals)

iv. निविदा पूछताछ नियम और शर्तों से विचलन/बहिष्करण की सूची (यदि कोई हो)।

List of deviations/exclusions from the tender enquiry terms and conditions (if any).

13. **पूर्व अनुबंध अखंडता संधि / PRE CONTRACT INTEGRITY PACT**

निविदा में भाग लेने वाले बोलीदाताओं को पूर्व अनुबंध अखंडता समझौते पर हस्ताक्षर करना होगा, यदि बोली 1 करोड़ रुपए से अधिक है।

The bidders who are participating in the tender shall sign the pre contract integrity pact, in case the bid is above Rs 1 crore.

14. **एमएसएमई - विशेषाधिकार / MSME- PRIVILEGES**

सीएसएल वेबसाइट (www.cochinshipyard.in) के अनुसार एमएसएमई, स्टार्ट-अप आदि से संबंधित भारत सरकार की सार्वजनिक खरीद नीति पहल इस निविदा के लिए लागू होगी।

Public procurement policy initiatives of Govt. of India, pertaining to MSME's, Start-up etc. as per CSL website (www.cochinshipyard.in) shall be applicable for this tender.

15. कोचीन शिपयार्ड लिमिटेड (सीएसएल) ने ट्रेड्स पोर्टल अर्थात आरएक्सआईएल, एम1 एक्सचेंज और इनवॉयस मार्ट में पंजीकरण कराया है। वे विक्रेता जिन्होंने ट्रेड्स पोर्टल में पंजीकरण कराया है, वे ट्रेड्स पोर्टल के ज़रिए भुगतान को संसाधित करने के लिए संबंधित निष्पादन अधिकारी को सूचना के तहत संबंधित पोर्टल में चालान अपलोड कर सकते हैं। आपूर्तिकर्ताओं से अनुरोध है कि ट्रेड्स पोर्टल में चालान अपलोड करने से पहले, जहां भी लागू हो, गुणवत्ता निरीक्षण स्थिति के संबंध में संबंधित निष्पादन अधिकारी से जांच करें।

Cochin Shipyard Limited (CSL) has registered in the **TReDS Portal viz., RXIL, M1xchange and Invoice Mart.** Those vendors who have registered in the TReDS portal may upload the invoice in the respective portal under an intimation to concerned executing officer for processing the payment through TReDS portal. Suppliers are requested to check with the concerned executing officer regarding the Quality inspection status, where ever applicable, before uploading the invoices in TReDS portal.

16. सीएसएल के पास पूरा ऑर्डर देने या ऑर्डर की मात्रा का कुछ हिस्सा देने या काम को दो या दो से अधिक फर्मों/उपठेकेदारों में विभाजित करने या किसी भी निविदा को स्वीकार या अस्वीकार करने, या निविदा खोलने की तारीख बढ़ाने, और या कुल निविदा प्रक्रिया को रद्द करने और सभी को अस्वीकार करने का अधिकार सुरक्षित है। अनुबंध प्रदान करने से पहले किसी भी

समय निविदाएं। सीएसएल प्रभावित फर्म(फर्मों) के प्रति कोई दायित्व नहीं निभाएगा, सीएसएल की कार्रवाई के आधार के बारे में प्रभावित फर्म(फर्मों) को सूचित करने का कोई दायित्व नहीं होगा। बोलीदाताओं से अनुरोध है कि वे नोट करें और तदनुसार बोली लगाएं।

CSL reserves the right to place order whole or part of order quantity or split the work on two or more firms/subcontractors or to accept or reject any tender, or extend the tender opening date, and or to cancel the total tender process and reject all tenders at any time prior to award of the contract. CSL will not incur any liability to the affected firm(s), any obligation to inform the affected firm(s) of the grounds for CSL's action. Bidders are requested to note and quote accordingly.

17. मुख्य महाप्रबंधक, पोत निर्माण प्रभाग, कोचीन शिपयार्ड लिमिटेड, निविदा या उसके हिस्से को स्वीकार करने हेतु अधिकृत व्यक्ति है, जो न्यूनतम निविदा को स्वीकार करने हेतु स्वयं को बाध्य नहीं करता है और बिना कोई कारण बताए प्राप्त किसी या सभी निविदाओं को अस्वीकार करने का अधिकार सुरक्षित रखता है।
Chief General Manager, Ship Building Division, Cochin Shipyard Limited, is the authorized person to accept the tender or part thereof, who does not bind himself to accept the lowest tender and reserves the authority to reject any or all of the tenders received without assigning any reason.

कृते उप महाप्रबंधक / For Deputy General Manager
आउटसोर्सिंग विभाग / Outsourcing Department

ANNEXURE I

जांच की नियम और शर्तें / TERMS & CONDITIONS OF ENQUIRY

ELECTRICAL OUTFIT WORKS – ELECTRICAL CABLE LAYING WORKS IN TRAILING SUCTION HOPPER DREDGER

1. कार्य का विवरण / DESCRIPTION OF WORK

1.1. This tender enquiry pertains to the awarding of contract for **ELECTRICAL OUTFIT WORKS – Electrical Cable Laying Works in Trailing Suction Hopper Dredger** as per the following documents:

1.1.1. Cochin Shipyard Ltd - Terms and conditions (Annexure I)

1.1.2. Cochin Shipyard Ltd - General conditions (Annexure II)

1.1.3. Enquiry specification (Annexure III)

1.2. The scope of work includes Installation of Electrical Equipments, cabling (whole vessel), and MCT packing up to the entire satisfaction of CSL /IHC/Owner / Class surveyor, and up to the delivery of the vessel; with the available infrastructure facilities and Equipments / materials / consumables provided by Cochin Shipyard Ltd (CSL) in accordance with the enclosed Specifications and drawings, delivery schedule, CSL - Terms and conditions in all respects.

1.3. *Bidders* are requested to study the scope of work before submitting their offer. Clarification, if any, required may be obtained from **AGM (EOF)** before quoting.

2. विक्रेताओं के लिए पात्रता मानदंड / QUALIFICATION CRITERIA FOR VENDORS

The Bidder should qualify the following PQ Criteria:

2.1. **GENERAL**

2.1.1. Bidder shall be a single firm.

2.1.2. Bidder shall not be under a declaration of ineligibility issued by Govt. of India/ State govt./Public Sector Undertakings etc. The bidder shall not have been debarred / black listed by CSL or by any of the Public Sector Undertaking or Government department etc. The declaration of eligibility at Annexure VII shall be submitted in this regard.

2.1.3. All the qualifying documents indicated in the tender shall be strictly in the name of bidding firm. Qualifying documents submitted in the name of any other than bidding firm will not be considered for bidding firm's qualification.

2.2. TECHNICAL EXPERIENCE

Technical pre-qualification requirement is given below:

2.2.1. Technical requirement for cabling (whole ship)

a) The sub-contractor should have prior cable laying experience in ships, minimum 90km against a single work order. The firm has to submit the documents which validates the above mentioned experience requirement. Contractor should have the experience in executing similar jobs in CSL or other yards/projects. Necessary documents in proof of carrying out similar work in other yards/projects shall be submitted with the offer.

b) The sub-contractor should have experience in the packing of MCT in ships. The firm has to submit the documents which validates the above mentioned experience requirement.

c) The Sub-Contractor should deploy a minimum of 50 workmen. An undertaking which validates the above requirement has to be submitted by sub-contractor.

d) Separate supervisors for cable laying of power cables, control and monitoring cables and Navigation and Communication systems to be provided by the contractor. Document supporting the experience of the supervisors is to be provided.

2.3.2. Documents to prove credentials of the firm to undertake the subject work. eg: Details of available equipment's & facilities, Skilled / qualified Manpower, Work experience of similar job, etc. The firm has to submit the documents which validate the above mentioned Clause 2.2.1 requirements. Work order for material supply will not be considered.

2.3.3. The similar works experience of parent company / subsidiary / Sister Company of the Bidder shall not be considered.

2.3.4. CSL reserves the right to demand hardcopies of any of the above documents and any other related documents, if required. Bidders shall comply with the same.

2.3. **FINANCIAL CAPABILITY**

2.3.1. The bidder shall have an average annual financial turnover of **Rs. 30 Lakhs** during the last three years ending on 31st March 2024.

2.3.2. The Bidder shall enclose with its Proposal, certificate issued by Chartered Accountant with their seal and signature, stating its turnover during the past three years. Certificate shall be as per the format placed at Appendix – B.

2.4. **OTHER CONDITIONS**

2.4.1. The bidding firm shall have key personnel having single point of contact with contract details. He/she shall have adequate and specialized experience capable of discharging their responsibilities.

2.4.2. The bidding firm should have valid PAN and GSTIN and details of PAN / GST Registration Number and current valid Tax Clearance Certificate shall be submitted along with the offer.

2.4.3. Bidder should submit duly signed compliance matrix placed at Appendix – A for technical deviation/queries if any along with the offer.

2.4.4. If required, the documents / certificates submitted by bidder will be verified with source directly by CSL. Misleading or false representations in the forms, statements and attachments submitted in proof of eligibility requirements will result in summarily rejection / disqualification of the submitted offer at any point of time whatever may be the status of the process. Also, the firm will not be considered for further tendering for a period of three (3) years henceforth.

2.4.5. RIGHT TO VERIFICATION: CSL has the right to verify the authenticity of bidder/ documents submitted by them and/or inspect the facilities if felt necessary. Based on this CSL reserves the right to accept and reject any and all bids, which in its opinion, appears to be most advantageous to CSL.

3. **प्रस्ताव की वैधता / VALIDITY OF OFFER**

3.1. The offer shall be valid for acceptance for a period of 90 days from the date of opening of the Part-I Techno-Commercial Bid.

4. **अनुबंध प्रदान करने का तरीका / METHOD OF AWARDING CONTRACT**

4.1. Contract will be concluded with the Bidder qualifying to techno-commercial conditions and emerging as L1 bidder

4.2. CSL reserves right to reduce/ increase the percentage work or cancel partially or fully based on the performance firm at site.

4.3. CSL reserves the right to cancel the tender at any stage without assigning any reasons whatsoever based on CSL requirement. The decision of CSL regarding the same shall be final and conclusive.

5. कार्य की प्रगति तथा समापन की समय - सारणी / WORK PROGRESS AND SCHEDULE OF COMPLETION

5.1. All Works corresponding to the vessel should be completed within 6 Months from the date of working area readiness from CSL.

5.2. The contractor in turn shall submit their detailed scheduled of completion of the work, in consultation with the officer In-charge. The progress of work shall be made in tandem with the progress of completion of the vessel allowing sufficient time for other interface activities/works.

5.3. Yard has the right to change the schedules of the project to the interests of the company and the firm should be capable of adjusting the resources according to the instructions from the Yard contact person.

5.4. Detailed working schedule (Weekly/monthly) etc to be prepared and submitted to yard personnel. However, a detailed overall schedule, in a reasonable manner should be submitted prior to commencement of work.

6. कार्य प्रक्रिया / WORK PROCEDURE

6.1. The work procedure briefly described below, detailed for each category of works are mentioned in the Annexure III to the tender enquiry.

6.2. Necessary job instructions, drawings etc. for the work will be issued by CSL.

6.3. Contractor is to carry out the work as per the specifications / drawings supplied, and to the satisfaction of CSL.

6.4. Contractor should maintain the quality as per CSL Quality Standards, yard quality procedures. Inspection will be carried out during fabrication by CSL.

6.5. Contractor shall submit the weekly /monthly progress reports to CSL.

7. अनुबंध की वैधता / VALIDITY OF CONTRACT

7.1. Once the contract is awarded, the price offered and mutually agreed shall remain firm (Contract concluded price as per Annex-V) till completion of work and no escalation in rate shall be allowed by CSL on whatsoever reason thereafter.

8. निरीक्षण / INSPECTION

8.1. The complete work is to be carried out with the highest degree of workmanship under the inspection of CSL, Classification society (when specifically indicated in the technical specifications), Ship owner, or any other agency nominated by Shipyard.

9. बोलियां जमा करने के लिए दिशानिर्देश / GUIDELINES FOR SUBMISSION OF BIDS

9.1. **Technical Bid (Part –I)**

9.1.1. The following shall be submitted along with technical Bid, failing which the bid may be summarily rejected :-

9.1.2. The technical bid as specified in the scope of work (Annexure III) duly signed shall be submitted along with the offer

9.1.2.1. Original tender document general Terms & conditions and technical specifications placed at Annexure I, II & III duly signed on all pages.

9.1.2.2. The commercial Check List at Annexure IV filled up completely and duly signed

9.1.2.3. Copy of un-priced bid format of works at Annexure V.

9.1.2.4. As per Govt. of India guidelines, Integrity pact (IP) should be signed for all contracts above Rs. One Crore. Accordingly IP should be signed and forwarded along with the offer.

9.1.2.5. The declaration of eligibility at Annexure VII

9.1.2.6. All other documents relevant to this tender.

9.1.3. The non-submission of duly filled commercial checklist will lead to the rejection of the bids.

9.2. **Price Bid (Part-II)**

9.2.1. The bid shall be comprehensive of the nature of for **ELECTRICAL OUTFIT WORKS – Electrical Cable Laying Works in Trailing Suction Hopper Dredger** shall be inclusive for all the applicable charges envisaged under the scope of the contractor as specified in the technical specification Annexure III and other terms & conditions of this tender.

9.2.2. The rates quoted by the contractor are deemed to include for all costs and expanse, taxes, duties except GST in connection with the transportation under contract. No additional payment whatsoever shall be paid by CSL at any stage of this work. The payment of GST shall be paid as applicable.

9.2.3. Bidders shall quote total amount in figures and in words. Corrections and additions if any must be attested/ duly signed by the bidder. In the case of error in multiplication/addition in amount calculated, the rate quoted will be considered as correct and the amount will be calculated accordingly. Conditional rebates & discounts, incomplete/ ambiguous offer will be rejected.

9.2.4. The price bid shall be all inclusive of scope of contractor on lump sum basis and any rates on variable basis will not be accepted within the price bid and thereafter throughout the period of the contract. Any variable rates if deemed inevitable and applicable only in special cases/situations (not in the normal course of execution of contract) will only be considered for mutual agreement.

9.2.5. Price Bid Format: The price bids shall be prepared as per the format given in Annexure V to the enquiry. The bidder must quote all line items as per price bid format any failure in this regard will lead to the rejection of bid.

9.2.6. Rates of individual line items for the overall L1 is considered as L1 rate irrespective of lower rates in case of the line items of other bidders.

9.2.7. Currency: The price bids shall be prepared in Indian National Rupees (INR) for all bidders. Any deviation in this regard will not be acceptable.

9.2.8. As per tender condition, the price bid which were not opened will not be returned back at any reason.

9.2.9. The bids which are not conforming above requirements shall be summarily rejected without any further notice.

10. असामान्य रूप से कम उद्धृत दरें /ABNORMALLY LOW QUOTED RATES:

In case the price of L-1 Bidder is found to be unreasonably low and/ or bidder expresses desire to withdraw from the tender after opening of price bid, then tender will be cancelled and suitable penal action as per CSL procedure shall be taken against the firm.

11. कर / TAXES

11.1. GST shall be applicable extra on the prescribed work. Bidders should indicate the applicable GST percentage and HSN code of the category in the offer. Bidders are also requested to furnish the following details in the invoice/Bill.

11.1.1. Applicable rate of GST/SAC Code

11.1.2. Firms GST Reg. No.

11.1.3. Service accounting code (SAC) as prescribed by statutory authorities.

11.1.4. GST Reg. No. of Cochin Shipyard Ltd **(32AAACC6905B1ZD)**.

11.2. Any new tax/duty that may be made effective by the government for this work and paid by the contractor shall be reimbursed on production of documentary evidence.

12. भुगतान की शर्तें / PAYMENT TERMS

12.1. Payment will be released in 5 stages, for work completion stages and on certification by the Officer-in-charge based unit rates and actual work done as noted below:

Stage -1: Payment of 15% of total value of work order, after completion of 25% cabling.

Stage -2: Payment of next 25% of total value of work order, after completion of 50% cabling.

Stage -3: Payment of next 25% of total value of work order, after completion of 75% cabling.

Stage -4: Payment of next 15% of total value of work order, after completion of 90% cabling.

Stage -5: Payment of next 20% of total value of work order, after completion of 100% cabling.

12.2. All claims for payment for the work/additional work shall be submitted by the subcontractor within one month of completion of work.

12.3. An invoice upload facility by vendor is established through the Vendor Invoice Management (VIM) Portal is currently available for supply as well as service vendors including subcontractors so as to facilitate transparency and timely payment. The portal can be accessed at: https://apps.cochinshipyard.in:446/vim/Home/.jsp

The same can also be accessed via Cochin Shipyard Website (https://cochinshipyard.in) as below;

Path: Cochin Shipyard Website --> Related Links --> Vendor Payment Info

12.4. All invoices above 10 Lakhs (including GST) are required to be digitally signed by the vendors and uploaded in VIM portal. The direct submission of invoices value above 10

Lakhs will not be accepted. Once the invoices are digitally signed and uploaded, there is no need to submit the hard copy for processing the payment.

12.5. Service Acknowledge Number (SAN) to be obtained from the Executing Officer at the time of certification of Work Completion Certificate (WCC) for the above process.

12.6. The invoice can be tracked using the generated Invoice Tracking Number till the payment.

12.7. Statutory levies such as I.T, Contribution towards PF, ESI etc., shall be deducted from the bill as applicable.

12.8. Payment will be made by RTGS/NEFT to the account of contractor. The name of the bank, branch, A/C No., IFSC code & other particulars shall be furnished by the contractor in the proforma of CSL.

13. बयाना राशि /EARNEST MONEY DEPOSIT (EMD)

13.1. Bidders shall furnish Earnest Money Deposit (EMD) equivalent to **Rs. 1 Lakhs** by way of RTGS/NEFT to the following account of Cochin Shipyard Ltd, Kochi

Bank	State Bank of India
IFSC	SBIN0004062
Account No.	10319928321 of Cochin Shipyard Ltd.

13.2. The bidder shall submit the proof of such transfer along with the submission of technical bid.

13.3. This shall be returned after finalization of contract and upon receipt of Security deposit in accordance with clause 14 below, with respect to successful bidders; With respect to unsuccessful bidders, the same shall be returned within 15 days of issuance of PO/Contract.

13.4. Bidders belonging to Micro and Small Enterprises (MSE's) category are exempt from furnishing EMD subject to the bidders producing valid UDYAM Certificate and shall be duly verified by CSL. Bidders who fail to submit UDYAM Certificate along with the Techno-Commercial Offer shall not be considered eligible for EMD exemption.

13.5. In case the offer validity is extended on mutual consensus, the validity of EMD shall be mutually extended, EMD may be forfeited in the following cases:

a) Bidder withdraws, amends, impairs or derogates from the tender, agreed conditions in any respect within the period of validity of his offer.
b) Non-acceptance of order.

14. प्रतिभूति जमा / SECURITY DEPOSIT

14.1. The successful tenderer shall remit 5% of the value of the contract as security deposit within 15 days of receipt of the work order. This amount has to be remitted by way of demand draft or bank guarantee (in approved proforma of CSL) from any of the nationalized banks/ Scheduled Indian Bank, valid till the satisfactory completion of the entire work. The Security Deposit will be released after satisfactory completion of the contract. The Security Deposit will not bear any interest.

15. निष्पादन गारंटी / PERFORMANCE GUARANTEE

15.1. The complete work carried out by the contractor shall be guaranteed against performance of work and/or poor workmanship for a period of one year from the date of delivery of vessel. Any damage or failure due to defects in execution of the work for a period of 12 months from the date of delivery of vessel, such damage or failure occur within the guarantee period, the contractor shall rectify/rework the defect as applicable without any extra expenditure to CSL and such repaired work shall be guaranteed for a further period of one year from the date of repair.

15.2. Should any unsatisfactory performance and / or damage or failure occur due to poor workmanship and poor quality material used by the contractor, the contractor shall be solely responsible for payment/reimbursement of expenditure incurred by Ship owner for rectifying the defect.

15.3. Towards this, a performance guarantee equivalent to 5% of the total value of the contract to be furnished by the contractor within 15 days of receipt of work order, by way of a bank guarantee (in approved proforma of CSL) from a nationalized bank / Scheduled Indian Bank valid till the expiry of the guarantee period. (Payment will be released only on submission of either PBG or SD)

15.4. PBG will be returned to the Contractor on completion of 01 year after successful delivery of vessel on certification of nil liability to CSL by Officer-in charge.

15.5. Performance Guarantee is applicable for all bidders irrespective of MSME/NSIC registration for necessary coverage under the performance guarantee clause.

16. परिसमापन क्षतिपूर्ति / LIQUIDATED DAMAGES

16.1. The progress of work will be monitored against the mutually agreed detailed schedule referred in clause. Liquidated damages for delays in execution of the work envisaged as per this order on account of the contractor, for any reason other than force majeure conditions, will be recovered at the rate of ½% (half percent) per week or part of the week of the total basic price of delayed work thereof, subject to a maximum of ten (10%) percent of the basic value of the delayed work.

17. आदेश रद्द करना और जोखिम अनुबंध / CANCELLATION OF ORDER AND RISK CONTRACTING

17.1. In the event the contractor fails to complete the work promptly and satisfactorily as per the terms of the order, and if the work is delayed beyond the agreed schedule, CSL, without prejudice, reserves the right to cancel the order and get the work done at contractor's cost and the expenditure so incurred including any damage or loss will be recovered from him and the Security Deposit furnished by him is liable to be forfeited either in whole or in part.

17.2. In addition to above tender holiday will be imposed against the firm as per discretion of CSL.

18. कार्मिकों की सुरक्षा और प्राथमिक चिकित्सा/SAFETY OF PERSONNEL AND FIRST AID

18.1. The contractor shall be entirely responsible for the safety of all the personnel employed by him on the work. In this regard, he may adopt all the required safety measures and strictly comply with the safety regulations in force. A copy of CSL's "Safety Rules for Contractors (Revised)" is available with Execution department for reference.

18.2. The Contractor may arrange to suitably insure all his workmen/ other personnel in this regard. CSL will not be responsible for any injury or illness to the Contractor's workmen/other personnel during execution of the works due to whatsoever reasons.

18.3. In this regard, the Contractor will have to fully indemnify CSL against any claims made by his workmen/other personnel.

18.4. The Contractor shall provide and maintain, so as to be readily accessible during all working hours, a first aid box with prescribed contents at every place where he employs contract labour for executing the works.

19. अप्रत्याशित घटना / FORCE MAJEURE

19.1. Should failure in performance of any part of this contract arise from war, insurrection, restraint imposed by Government act or legislation of other statutory authority, from explosion, riot, legal lock-out, flood, fire, act of Govt. or any inevitable or unforeseen event beyond human control which will be construed as a reasonable ground for extension of time, CSL may allow such additional time as is mutually agreed to be justified by the circumstances of the case.

19.2. The occurrence / cessation of force majeure situation have to be informed with documentary evidence within 15days from the date of occurrence / cessation.

20. मध्यस्थता / ARBITRATION

20.1. Any disputes arising during the currency of the contract shall, in the first instance be settled by mutual discussions and negotiations. The results of such resolution of dispute shall be incorporated as an amendment to the contract, failing which the parties can resort to arbitration.

20.2. If any dispute, disagreement or question arising out of or relating to or in consequence of the contract, or to its fulfillment, or the validity of enforcement thereof, cannot be settled mutually or the settlement of which is not herein

Specifically provided for, then the dispute shall within thirty days from the date either party informs the other in writing that such disputes, disagreement exists, be referred to arbitration. The arbitrators shall be appointed and the arbitration proceedings shall be conducted in accordance with and subject to the Arbitration and Conciliation Act, 1996 (No. 26 of 1996) as amended form time to time and the decision of the Arbitrators shall be final and binding on the parties hereto. The arbitration will be done by a Board comprising one officer nominated by each party, and a mutually agreed Umpire. Each party shall bear its own cost of preparing and presenting its case. The cost of arbitration shall be shared equally by the parties unless the award provides otherwise. The enforcement of the award shall be governed by the rules and procedures in force in the State in which it is to be executed. Performance under this Contract shall however, continue during arbitration proceedings and no payment due or payable by the parties hereto shall be withheld unless any such payment is or forms a part of the subject matter of arbitration proceedings.

20.3. In case of disputes, the same will be subjected to the jurisdiction of courts at Ernakulam, Kerala, India only.

21. क्षेत्राधिकार / JURISDICTION

21.1. All questions, disputes or differences arising under/out of or in connection with this contract shall be subject to the jurisdiction of the Courts in Cochin.

22. श्रम कानून और विनियम /LABOUR LAWS AND REGULATIONS

22.1. The Contractor shall undertake and execute the work with contract Labour only after taking license from the appropriate authority under the Contract Labour (Regulation & Abolition) Act 1970.

22.2. The Contractor shall observe and comply with the provisions of all labour and industrial laws and enactments and shall comply with and implement the provisions of the Factories Act, 1948, `Employees Provident Funds & Miscellaneous Provisions Act, 1952, Employees State Insurance Act, Payment of Gratuity Act, minimum Wages Act, Payment of Bonus Act, Contract Labour (Regulation and Abolition) Act and all other enactments as are applicable to him and his workmen employed by him. The Contractor shall inform CSL his license number from the Central Labour Commissioner.

22.3. All contract workmen, except those exempted under the respective Acts, shall necessarily be insured under the ESI scheme and be made members of the EPF Scheme from the day of their engagement as contract workmen in the Company. All such insured contract workmen should carry with them their ESI Identity Card for verification by the authorities. No contract workmen without a valid ESI Identity Card for verification by the authorities will be permitted to work in the company.

22.4. The Contractor shall submit the Compliance Certificate by means of uploading relevant documents such as Electronic Challan cum Receipt, Challans etc. as having remitted the contributions towards EPF/ESI in respect of their workers, in the goggle form provided for the purpose, every month so as to reach Welfare Section on or before 22nd of every month. Google form link: https://forms.gle/3GidCgsP4jHhXDJt9

22.5. The Contractor shall submit the Labour Reports/Returns as required by the Company from time to time in respect of their workmen in standard format to the concerned contracting officer so as to enable the same to reach Personnel Department by the 5th of every month. Delayed submission of the same shall attract penal interest /damages at the rate as levied by the respective authorities under the relevant Acts.

22.6. The Contractor shall maintain the records viz. Muster Roll, Acquaintance Roll with full details, Account books etc., in original. These are required for inspection by the concerned authorities under each scheme.

22.7. If the Contractor fails to pay any contributions, charges or other amounts payable under any of the aforementioned provisions of law, CSL shall deduct or adjust amounts equivalent to such contribution, charges or amounts from amount payable to him by CSL, including any deposit or amounts payable against bills and make payments on his account to the appropriate authority. He shall not be entitled to question or challenge such deductions, adjustments or payment made by CSL.

22.8. Any other amount payable under any law or in respect of any person employed by the Contractor, if not paid by him, shall be deducted or adjusted by CSL out of any amount payable to the Contractor including any Security Receipt and paid ever or withheld for payment by CSL.

22.9. The Contractor shall be fully responsible for the conduct and discipline of the workmen employed by him in the Company premises. If such workmen commit any misconduct or criminal act inside the Company, the Contractor shall take appropriate action against such workmen. The contractor shall abide by the instructions/ guidelines issued by the Company for maintenance of discipline and good conduct among the workmen employed by him.

22.10. All person who are engaged for various works in CSL either directly or through contractors, should produce the following documents prior to issuing their entry passes:

22.11. Passport/attested copy of passport with photo and address particulars. OR

22.12. Police clearance certificate with photo and address particulars. (Police clearance certificate to the effect that the concerned person is staying in the area of jurisdiction of the certificate issuing Police Station and that the person is not involved in any criminal offences as per the records available therein.)

22.13. Application and Declaration for enrolling under Employees Provident Fund and ESI Scheme- 3 individual passport size photographs and two copies of family photographs of the members.

22.14. **Contractors are requested to familiarize themselves with the labour rules & regulations prevailing in CSL including the labour wage pattern of contract labour as per the settlement between the trade unions & contractors.**

23. आईएमएस दिशानिर्देश /IMS GUIDELINES

23.1. CSL has implemented an Integrated Management System (IMS) consisting of Environmental Management system (EMS), Occupational Health and Safety Management System (OHSMS) and the Quality Management System (QMS) within the yard. As part of IMS, subcontractors shall comply with the following measures related to the Quality, Health, and Safety & Environment (QHSE) policy of CSL.

23.1.1. Meeting or exceeding customer requirements.

23.1.2. Assuring quality of the products and service.

23.1.3. Preventing occupational ill health & injuries.

23.1.4. Ensuring safe work sites.

23.1.5. Conserving natural resources.

23.1.6. Preventing / minimizing air, water & land pollution.

23.1.7. Handling and disposal of Hazardous wastes safely.

23.1.8. Complying with statutory & regulatory and other requirements.

23.1.9. Developing skills and motivating employees.

23.2. Occupational Health, safety & Environmental requirements of CSL shall also include the following.

23.3. The contractor (or a sub-contractor performing work on behalf of the contractor) is deemed to comply with the Occupational health, safety and environmental policy of the company and also to all operational controls/standard operating procedures and shall undertake the work in total compliance with the requirements of the established Integrated Management System (IMS) of the company.

23.4. The Contractor shall undertake the work in total compliance with all applicable legal/statutory requirements related to occupational health, safety and environment effective in the state of Kerala.

23.5. It is the sole responsibility of the contractor to assure that any sub-contractor/s who shall perform works in company lands/facilities/worksites on behalf of the contractor, is also following all requirements related to the Integrated Management System of the company and the health/safety/environmental Rules effective in the state.

23.6. The contractor shall provide/implement and operate/practice all occupational health, safety and environmental management measures/facilities, for their period of contract, in their activities/at their work sites, which shall be required according to the IMS of the company or that required by the health/safety/environmental Rules established and effective in the state, at their own cost.

23.7. If any contractor failed to comply with or violated any clauses/requirements of occupational health, safety and environmental Rules effective in the state, in their activities or at work sites and the same shall be exposed to the government or any competent authorities upon inspections, the contractor shall be solely responsible for all liabilities caused by his/her action and shall be responsible for paying the penalty and taking stipulated corrective actions insisted by the authorities within the specified time, at their own cost. Any liability to the company in this regard needs to be compensated by the contractor.

23.8. Upon completion of the work, contractor shall clear the area and shall not leave any Occupational health/safety/environmental liabilities to the company, from their activities at the worksites.

23.9. Any clarification related to IMS requirements of the yard, may be obtained by the contractor from the DGM (In charge of work execution) or the authorized representative of the contract, prior to the commencement of work.

24. बिजली नियम और विनियमन / ELECTRICITY RULES AND REGULATION

24.1. The contractor shall adhere to the various rules in respect of electrical installation as per the Indian Electricity Rules and Regulations and Electrical Inspectorate Standards in order to make sure that men and materials are safe from hazards.

25. गोपनीयता खंड / SECRECY CLAUSE

25.1. The CONTRACTOR shall be responsible to ensure that all persons employed by them in the execution of any work in connection with this contract are aware of the provisions of the official secrets act 1923 and to comply with the same. The CONTRACTOR shall also ensure secrecy of design, construction, equipment and completion of the vessel. Any information provided to you under this contract is to be treated as strictly confidential and is not to be disclosed to any person or persons not concerned therewith.

25.2. All documents under this Contract transferred between the parties shall be treated as UNCLASSIFIED unless explicitly marked.

25.3. The CONTRACTOR shall ensure that their organization, suppliers/ installation agency/test and trials teams etc shall not communicate for use in advertising, publicity, sales release or in any other medium, system details, photographs and reproduction of equipment and their fitment on board.

25.4. SECRECY, Titles: Maps, layouts and photographs of the unit/plant including its surrounding regions showing vital installation for national security of CSL country shall

not be published or disclosed to the third parties or taken out of the country without prior written approval of the CSL and upon execution of confidentiality agreements satisfactory to the CSL with such third parties prior to disclosure.

26. **HEALTH, SAFETY & ENVIRONMENT CONTRACT GUIDELINES FOR OEMS /TURNKEY JOBS / SUB CONTRACT WORKS INSIDE CSL**

INTRODUCTION

26.1. CSL is the largest public sector shipyard in India in terms of dock capacity, and caters to clients engaged in the defence sector in India and clients engaged in the commercial sector worldwide.

26.2. CSL is committed to provide safe and healthy work environment for the prevention of work- related injury and ill health by following the best practices in safety. CSL is certified Occupational Health and Safety management System and Environmental Management system under ISO standards/international standard.

26.3. Many of the works of CSL at various sites are executed by the sub-contractors. During these works, sub-contractors personnel are likely to be exposed to different types of hazards. Similarly unsafe acts of contractor's personnel may create hazards for CSL staff or workmen of other contractors working at the site. Such unsafe acts may also pose danger to the existing installations and even to members of public.

26.4. CSL ensures that the requirements of its HSE Management System are convened by contractors and their workers. This guide is prepared to facilitate safe working during execution of contract works. The General guide lines and HSE requirements are given below for compliance in CSL.

GENERAL GUIDELINES

26.5. OEMs/Turnkey jobs /Contractors are selected to work inside the CSL based on their track record.

26.6. Along with the contract order/Registration, a copy of the HSE Safety Handbook (CSL/ QMS/S&F/SOP 02 – Refer CSL Website) of CSL is given to all contractors. The details of all HSE requirements to be followed in CSL for the various types of work are detailed in the hand book. The OEMs/Turnkey jobs /Contractors shall go through all the details and strictly follow the relevant HSE guidelines for their work. In case of any doubt the same shall be clarified from Chief Safety Officer (CSO). Being ignorant of these HSE requirements will not be treated as an excuse for any HSE violations during course of work.

26.7. OEMs/Turnkey jobs /Contractors workmen are given a multilingual HSE induction and

Emergency Response training. The individual passes for contractors and their workers are issued only after successful completion of this training. The passes are revalidated every year after successful completion of refresher training. Training requirements of other roles of the subcontractor's staff shall be complied as per the CSL requirements time to time.

26.8. Before start of any work, the CSL officer in charge explains the scope of work and the safety precautions, hazards, PPE usage as per PPE matrix of CSL, Work Instructions, SOPs, Emergency responses to the contractor and his workers. Only trained worker with necessary skills are allowed to work as per the requirement. Necessary PPEs for the work are to be arranged by the contractor.

26.9. Workmen shall have Cotton coverall with identifiable logo on the dress. Supervisors, fire watch man if required, safety staff and other workforce shall be deployed as per CSL guide lines.

26.10. The site work supervisor of the OEMs/Turnkey jobs /Contractors shall be ensured that works are being carried out by CSL HSE requirements on daily basis and till the completion of works. The safe start and safe end requirements shall be verified by the site work supervisor on daily basis.

26.11. OEMs/Turnkey jobs /Contractors HSE performance will be evaluated on HSE matters as per the CSL policies time to time.

26.12. During the course of work if any HSE violation is noticed the same is dealt as per the Rewards and Reprimand (R&R) Policy of CSL.

26.13. HSE Plan to be submitted to S&F Dept while commencing the work in CSL and shall be resubmitted in every year.

HSE REQUIREMENTS

26.14. The OEMs/Turnkey jobs /Contractors shall take all safety precautions during the execution of awarded work and shall maintain and leave the site safe at all times. At the end of each working day and at all times when the work is temporarily suspended, he shall ensure that all materials, equipment and facilities will not, cause damage to existing property, personal injury or interfere with the other works of the project or Station.

26.15. The OEMs/Turnkey jobs /Contractors shall provide and maintain all type of lights, guards, fencing, warning signs, caution boards and other safety measures for vigilance as and where necessary or as required by the CSL officer-in-charge or Safety staff. The caution boards shall also have appropriate symbols.

26.16. Where Permit to work (PTW) is required, the work has not started without obtaining the

necessary permit and the PTW requirements are followed strictly throughout the work.

26.17. For Project specific or non-routine work on the existing installations, separate Job Safety Assessment (JSA) is to be prepared by the contractor, cleared by the Dept in charge and approval obtained from CSO before start of work. The work shall be executed through Notification Control Procedure (NCS).

26.18. A separate HSE plan will be required for the new projects in the yard or any turnkey projects. It shall be in line with CSL HSE requirements and same shall be routed through respective S&F dept and approved by respective HOD.

26.19. OEMs/Turnkey jobs /Contractors shall hold toolbox talks with his workers on daily basis to convey matters regarding the Safety aspects of the work.

26.20. The OEMs/Turnkey jobs /Contractors shall plan his operations so as to avoid interference with other Departmental works and other Sub-Contractors at the site. In case of any interference, requires, coordination shall be sought by the contractor from the Department for safe and smooth execution of work. This shall be done through CSL executing officer.

26.21. The OEMs/Turnkey jobs /Contractors shall at all times keep their work spot, site office and surroundings clean and tidy from rubbish, scrap, surplus materials and unwanted tools and equipment. Welding cables, hoses and electrical cables shall be so routed as to allow safe way to all concerned.

26.22. All waste generated in course of the work shall be segregated as per the yard requirements and shall be disposed at the respective collection pallets / points of the work areas as the case may be. Any kind of pollution made by the subcontractor shall attract the reprimand proceedings.

26.23. All necessary precautions shall be taken to prevent outbreak of fires at the work site. Adequate provisions shall be made to prevent the possibility of fires and ensure the availability of fire extinguishers at site.

26.24. The OEMs/Turnkey jobs /Contractors shall be held responsible for non-compliance of any of the safety measures and delays, implications, injuries, fatalities and compensation arising out of such situations of incidents including statutory obligations.

27. सामान्य शर्तें / GENERAL CONDITIONS

27.1. Quality of workmanship shall conform to the specification/ standards laid down by CSL

27.2. CSL reserves the right to award the work to more than one contractor or to take over partially or fully the work depending upon the scheduled requirements.

27.3. Compliance of all statutory safety requirements and other safety rules stipulated by CSL

and other applicable statutory bodies shall be the responsibility of the Contractor while working at CSL premises. The Contractor should ensure that their workmen and staff are adequately covered under Insurance.

27.4. Damages caused to the Shipyard properties/tools/accessories should be rectified by the Contractor at his cost or proportional recoveries will be made from the contractor while passing their bills for payment.

27.5. Cochin Shipyard Limited reserves the right to terminate the Contract at short notice in case the Contractor's performance is found not satisfactory with regard to progress of work, quality, time factor, labour dispute with their workers, poor safety records etc., and other contractual obligations. No claim whatsoever will be entertained by Cochin Shipyard Limited on this account.

27.6. The Contractor shall have to engage men on round the clock basis and also on Sundays and holidays, if required. Work has to be completed to the satisfaction of Cochin Shipyard representative deputed for the job. The job should be completed at the time specified by the representative deputed for the job for each stage of work.

27.7. The Contractor shall indemnify CSL and CSL's personnel against any claims arising out of accidents or injuries to workmen or other persons or damage to other property which may arise during the execution of the contract or from breach of any Law or Regulation prior to delivery and acceptance of the items at CSL.

27.8. It is also to be understood by the Contractor that Cochin Shipyard Limited does not bind itself to give the Contractor any regular or specific quantity or area of work and it shall be done at the sole discretion of CSL depending on the prevailing site conditions and other limiting factors and no claim on this account from the contractor shall be entertained.

27.9. The Contractor shall also be governed by the General Conditions of Contract of CSL, General Safety Rules and other relevant labour laws.

27.10. The contractor shall arrange to collect and clean up every day all waste, scraps; debris, etc. generated by the work men while working onboard the vessel and other locations and dispose the same suitably at his cost to the full satisfaction of CSL. In case any failure on his part to comply with this requirement, CSL will arrange the required cleaning entirely at the contractors cost.

27.11. The upper age limit of all workers and supervisors employed by the contractor and those contractors who do or supervise the job themselves shall be as per the prevailing rules of CSL.

27.12. General Manager (SB) or his authorized representative will be the Officer-in-charge of this Contract.

27.13. Withdrawal of the quotation after it is accepted or failure to make contract execution within the stipulated completion period will entail cancellation of the order and forfeiture of EMD/ Security Deposit, if any/ and or risk purchase.

27.14. Subcontracting to other vendors shall be only after written intimation and approval of competent CSL authorities. Vendor shall not delegate or subcontract any of its obligations under the agreement without CSL's written consent. Vendor will remain liable for all subcontracted obligations and all acts or omissions of its subcontractors.

27.15. The procedures of work, standard operating procedures of work including documents like welding procedure specifications developed by CSL are intellectual property of CSL. Vendors shall not use or copy the procedure in any format without the written consent of competent authorities of CSL.

27.16. Vendor shall return the CSL resources to CSL immediately after provision of all deliverables and services or any termination of the agreement.

27.17. Conditional discounts, if any, will not be reckoned for tender evaluation/comparison purposes. However the same will be considered at the time of placement of purchase order if the firm turns out to be lowest bidder.

28. अधिलेखन और सुधार / OVERWRITING & CORRECTIONS

28.1. Tenders shall be free from overwriting or erasures. Corrections and additions, if any, shall be duly attested and a separate list of such corrections shall be attached with the offer.)

28.2. All terms and conditions, other than those mentioned above, contained in the Enquiry specification and drawings (Annexure I), Cochin Shipyard Ltd - General Terms and conditions (Annexure II) and other annexure pertaining to this tender shall also be attested by the bidder as a token of acceptance.

28.3. CSL reserves the right to reject any or all bids without assigning any reasons whatsoever and or based on the past unsatisfactory performance by the bidders at CSL/other PSE's/Government Departments. After issuing the work order, CSL reserves the right to terminate the contractor if the performance of the contractor is not found satisfactory. The decision of CSL regarding the same shall be final and conclusive.

कृते उप महाप्रबंधक / **For Deputy General Manager**
आउटसोर्सिंग विभाग / **Outsourcing Department**

ANNEXURE-II

कोचीन शिपयार्ड लिमिटेड / COCHIN SHIPYARD LIMITED
कोच्ची / KOCHI-682015

आउटसोर्सिंग विभाग / OUTSOURCING DEPARTMENT

सामान्य शर्तें / GENERAL CONDITIONS

1. The complete work to be carried out with the highest degree of workmanship under the inspection of CSL, Classification Society (when specifically indicated in the technical specifications), Ship owner, or any other agency nominated by the Shipyard.
2. Any minor modifications, resulting from the change in statutory regulations prevailing at the time of final inspection of work by Classification Society, to be carried out by the Contractor free of cost. In case of rework/modification/additional work, written consent is to be obtained from the Officer-in-charge before commencement of the work.
3. Contractor shall carry out the complete work in accordance with Shipyard's approved drawings. Any minor modifications from drawing or any other work or supply of material, which is not specified hereunder, but is considered incidental and essential for the successful completion of the job shall be carried out by the Contractor without any additional charge.
4. Contractor shall execute, during or after completion of the work, any minor job connected with the work, should it be considered necessary by Shipyard and/or Classification Society
5. The contractor shall be responsible for any damage caused to the material supplied by CSL. Compensation with penalty for damage or loss of the item will be recovered from the Contractor, in the event of loss or damage.
6. Contractors are required to work round the clock / Sundays/ holidays as per the requirement of concerned department in order to complete the work in time.
7. Any particulars/literature/information/certificates required by the Shipyard in connection with the work is to be forwarded free of cost.
8. All correspondence with the Shipyard to be in English language. All documents and plans to be in English language and in metric units.

कृते उप महाप्रबंधक / For Deputy General Manager
आउटसोर्सिंग विभाग / Outsourcing Department

ANNEXURE III

कार्य क्षेत्र / SCOPE OF WORK

ELECTRICAL OUTFIT WORKS – ELECTRICAL CABLE LAYING WORKS IN TRAILING SUCTION HOPPER DREDGER

1. INTRODUCTION

Cochin Shipyard Ltd and Royal IHC Dredging together signed an agreement for the design and engineering, hardware and support package for the licensed construction of India's largest dredger Beagle® 12 trailing suction hopper dredger (TSHD). The new dredging vessel will be used by DCI for safeguarding and improving the accessibility of the ports and waterways of India. With the construction of this new TSHD for DCI, IHC Dredging is looking forward to become the technical partner of Cochin Shipyard Ltd. The new vessel to be built is part of the Beagle® series of medium sized TSHDs. These TSHDs have a hopper volume ranging from 4,000 to 12,000m3, are designed for a wide range of dredging activities and are known for their high efficiency and maximum uptime. Cochin shipyard Ltd intends to outsource the Electrical Cable Laying Works of Trailing suction hopper Dredger as detailed below to competent subcontractors.

2. VESSEL DETAILS

Main Particulars of vessels
No. of vessel: one

Length overall	127.00M
Length b.p.p	117.00 M
Breadth mld	28.40 M
Depth mld	10.40M
Design draught	8.00 M
Max Draught, Approx	9.00 M

3. CLASSIFICATION

Type of vessel: TRAILING SUCTION HOPPER DREDGER (TSHD).

The vessel shall be designed and constructed under supervision of Royal IHC and in accordance with the regulations of **Lloyd's and IRS** for dual class classification mark:

Ship type: Trailing Suction Hopper Dredger

Electrical installations comply with the requirements of Royal IHC classification rules. Where no further specification is provided, the electrical installations shall comply with IHC standards, including the following publications: NEN-IEC 60092-352:2006, Royal IHC Yard standard I117, I116-6, C730SS & C730SS, C101, C330m-ST52, Royal IHC Yard standard& I119-1.

4. SCOPE OF WORK

The work shall be carried out based on the contract specification, general arrangement drawing, CSL mentioned standards (refer Appendix-I), IHC standards (refer Appendix-H&K), OEM standards (refer Appendix J&L) and Design drawings. The scope of contractor involves cabling (whole vessel) and MCT packing up to the entire satisfaction of CSL / IHC/Owner / Class surveyor, and up to the delivery of the vessel, which includes the following.

a) Complete cabling onboard vessel which also includes CAT 7/CAN BUS/FIBRE OPTIC/ MODBUS/ COAXIAL/PROFIBUS cables and any special cables as per CSL, IHC & marine standards.

b) Cable laying of heat tracing system is under the scope of sub-contractor. The installation of cables are to be done as per the OEM standards (Refer Appendix L for more details)

c) Dressing of cables (both temporary and permanent). The general practice of laying cable is on Cable Hangers for main cable ways. Cable saddles are used for less number of cables. Cables are held in position on hangers, racks and cable saddles by means of metallic/nonmetallic material Clips. The metal should be of Stainless steel. Inside panel boards nylon cable ties can be used for dressing. Cables exposed to weather deck shall be secured with stainless steel band with buckles .All cables shall be effectively supported and secured without damaging the outer covering of the cables. Clips, saddles bands and supports shall not present any sharp edges against the cables.

d) Nylon cable ties required for the temporary dressing of cables are in the scope of sub-contractor.

e) Cabling includes under water transducer cables, antenna communication cables, maker cables and various inbuilt sensor cables. (Installation of underwater sensors and antennas are not under sub contractor scope)

f) The MCT packing for the entire ship is the responsibility of the subcontractor and must be done according to the OEM instructions. The survey should be completed in accordance with Class/IHC requirements, either through an air leak test or visual inspection. The subcontractor is also required to complete and submit the MCT Installation Checklist as per Appendix J. MCT packing for individual equipments will be under the scope of cable termination agency. Packing of MCT (EMC type/ Non EMC type) shall be done according to the manufactures (Roxtec) standards.

g) Cable segregation and routing shall be done as per the EMC Management Control Document (Annexure-H). Cable arrangement for single core cables to be strictly adhered as per the document. Cable categories are Power Supply Lighting (S1),
Control signals (S2), Radio (S3), Transmission/Converter (S4), Fibre optics etc. Cable segregation into categories according to different signal types, and cable installation with intermediate free spaces should be ensured as per recommendations of IEC60533 (chapter B.2.5). Single cables or bundles of cables of different categories which run parallel for distances exceeding 1 m should be installed with an intermediate free space as much as practical possible between the different categories of cables (100 mm). Single cables or bundles of cables of different categories which cross each other must cross each other with an angle of 90 degrees.

INSTRUCTION FOR FIXING CABLES

- Power cables larger than 35mm² below/on top of cable trays Large strips = 1 SS - 2 Nylon
- Cables on cable racks in machinery area = 1 SS - 2 Nylon
- Cables on cable racks in accommodation area = 1 SS - 2 Nylon
- Cables on cable racks in exposed area = metallic (stainless steel)
- Cables on flat bar in machinery area = 1 SS - 2 Nylon
- Cables on flat bar in accommodation area = 1 SS - 2 Nylon

h) Fiber optic cables shall be fastened with Nylon cable ties all the way. When control cables and fibre optic cables are bunched together, it shall be fastened with Nylon cable ties all the way.

i) Fixing of Name Tags for cables. All the cables must be fitted with corresponding cable tags. Sleeve printing and fixing on cables are also under the scope of subcontractor. Sleeve printer and other accessories are to be arranged by subcontractor. Materials required for Cable ID tag like, PVC ferrule and PVC strip are under the scope of sub-contractor.(Supply of SS Metal Embossing Tags used for weather deck cable tagging are CSL scope, but tag installation is subcontractor scope).

j) Deck cables and cables exposed to mechanical damage are to be protected by means of galvanized solid drawn steel pipe. (Installation of galvanized pipes is CSL scope).

k) No cables shall generally be painted. Any paint and over-spray shall be cleaned off all cabling.

l) Cables for essential/emergency power for lighting, internal communication or signals shall be routed clear of galley, laundry, machinery spaces and other area of high risk fire.

m) The minimum internal bending radius for power and control cables shall be in accordance with the manufacturer's recommendations.

n) Where duplicate supply is required for the same service, the routes are to be different.

o) Power cable of maximum 6 cables or signal cables of maximum 15 cables shall be bunched together by one clamp. If bunching of larger formations is used for cables expected shall be under full load simultaneously, a correction factor of 0.85 shall be applied.

p) According to IHC standards, cables passing through a coaming must be secured inside the coaming using a saddle wherever required. (The installation of these saddles will be in the scope of CSL). For goose necks and electrical conduit pipes, flat bars (50mm) must be provided at both ends to facilitate cable strapping. (The installation of these saddles will be in the scope of CSL).

q) Any minor modification (Hot works) required in the cable way during cable laying. (Major modifications will be CSL scope).

r) IHC site representatives shall recommend minor modifications based on site conditions during the course of work to facilitate cable laying. The subcontractor must carry out these modifications after obtaining approval from the executing officer, without any additional payment.

s) Material movement & accounting of the items are in the scope of work of contractor. Contractor shall inform CSL Officer in Charge regarding the variations in the actual length of cables laid onboard vessel after comparison with the cable schedule on daily basis. Contractor shall note down the cut length of cables from drums, record in prescribed formats and submit to CSL Officer in Charge on daily basis.

t) Providing sufficient protection of the laid cables as per Yard direction (Material for protection is under scope of CSL). During hot works, all cables exposed to sparks from welding/blow pipe works shall be properly protected by means of an incombustible carpet/cloth.

u) Survey presentation to Yard I&QC, IHC, Owners and Class authorities as per yard practices which coming under the above scope of work.

v) Rectification of defects as per the comments from Yard I&QC, IHC, Owners & Class authorities.

w) All tools and tackles including cable drum stand, winch and cable tying machines required for the work are under the scope of the sub-contractor.

x) Minor staging up to 3m height shall be erected by the contractor for the work using CSL material without any separate payment. Any requirement over and above this shall be arranged by CSL separately.

y) Megger reading/ Insulation Value of cables to be taken as and when required and properly recorded for onward submission to QC department.

z) Total estimated length of the cables indented per vessel is approximately 1, 40,000 meters. Required cables will be supplied by the Yard. Since ship's cable scheduling works in progress, the length of cables indicated is approximate only.

5. NOTES

a) Electrical equipments & systems includes all the Power, Lighting, Control & Monitoring, Signals, Communication (Internal, external, GMDSS), Fire detection alarm, General alarm,

Navigation systems (includes bottom equipments) etc. as mentioned in the wiring diagrams as per Appendix D.

b) Minor re-works on the installation has to be expected in considering the outfitting of items, and the changes has to be carried out as per the drawings issued by design department time to time.

c) Minor rectification / modification works have to be undertaken by the contractor as part of the job, at no extra cost. However, major rectification / modification works shall be treated as an additional work, and payment shall be released based on actual man-hour expenditure/pro-rata basis as certified by the executing officer. Major & minor work shall be decided on a case-by-case basis and the same shall be intimated to the subcontractor before commencement of the work.

d) Also a conciliatory approach shall be taken towards all the working agencies on the vessel in a team spirit to achieve the project success in time.

e) In the event that the sub-contractor is unable to fulfill the stipulated manpower levels as outlined in clause 2.2.1 C of ANNEXURE- I, the yard retains the prerogative to allocate the necessary manpower so as to meet the project targets. The contractor shall bear the responsibility for the expenses associated therewith, and said amount shall be debited during the stage payments.

6. OTHER RESPONSIBILITIES OF THE OUTSOURCED FIRM

a) The transportation, storage, preservation and protection of the materials etc., intended for installation on the ship, will be under the responsibility of the firm.

b) All works shall be carried out according to approved drawings issued by Yard and Yard/IHC standards provided.

c) All work to comply with the requirements of the Classification Society/ IHC/Owners/Marine standards /CSL Quality standard and based on the building practice of the Yard.

d) Qualified Manpower, equipment's, tools with valid certification, welding sets etc. necessary for the work will be the responsibility of the firm, and should be carried out as per CSL standards.

e) Yard has the right to change the schedules of the project to the interests of the company and the firm should be capable of adjusting the resources according to the instructions from the Yard contact person.

f) Detailed working schedule (Weekly/monthly) etc. to be prepared and submitted to yard personnel. However, a detailed overall schedule, in a reasonable manner should be submitted prior to commencement of work.

g) Localized lighting, DBs etc. for the smooth work to be arranged by the firm. Required general lights/DBs etc. shall be arranged by Yard based on availability.

h) Mobilizing own equipment's, necessary working tools and tackles, safety and protective gear for their personnel inside the yard for carrying out the work as per Safety/Statutory rules/Yard rules of working people under the firm is the responsibility of the firm.

i) Firm shall be responsible for safety and welfare of all its employees employed for construction, and shall be responsible for payment of all salaries to their employees and other statutory dues and for all provisions of statues governing them.

j) Once the item/material is issued to the contractor, proper accounting of the items consumed shall be maintained, till the delivery of vessel.

k) The contractor, on receipt of any material, is requested to immediately verify the quality and quantity of the material with respect to the requirement and inform the executing officer any shortage/discrepancy noted/anticipated well in advance so that CSL can take corrective action in time.

7. SCOPE OF YARD

a) The design & supply of materials for Cable Laying for the mentioned scope of work except the materials required for Cable ID tags used inside vessel. SS Metal Embossing tags used for tagging cables in the weather decks will be supplied by CSL.

b) Estimated quantities of welding consumables, grinding and cutting wheels.

c) Estimated quantities of paints, thinner and primer.

d) Power supply, Water, compressed air (at available pressure) and cutting gases at centralized points.

e) Services of CSL cranes and forklifts will be provided subject to availability.

f) Required space for fabrication & working inside the Yard (as on available area)

g) Power and water supply to office space / container / room, at free of cost.

h) Staging above 3 m height

i) Necessary items like fire cloth, polythene/silpaulin sheets, Bubble sheets etc. required for protection of equipments.

j) Installation of cable ways & equipment seats, installation of equipments, cable termination and commissioning of equipments/systems.

8. METHODOLOGY OF WORKING

a) A detailed project report to be submitted prior to commencement of works.

b) The subcontractor shall deploy/nominate a person who will be in charge of the work for the entire period of project execution. He shall keep close liaison with CSL officers/supervisors concerned and ensure smooth and satisfactory progress of the work from time to time and shall be available for the entire duration of the project.

c) Necessary competent supervisors for the work, to be deployed.

d) Employees of the firm shall work under close coordination with yard personnel, contractors and other agencies working in the vessel with a conciliatory approach and team spirit to achieve the project completion in time.

e) The Contractor is expected to have full knowledge and understanding of the Labour rates, conditions, practices etc. prevalent in the Yard and premises. The contractor shall be entirely responsible for all matters related to manpower and labour engagement for the subject contract.

f) Issues related to availability and utilization of manpower shall be dealt by the Contractor. Availability of competent labour with requisite skills for the specified jobs shall be ensured by the contractor.

g) The complete work is to be carried out with the highest degree of workmanship under the inspection of CSL, IHC, Classification society (when specifically indicated in the technical specifications), Ship owner, or any other agency nominated by Shipyard.

h) The contractor shall execute the work in every area under instruction/intimation to CSL personnel at site. Clearance from CSL in terms of permits/internal regulations etc. as applicable from time to time shall be obtained. The contractor shall obtain necessary hot work sanctions, permission to work in confined areas, safety clearance for scaffolding done by the contractor, electrical related provisions etc. as per CSL safety rules.

i) The Contractor is to ensure proper cleanliness all around his work area while working on board ship. The contractor shall arrange to collect and clean up every day all the waste, scrap, debris etc. generated by his workmen while working on board the ship and other locations and deposit the same suitably at specified location at his cost to the complete satisfaction of Yard. In case of any failure on his part to comply with the requirement, Yard will arrange the required cleaning entirely at the contractor's cost.

j) The firm / contractor shall be responsible for any damage caused to the material supplied by CSL. Compensation with penalty for damage or loss of the item will be recovered from the Contractor, in the event of loss or damage. The responsibility is limited only with respect to the damages caused due to any mistake or negligence of contractor.

k) Contractor / firm are required to work round the clock / Sundays/ holidays as per the requirement of concerned department in order to complete the work in time.

l) The upper age limit of all workers and supervisors employed by the contractor / firm and those contractors who do or supervise the job themselves shall be as per the prevailing rules of CSL.

m) Any particulars/literature/information/certificates required by the Shipyard in connection with the work is to be forwarded free of cost.

9. SAFETY/STATUTORY RESPONSIBILITY

a) The contractor shall be entirely responsible for the safety of all the personnel employed by him on the work. In this regard, he should adopt all the required safety measure and strictly comply with the safety regulations in force. A copy of CSL's "Safety Rules for Contractors (Revised)" is available with the execution department for reference.

b) The Contractor should arrange to suitably insure all his workmen/other personnel in this regard. CSL will not be responsible for any injury or illness to the Contractor's workmen/other personnel during execution of the works due to whatsoever reasons.

c) In this regard, the Contractor will have to fully indemnify CSL against any claims made by his workmen/other personnel.

d) The Contractor shall provide and maintain so as to be readily accessible during all working hours, a first aid box with prescribed contents at every place where he employs contract labour for executing the works.

कृते उप महाप्रबंधक / For Deputy General Manager
आउटसोर्सिंग विभाग / Outsourcing Department

ANNEXURE- IV

तकनीकी वाणिज्यिक जांच सूची / TECHNO COMMERCIAL CHECK LIST

(To be submitted by the bidder)

TENDER NO. SB-OSD/TSHD/928/2025 Dtd: 19-02-2025

Firm Name:

(Bidders may confirm acceptance of the Tender Conditions/deviations if any to be specified)

SL No.	Tender Enquiry Requirements	Confirmation from bidder (strike off whichever is not applicable)	Specific comments /Remarks
1	Scope of work as per Technical Specification/Drawings/ General Terms & conditions (Annexure III)	Agreed as per tender /Do not agree	
2	Whether technical bid & two price bids are submitted in separate PDFs?	Yes / No	
3	Schedule of work as specified in technical specification/ price bid of this tender is acceptable	Yes/ No	
4	Submission of Information/Documents with offer	Submitted/Not submitted	
5	Submission of MSME and NSIC registration document with offer	Submitted/Not submitted	
a	Specify the current position of the firm	MSME/MSE/Startup	
6	Offer Validity (date)	90days - Agreed as per tender/Do not agree	
7	Completion period as mentioned in the tender enquiry is acceptable	Yes/ No	
8	Taxes & Duties	Specified/included in Price	
9	Payment terms - confirm		
a	Stage Payment	Agreed as per tender/Do not agree	

b	Any others (Specify details)		
10	Price shall remain firm and fixed and No Escalation in prices after awarding of contract	Agreed as per tender/Do not agree	
11	Security Deposit & Performance Guarantee Clause	Agreed as per tender/Do not agree	
12	Termination of contract/risk purchase as per relevant clause in the terms & conditions of tender enquiry is acceptable	Yes / No	
13	Force Majeure	Agreed as per tender/Do not agree	
14	Liquidated damages and cancellation of contract	Agreed as per tender/Do not agree	
15	Arbitration & Jurisdiction clauses	Agreed as per tender/Do not agree	
16	Confirm all other terms and conditions of our enquiry are acceptable.	Confirmed/Not confirmed	
17	Confirm, un-priced price bid (price bid without price) is submitted with Part – I bid	Confirmed/Not confirmed	
18	Mode of submission of tender	Direct / Email	
19	Fully aware about the safety, general rules, regulations, standards, validity of offers and price, entry pass eligibilities.	Yes / No	
20	Is your firm registered under TReDS	Yes/No	
21	Is your firm registered as vendor in CSL	Yes/No	
22	Annual turnover requirement, during last 3 years, ending 31st March of the previous financial year	Agreed as per tender/Do not agree	
23	Do your firm have valid registration under statutory schemes such as ESI / EPF	Yes/No	
24	Deviations from Tender conditions	No Deviations /Deviations are specified	

हस्ताक्षर / Signature:
ठेकेदार का पता / Address of the Contractor
मुहर / Seal

ANNEXURE-V

मूल्य बोली प्रारूप / PRICE BID FORMAT

TENDER NO. SB-OSD/TSHD/928/2025 Dtd: 19-02-2025

ELECTRICAL OUTFIT WORKS – ELECTRICAL CABLE LAYING WORKS IN TRAILING SUCTION HOPPER DREDGER

SL.No	Type of cable (Outer diameter in mm)	Total Qty in meters (A)	Rate per unit meters (B) in INR	Total amount (C) = (A)*(B) in INR
1	Up to 15mm	100000		
2	15 mm and up to 25 mm	32500		
3	25 mm and up to 35 mm	6500		
4	35 mm and above	1000		
5	**SUB TOTAL (SUM OF SL No. 1 *to* SL No. 4)**			
6	**GST …….% HSN CODE……**			
7	**GRAND TOTAL (SUM OF SL No. 5 + SL No. 6)**			

Grand Total amount (in words)
Rupees……
……
……

NOTE:

A. L1 will be determined based on Sub total amount **SL. No. (5)** Excluding GST.
B. GST as per the prevailing rate will be paid.
C. L1 declaration will be based on the price bid verification by CSL finance dept as per the calculation specified.
D. Unit quoted shall be inclusive of labor costs, handling charge, Equipment's, Tools & tackles, consumable charges and any other cost included for the satisfactory completion of all works as specified in the scope of work.
E. Quantity mentioned in the price format is only indicative. Downward or upward variation of quantity shall be anticipated. Payment will be made as per the actual quantity installed against each type of item.

Signature of Contractor/authorized signature
of firm or agency:
Name of contractor or authorized signatory of
firm/agency:
Designation:
Address:
Contact No:

ANNEXURE-VI

PRE CONTRACT INTEGRITY PACT

COCHIN SHIPYARD LIMITED

OUTSOURCING DEPARTMENT

General

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on …….…… day of the month of ……..……., between Cochin Shipyard Ltd (CSL), A Government of India Enterprise under the Ministry of Ports, Shipping & Water Ways having its registered office at Cochin, Kerala, India (hereinafter called the "PRINCIPAL") of the First part and M/s……...…… (hereinafter called the "BIDDER/Seller") of the second part.

WHEREAS the PRINCIPAL proposes to procure ……..…… and the BIDDER/Seller is willing to offer/has offered the stores and

WHEREAS the BIDDER is a private company / public company / Government undertaking / partnership/registered export agency, constituted in accordance with the relevant law in the matter and the PRINCIPAL is a Government of India Enterprise.

NOW, THEREFORE,

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to:-

Enabling the PRINCIPAL to obtain the desired said stores/equipment/item at a competition price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and

Enabling BIDDERs to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the PRINCIPAL will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:-

1. Commitments of the PRINCIPAL

1.1 The PRINCIPAL undertakes that no official of the PRINCIPAL, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting on implementation process related to the contract.

1.2 The PRINCIPAL will, during the pre-contract stage, treat all BIDDERs alike and will provide to all BIDDERs the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERs.

1.3 The officials of the PRINCIPAL will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the PRINCIPAL with full and verifiable facts and the same is prima facie found to be correct by the PRINCIPAL, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the PRINCIPAL and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the PRINCIPAL the proceedings under the contract would not be stalled.

2. Commitments of BIDDERs

The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:-

The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the PRINCIPAL, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract

in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the PRINCIPAL or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract of any other contract with the government for showing or forbearing to show favour or disfavor to any person in relation to the contract of any other contract with the Government.

BIDDERs of foreign origin shall disclose the name and address of their Indian agents and representatives, if any and Indian BIDDERs shall disclose their foreign principals or associates, if any, in the bid.

BIDDERs shall disclose the payments to be made by them to their Indian agents/brokers or any other intermediary, in connection with this bid/contract in the bid and the payments have to be in Indian Rupees only.

The BIDDER further confirms and declares to the PRINCIPAL that the BIDDER is the original manufacturer/ integrator/authorized agent of the stores/equipment/items and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the PRINCIPAL or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the PRINCIPAL or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

The BIDDER shall not use improperly, for purposes of competition or personal gain, pass on to others, any information provided by the PRINCIPAL as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

The BIDDER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.

The BIDDER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.

If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of the PRINCIPAL, or alternatively, if any relative of an officer of the PRINCIPAL has financial interest/stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of tender. The term 'relative' for this purpose would be as defined in section 6 of the Companies Act 1956.

The BIDDER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee or the PRINCIPAL.

3. Previous Transgression

3.1 The BIDDER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify; BIDDER's exclusion from the tender process.

3.2 The BIDDER agrees that if it makes incorrect statement on this subject, BIDDER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

4. Earnest Money (Security Deposit)

4.1 While submitting commercial bid, the BIDDER shall deposit an amount (to be specified in RFP) as Earnest Money as applicable/Security Deposit, with the PRINCIPAL through any of the following instruments:

(i) Bank Draft of Pay Order in favor of CSL.

(ii) A confirmed guarantee by an Indian Nationalized Bank, promising payment of the guaranteed sum to the PRINCIPAL on demand within three working days without any demur whatsoever and without seeking any reasons whatsoever. The demand for payment by the PRINCIPAL shall be treated as conclusive proof of payment.

(iii)Any other mode or through any other instrument (to be specified in the RFP).

4.2 The Earnest Money if applicable/Security Deposit shall be valid upto the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the PRINCIPAL, including warranty period.

4.3 In case of the successful BIDDER a clause would also be incorporated in the Article pertaining to Performance Bond in the Purchase Contract that the provisions of sanctions for Violation shall be applicable for forfeiture of Performance Bond in case of a decision by the PRINCIPAL to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.

4.4 No interest shall be payable by the PRINCIPAL to the BIDDER on Earnest Money/Security Deposit for the period of its currency.

5 Sanctions for Violations

5.1 Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the PRINCIPAL to take all or any one of the following actions, wherever required:-

(i) To immediately call off the pre contract negotiations without assigning any reason or giving any; compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

(ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/ Performance Bond (after the contract is signed) shall stand forfeited either fully or partially, as decided by the PRINCIPAL and the PRINCIPAL shall not be required to assign any reason therefore.

(iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.

(iv) To recover all sums already paid by the PRINCIPAL, and in the case of an Indian BIDDER with interest thereon at 2% above the prevailing Prime Lending Rate of State Bank of India, while in case of a BIDDER from a country other than India with interest thereon at 2% above the LIBOR (London Inter Bank Offer Rate). If any outstanding payment is due to the BIDDER from the PRINCIPAL in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.

(v) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the PRINCIPAL, along with interest.

(vi) To cancel all or any other contracts with the BIDDER. The BIDDER shall be liable to pay compensation for any loss or damage to the PRINCIPAL resulting from such cancellation/recession and the PRINCIPAL shall be entitled to deduct the amount so payable from the money(s) due to the BIDDER.

(vii) To debar the BIDDER from participating in the future bidding processes of CSL for a minimum period as deemed appropriate, which any be further extended at the discretion of the PRINCIPAL.

(viii) To recover all sums paid in violation of this Pact by BIDDER(s) to any middleman or agent or broker with a view to securing the contract.

(ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the PRINCIPAL with the BIDDER, the same shall not be opened.

(x) Forfeiture of Performance Bond in case of a decision by the PRINCIPAL to forfeit the same without assigning any reason for imposing sanction for violation of this pact.

5.1 The PRINCIPAL will be entitled to take all or any of the actions mentioned at para 6.1(i) to (x) of this pact also on the Commission by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER), of an offence as defined in chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.

5.2 The decision of the PRINCIPAL to the effect that a breach of the provisions of this pact has been committed by the BIDDER shall be binding on the BIDDER. However, the BIDDER can approach the Independent Monitor(s) appointed for the purposes this Pact.

6 Fall Clause

6.1 The BIDDER undertakes that it has not supplied/is not supplying similar product/systems/items or subsystems at a price lower than that offered in the present bid in respect of any other Ministry/Department of the Government of India or PSU and if it is found at any stage that similar product/systems or sub systems/items was supplied by the BIDDER to any other Ministry/Department of the Government of India or PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER to the PRINCIPAL, if the contract has already been concluded.

7 Independent Monitor

7.1 The PRINCIPAL has appointed Independent Monitor (hereinafter referred to as Monitor) for this Pact in consultation with the Central Vigilance Commission.

Dr. Vinod Bihari Mathur, IFoS (Retd.)
D302, Arborea Luxury Homes,
Tarla Nagal, Near Doon Helidrome,
Dehradun, Uttarakhand - 248001
Mobile: 9412054648
Email: **vbm.ddn@gmail.com**

7.2 The task of the Monitor shall be to review independently and objectively, whether and to what extend the parties comply with the obligations under this Pact.

7.3 The Monitor shall not be subject to instructions by the representatives of the parties and perform their functions neutrally and independently.

7.4 Both the parties accept that the Monitor has the right to access all the documents relating to the project/procurement, including minutes of meetings.

7.5 As soon as the Monitor notices, or has reason to believe, a violation of this pact, he will so inform the Authority designated by the PRINCIPAL.

7.6 The PRINCIPAL accepts that the Monitor has the right to access without restriction to all Project documentation of the BUYER including that provided by the BIDDER. The BIDDER will also grant the Monitor, upon his request and demonstration of a valid interest, unlimited access to his project documentation. The same is applicable to Subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the BIDDER/Subcontractor(s) with confidentiality.

7.7 The PRINCIPAL will provide to the Monitor sufficient information about all meetings among the parties related to the Project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.

7.8 The Monitors will submit a written report to the designated Authority of PRINCIPAL /Secretary in the Department/ within 8 to 10 weeks from the date of reference or intimation to him by the PRINCIPAL /BIDDER and, should the occasion arise, submit proposals for correcting problematic situations.

8 Facilitation of Investigation

In case of any allegation of violation of any provisions of this pact or payment of commission, the PRINCIPAL or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER. The BIDDER shall provide necessary information and documents in English and shall extend all possible help of the purpose of such examination/inspection.

9 Law and Place of Jurisdiction

9.1 This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the PRINCIPAL.

9.2 A person signing Integrity Pact shall not approach the Courts while representing the matters to Independent External Monitor and shall await await their decision in the matter.

10 Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extent law in force relating to any civil or criminal proceedings.

11 Validity

11.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 5 years or the complete execution of the contract to the satisfaction of both the PRINCIPAL and the BIDDER/Seller, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

11.2 Should one or several provisions of this Pact turn out to be invalid; the remainder of this pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

The parties hereby sign this Integrity Pact at ……on …….

For & on behalf of PRINCIPAL **Cochin Shipyard Limited** **(Office Seal)**	**For & on behalf of BIDDER** **(Office Seal)**
Witness	Witness
1……	1…….
2……	2…….

* Provisions of these clauses would need to be amended/deleted in line with the policy of the BUYER in regard to involvement of Indian agents of foreign suppliers.

ANNEXURE-VII

DECLARATION

I hereby declare that the details furnished in this tender proposal are true and correct to the best of my knowledge and belief. In case any of the information is found to be false or untrue or misleading or misrepresenting, I am aware that I will be held liable for it and CSL is free to take any legal / commercial action not limited to barring / blacklisting.

We hereby declare that we are not under a declaration of ineligibility / blacklisting /debarring/ tender holiday from doing business issued by Govt. of India / State govt. / Public Sector Undertakings etc.

Yours faithfully,

_____

(Signature & Seal of Authorised Signatory)

APPENDIX- A

COMPLIANCE MATRIX

Clause No.	Compliance/ Deviation

Notes:

1. If offer is not fully conforming to the requirements given in any clause of this specification, the deviation shall be stated in detail against the particular clause in the Compliance matrix.

APPENDIX - B

FORMAT FOR FINANCIAL CAPABILITY

Sl. No.	Last three Financial Year	Annual Turnover
1	Year 2021-22	
2	Year 2022-23	
3	Year 2023-24	

To be signed by the Authorized Signatory of the Applicant with Name, Designation, seal and date.

Certificate from Chartered Accountant:

This is to certify that _____ (name of the Applicant) has received the payments shown above against the respective years and that the net worth is as computed.

Name of the Authorized Signatory representing Auditing firm:
Designation:
Name of firm (Chartered Accountant):

Signature of the Authorized Signatory:

Seal of Audit firm

APPENDIX - C

UNDERTAKING

I, Shri …….....in my capacity as Managing Partner / Chairman & Managing Director / Proprietor of M/s. …….do hereby give an undertaking that we shall provide Man power as per the clause 2.2.1 (c) of Annexure I of the tender enquiry no. SB-OSD/TSHD/928/2025 Dtd: 19.02.2025.

Signature of Contractor/authorised signatory of firm or agency:

Name of contractor:

Designation of authorised signatory of firm/agency:

Address:

Contact No:

APPENDIX - D

LIST OF DRAWINGS TO BE ISSUED BY CSL		
SL. No	**Drawing to be issued**	**Remarks**
1	Fitting arrangement of electrical equipment seat and cable way	
2	MLF – Cable	
3	Electric cable schedule	
4	Wiring diagram	
5	Electrical Outfit Practice and Standards	

APPENDIX-E

PERFORMANCE EVALUATION FORM

	Evaluation Grade Points Awarded (Grade Points X Weightage)					
Parameters	Grade	Excellent	Good	Average	Bad	Very Poor
	Weightage	**5**	**4**	**3**	**2**	**1**
Timely Completion as per Project schedule	10					
Work Planning & Coordination	2					
House Keeping and HSE	2					
Responsiveness to critical and complex works	2					
Overall Quality Management	2					
Integrity and Professionalism	2					
Total Grade Points *(sum of points in each grade)*	**20**					
Grand total of grade points awarded (Max 100)						

Points to be considered during evaluation

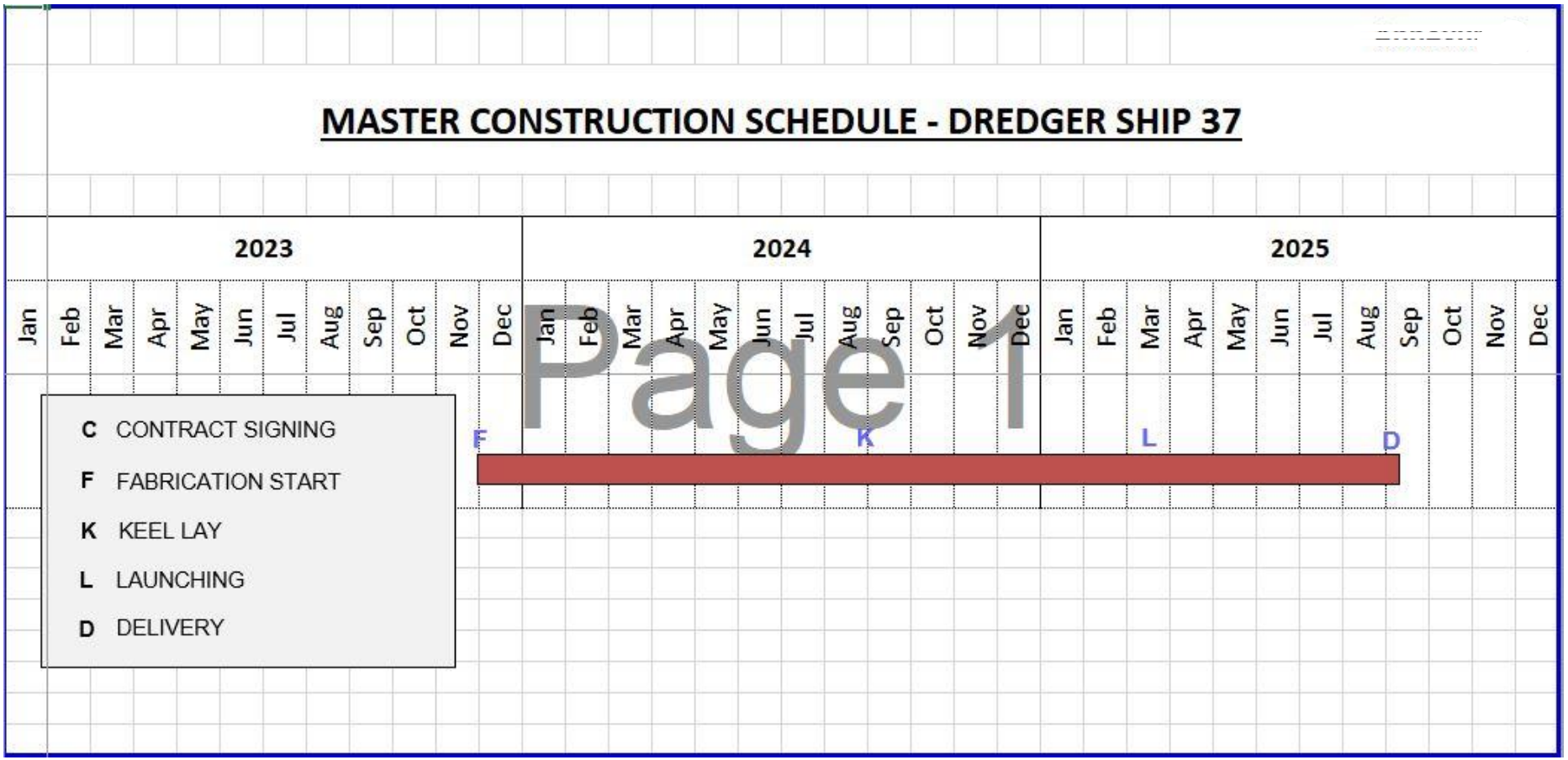
Timely Completion as per Project schedule	Completion of work within stipulated time, including class surveys & till submission of proper quotation. (No Reworks/Survey failures)
Work Planning & Co-ordination	Planning of (material, labour & machinery) for smooth execution of work, coordination with multiple agencies/stakeholders, Pro-active approach in avoiding hindrance of work, Supervisory skills, communication etc.
Responsiveness to critical and complex works	Willingness to execute complex works understanding the importance of the work for CSL, deployment of adequate workers in time & round the clock in critical tasks.
Overall Quality Management	Quality of Work, No of QC/Class survey points, Re-works, RT/Survey Failures, quality of manpower, supervisors etc. to be considered
House Keeping and HSE	Adherence to CSL HSE policies and instructions especially based on Number of Unsafe acts/ near misses ,use of PPEs, commitment & continuing practices for good housekeeping at site including waste management, daily tool box meetings at site.
Integrity and Professionalism	Responsiveness & commitment to work, uniforms to workers, appropriate & polite behaviour at site, ethics in preparation of quotations, corrections in quotation, proper documentation.

Signature (CSL Officer in-Charge)	
Name & Design	

COCHIN SHIPYARD LTD

APPENDIX F

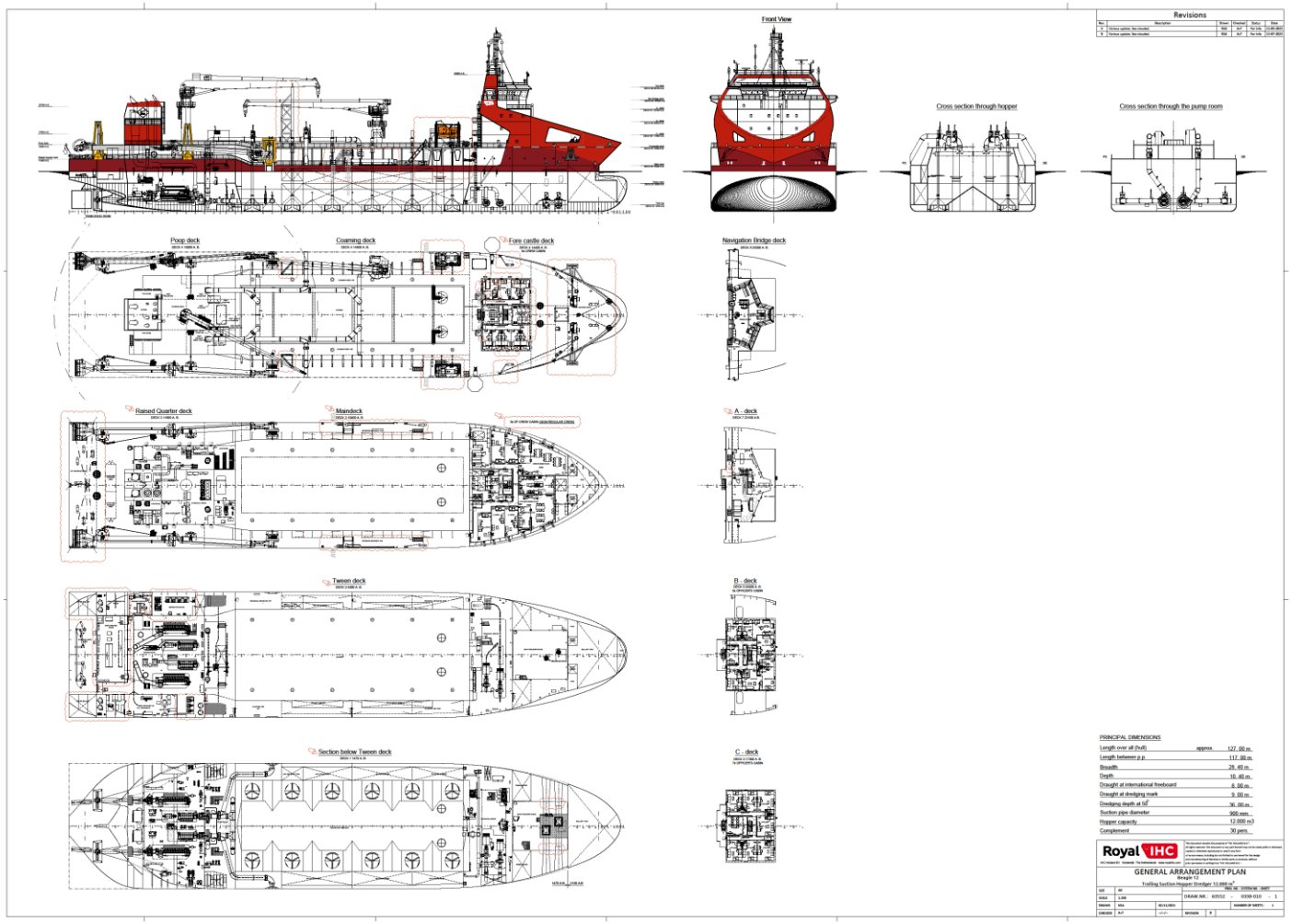
MASTER CONSTRUCTION SCHEDULE



COCHIN SHIPYARD LTD

APPENDIX G

GENERAL ARRANGEMENT (GA) OF VESSEL



COCHIN SHIPYARD LTD

APPENDIX H

ANNEXURE E

IHC Quality Manual

Royal IHC

IHC Systems B.V.

General design installation

Quality manual

Systems project number	SH037
Systems document number	101000-0007
Systems document revision	01
Systems document type	Q010
Systems document status	Released for Information
Document from	Systems
Supplier document number	
Supplier document revision	
Client vessel number	SH037
Client document number	
Client component number(s)	
External Customer doc. no.	

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Document information.

Document	Information
Number of pages Document File name Author Supplier	36 SH037-101000-0007-1-Q010.docx P. van Dalen IHC Systems
Owner vessel Name vessel Yard	DCI Dredge Brahmaputra IHC / CSL

Document history

Revision	Date	Status	Description
1	10-03-2022	For Installation	

Approval

Name	Role	Date	Signature
P. van Dalen	Author	10-03-2022	
F. Verschuuren	Quality Control	14-06-2022	
T. van Buren	Approval	14-06-2022	

Table of contents

Revision Control

Any revision on this quality book can be proposed and will be reviewed and confirmed by the responsible E&A engineers prior to the implementation. If required other departments inside Royal IHC will be consulted.

References

No.	Document	Reference
1	Record abbreviations	SH037-106000-0005-Z290
2	EMC management control document	SH037-101000-0006-I130
3	Inspection procedure steelwork	SH037-106000-2002-Z137
4	Inspection procedure cabinet	SH037-106000-2003-Z137
5	Inspection procedure final room	SH037-106000-2001-Z137
6	Standard materials electrical installation	SH037-106000-2002-M035
7	Cable wire colour table	SH037-880000-0009-SY35
8	Electrical installations in ships-Part 352	NEN-IEC 60092-352:2006
9	Basic agreements for cable trays	Royal IHC Yard standard I117
10		
11		
12	Typical cable supports welded to primary constr.	Royal IHC Yard standard I116-6
13	Cable fixation strip at cable pipe ends	Royal IHC Yard standard C730 & C730SS
14	Dimensions of steel pipes	Royal IHC Yard standard C101
15	Dimensions of threaded sockets	Royal IHC Yard standard C330M-ST52
16	Pipe clamps	Royal IHC Yard standards I114 & I119-1

Definitions and abbreviations

Definitions and abbreviations are listed in the Record abbreviations reference document[1].
Abbreviations and definitions which are specific for this document:

Electrical contractor	Any contractor supplying and installing an electrical installation or system
Cable routing	The entire design which defines how cables have to follow the cable tray network.
Cable tray routing	The entire design which defines how cable trays have to be installed.
Cable tray	A standard metal construction provided on board to support cables.
Cable strip	A standard metal construction on board to support a limited number of cables.
Cable pipe	Galvanized steel cable pipe is applied where cables are led through for mechanical and/or EMC protection.
Multi Cable Transit (MCT)	A standard part which is designed to be installed in a water or weather tight or fire integrity deck or bulkhead and trough which a group of cables can pass.
Cable gland	A standard part to provide a watertight penetration for a single cable.
Coaming	A provision to protect cables for damage by hitting or water flooding.
Bending radius	The minimum bending radius for a cable as specified by its manufacturer or any other recognized regulatory body.
Cable binder (i.e. TY-RAP)	A standard piece of material to fasten one or more cables.

1. Introduction

The purpose of this document is to specify the minimum standards of the electrical installations for projects to be built at/or under contract of Royal IHC.

Project specific requirements will be attached to this manual with a separate project specific document.

Each electrical contractor who is installing electrical systems or installations is responsible for adequate and suitable tools for the intended services.
Examples are, but not limited to:

- Torque tools for securing/confirming the electrical connections (only for rail connections and main feeder cables)
- Calibrated testing instruments
- Tools for fitting ferrules and cable lugs
- Cable peeling knives
- Etc.

The electrical contractor have to use the materials as described in standard materials electrical installation reference document[6].

When alternative standards for the execution of electrical installations on board are used by any contractor it is up to Royal IHC to decide whether these are equivalent to the ones as described in this document. The electrical contractor cannot derive any right to deviate from these standards if any electrical system or installation from others is not in compliance with these standards.

All Equipment, cables, materials should be installed according vendor documentation and according this document. In case of any deviation Royal IHC have to decide.

1.1 Standard

The standards described in this document are based on:

- Rule requirements (i.e. Bureau Veritas, Det Norske Veritas or Lloyds Register of Shipping)
- IEC publications applicable for the project
- Common practice of workmanship for maritime electro technical installations
- Royal IHC standards
- Earthing and EMC according “EMC management control document” reference document [2]

2. Cable support systems

This chapter describes the principals of the cable supporting systems.

2.1 Common practice

Cable tray routing is a design and engineering activity which describes the location, position and sizes of the cable tray network and it consist of cable trays and penetrations. This information should be available on production drawings in time according planned activities.

Secondary iron-works like cable strips and cable pipes are to be determined during pre-outfitting and outfitting period and is based on the installation engineering activities of all electrical equipment. Relevant information should be available in time according planned activities.

The following criteria to be observed during the cable tray routing design activities;

- Cable tray to be applied within the range of 100mm and 600mm.
- The supports, including the welds, to have sufficient strength to carry the expected cable load.
- Bends in cable trays to be curved. The radius depends on the type of cables placed on these cable trays. Generally no straight angle bends (90 degrees) are allowed. See also “Basic agreements for cable trays” reference document [9].
- Separation of cabling have to achieve the EMC requirements according “EMC management control document” [2].
- Cable tray routing to be away from excessive heat areas or surfaces such as boilers or exhaust gas lines etc.
- Cable tray routing to be free from service, transport or hoisting areas.
- Crossings of cable trays on the same height are not allowed.
- Suitable protection against mechanical damages to be provided.
- Cables for essential services may not pass through high fire risk areas such as galley’s, engine-, boiler- and separator rooms. Special precautions need to be considered such as fire insulated cable pipes or cable ducts.
- When length and movement differences are to be expected, expansion points must be provided in the cable tray routes.
- Where required for any additional protection (electromagnetic or mechanic) cables to be installed in pipes or ducts.
- Cables may only be installed on/in dedicated provisions like, cable trays, cable strips and cable pipes and may not be installed on other structures like liquid piping, air ducts, foundations or their supports.
- Generally the supports for cable trays, cable pipes and cable strips are to be attached to the ship’s structure.
- Size and location of additional penetrations which are not available in the design documents and which are to be decided by production department are to be checked with the ship’s structural design parameters in cooperation with the Royal IHC engineering department.

2.2 Material

Cable tray supports and cable strips to be of steel S235JR sand blasted SA 2.5 and provided with shop primer before installing on board.

Cable pipes to be of galvanized steel.

Only in accommodation areas and general service areas (i.e. stores) synthetic pipes may be applied for local cabling. Such cable pipes to be of low smoke, self-fire-extinguished and halogen free material.

2.3 Cable trays

The following main cable trays are generally used (See also Figure 1):

- Cable tray with flat rungs (≤ 300mm)
- Cable tray with V-profiled rungs (≥100mm up till 600mm)
- Cable tray with Z-profiled rungs (≥100mm up till 600mm)

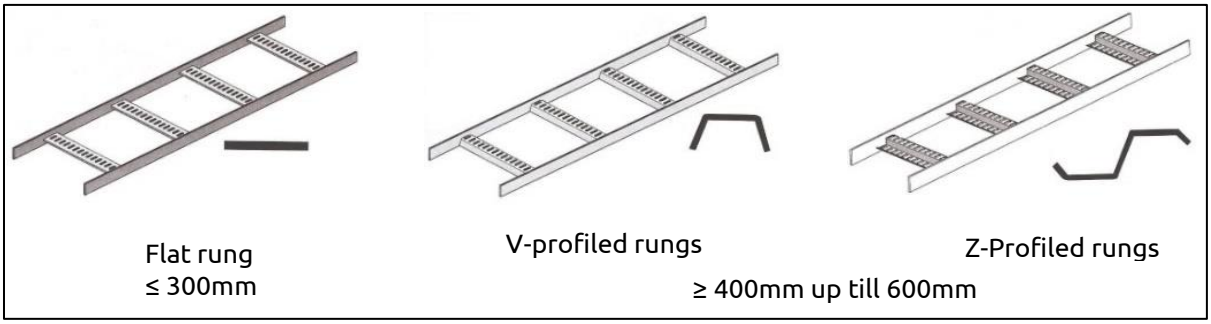


Figure 1: Generally used main cable trays

Bends in cable trays to be curves as in Figure 2. Generally no straight angle bends (90 degrees) are allowed.
The intermediate distance between each rung to be max. 300mm.

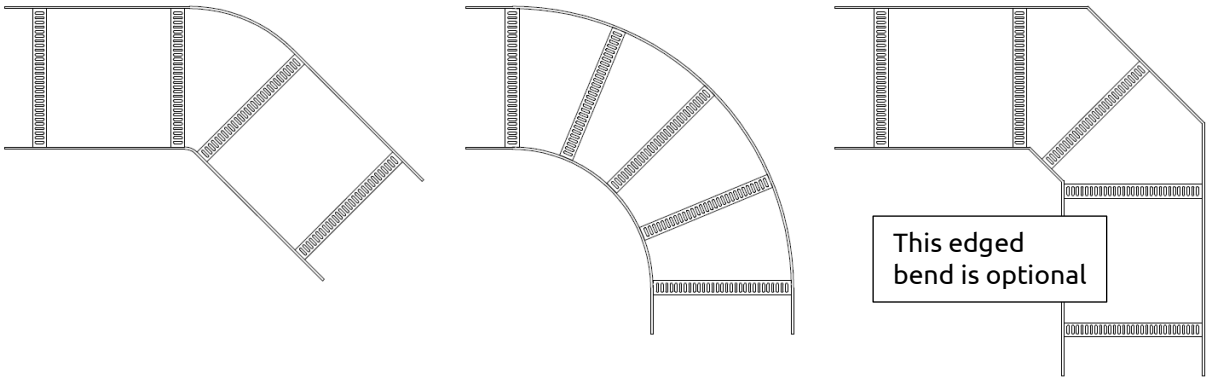


Figure 2: Generally used cable tray bends.

2.3.1.1 Fitting instructions

Generally strips, angle bars and other supports for cable trays, strips and pipes to be welded to the structure (i.e. beams, girders, frames). Supports to be welded as shown on following principal details [12]. In Figure 3, Figure 4 and Figure 5 several examples are illustrated.

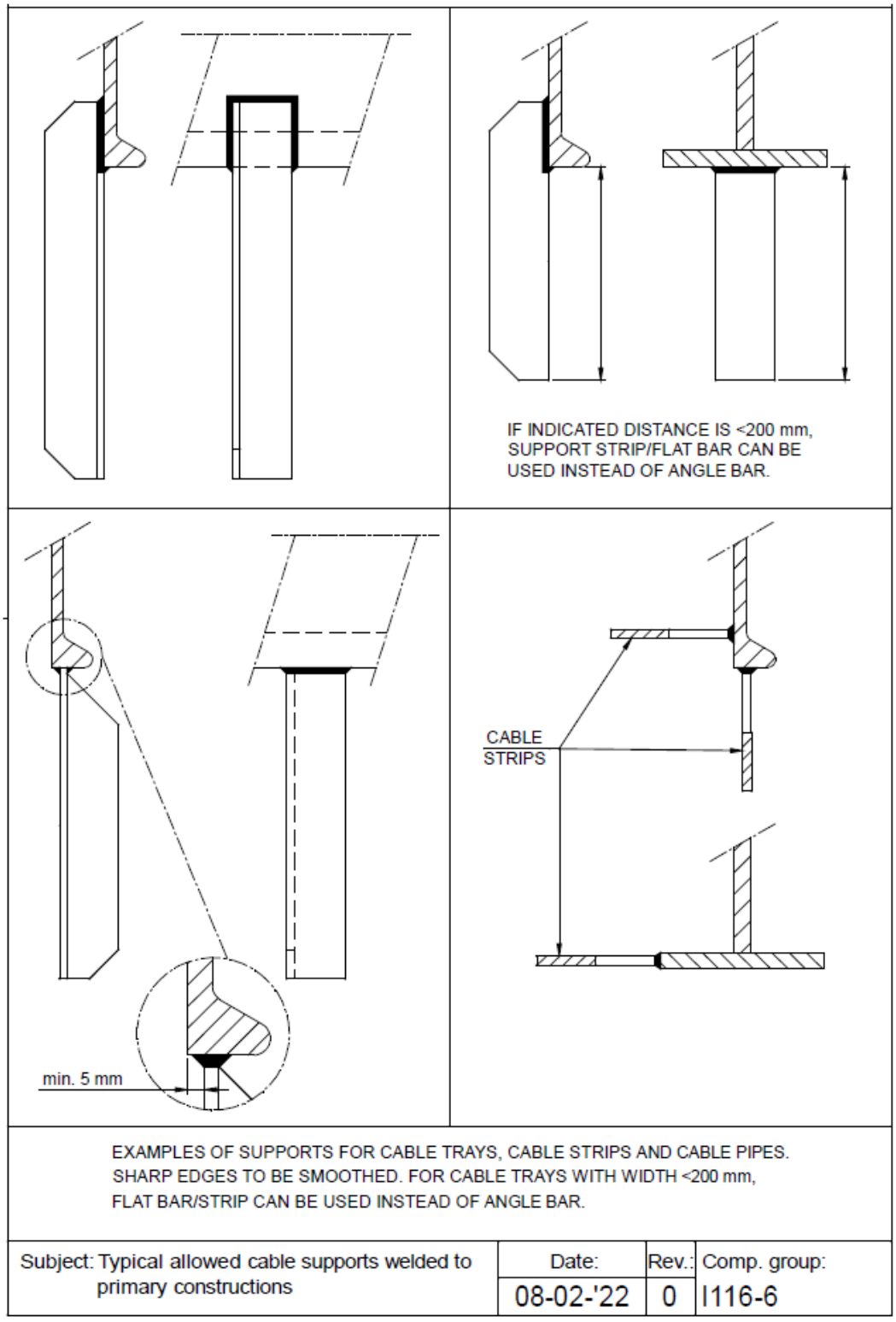


Figure 3: Theoretical welding methods of support to ship structure

2.3.1.2 Fitting instructions

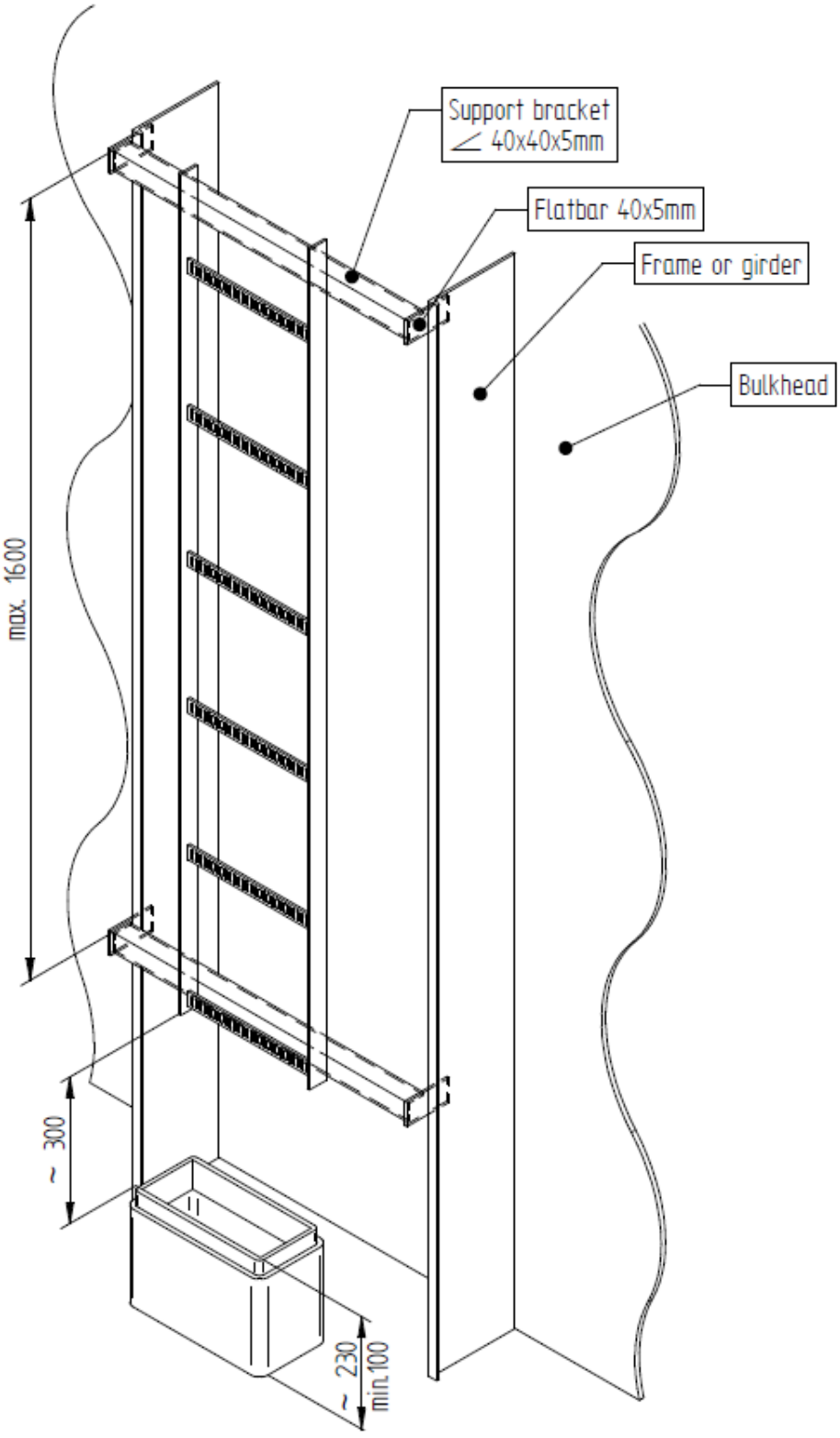


Figure 4 Typical for vertical cable tray support in non-exposed areas

Where it is not feasible or practicable to weld the supports to beams and girders the support brackets may be welded to deck or bulkhead plating (except to the shell). In such cases a double plate for each support to be added to avoid “hard” stress points.

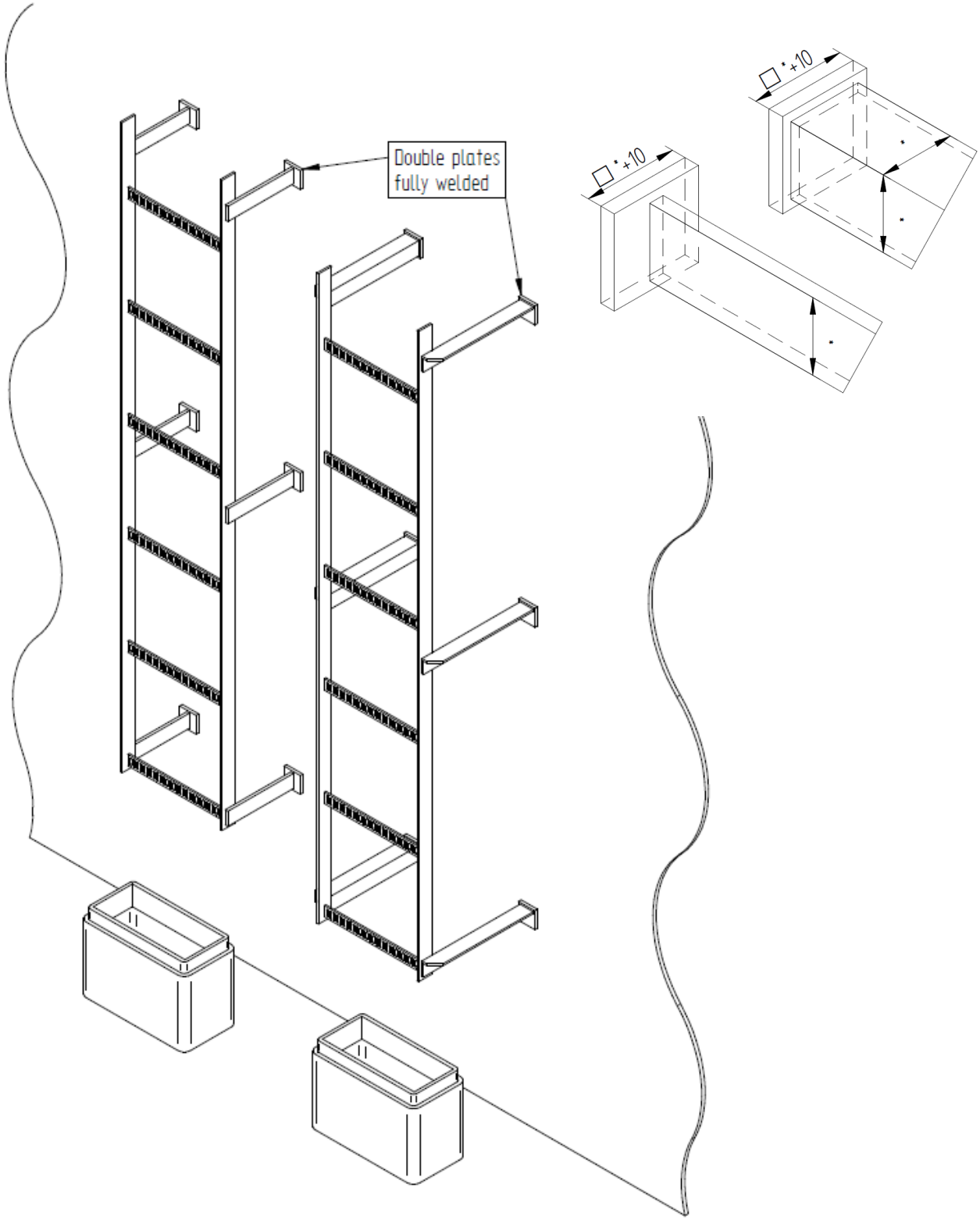


Figure 5 Typical cable tray supports welded to plating

Angle bars and flat bars for supporting the cable trays to the ship's structure are to be applied for all cable trays. The free ends of each angle bar or flat bar to be rounded or canted and brake sharp edges. Maximum lengths for flat bars and angle bars to be as given in table 1.
All supporting bars to be fully welded in exposed and wet areas.

Length (L) from ship's structure	Angle bar	Flat bar
≤200mm	40x40x5mm	30x8mm or 40x8mm
≥200mm till ≤500mm	40x40x5mm	-
≥500mm till ≤1000mm	50x50x5mm	-
≥1000mm	60x60x6mm	-

Table 1: Dimensions of cable tray supports

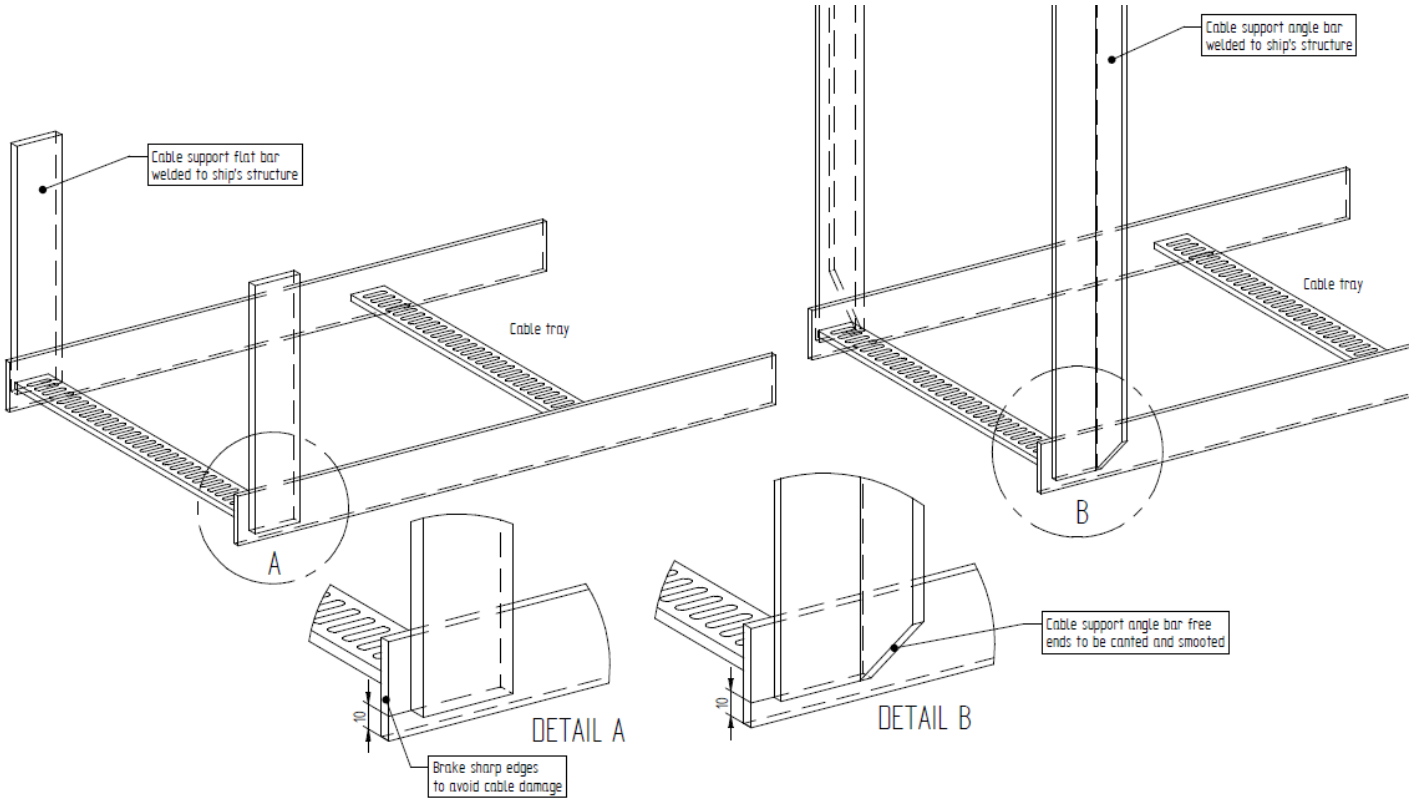


Figure 6 Typical details for cabletray flatbar and canted, smoothed anglebar supports

At any penetration the last cable tray support to be fitted at a maximum distance of approx.300mm from the penetration, reinforcement or cut-out. See Figure 7 for some examples.

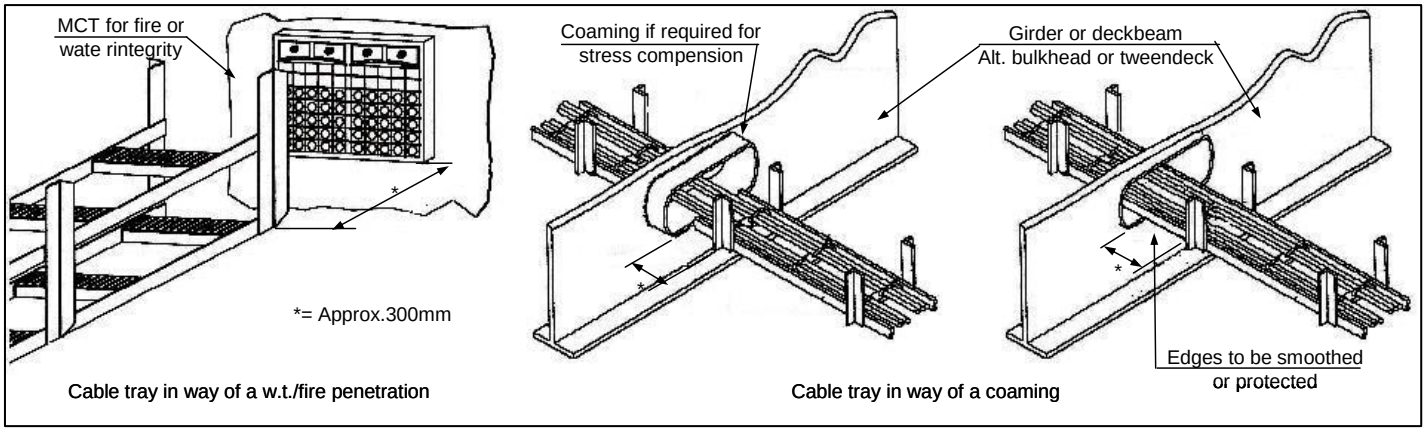


Figure 7 Typical of cable tray supports near penetrations and cut-outs

2.3.2 Cable strips

Cable strips can be applied to install a limited number of cables. The sizes of a cable strip should be 30, 40 or 50x5mm. The intermediate minimum distance of the support strips is approx. 500 and with a maximum of approx. 700mm. An example of a cable strip is shown in Figure 8. Remark: The length of legs depends on the thickness of the insulation.

Generally the supports to be welded to the ship's structure and not directly to decks or bulkheads. In wet areas and on open decks full welds to be applied. Otherwise one side tag welding and other side full welding will be accepted.
In the case where such supports are positioned to decks or bulkheads a double plate to be added and fully welded.

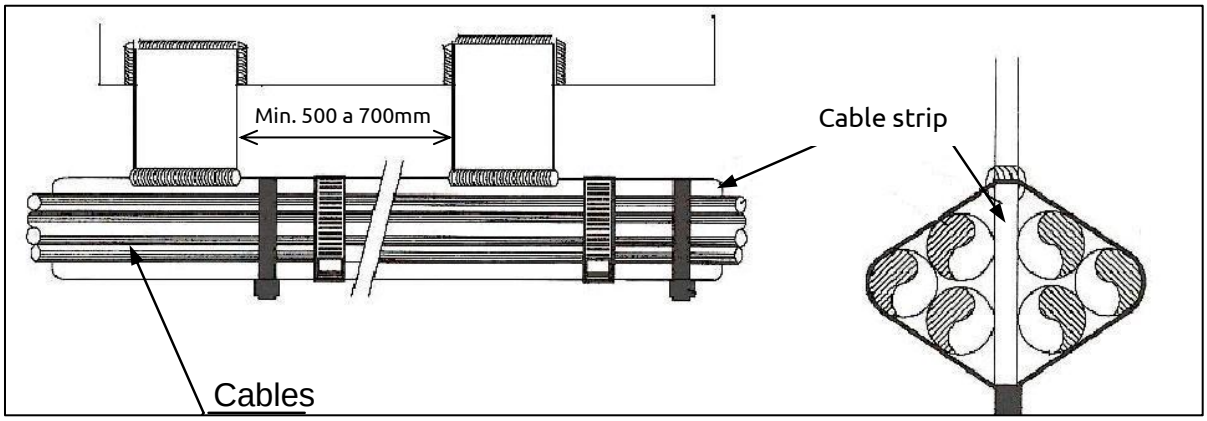


Figure 8: Typical of the cable strip

2.3.3 Cable pipes, conduits or trunking

Where cables should be mechanically protected or where cables are to be laid in pipes to avoid electromagnetic interference cable pipes to be applied. See Figure 9 and Figure 10 for some examples regarding cable pipe installations. The size of the cable pipes are to be selected by the electrical design department based on the applicable rules. See reference document [8]

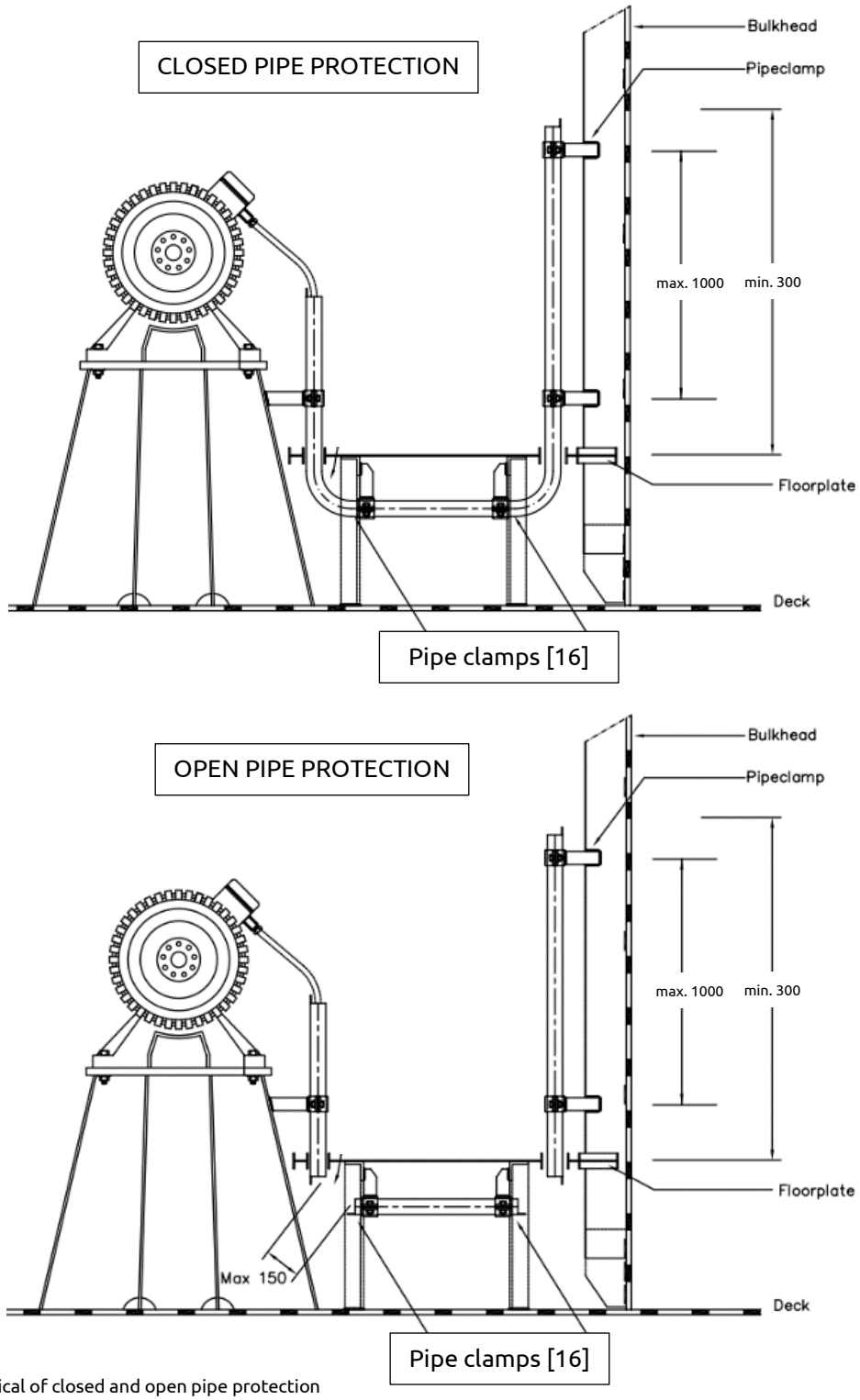


Figure 9: Typical of closed and open pipe protection

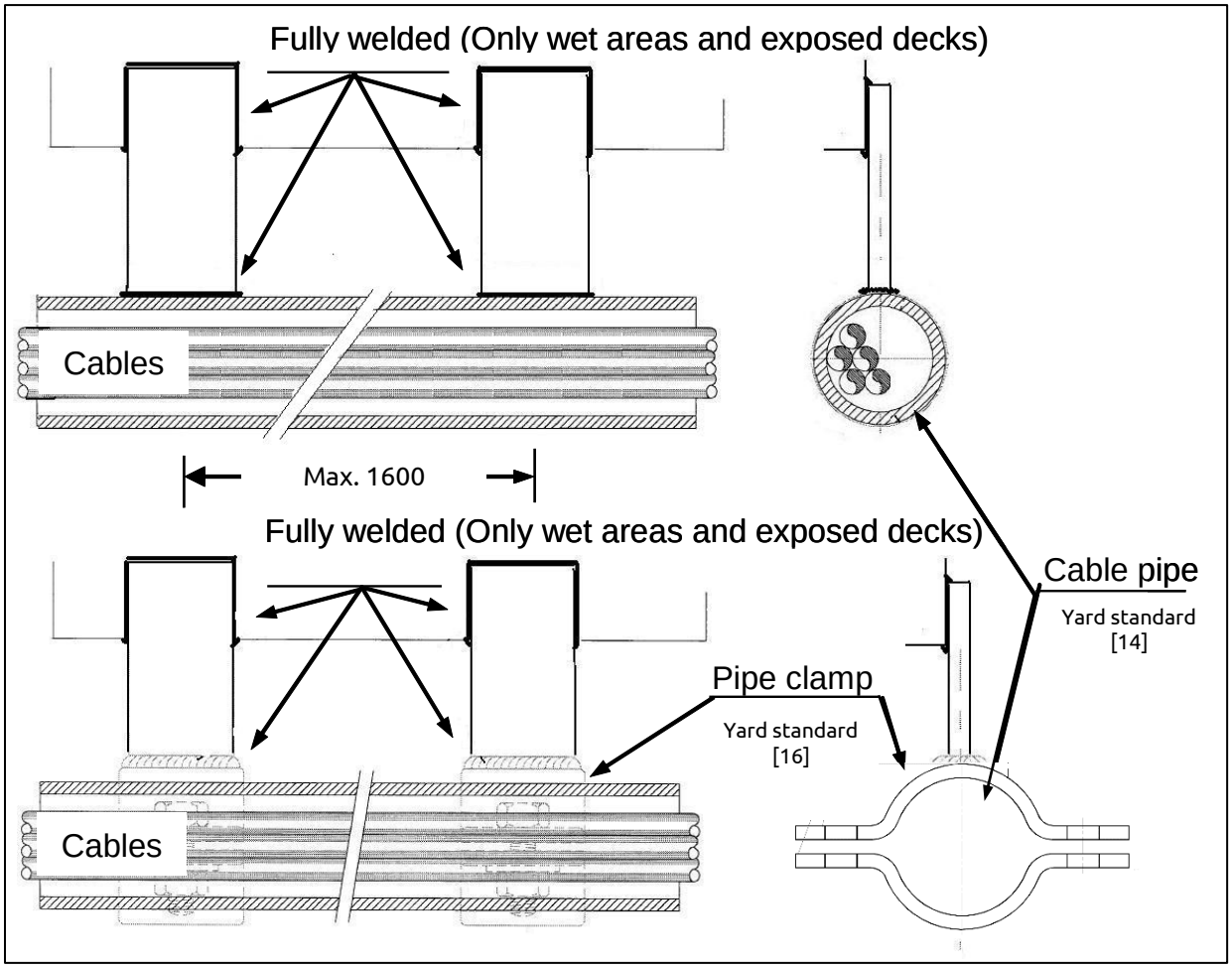


Figure 10: Typical for cable installation in pipe

For cable pipe installation the following details to be taken into consideration:

1. Drain holes to be provided where condensation or water cannot escape.
2. Pipe ends to be smoothened.
3. Cable pipe ends should have lugs at both ends to be able to fix the cables with ty-raps [13].
4. Cable pipes to be pre-galvanized and pipe thickness according IHC standard C101 [14].
5. Double pipe pieces to be applied when a cable pipe passes a weather or water tight deck. Doubling length approximately 100mm with approximately 50mm above deck.
6. Cable pipes can be fitted with legs of strip welded directly to the pipe or with pipe clamps [16]. Distance between legs or clamps is max. 1600mm depending of the straightness of the pipe
7. Single cable pipe penetrations in WT and/or fire bulkheads and decks and exposed areas are to be provided with a thread socket with metric thread for fitting a WT cable gland at one (exposed) side [15].

2.3.4 Weld finishing

All welds for the described details to be cleaned with wire brush and to be free of welding spatters and other dirt.

2.4 Lighting fixtures

Lighting fixtures to be fitted on:

- Pipe support assembly
- Angle bar supports
- Directly to the cable tray system

2.4.1 Pipe support assembly examples

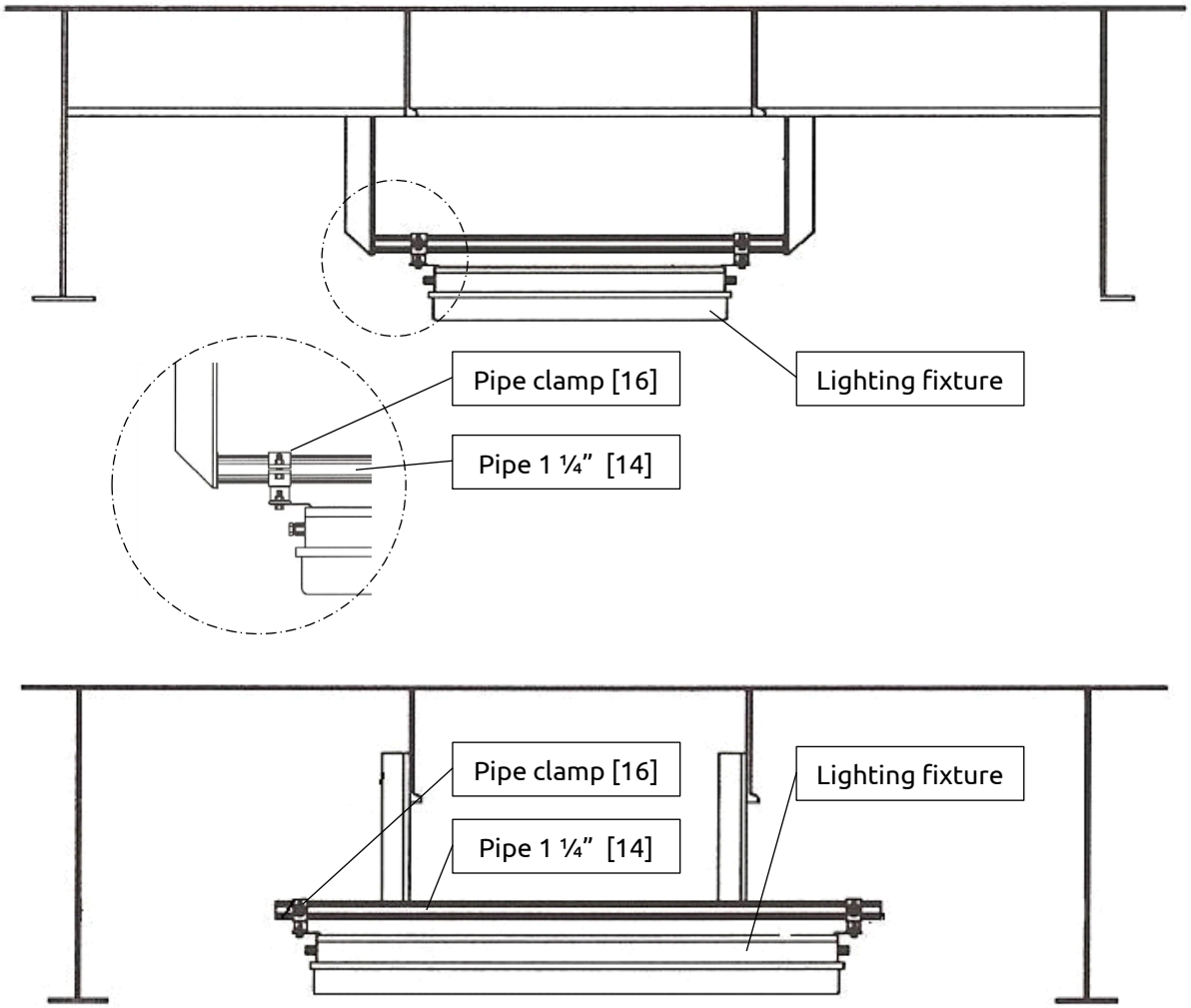


Figure 11: Typical mountings of FL lighting fixture on pipe

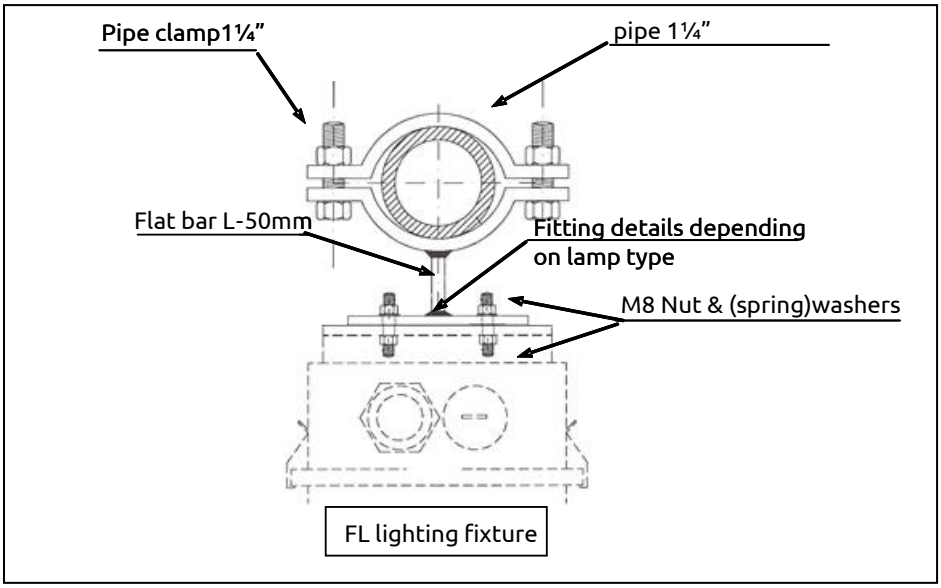


Figure 12: Typical of pipe mounting assembly

2.5 Multi Cable Transit (MCT)

Cable penetrations are standard items designed for installing a group of cables or a single cable through a solid plate (i.e. deck, bulkhead or enclosure) or ship's construction.
A cable penetration can be either:

- Multi Cable Transit (MCT),
- Cable Gland, or
- Coaming/Ring

Generally a cable penetration for the following duties can be distinguished:

- Water tightness (i.e. w.t. bulkheads and decks, enclosures of electric equipment)
- Fire integrity (i.e. A-class decks and bulkheads)
- Others (depending on typical design or engineering criteria)

For each type of cable penetration special standard items are available.

Generally when more than one cable have to pass through a watertight or fire integrity bulkhead a MCT is selected. Such MCT can also be applied if more cables have to enter into bigger electrical equipment like generators and switchboards.
There are several by MCT brands available in the market but Royal IHC allow to use the below listed brands only.

- MCT Brattberg
- Roxtec
- Geaquello® (only after written permission of Royal IHC)

Geaquello® is a sealing system for making removable, fire-retardant, gas- and watertight cable and pipe penetrations for ships and offshore applications. This type of penetration may only be used in exceptional cases after written permission of Royal IHC.
All of these types of penetrations have been designed for a specific duty and are tested and certified accordingly.
Before selecting the type of MCT it should be confirmed that all required certificates are still valid.
Each metal frame should have a maker's reference code as in Figure 13.

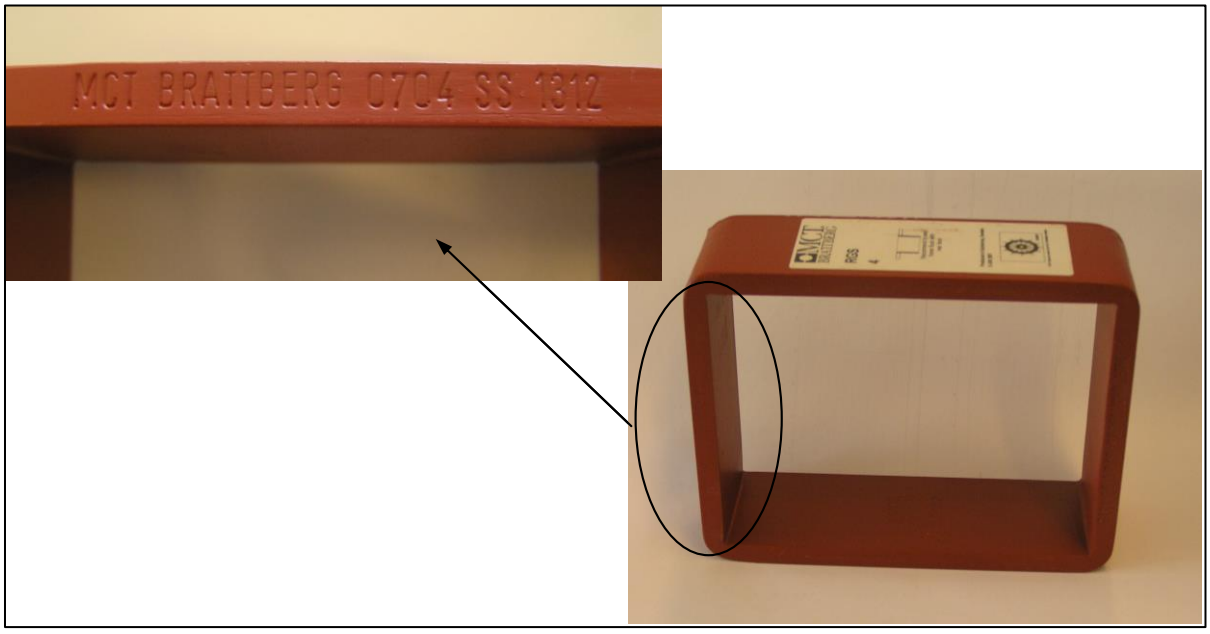
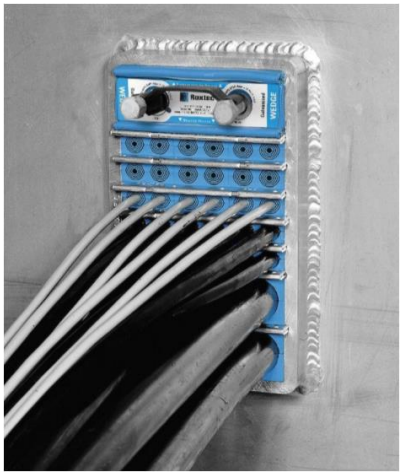


Figure 13: Details of maker's reference for MCT frames

In this quality manual there are two brands used as example. Brattberg RGS and RGP and Roxtec S- and R-transit are used as examples in Figure 14 and Figure 15.

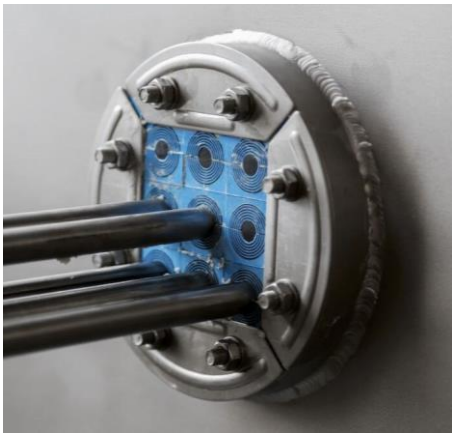
Brattberg RGS



Roxtec S-transit

Figure 14: Rectangular type penetration

Brattberg RGP



Roxtec R-transit

Figure 15: Circular type penetration

In weather exposed areas round or rectangular type MCT's can be used.
The inserts are to be raised in such a way that water will not be collected around the cables to avoid cable damage. See Figure 16.

Inserts to be raised to avoid water collection

NOT ACCEPTABLE on exposed decks

Figure 16: Typical of Round MCT on weather exposed deck

MCT-frames fitted in weather or watertight decks or where mechanical damage can be expected to welded in a coaming frame with a height of 500mm. In case this is not possible a minimum height of 100mm above the finished deck level can be used.

Figure 17: Typical MCT penetration on weather exposed deck with coaming

Table 2: Reference table cable tray versus MCT to be used to determine the size of the required MCT in relation to the cable tray size.

Minimum cable tray size (mm)	Type of Brattberg Multi Cable Transit	
100	RGS-2	
150	RGS-4	
200	RGS-6	
300	RSG-8	RGS-4x2
400	RGS-6+6	RGS-4x3
500	RGS-8+8	RGS-4x4
600	RGS-8+8	RGS-4x5

Table 2: Reference table cable tray versus MCT

2.5.1 Installation requirements

For a proper installation of a MCT penetration the MCT supplier guidelines needs to be followed. In the paragraphs below some items are highlighted.

2.5.1.1 Cut-out tolerances

The size of the cut-out in the deck or bulkhead for fitting a multi cable transit to be carefully determined within the tolerances as specified by the manufacturer.

2.5.1.2 Welding instructions

Another issue which is very important to take into account are the instructions for welding such MCT frames.

If the welding instructions are not followed there might be a change that the frame is deformed. In that case the penetration cannot be fully closed and tightened. All penetrations have to be through welded at both sided.

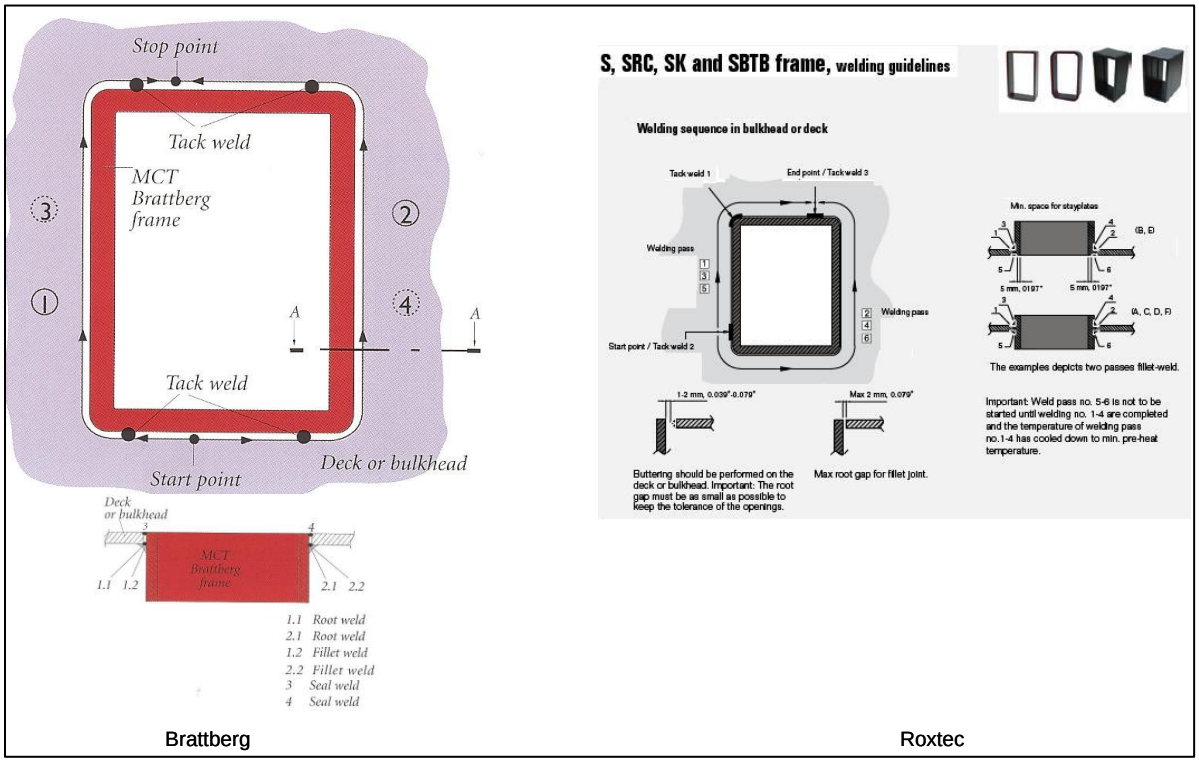


Figure 18: Example of Welding instruction

2.5.1.3 Completion of the MCTs

Only stainless steel stay plates are allowed to be used in MCT's.

2.5.1.4 Painting of MCT's

It is not allowed to paint the inside of any MCT frame.

2.5.1.5 Single core cables through MCT's

Single core cables shall not be separated by magnetic material in a way eddy currents can be formed. As a result through one MCT 3 different phase should run.

2.6 Cable gland

A cable gland is generally applied to penetrate a single cable through a watertight compartment or enclosure of an electric equipment.
A compartment penetration can be either through a deck or a bulkhead.
A penetration through an enclosure can be any electric equipment (i.e. lighting fixture, control panel, rotating machine or a junction box).

A cable gland is a standard piece of equipment which is readily available in the market. A wide range in type and materials are available. Standards installation material is specified in material list [6]. Third party equipment suppliers can use other brands.

Each selected type to be suitable for the intended design criteria. The basic requirement is the IPXX protection.

In dry accommodation areas electric equipment (lighting, outlet sockets, small consumers) may be connected with a standard junction box. The junction box need to be provided with cable glands.

2.7 Penetrations through non-classified ship's constructions

Cables passing through beams, girders, web frames, tween decks or other non-classified ship's constructions just an opening to be provided as in Figure 19.

Special attention to be paid to:

- Smoothing of the opening surroundings.
- Lead the cables free from the surroundings through the coaming. If so required additional cable supports to be welded to the coaming.

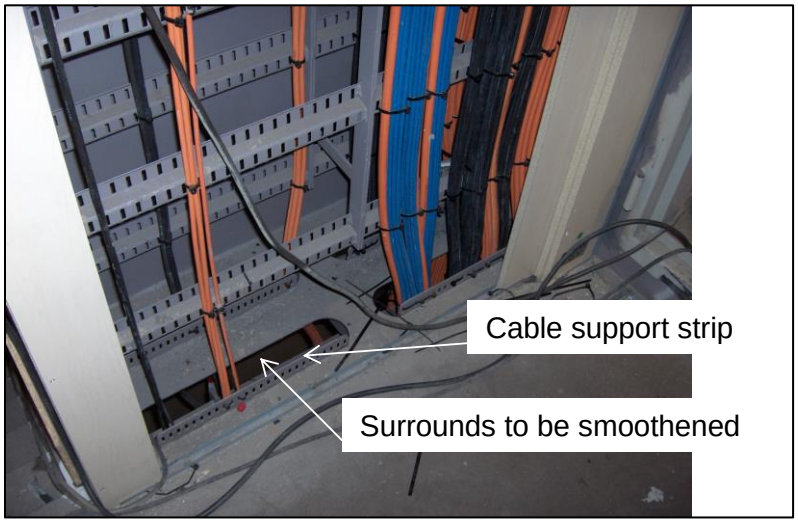


Figure 19: Typical for cable penetration through tween deck

2.8 Wrong type of penetrations

It is not allowed to use the ship's construction provisions (i.e. welding holes) as cable penetration. Cables need to have their own penetration. See Figure 20 for some examples which are not allowed.

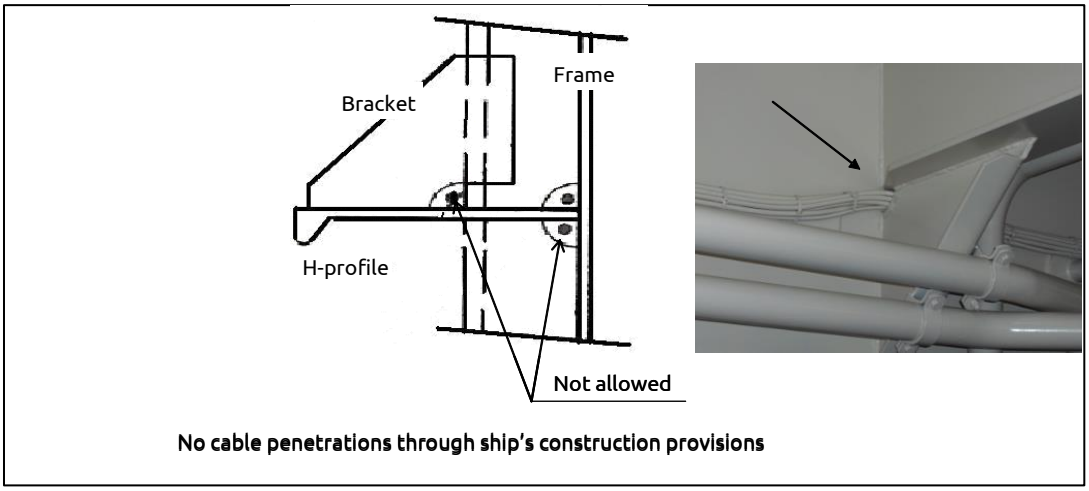


Figure 20: No cable penetration through ship's construction provisions

3. Cable installation

3.1 Introduction

Cables to be pulled in groups according to a cable book which is prepared in the engineering phase. To comply the EMC plan several cable groups to be recognized and followed. This is described in the EMC Management control document [2].

3.2 Special precautions

3.2.1 Damaging of cables

Special attention, by applying guide rolls or other means, to avoid damaging of the cables caused by sharp parts or by excessive friction from cable to cable.
Cable damaging (See Figure 21) can be occurred by sharp edges or by heat friction.

Figure 21: Damaged cables caused by cable pulling

In case of damaged cables the following steps to be taken:

- Cables to be repaired in accordance with maker's instructions
- Approved joint or junction box to be applied after Owner's or Class acceptance
- Cables to be completely renewed. (Only in case of serious cable damages).

3.2.2 Bending radius

The minimum bending radius as specified by the cable manufacturer and by the classification society should be followed.

3.2.3 Painting of cables

Cables which are pulled / installed on the cable trays needs to be protected with plastic or equivalent during painting of the room / equipment. It is not allowed to paint the cables. The paint itself can damage the cables.

3.3 Cable running

Each group of cables to run smoothly and straight on the entire cable route. Cables should not be twisted around each other. There also need to be sufficient slack in the cables at expansion points. Cables should not lie on sharp pieces.

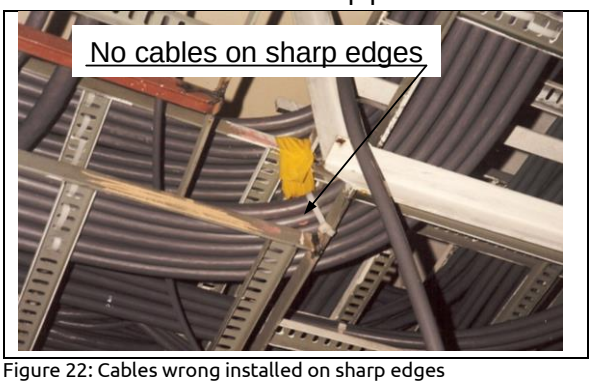


Figure 22: Cables wrong installed on sharp edges

3.4 Cable supporting

Cables are only fixed to cable trays, cable strips or in a cable pipe. Process piping or ducting should not be used for supporting cables as in Figure 23. These pipes need to be free for maintenance etc.

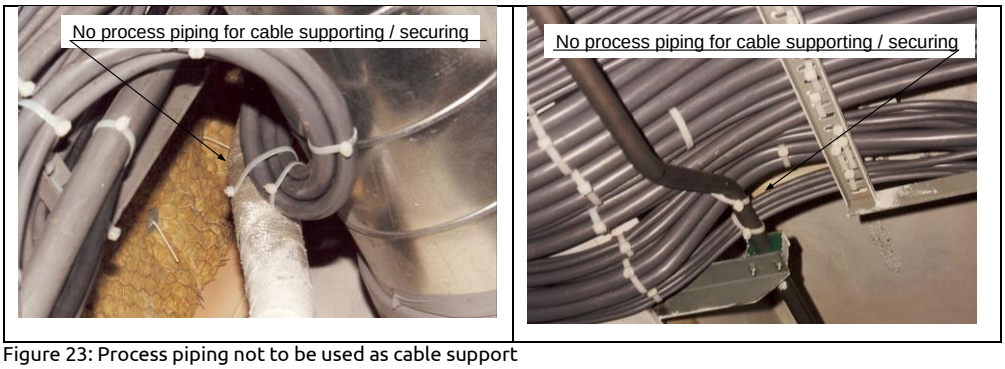


Figure 23: Process piping not to be used as cable support

Generally a cable may be unsupported maximum 300mm.
Unsupported cabling is only allowed if slack is required to absorb vibrations (i.e. on flexible mounted equipment).

3.5 Cable fixing and securing

On a cable tray the cable is fixed on each rung with a synthetic, steel or stainless steel cable binder. See also the document Standard materials electrical installation[6]
On a cable strip the distance between two fixes is approx. 250mm.

Cables on trays, strips and other special cable supports to be fixed in groups as per EMC document[2]. The EMC document describes a minimum distance between cable groups.

Metal type cable binders to be applied every 1000mm for cables which mounted on a vertical tray or flat bar or for cables fixed at the underside of a tray.

In case of single core cables in all situations stainless steel cable binders needs to be used according classification requirements. This means that also for cables on top of a cable tray stainless steel binders should be used.

3.6 Cable protection

The entire cable installation to be protected against mechanical damage, which can occur during normal ship's operation.

Generally the cables to be fixed free from sharp ship's constructions (i.e. cable tray edges, coamings).
Cables to be installed away from excessive heat surfaces. If this cannot be avoided special measures like heat insulation of heat resistant cables to be applied.

3.6.1 Examples

If in spite of all possible measures risk on mechanical damage is present additional provisions to be provided. The sharp edges needs to be provided with a protective gasket. An example is given in Figure 24.

For deck penetrations extended MCT to be used in situations where mechanical damage can occur as illustrated in Figure 25.

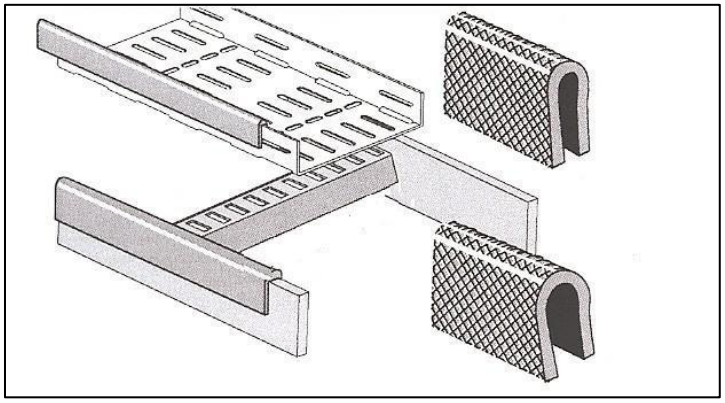


Figure 24: Local cable protection by a protective gasket

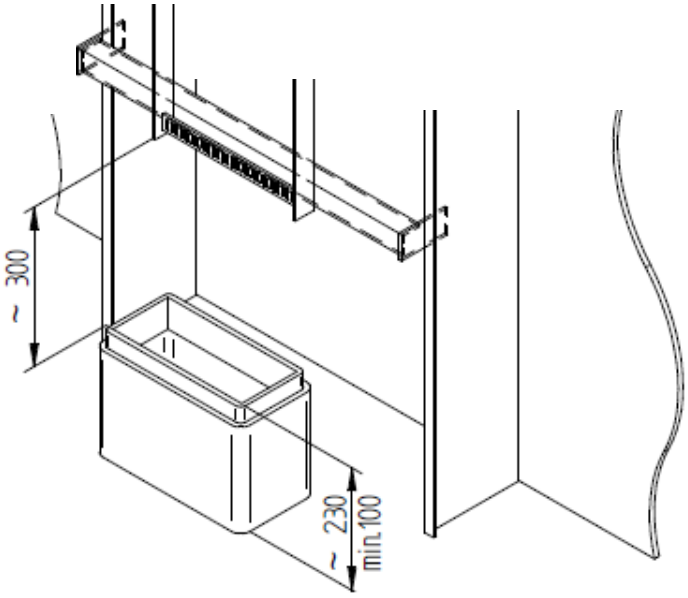


Figure 25: Protection by extended penetration

4. Installation electric components

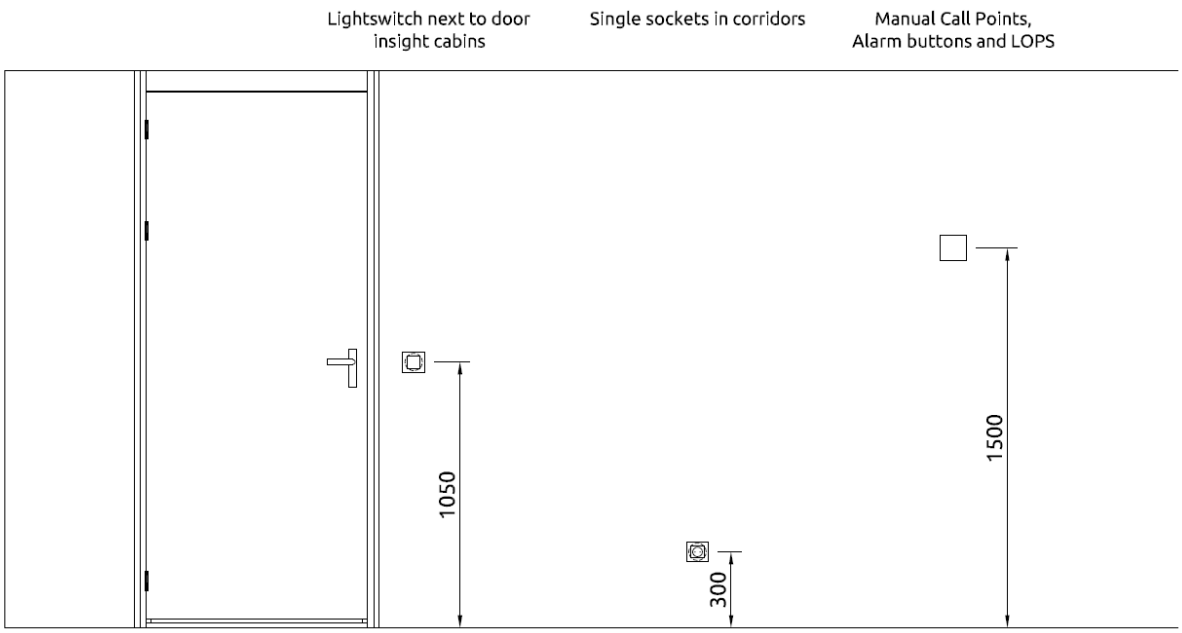
All equipment to be located in such a way that they are available for inspections, trouble shooting and testing.
All components in wet areas and weather decks to be fitted with stainless steel (AISI 316) material i.e. bolts, nuts, washers. A Teflon washer needs to be placed to avoid contact between different steel materials

Large deck mounted panels will be welded to the ship's structure.
In cases where several small electrical components are positioned at the same location a common frame to be provided on which these components are assembled.

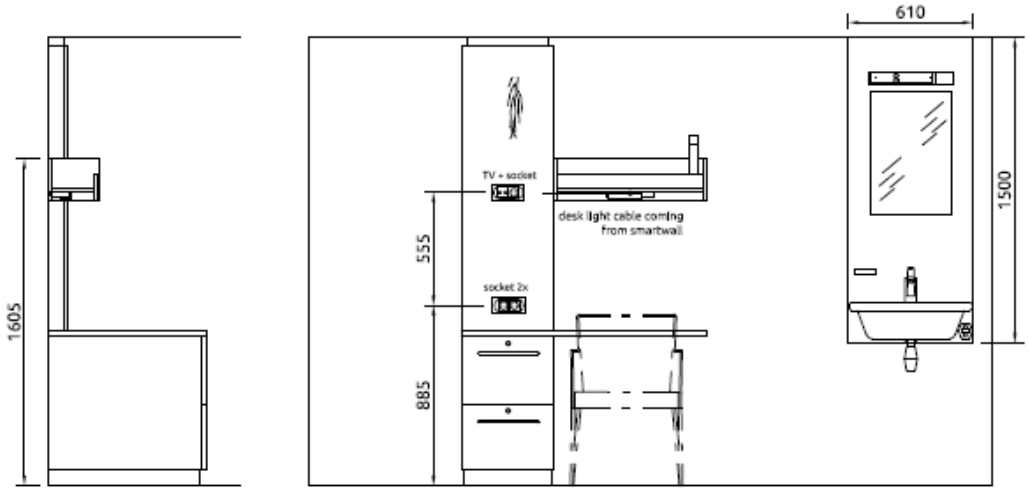
All equipment will have an indication label.

4.1 Heights of electric equipment

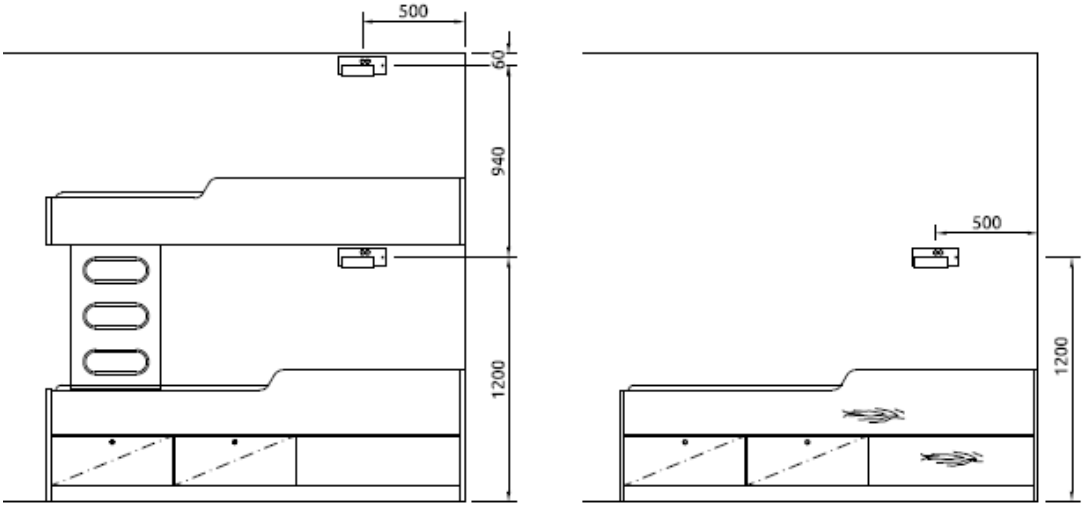
To unify the installation height of the common electrical components the following guidance to be followed. The heights to be adjusted if these cannot be maintained due to the surrounds.



Installation heights for accommodation spaces

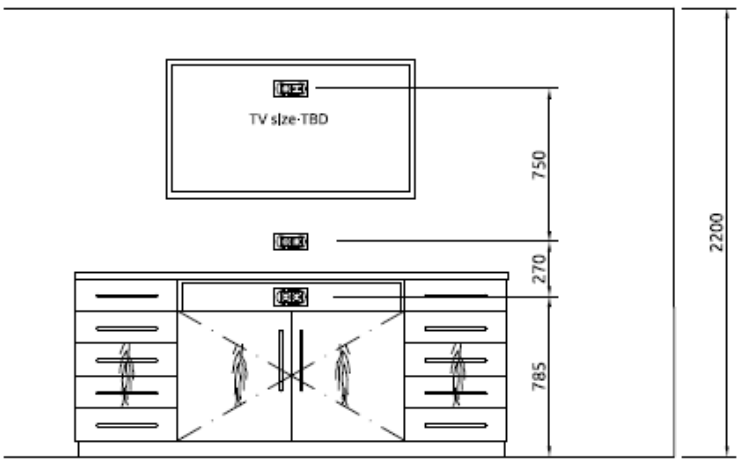


View standard desk.



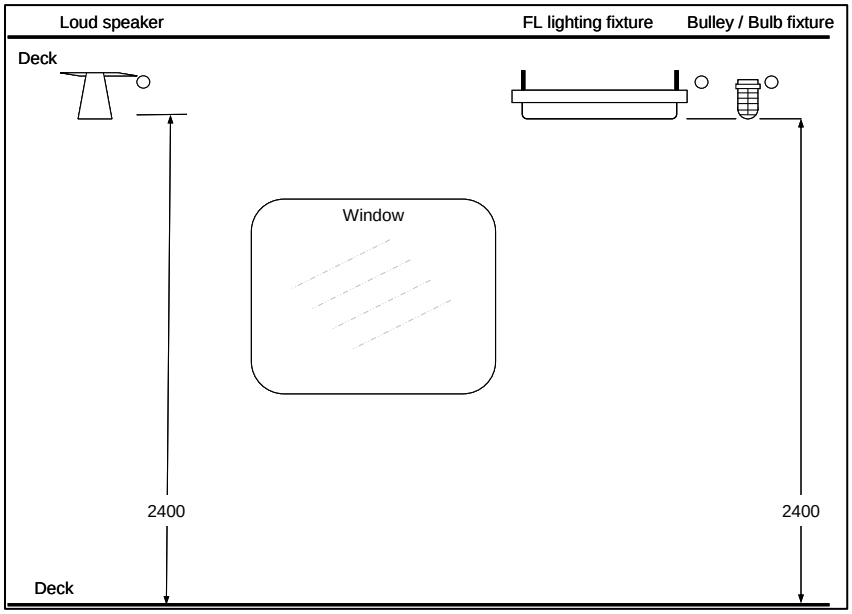
View bunk bed.

View single bed

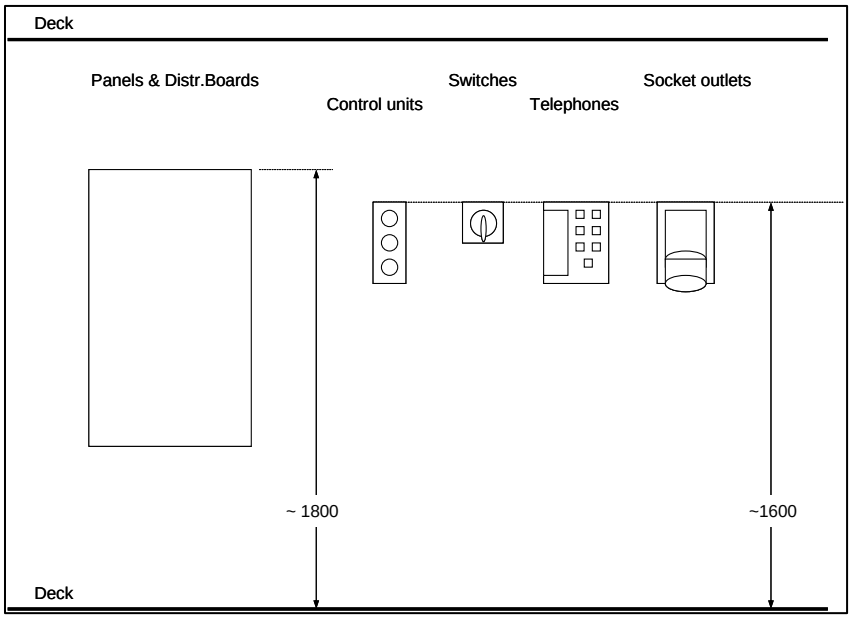


Recreation room.

Installation heights for accommodation spaces



Installation heights for lighting and speakers



Installation heights for machinery spaces

4.2 Junction boxes

Junction boxes can attached on cable trays on the following ways:
-With welded brackets
-With clamped brackets

For clamped brackets special clamp assemblies should be applied (see Figure 26). When the side strips of the cable trays have slotted holes those can be used to fix brackets onto for the junction box. It is not allowed to drill holes in the cable tray assemblies when cables are already pulled onto that cable tray.
Junction boxes fitted to bulkheads to be approx. 50mm extended from plating for painting and to provide a bolt/nut connection.

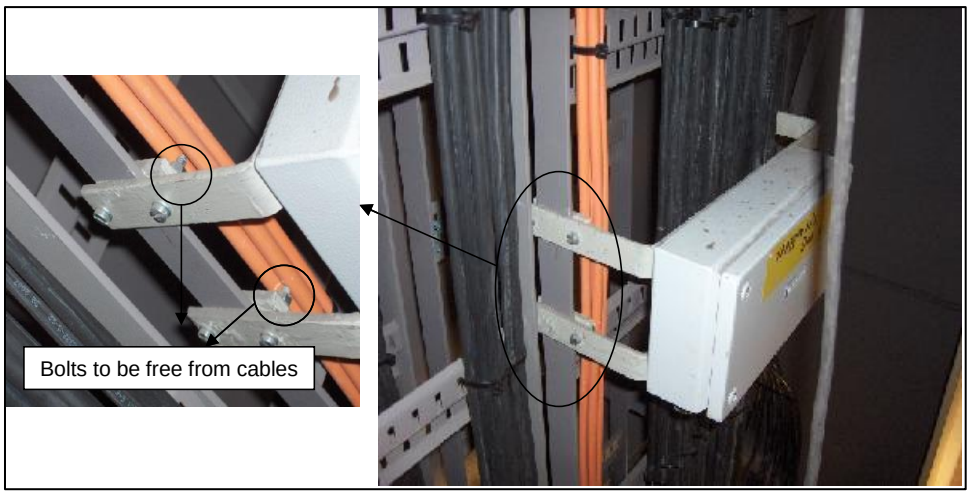


Figure 26: Junction box mounted on cable tray

Junction boxes should be accessible for maintenance(Figure 27).

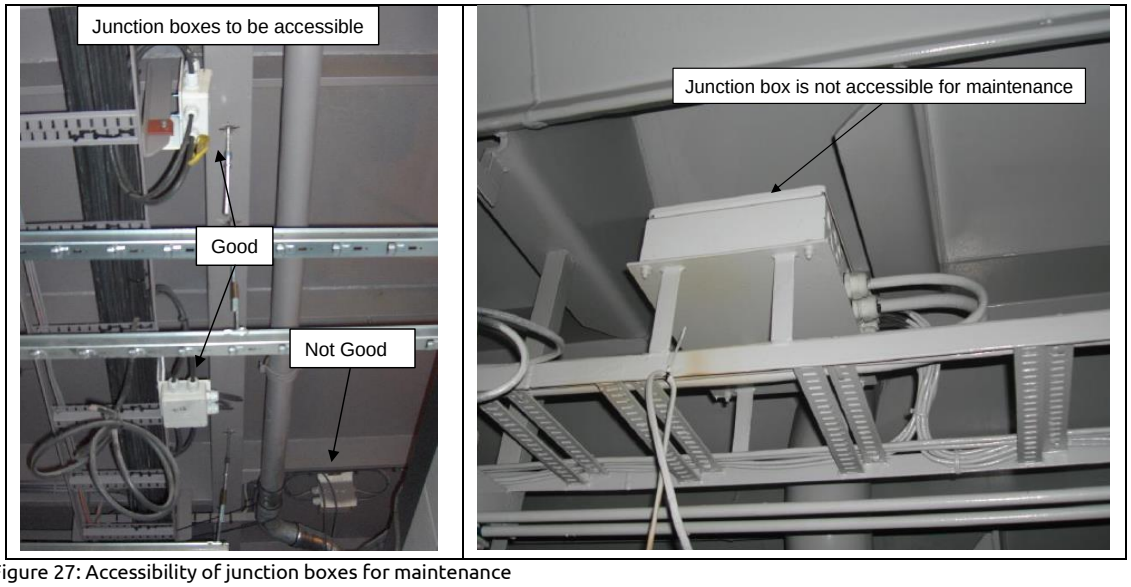


Figure 27: Accessibility of junction boxes for maintenance

Special attention to be paid for junction boxes in accommodation areas behind ceilings walls. Preferably such junction boxes to be positioned and grouped above recessed lighting fixtures or near planned hatches for easy access and maintenance (Figure 28).

Figure 28: Junction boxes at the rear of a wet cabin

5. Low voltage cable connection

After the installation of the cables and electrical equipment the cables can be connected and completed. The following activities to be done:

- Cable end finishing
- Cable coding
- Wire coding
- Using ferrules or cable lugs
- Termination

5.1 Connection of actuators or sensors

A so called pigtail should be applied when connecting an actuator or sensor. This to ensure reconnection possibility.

5.2 Cable end finishing

The outer insulation of the cables to be carefully removed without damaging the core insulation. Special tools for removing the outer insulation to be used. The use of “Stainley” knives or equivalent is not allowed.
Where armor or screening is used without litze a flexible earth wire needs to be connected to the armor or screening by use of a roll spring. See Figure 29.
For EMC cables the connection method is described in the EMC management control document[2].

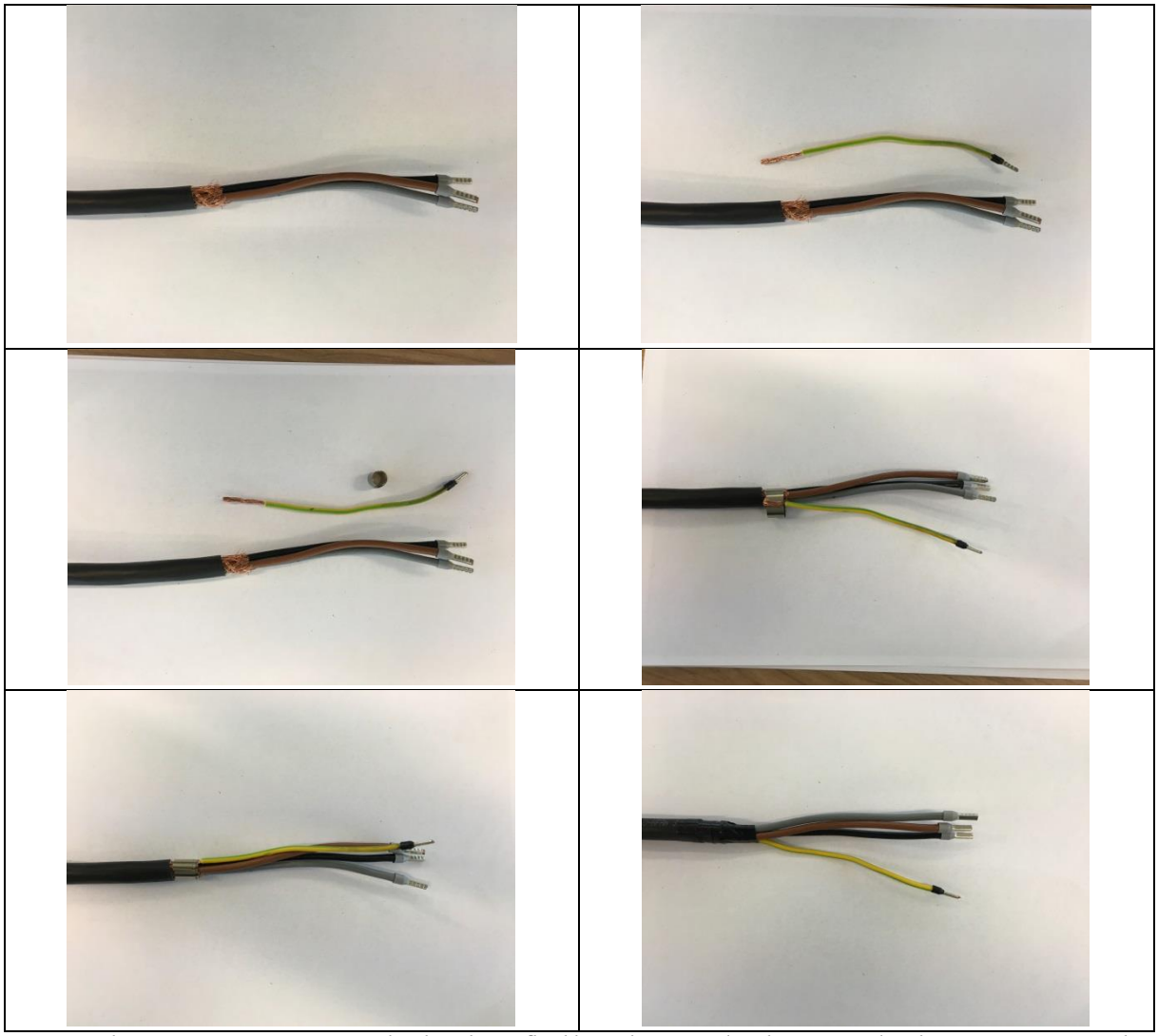


Figure 29: Where armour or screening is used without litze a flexible earth wire needs to be connected to the armour or screening by use of a roll spring.

5.3 Cable coding

Each cable should be clearly and permanently coded (Figure 30) before the cable enters the equipment.
The coding references as per the electrical diagrams to be applied. The branch circuits of the lighting installations are labeled with a reference to the breaker. Generally pen coding, directly applied on the cable or on paper stickers, is not considered as a permanent coding method.
The cable coding label should be fixed close to the gland or cabinet entry. For cables to big panels the cable coding should be added to the cables inside the panel just before the cables are entering into the cable ducts on the mounting plate.

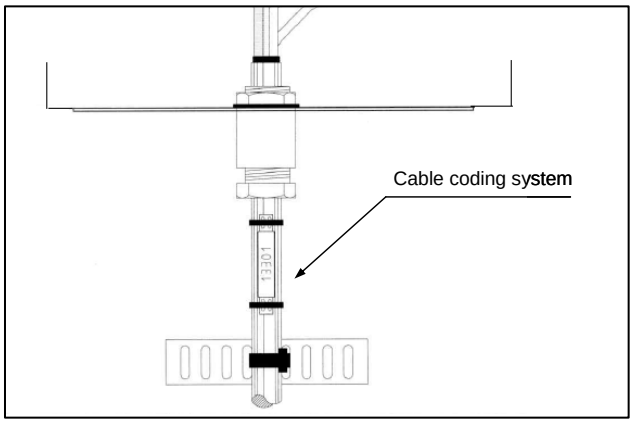


Figure 30: Typical of cable coding system

5.4 Cable core coding

Each cable core should be coded with the reference of the terminal strip and number. For details see Cable wire colour table [7]

Only for power cable used in lighting systems and 2 phase sockets it is not required to code the phase.
Earth core should be yellow/green wire, or a sleeve colour yellow green should be used. See also Cable wire colour table [7]

5.5 Spare cable cores

Spare cores which are not connected to terminals to be tightened together using tape and ty-raps. At the end a permanent visible label with the complete cable reference number and additional text “SPARE” to be provided.

5.6 Cable core connections

5.6.1 Cable core connection methods

Cable core connections can be made with the following methods:

- Bolt connections with cable lugs
- Screwed connections in standard terminal units with press plate with ferrules.
- Clamping connections (spring loaded) with special terminal units with ferrules.
    - Although not required by the terminal suppliers ferrules to be provided (except if datasheet explicitly mentions that ferrules are not allowed).

5.6.2 Wire crimp connections

Two different wire crimp connectors can be used;

- Wire lug
- Ferrules

Ferrules to be used till 6mm^2.

An isolated crimp connection needs to be applied on all cores ≤ 6mm^2.

Above 6mm^2 non-isolated wire lug connections can be used or the core can be mounted without crimp connection depending on cable type of termination.

5.6.3 Wire length

Keep always enough “over length” in the cable cores to have the possibility to change to another terminal. This is for cabinets as well as for the cable cores for the connection of an electromotor.

6. Special cable connection

6.1 Low voltage cable connection

LV connections to be made by an experienced person.

7. Inspection

During the inspection and hand over of the work from the electrical contractor this document will be used as reference.

The inspection of the electric installation is done in three stages.

- Inspections steelwork
- Inspections cabinets
- Inspections rooms

7.1 Inspection steelwork

The cable routing system (Iron-work) to be inspected prior to starting any cable pulling activity. Examples of items which will be checked are if the cable trays are installed according the drawings, are welded correctly and if required painted.
The document inspection procedure steelwork [3] will be used as detail checklist.

7.2 Inspections cabinet

After reporting that the connection work is completed the electrician should check if the cabinets are placed and connected according this manual. For the inspection the document inspection procedure cabinet [4] should be used as detail checklist.

7.3 Inspections final room

This is the final inspections done to handover a room. The inspection includes checking if all equipment is placed, cables are correctly pulled, connected and tagged according this manual. For the inspection the document inspection procedure final room [5] should be used as detail checklist.

COCHIN SHIPYARD LTD

APPENDIX I

CSL Electrical Outfitting Standards

TOTAL 64 PAGES INCLUDING COVER.
A4-64 SH

COCHIN SHIPYARD LTD

A GOVERNMENT OF INDIA ENTERPRISE
COCHIN-682015 , INDIA.

CSLYARD NO	SHIP 037	TRAILING SUCTION HOPPER DREDGER		
PROJECT				
CLASS	LRS/IRS			
OWNER	DCI			
APPROVED	KIRAN S RAJ	ELECTRICAL OUTFITTING PRACTICE AND STANDARDS		
REVIEWED	AKSHATHA			
CHECKED	VINEETH			
PREPARED	ARJUN V V			
DATE: 02.11.2023		SCALE: NTS	DRG NO: 037-K5700200	REV : R1

PLAN HISTORY

PART NO: 02.00 | 02 / 63

DRG NO: 037-K5700200

DATE	REV. NO	MARK	DESCRIPTION	DRAWN BY	CHECKED BY	REVIEWED BY	APPROVED BY
04.09.2023	0		FIRST ISSUE	ARJUN V V	VINEETH	AKSHATHA	KIRAN
02.11.2023	R1	R1	UPDATED AS PER IHC COMMENTS WITH RESPECT TO DREDGER VESSELS	ARJUN V V	VINEETH	AKSHATHA	KIRAN

GENERAL NOTE:

1. ALL DIMENSIONS ARE IN MM.
2. ALL BURS AND SHARP EDGE PARTS ARE TO BE SMOOTHLY REMOVED BEFORE PAINTING.
3. DOUBLE PLATES ARE REQUIRED WHILE WELDING TO THE BULKHEADS OR DECKS.
4. PIPE SLEEVES ARE REQUIRED FOR PENETRATION OF PIPES.
5. FOR ADDITIONAL INFORMATION PLEASE REFER IHC MANUAL (63552-0110.IM001-0)

INDEX

PART NO: 03.00 | 03 / 63

DRG NO: 037-K5700200

	INDEX	PART NO: 03.00	04/63
		DRG NO: 037-K5700200	

INDEX

PART NO: 03.00 | 05/63

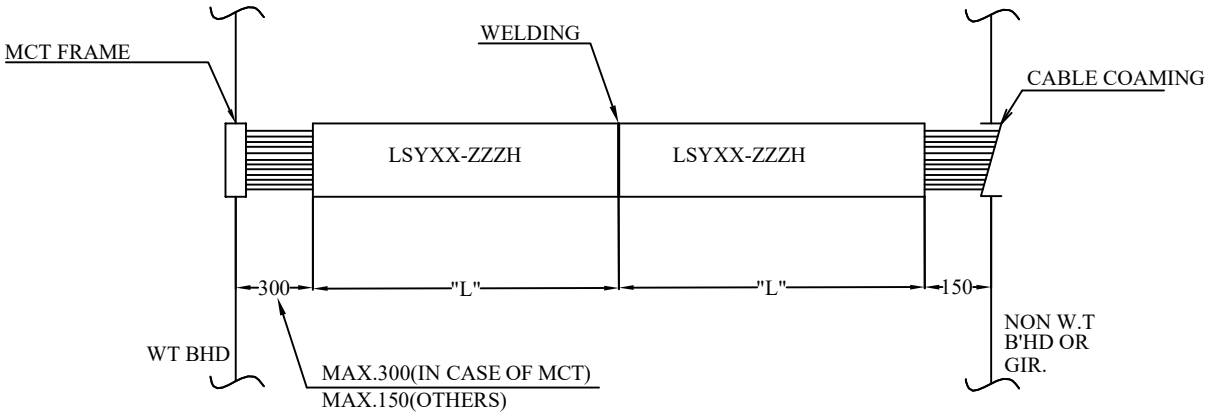
DRG NO: 037-K5700200

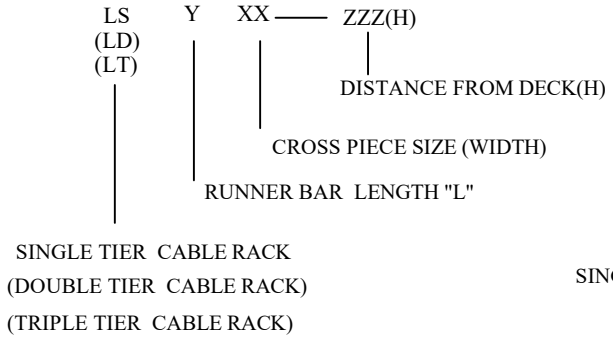
INDICATION METHOD FOR CABLE WAY

PART NO: 04.00

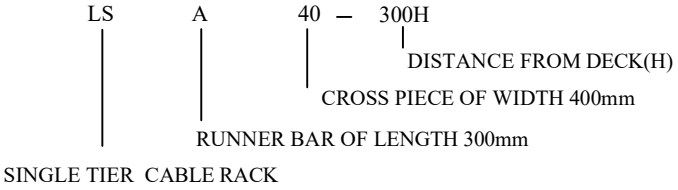
CABLE WAY INDICATION METHOD

DRG NO: 037-K5700200



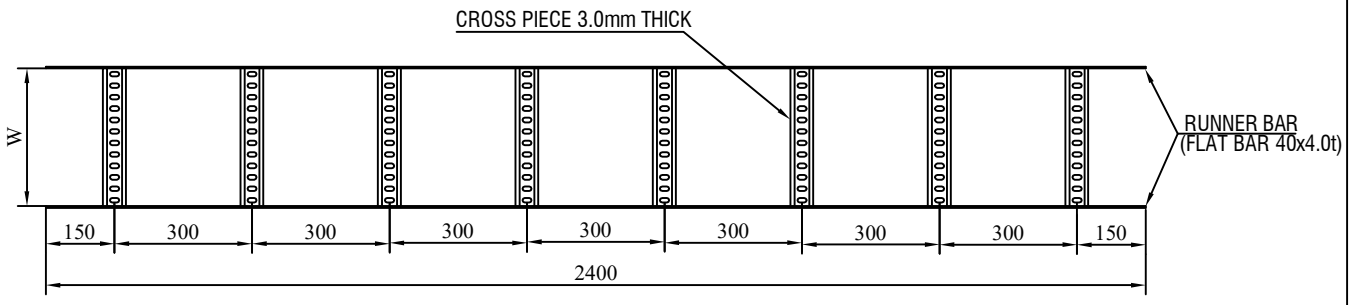


PIECE MARK EX : LSA40-300H

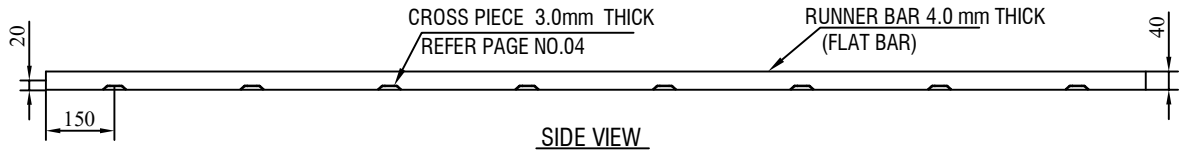


"L" (LENGTH) STANDARD OF CABLE RACK LENGTH*

SYMBOL	A	B	C	D	E	F	G	H	S
LENGTH (L)	300	600	900	1200	1500	1800	2100	2400	*SPECIAL



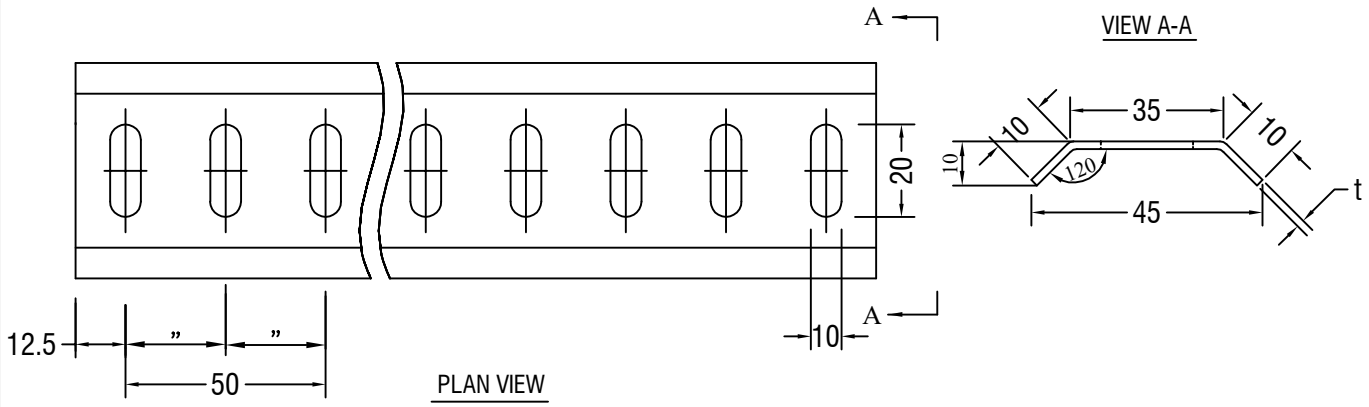
PLAN VIEW

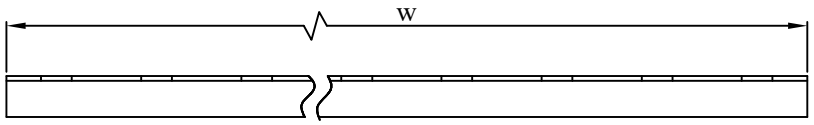


SIDE VIEW

*TYPES - A,B,C,D,E,F,G & SPECIAL (NON STANDARD LENGTH) CABLE RACKS SHALL BE CUSTOMIZED FROM "H" TYPE (2400 MM LENGTH) CABLE RACK

	CABLE INSTALLATION MATERIALS	PART NO: 05.01	07/63
	CROSS PIECE	DRG NO: 037-K5700200	





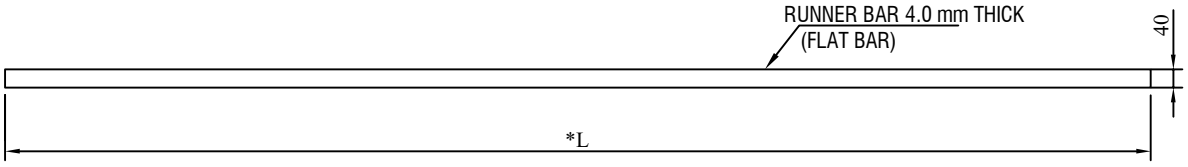
ELEVATION

MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE	W	t	NO. OF SLOTS / CROSS PIECE	WEIGHT Aprox.(KG)
L - 15	150	3	6	0.17
L - 20	200	3	8	0.23
L - 30	300	3	12	0.34
L - 40	400	3	16	0.45
L - 50	500	3	20	0.56
L - 60	600	3	24	0.68

	CABLE INSTALLATION MATERIALS	PART NO: 05.02	08 / 63
	RUNNER BAR (FLAT BAR)	**DRG NO: 037-K5700200**	

RUNNER BAR DETAILS



"L" (LENGTH) STANDARD OF CABLE RACK LENGTH*

SYMBOL	A	B	C	D	E	F	G	H	S
LENGTH (L)	300	600	900	1200	1500	1800	2100	2400	*SPECIAL

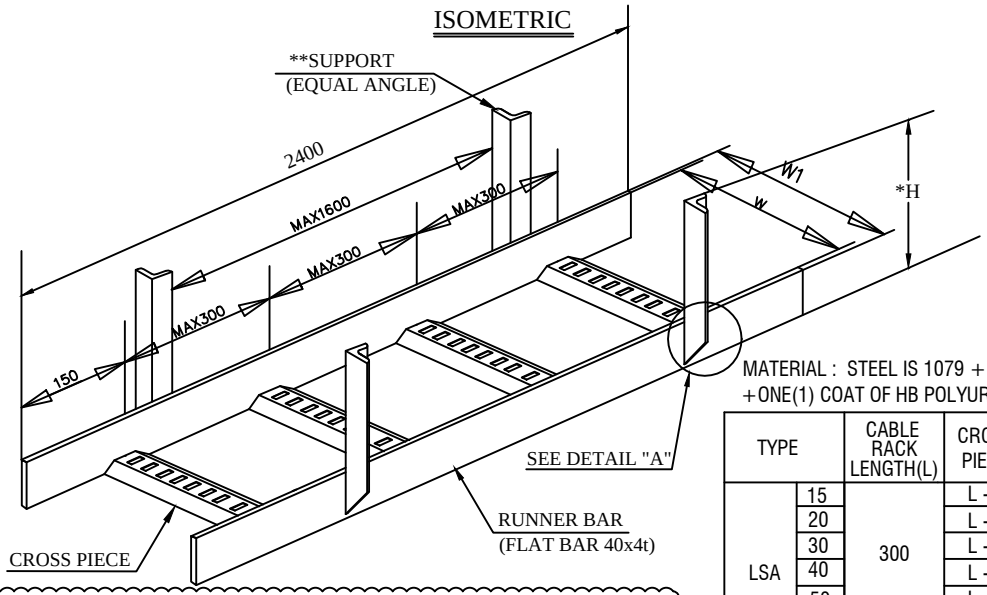
MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE	LENGTH (L)	WEIGHT Aprox.(KG)
A	300	0.28
B	600	0.56
C	900	0.84
D	1200	1.13
E	1500	1.41
F	1800	1.69
G	2100	1.97
H	2400	2.26

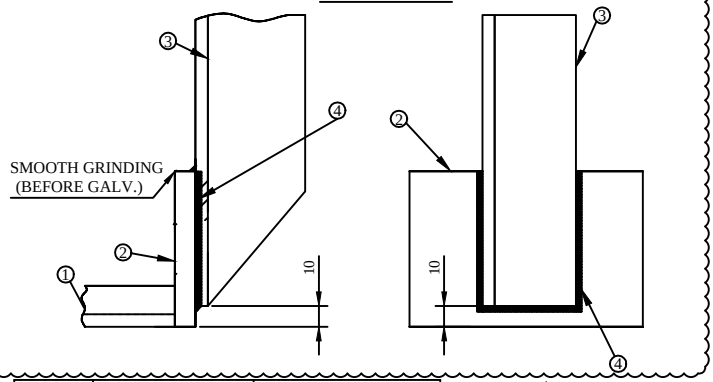
*TYPES - A,B,C,D,E,F,G,& SPECIAL (NON STANDARD LENGTH) CABLE RACKS SHALL BE CUSTOMIZED FROM "H" TYPE (2400 MM LENGTH) CABLE RACK

	CABLE INSTALLATION MATERIALS	PART NO: 05.03	09 / 63
	CABLE RACK (TYPICAL)	DRG NO: 037-K5700200	

ISOMETRIC



DETAIL "A"



ITEM NO.	DESCRIPTION	REMARK
1	CROSS PIECE	SEE PAGE 07
2	RUNNER BAR	SEE PAGE 08
3	SUPPORT	SEE NOTE
4	WELDING	

R1

R1

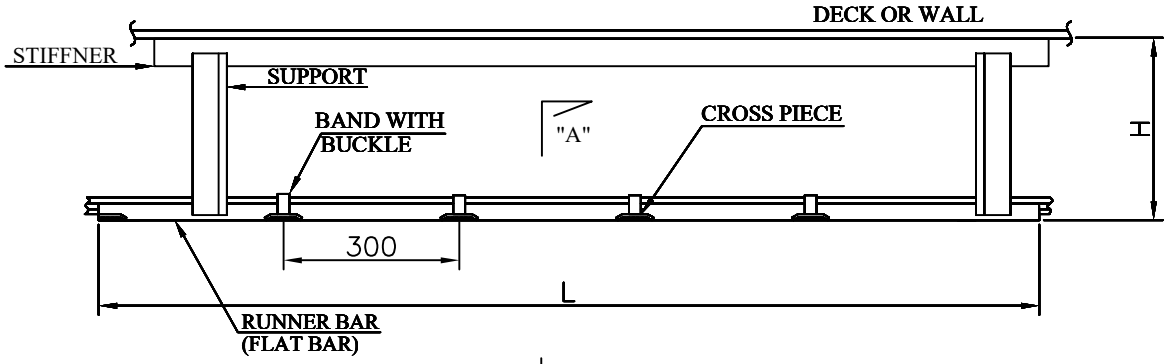
NOTE

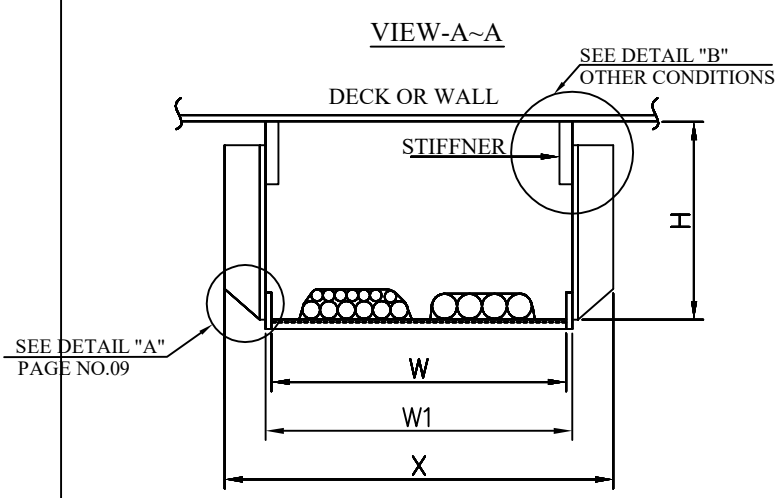
1. ** SUPPORT
   1. FOR ALL CABLE TRAY : 40X40X5 MS ANGLE
   2. SPECIAL CASES AS INDICATED IN DRAWINGS.
   3. CABLE TRAYS ARE TO BE SUPPORTED WITH MAXIMUM SPAN OF 1600 MM .
2. ** SUPPORT HEIGHT(H) SHALL BE DECIDED AS PER THE FIT. ARRG. DRG.
3. CABLE WAY SUPPORT TO BE WELDED TO THE CABLE RACK ON RUNNER BARS.
4. CABLE WAY SUPPORTS TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE WAY SUPPORTS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.
5. TYPES - A,B,C,D,E,F,G & SPECIAL (NON STANDARD LENGTH) CABLE RACKS SHALL BE CUSTOMIZED FROM "H" TYPE (2400 MM LENGTH) CABLE RACK

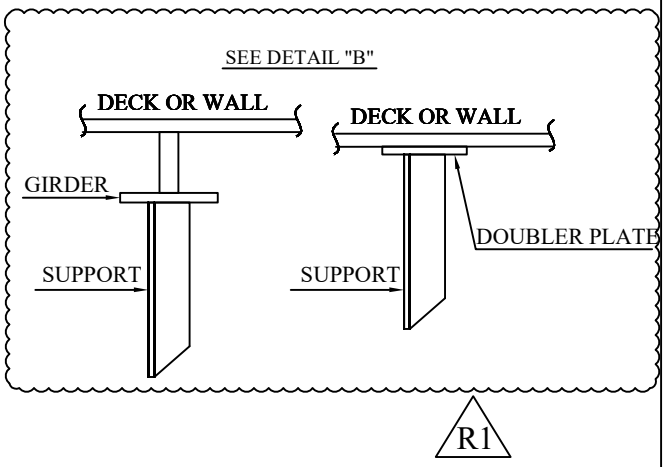
MATERIAL : STEEL IS 1079 + ONE(1) COAT OF EPOXY PRIMER +ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE		CABLE RACK LENGTH(L)	CROSS PIECE	W	W1	WEIGHT Aprox.(KG)
LSA	15	300	L - 15	150	158	0.92
	20		L - 20	200	208	0.98
	30		L - 30	300	308	1.09
	40		L - 40	400	408	1.20
	50		L - 50	500	508	1.32
	60		L - 60	600	608	1.43
LSB	15	600	L - 15	150	158	1.85
	20		L - 20	200	208	1.96
	30		L - 30	300	308	2.18
	40		L - 40	400	408	2.41
	50		L - 50	500	508	2.63
	60		L - 60	600	608	2.86
LSC	15	900	L - 15	150	158	2.77
	20		L - 20	200	208	2.93
	30		L - 30	300	308	3.28
	40		L - 40	400	408	3.61
	50		L - 50	508	508	3.95
	60		L - 60	608	608	4.29
LSD	15	1200	L - 15	150	158	3.69
	20		L - 20	200	208	3.92
	30		L - 30	300	308	4.37
	40		L - 40	400	408	4.82
	50		L - 50	500	508	5.27
	60		L - 60	600	608	5.72
LSE	15	1500	L - 15	150	158	4.61
	20		L - 20	200	208	4.90
	30		L - 30	300	308	5.46
	40		L - 40	400	408	6.02
	50		L - 50	500	508	6.59
	60		L - 60	600	608	7.15
LSF	15	1800	L - 15	150	158	5.54
	20		L - 20	200	208	5.87
	30		L - 30	300	308	6.55
	40		L - 40	400	408	7.23
	50		L - 50	500	508	7.90
	60		L - 60	600	608	8.58
LSG	15	2100	L - 15	150	158	6.46
	20		L - 20	200	208	6.85
	30		L - 30	300	308	7.64
	40		L - 40	400	408	8.43
	50		L - 50	500	508	9.22
	60		L - 60	600	608	10.01
LSH	15	2400	L - 15	150	158	7.38
	20		L - 20	200	208	7.83
	30		L - 30	300	308	8.73
	40		L - 40	400	408	9.64
	50		L - 50	500	508	10.54
	60		L - 60	600	608	11.44

	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.04	10/63
	CABLE RACK SINGLE TIER	DRG NO: 037-K5700200	







"L" (LENGTH) STANDARD OF CABLE RACK LENGTH*

SYMBOL	A	B	C	D	E	F	G	H	S
LENGTH (L)	300	600	900	1200	1500	1800	2100	2400	*SPECIAL

MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

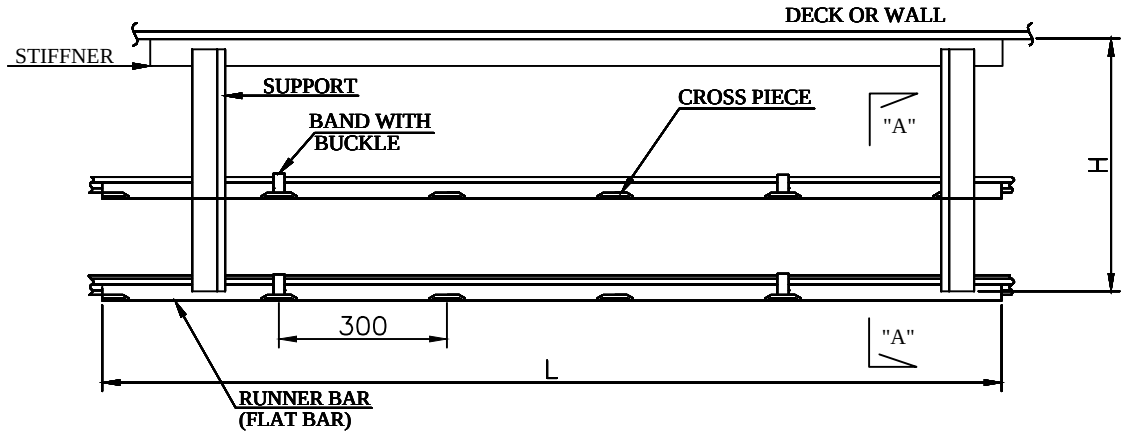
TYPE	CROSS PIECE	RUNNER BAR / SIDE PLATE	W	W1	X
LSA/B/C/D/E/F/G/H - 15	L - 15	40 X 4 F.B.	150	158	238
LSA/B/C/D/E/F/G/H - 20	L - 20	"	200	208	288
LSA/B/C/D/E/F/G/H - 30	L - 30	"	300	308	388
LSA/B/C/D/E/F/G/H - 40	L - 40	"	400	408	488
LSA/B/C/D/E/F/G/H - 50	L - 50	"	500	508	588
LSA/B/C/D/E/F/G/H - 60	L - 60	"	600	608	688

R1

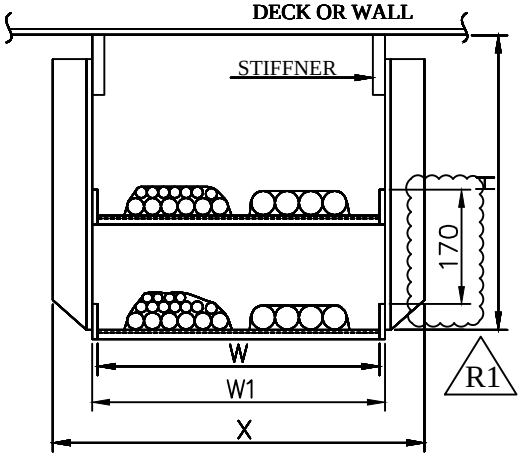
NOTE

1. ** SUPPORT
   1. FOR ALL CABLE TRAY : 40X40X5 MS ANGLE
   2. SPECIAL CASES AS INDICATED IN DRAWINGS.
   3. CABLE TRAYS ARE TO BE SUPPORTED WITH MAXIMUM SPAN OF 1600 MM .
2. ** SUPPORT HEIGHT(H) SHALL BE DECIDED AS PER THE FIT. ARRG. DRG.
3. CABLE WAY SUPPORT TO BE WELDED TO THE CABLE RACK ON RUNNER BARS.
4. CABLE WAY SUPPORTS TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE WAY SUPPORTS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.
5. TYPES - A,B,C,D,E,F,G & SPECIAL (NON STANDARD LENGTH) CABLE RACKS SHALL BE CUSTOMIZED FROM "H" TYPE (2400 MM LENGTH) CABLE RACK

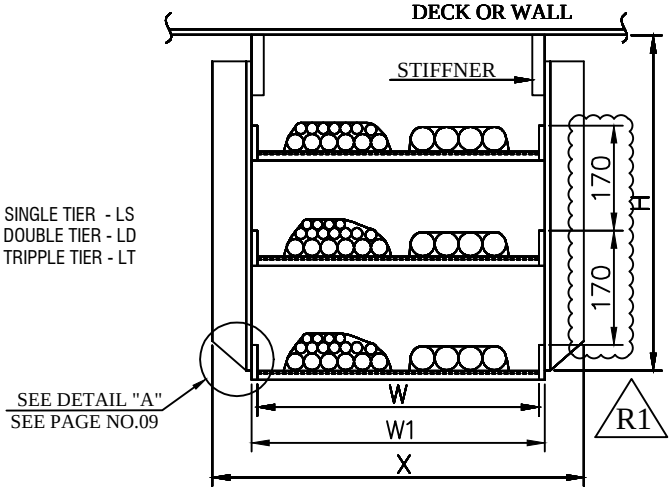
	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.05	11/63
	CABLE RACK DOUBLE TIER	DRG NO: 037-K5700200	



VIEW-A~A



SINGLE TIER - LS
DOUBLE TIER - LD
TRIPPLE TIER - LT



"L" (LENGTH) STANDARD OF CABLE RACK LENGTH*

SYMBOL	A	B	C	D	E	F	G	H	S
LENGTH (L)	300	600	900	1200	1500	1800	2100	2400	*SPECIAL

MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE	CROSS PIECE	RUNNER BAR SIDE PLATE	W	W1	X
LDA/B/C/D/E/F/G/H - 15	L - 15	40 X 4 F.B.	150	158	238
LDA/B/C/D/E/F/G/H - 20	L - 20	"	200	208	288
LDA/B/C/D/E/F/G/H - 30	L - 30	"	300	308	388
LDA/B/C/D/E/F/G/H- 40	L - 40	"	400	408	488
LDA/B/C/D/E/F/G/H - 50	L - 50	"	500	508	588
LDA/B/C/D/E/F/G/H - 60	L - 60	"	600	608	688

R1

NOTE

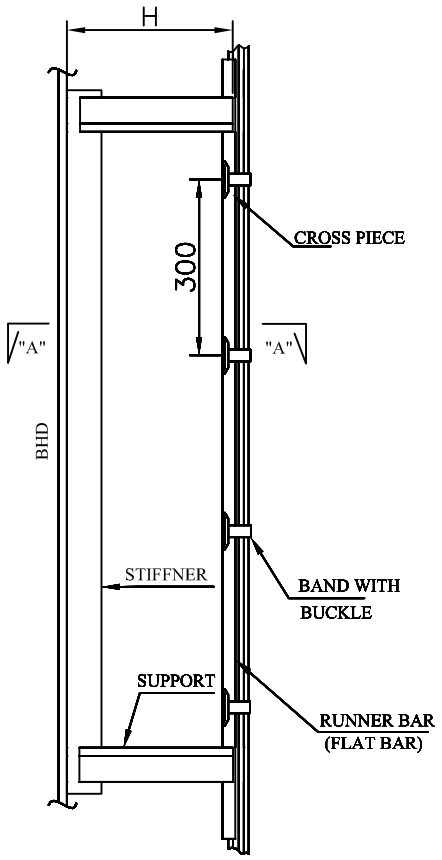
1. ** SUPPORT
   1. FOR ALL CABLE TRAY : 40X40X5 MS ANGLE
   2. SPECIAL CASES AS INDICATED IN DRAWINGS.
   3. CABLE TRAYS ARE TO BE SUPPORTED WITH MAXIMUM SPAN OF 1600 MM .
2. ** SUPPORT HEIGHT(H) SHALL BE DECIDED AS PER THE FIT. ARRG. DRG.
3. CABLE WAY SUPPORT TO BE WELDED TO THE CABLE RACK ON RUNNER BARS.
4. CABLE WAY SUPPORTS TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE WAY SUPPORTS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.
5. TYPES - A,B,C,D,E,F,G & SPECIAL (NON STANDARD LENGTH) CABLE RACKS SHALL BE CUSTOMIZED FROM "H" TYPE (2400 MM LENGTH) CABLE RACK

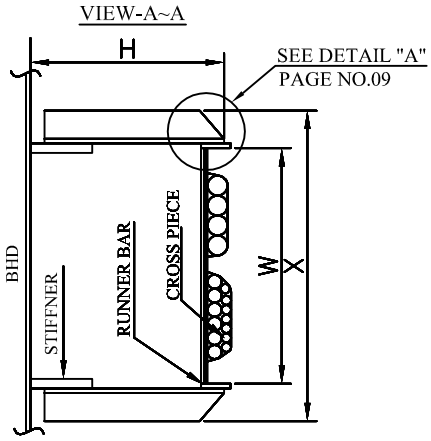
CABLE WAY INSTALLATION MATERIALS

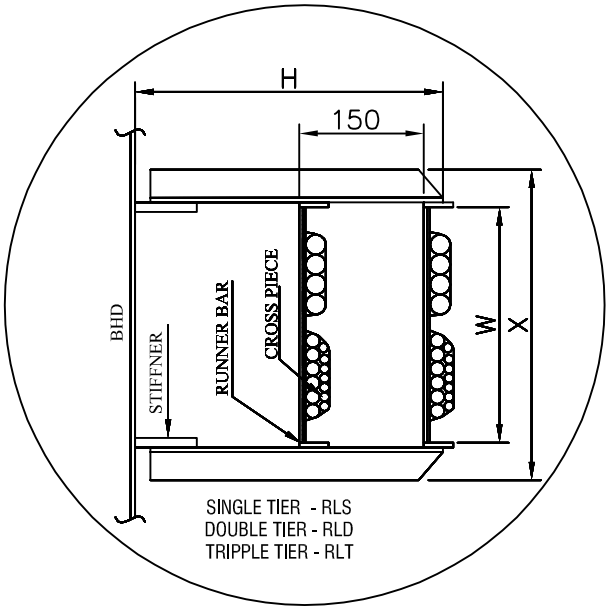
PART NO: 05.06 | 12/63

CABLE RACK VERTICAL (REVERSE TYPE)

DRG NO: 037-K5700200







"L" (LENGTH) STANDARD OF CABLE RACK LENGTH*

SYMBOL	A	B	C	D	E	F	G	H	S
LENGTH (L)	300	600	900	1200	1500	1800	2100	2400	*SPECIAL

MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

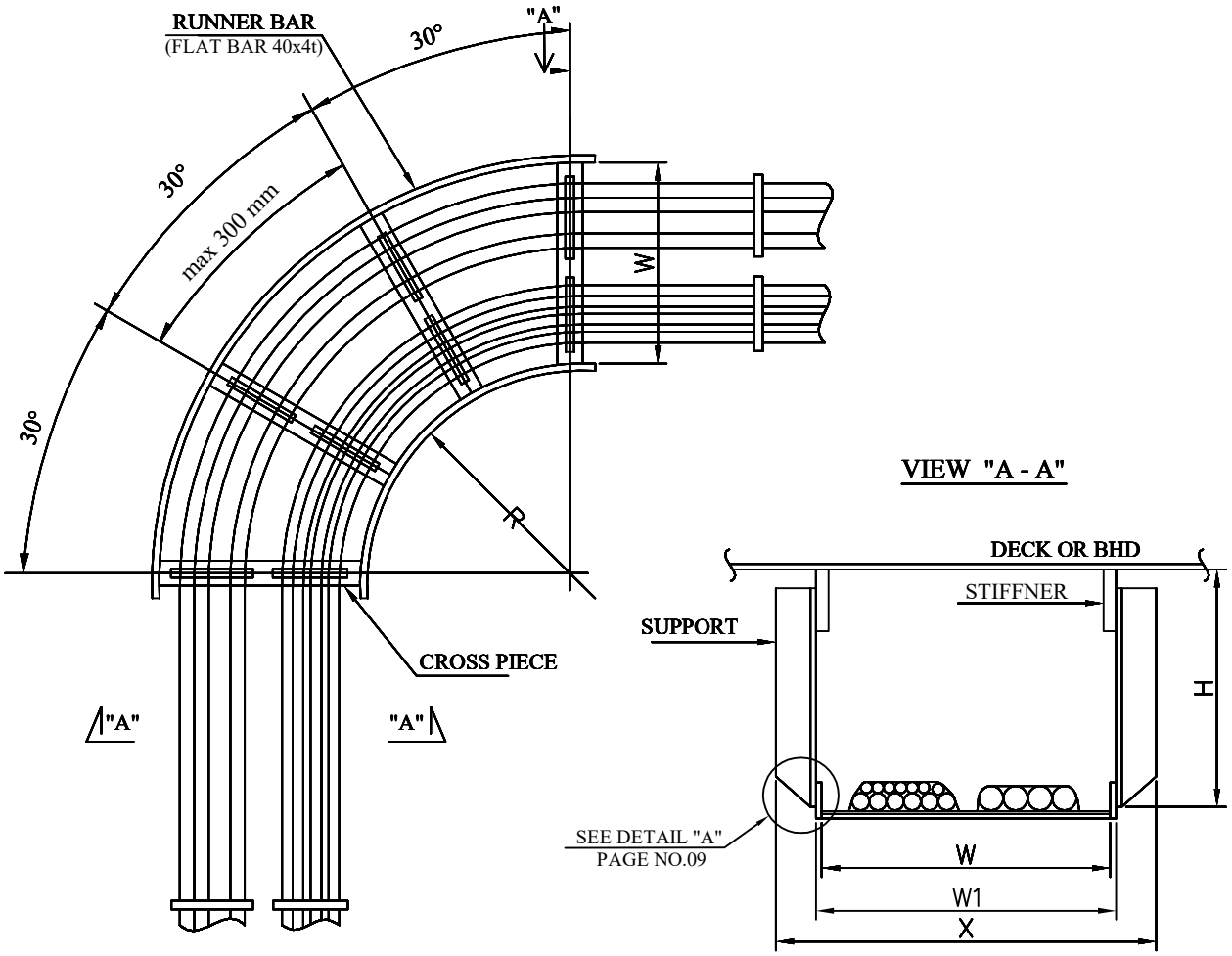
TYPE	CROSS PIECE	RUNNER BAR SIDE PLATE	W	W1	X
RLSA/B/C/D/E/F/G/H - 15	L - 15	40 X 4 F.B.	150	158	238
RLSA/B/C/D/E/F/G/H - 20	L - 20	"	200	208	288
RLSA/B/C/D/E/F/G/H - 30	L - 30	"	300	308	388
RLSA/B/C/D/E/F/G/H - 40	L - 40	"	400	408	488
RLSA/B/C/D/E/F/G/H - 50	L - 50	"	500	508	588
RLSA/B/C/D/E/F/G/H - 60	L - 60	"	600	608	688

R1

NOTE

1. ** SUPPORT
   1. FOR ALL CABLE TRAY : 40X40X5 MS ANGLE
   2. SPECIAL CASES AS INDICATED IN DRAWINGS.
   3. CABLE TRAYS ARE TO BE SUPPORTED WITH MAXIMUM SPAN OF 1600 MM .
2. ** SUPPORT HEIGHT(H) SHALL BE DECIDED AS PER THE FIT. ARRG. DRG.
3. CABLE WAY SUPPORT TO BE WELDED TO THE CABLE RACK ON RUNNER BARS.
4. CABLE WAY SUPPORTS TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE WAY SUPPORTS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.
5. TYPES - A,B,C,D,E,F,G & SPECIAL (NON STANDARD LENGTH) CABLE RACKS SHALL BE CUSTOMIZED FROM "H" TYPE (2400 MM LENGTH) CABLE RACK

	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.07	13/63
	CABLE RACK BEND TYPE	DRG NO: 037-K5700200	



W<300 : NO. OF *CROSS PIECE - 3 Nos AND W>300 : NO. OF #CROSS PIECE - 4Nos.

* W<500 R = 300, W≥500 R=400

MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE	HANGER	RUNNER BAR	W	W1	X	WEIGHT Aprox.(KG)
LSR15	L - 15	40 X 4t F.B.	150	158	238	2.24
LSR20	L - 20	"	200	208	288	2.65
LSR30	L - 30	"	300	308	388	3.38
LSR40	L - 40	"	400	408	488	4.56
LSR50	L - 50	"	500	508	588	5.41
LSR60	L - 60	"	600	608	688	6.25

NOTE

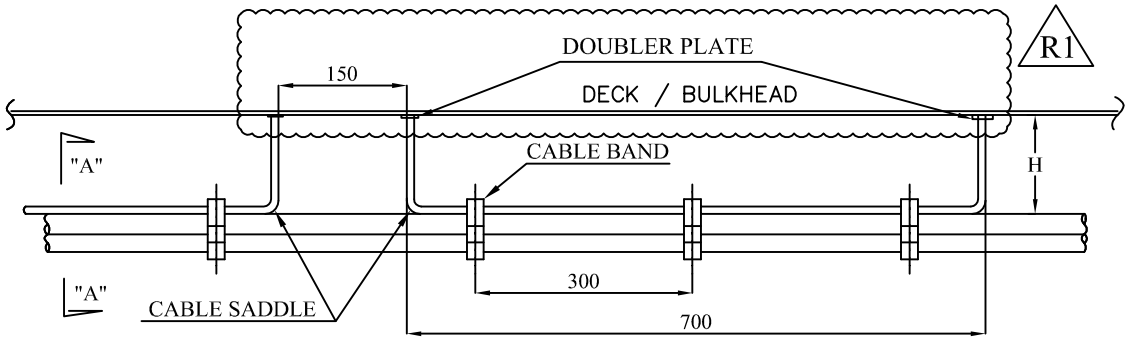
1. ** SUPPORT
   1. FOR ALL CABLE TRAY : 40X40X5 MS ANGLE
   2. SPECIAL CASES AS INDICATED IN DRAWINGS.

2.** SUPPORT HEIGHT(H) SHALL BE DECIDED AS PER THE FIT. ARRG. DRG.

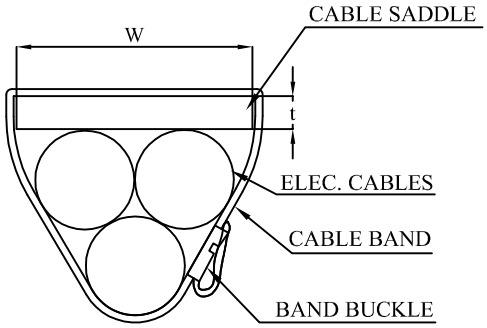
3. CABLE WAY SUPPORTS TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE WAY SUPPORTS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.

4. CABLE WAY SUPPORT TO BE WELDED TO THE CABLE RACK ON RUNNER BARS.

	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.08	14/63
	CABLE SADDLE - "FB" TYPE	DRG NO: 037-K5700200	



SEC. "A - A"

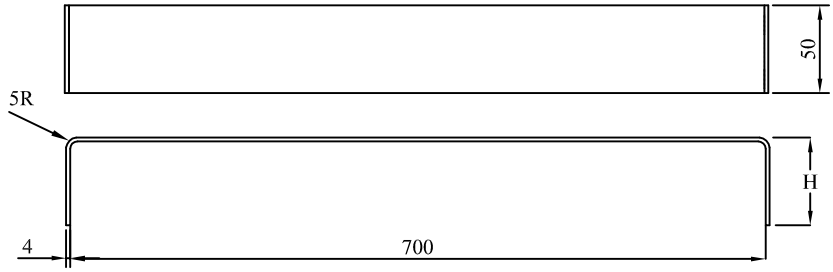


MATERIAL : STEEL IS 1079 + ONE(1) COAT OF EPOXY PRIMER +ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE		H	WEIGHT Aprox.(KG)	REMARK
FB3	-70H	70	1.48	SEE TYPE "1"
	-200H	200	1.94	
	-330H	330	2.40	
FB5	-70H	70	2.60	SEE TYPE "2"
	-200H	200	3.89	
	-330H	330	4.80	

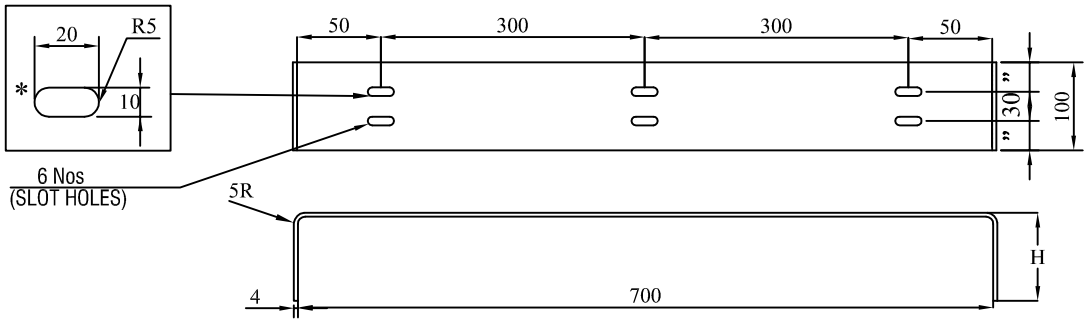
TYPE 1

1 "FB-3" TYPE CABLE SADDLE



TYPE 2

2 "FB-5" TYPE CABLE SADDLE



R1

1.CABLE SADDLES ARE USED TO SUPPORT ONE TO TEN CABLES.

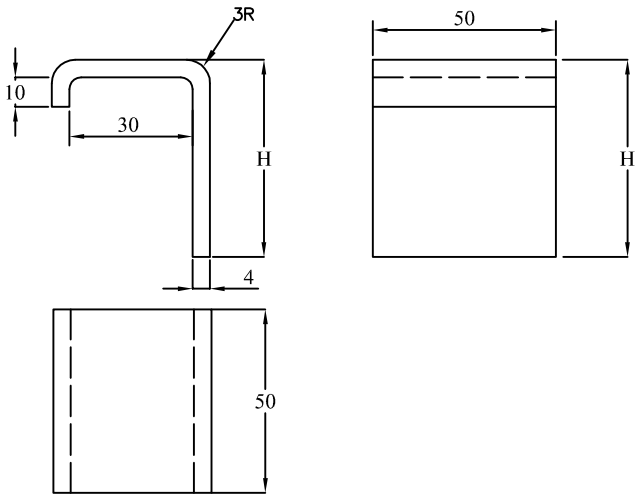
2. FLAT BAR "FB3,FB5 TO BE SUITABLY CUT AND USED AS PER THE DIMENSION ON CORRESPONDING FITTING ARRG DRG. THE CUTTING OF HEIGHT "H" TO BE DONE AS BELOW ONLY.
   H < 70MM - FB3-70H/FB5-70H TO BE USED
   H > 70 & < 200 - FB3-200H/FB5-200H TO BE USED
   H > 200 & < 330 - FB3-330H/FB5-330H TO BE USED

3. CABLE SADDLES TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE SADDLES ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.

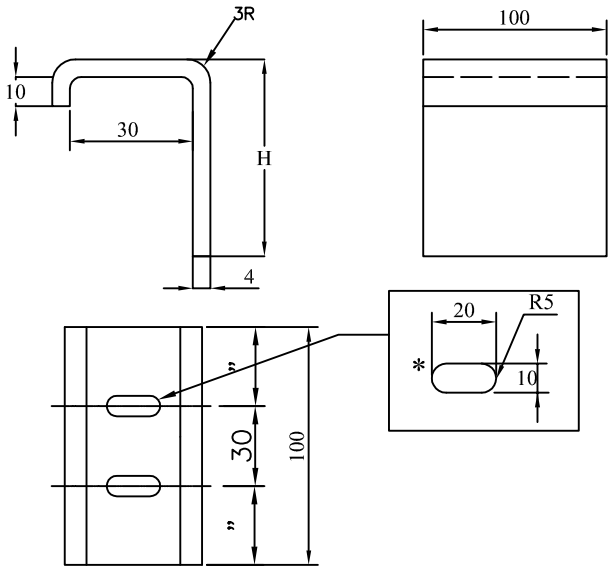
	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.09	15/63
	CABLE SADDLE - "SFG" TYPE	DRG NO: 037-K5700200	

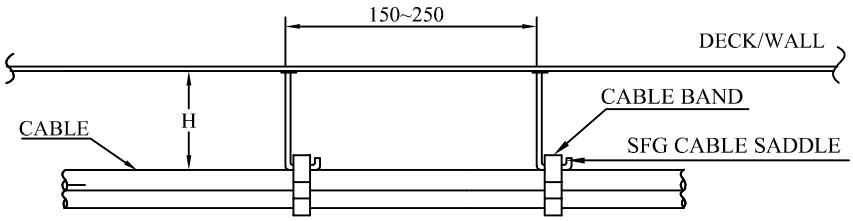
THIS "SFG" CABLE HANGER SHALL USUALLY BE USED AT CURVED AND/OR SHORT CABLE WAY.

TYPE 3
'SFG3' TYPE CABLE SADDLE



TYPE 4
'SFG5' TYPE CABLE SADDLE





MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE		H	WEIGHT Aprox.(KG)	REF DRG
SFG3	70H	70	0.19	SEE TYPE "3"
	200H	200	0.42	
	330H	330	0.65	
SFG5	70H	70	0.35	SEE TYPE "4"
	200H	200	0.75	
	330H	330	1.16	

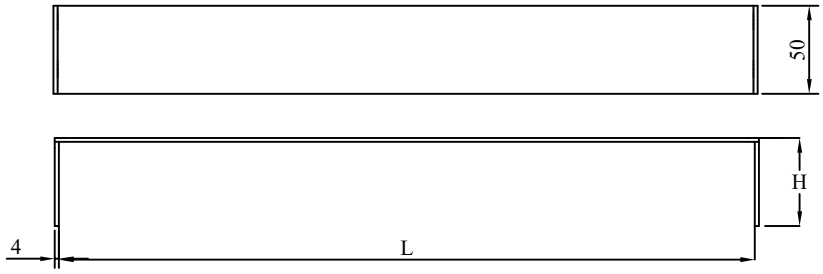
R1

1. CABLE SADDLES ARE USED TO SUPPORT ONE TO TEN CABLES. WHERE EVER THE OTHER ROUTING MATERIALS NOT USEBLE.
2. FLAT BAR "SFG3,SFG5 TO BE SUITABLY CUT AND USED AS PER THE DIMENSION ON CORRESPONDING FITTING ARRG DRG. THE CUTTING OF HEIGHT "H" TO BE DONE AS BELOW ONLY.
   H < 70MM - SFG3-70H/SFG5-70H TO BE USED
   H > 70 & < 200 - SFG3-200H/SFG5-200H TO BE USED
   H > 200 & < 330 - SFG3-330H/SFG5-330H TO BE USED
3. CABLE SADDLES TO BE WELDED TO THE STIFFNERS/GIRDERS AS FOR AS POSSIBLE. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE SADDLES ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.

	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.10	15A / 63
	CABLE SADDLE - "FB" TYPE	DRG NO: 037-K5700200	

TYPE 5

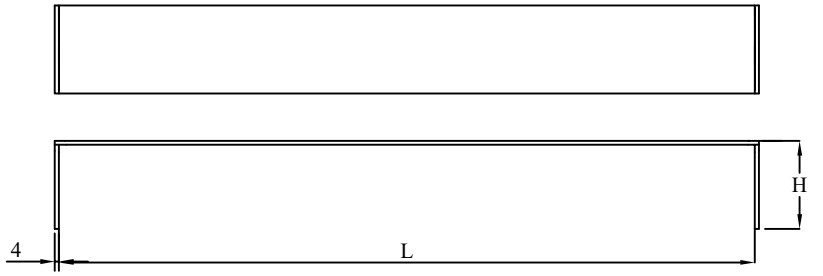
1 "FB-3" TYPE CABLE SADDLE

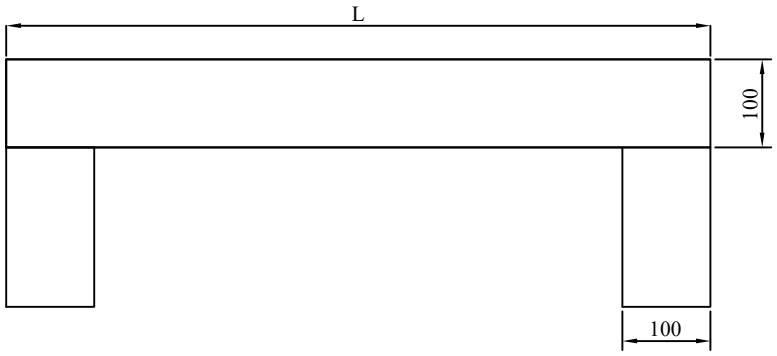


TYPE 6

1 "FB-5" TYPE CABLE SADDLE

R1





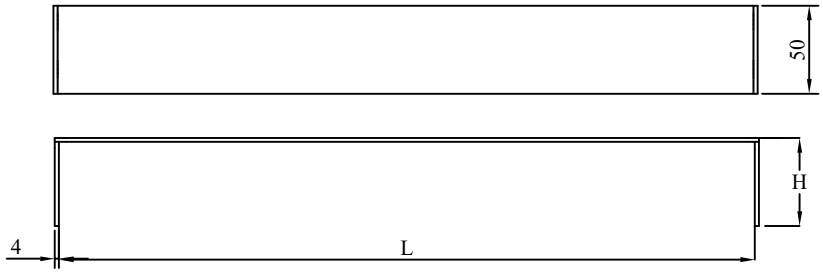
MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE	L	WEIGHT Aprox.(KG)	REF DRG
FB3A	750		SEE TYPE "5"
FB3B	1000		
FB3C	1200		
FB3D	1500		
FB5A	750		SEE TYPE "6"
FB5B	1000		
FB5C	1200		
FB5D	1500		

	CABLE WAY INSTALLATION MATERIALS	PART NO: 05.11	15B / 63
	CABLE SADDLE - "FB" TYPE	DRG NO: 037-K5700200	

TYPE 5

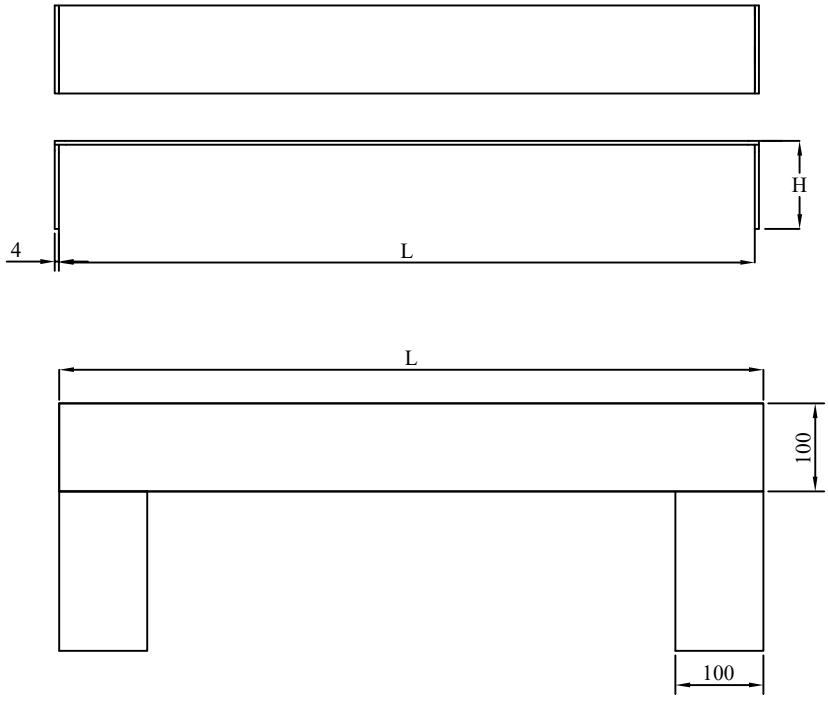
1 "FB-3" TYPE CABLE SADDLE



TYPE 6

1 "FB-5" TYPE CABLE SADDLE

R1



MATERIAL : STEEL IS 1079+ONE(1) COAT OF EPOXY PRIMER+ONE(1) COAT OF HB POLYURETHANE FINISH (OFF WHITE)

TYPE	L	WEIGHT Aprox.(KG)	REF DRG
FB3A	300		SEE TYPE "5"
FB3B	600		
FB3C	900		
FB5A	300		SEE TYPE "6"
FB5B	600		
FB5C	900		

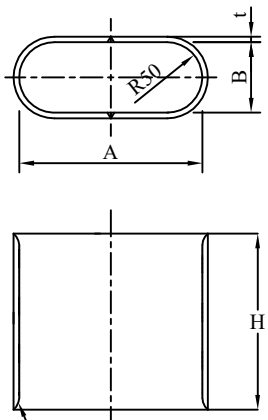
CABLE PENETRATION

PART NO: 06.01

CABLE COAMING

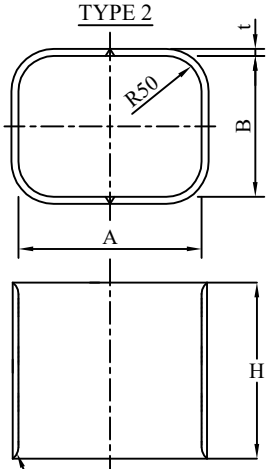
DRG NO: 037-K5700200

TYPE 1



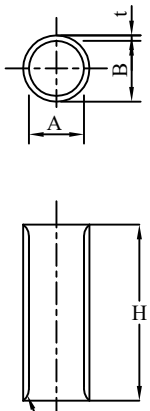
ROUND EDGE
TO AVOID DAMAGE TO CABLE

TYPE 2



ROUND EDGE
TO AVOID DAMAGE TO CABLE

TYPE 3



ROUND EDGE
TO AVOID DAMAGE TO CABLE

* "XX" : "DC" , "EC"

PIECE MARK	SIZE				TYPE	WEIGHT(kg)	REMARK
	A	B	t	H DC EC		DC EC	
XX - 1610	160	100	8	100	1	2.88	
XX - 2110	210	100	8	100	1	3.51	
XX - 2610	260	100	8	100	1	4.14	
XX - 2615	260	150	8	100	2	5.13	
XX - 2620	260	200	8	100	2	5.40	
XX - 3610	360	100	8	100	1	5.40	
XX - 3615	360	150	8	100	2	6.02	
XX - 3620	360	200	8	100	2	6.65	
XX - 4610	460	100	8	100	1	6.65	
XX - 4615	460	150	8	100	2	7.28	
XX - 4620	460	200	8	100	2	7.91	
XX - 4625	460	250	8	100	2	8.54	
XX - 5610	560	100	8	100	1	7.91	
XX - 5615	560	150	8	100	2	8.54	
XX - 5620	560	200	8	100	2	9.16	
XX - 6610	660	100	8	100	1	9.16	
XX - 6615	660	150	8	100	2	9.79	
XX - 6620	660	200	8	100	2	10.42	
XX - 6625	660	250	8	100	2	11.05	
XX - 7610	760	100	8	100	1	10.42	
XX - 7615	760	150	8	100	2	11.05	
XX - 7620	760	200	8	100	2	11.68	
XX - 8615	860	150	8	100	2	12.30	
XX - 8620	860	200	8	100	2	12.93	
SPECIAL							CASE BY CASE
XX - 50A	52.5	60.3	3.91	100	3	0.54	SCH. 40
XX - 80A	77.9	88.9	5.49	100	3	1.13	"
XX - 100A	102.3	114.3	6.02	100	3	1.60	"
XX - 50A	49.2	60.3	5.54	100	3	0.74	SCH. 80
XX - 80A	73.6	88.9	7.62	100	3	1.52	"
XX - 100A	97.18	114.3	8.56	100	3	2.23	"

	CABLE PENETRATION	PART NO: 06.02	17 / 63
	MARINE WATERTIGHT CABLE GLANDS BULKHEAD / DECK MOUNTED TYPE	DRG NO: 037-K5700200	

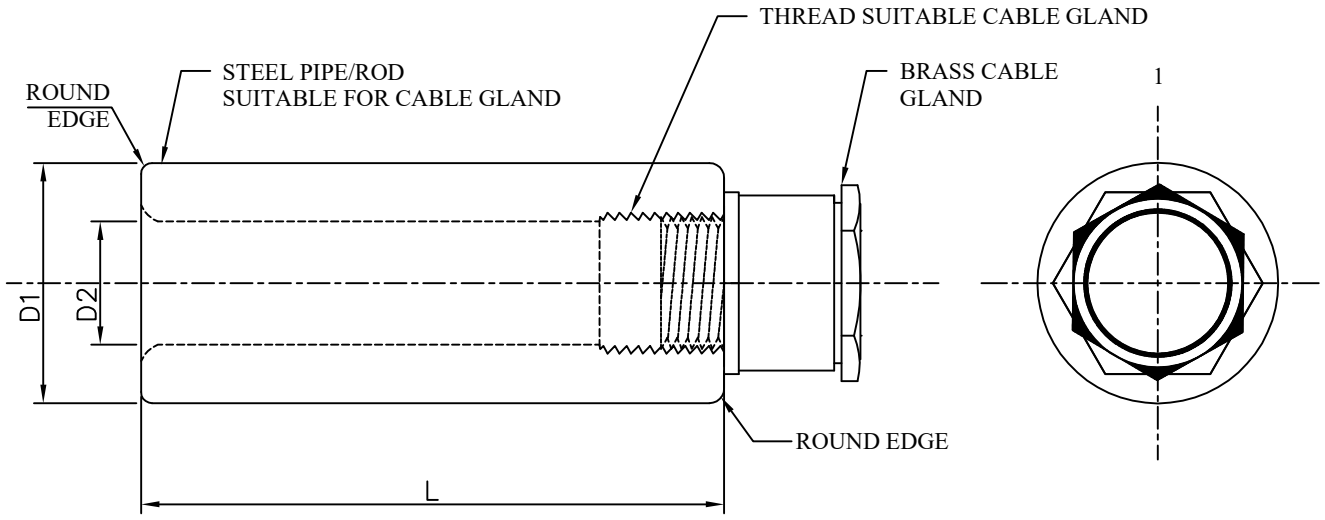


TABLE-1

NO.	*NAME	LENGTH (L) (MM)
1	M25-150	150
2	M25-050	50
3	M25-150	200
4	M25-200	200

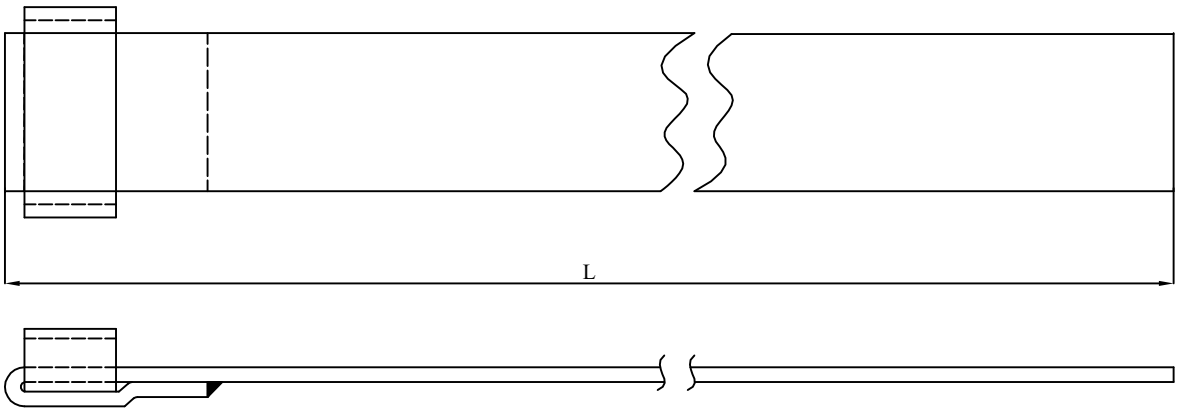
L= VARY AS PER THE THICKNESS OF INSULATION / OTHER REQUIREMENTS.

* M25, M1500, M200 MEANS THE GLAND SIZE USED FOR INSTALLATION

The cable glands penetrating to weather deck to be positioned below the cable entry point of the equipment to which it serve so as to prevent the water dripping into the equipment. Location of the pipe glands will be clearly indicated in the respective yard plans.

1. "L" SHALL BE DECIDED ACCORDING TO THE CONNECTION POINT OF THE EQUIPMENT,ETC

	CABLE INSTALLATION MATERIALS	PART NO: 07.01	18/63
	ELECTRIC CABLE BAND WITH BUCKLE (316 STAINLESS STEEL)	DRG NO: 037-K5700200	

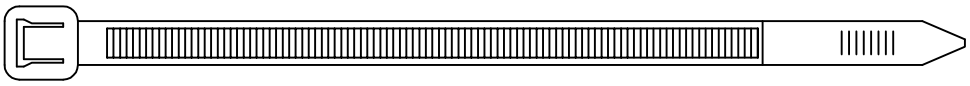


NOTE

1. MATERIAL : STAINLESS STEEL
2. LENGTH AND WIDTH : SHALL BE DECIDED BY THE CABLE SIZE

	CABLE INSTALLATION MATERIALS	PART NO: 07.02	19/63
	CABLE TIES	DRG NO: 037-K5700200	

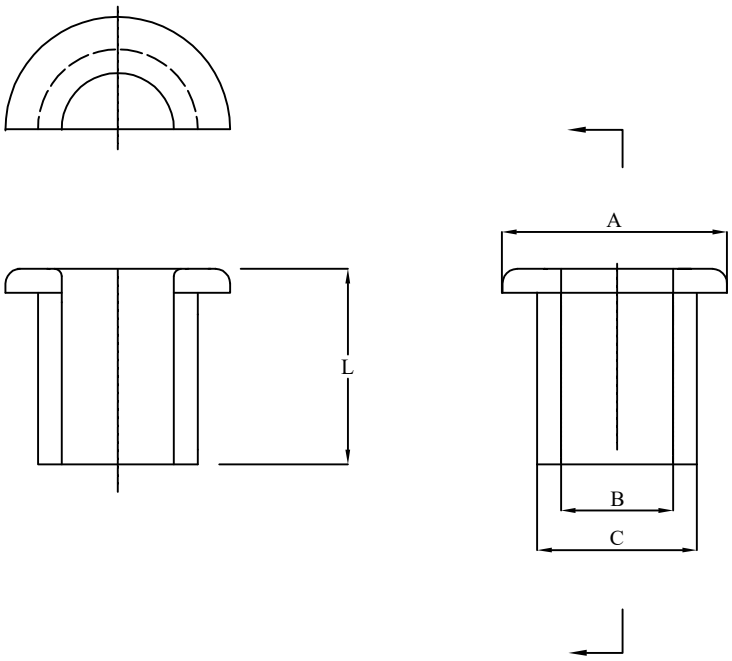
LOCKING CABLE TIE



NOTE

1. MATERIAL : WEATHER RESISTANT , UV RESISTANT NYLON.
2. LENGTH AND WIDTH : SHALL BE DECIDED BY THE CABLE SIZE
3. COLOUR : NATURAL OR BLACK
4. USED FOR TEMPORARY CABLE TYING (WHITE) AND TYING INSIDE ELECTRICAL CONTROL PANELS (BLACK).

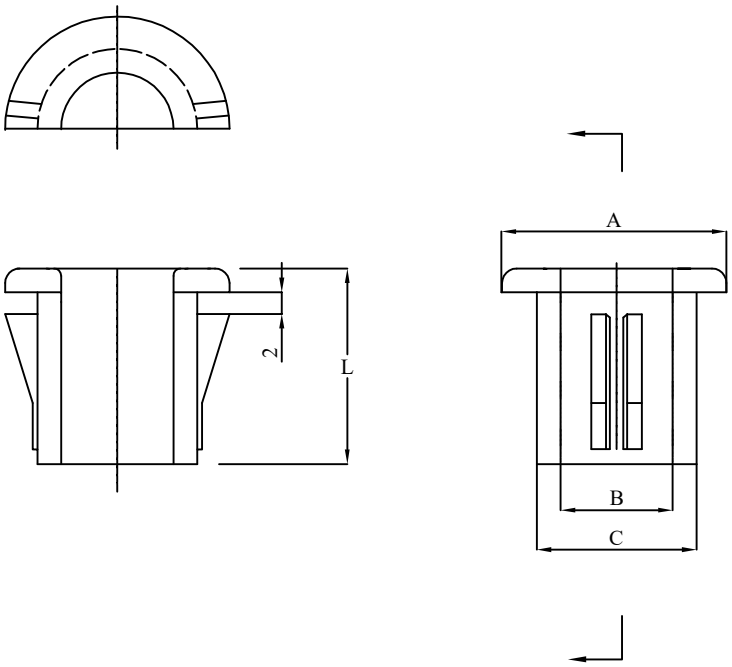
	CABLE INSTALLATION MATERIALS	PART NO: 07.03	20/63
	VINYL BUSHING	DRG NO: 037-K5700200	



MATERIAL : VINYL

1. LENGTH & WIDTH : SHALL BE DECIDED BY THE CABLE SIZE

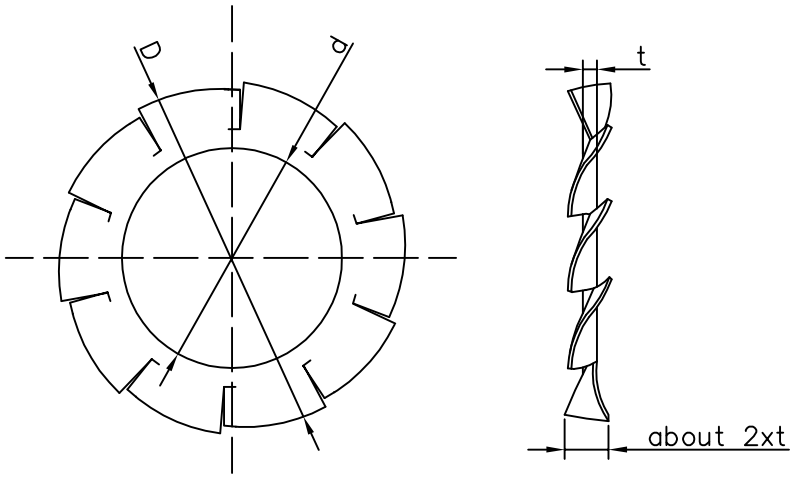
	CABLE INSTALLATION MATERIALS	PART NO: 07.04	21/63
	VINYL BUSHING(SPRING TYPE)	DRG NO: 037-K5700200	



MATERIAL : VINYL

1. LENGTH & WIDTH : SHALL BE DECIDED BY THE CABLE SIZE

	CABLE INSTALLATION MATERIALS	PART NO: 07.05	22/63
	TOOTHED LOCK WASHER FOR EARTHING	DRG NO: 037-K5700200	



MATERIAL: SPRING STEEL

DESIGNATION	NOMINAL SIZE	d		D		t		NO.OF TOOTH	WEIGHT (gm)
		PREFERRED DIMENSION	TOLERANCE	PREFERRED DIMENSION	TOLERANCE	PREFERRED DIMENSION	TOLERANCE		
LW	4	4.4	+ 0.30	11	− 0.50	0.63	±0.040	12	1.2
	8	8.4		15		0.80	±0.050		2
	10	10.5	+ 0.40	18		0.90			2.5
	12	12.5		21	−0.60	1.00	±0.055		3

INSTALLATION OF CABLES:-

GENERAL

This part covers the description of items used for the installation of cables onboard ships, various methods for the installation of cables and precautions to be taken considering various standards and rule requirements.

PRACTICE FOR INSTALLATION OF CABLES

Cables in ships are subjected to rigorous environmental conditions such as excessive heat, exposure to accumulation of oil or water and risk of mechanical and chemical damage.

Following general points to be noted while designing the cable installations:-

- All cables shall be effectively supported and secured without damaging the outer covering of the cables.

- Deck cables and cable exposed to mechanical damage are protected by means of galvanized solid drawn steel pipe.

- Cables shall be provided with heat shrinkable tubes to seal the cable and glands for all weather deck installation.

- During hot works, all cables exposed to sparks from welding/blow pipe works shall be properly protected by means of an incombustible carpet or curtain

- No cables shall generally be painted. Any paint and over-spray shall be cleaned off all cabling.

- Cables are not to be supportd on to the PE earth bar.

- Extra cable length is not allowed for termination. cable inside the panel except for spare cables.

- Cables to be terminated just after passing the cable glands.

R1

- Wires to be guided through suitable cable ducts.

- Suitable extra length for wires should be only made for connecting the spare wires.

R1

- Terminals with bottom connections to be used to avoid the over length in connecting the wires.

- Cables for essential/emergency power for lighting, internal communication or signals shall be routed clear of galley, laundry, machinery spaces and other area of high risk fire.

- The minimum internal bending radius for power and control cables shall be in accordance with the manufacturers recommendations.

- Clips, saddles bands and supports shall not present any sharp edges against the cables.

- Where duplicate supply is required for the same service, the routes are to be different.

- All the cables must be with corresponding cable tags and for core identification,ferules can be used

The general practice of laying cable is on cable Hangers for main cable ways. Cable saddles are used for less number of cables. Angle supports are used for supporting cable hangers and racks to the main structure.

Cables are held in position on hangers racks and cable saddles by means of metallic/non metallic material Clips.The metal should be of Stainless steel. Inside panel boards nylon cable ties can be used for dressing Cables exposed to weather deck shall secured with stainless steel band with buckles .

Cables shall be supported so close to an enclosure entry through cable gland to avoid mechanical stress cable gland.

- INSTRUCTION FOR FIXING CABLES

1. Power cables larger than 35mm² below/on top of cable trays
   Large strips = 1 SS - 2 Nylon

2. Cables on cable racks in machinery area = 1 SS - 2 Nylon

3. Cables on cable racks in accommodation area = 1 SS - 2 Nylon

4. Cables on cable racks in expossed area = metalic (stainless steel)

5. Cables on flat bar in machinery area = 1 SS - 2 Nylon

6. Cables on flat bar in accommodation area = 1 SS - 2 Nylon

7. Fibre optic cables shall be fastened with Nylon cable ties all the way.

8. When control cables and fibre optic cables are bunched together shall be fastened with Nylon cable ties all the way.

- CABLE BUNDLES:

Power cable of maximum 6 cables or signal cables of maximum 15 cables shall be bunched together by one clamp.
If bunching of larger formations is used for cables expected shall be under full load simultaneously, a correction factor of 0.85 shall be applied.

	GENERAL REFERENCE	PART NO: 08.02	26/63
	TYPICAL ARR'T OF ELECTRICAL APPARATUS IN ACCOMMODATION	DRG NO: 037-K5700200	

- HEIGHT OF RECEPTACLE ;

  THE HEIGHT OF RECEPTACLES SHALL BE AS FOLLOWS;

  A) 1200mm ABOVE THE FLOOR TO BOTTOM FOR WALL MOUNTED EQUIPMENTS

  B) FOR DRINKING WATER FOUNTAIN, REFRIGERATOR : 300mm ABOVE EQUIP, OR INSIDE COVERING BOX

  C) FOR IRON IN LAUNDRY : 300mm ABOVE IRON BOARD AND 100mm OFF FROM THE END OF THE IRON BOARD.

  D) FOR ELEC. SHAVER : BUILT IN THE LIGHTING FIXTURE OR TOILET CABINET.

  E) FOR TOASTER,RANGE,COFFEE POT : 400mm ABOVE TABLE.

- JUNCTION BOX :
  TO BE LOCATED WHERE ACCESSIBLE FOR CHECKING.

- BUZZER AND CALLING PUSH BUTTON :

  A) PUSH BUTTON FOR PROVISION/COLD STORE : 1400mm ABOVE FLOOR.

NOTE: THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

INSTALLATION PRACTICE ON EARTHING:-

GENERAL

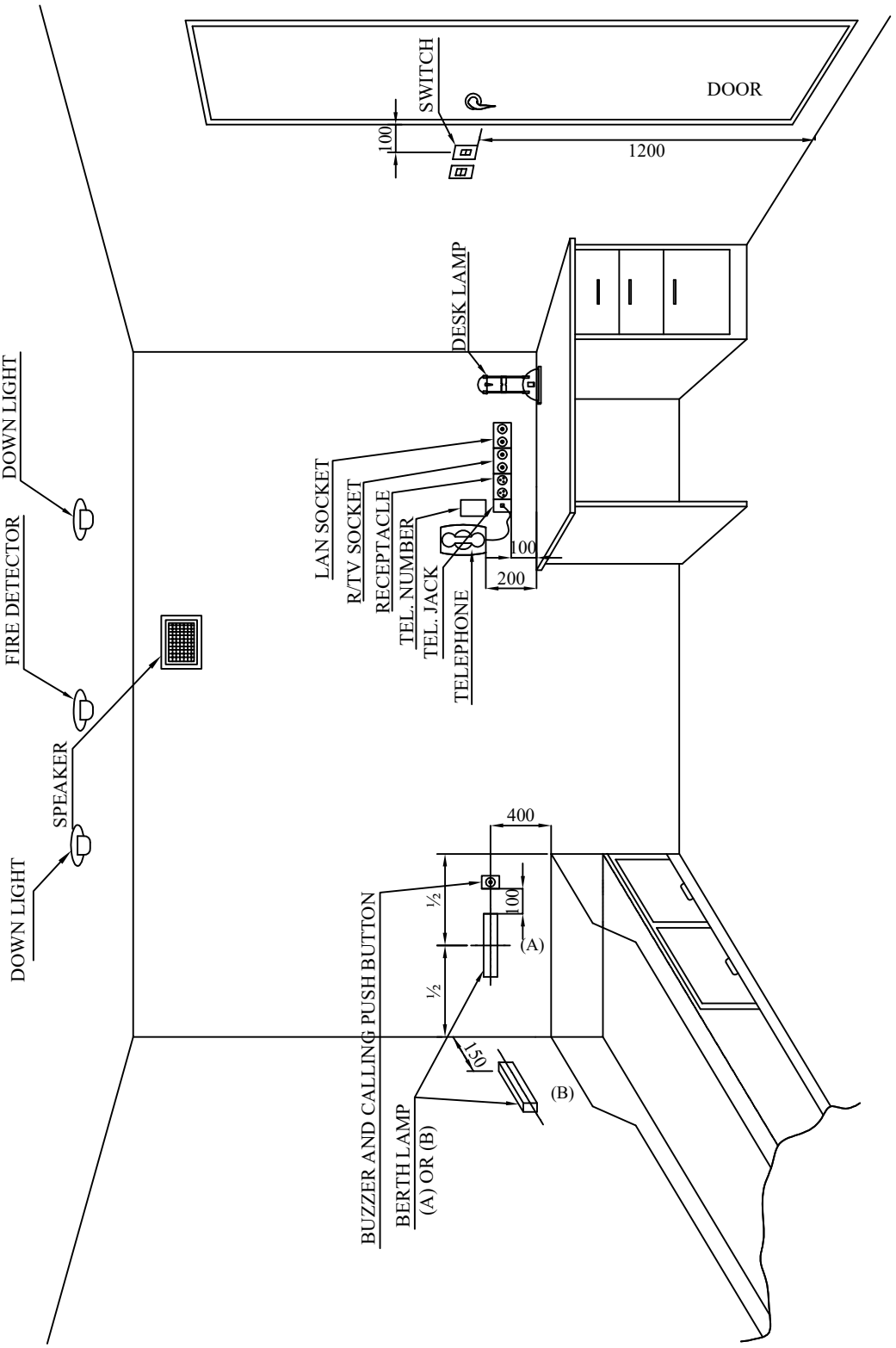
Generally all metal parts of the electrical installation, other than current carrying parts be earthed. Earthing may however be omitted for double insulated equipment, low voltage equipment etc.

The connection of earth conductors to the earth bar and to the hull, shall be made by corrosion-resistant screws or clamps. Cross section shall correspond to the earth conductor

Earthing of instrumentation and communication cable screens shall be done according to makers requirement. For these cables with only one screen the cable screen shall be earthed in both ends.

	GENERAL REFERENCE	PART NO: 08.04	28 / 63
	TYPICAL LAYOUT-TYPE "A"	DRG NO: 037-K5700200	

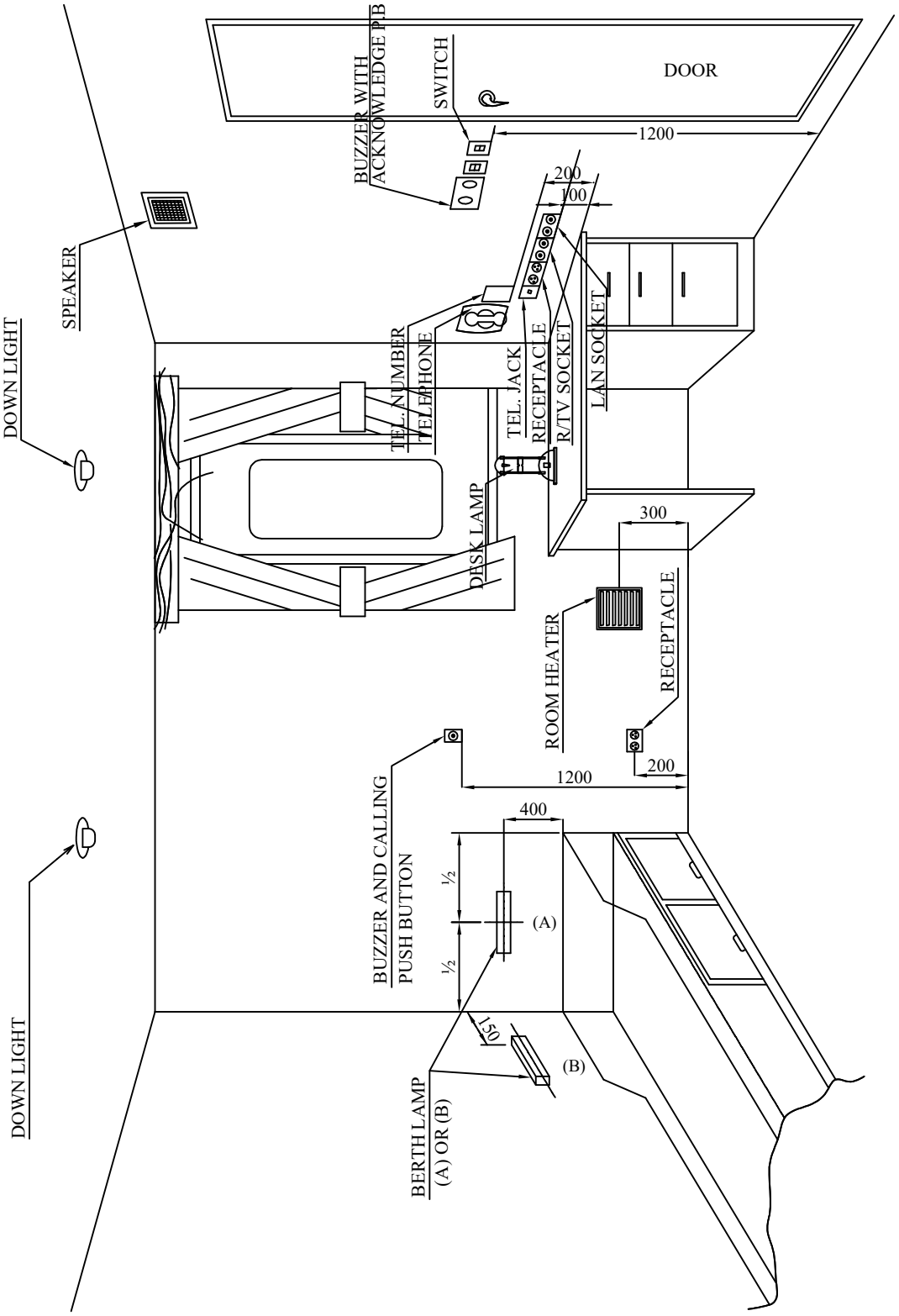
(CABIN)



NOTE:- THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

	GENERAL REFERENCE	PART NO: 08.05	29/63
	TYPICAL LAYOUT-TYPE "B"	DRG NO: 037-K5700200	

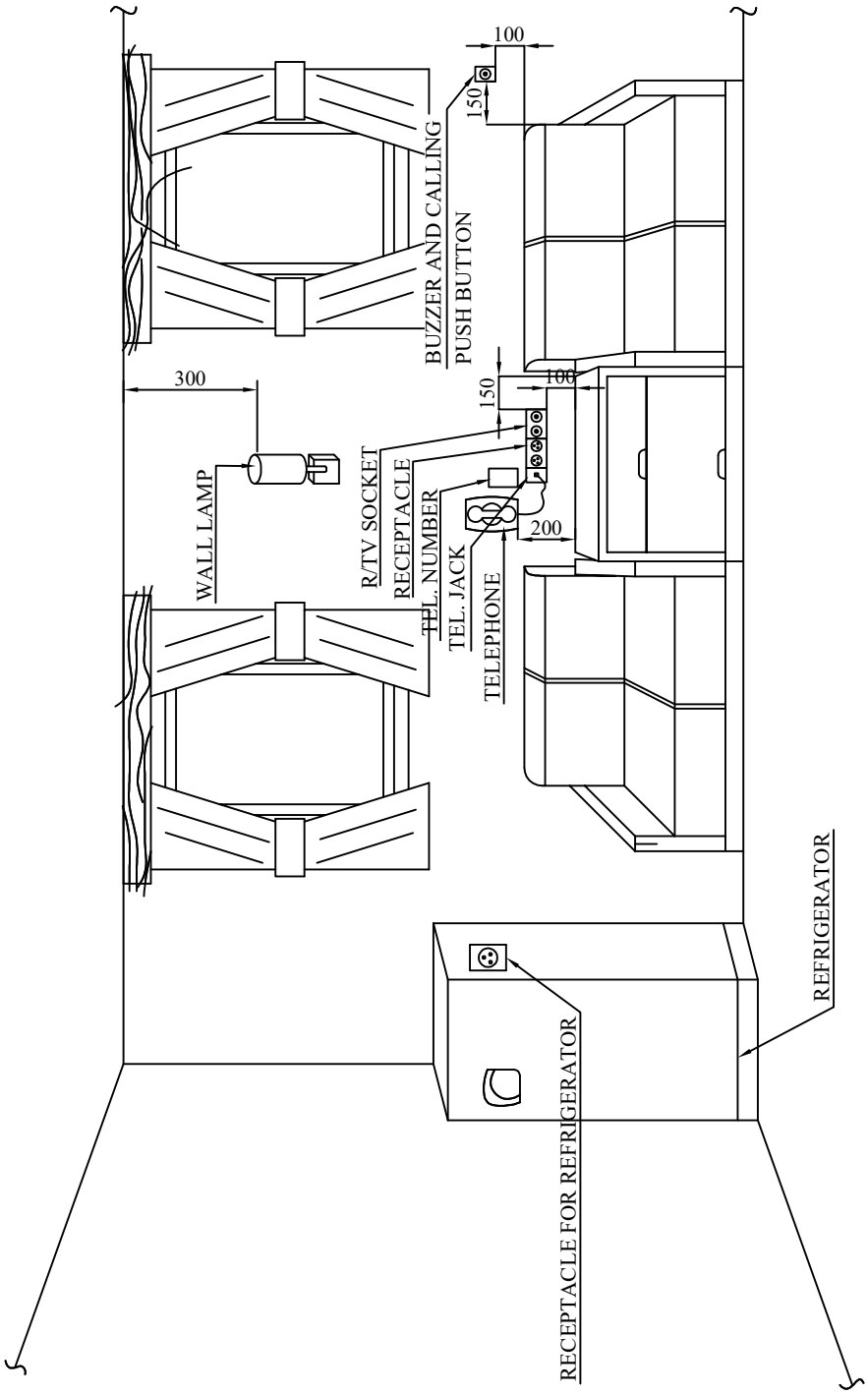
(CABIN)



NOTE:- THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

	GENERAL REFERENCE	PART NO: 08.06	30/63
	TYPICAL LAYOUT-TYPE "C"	DRG NO: 037-K5700200	

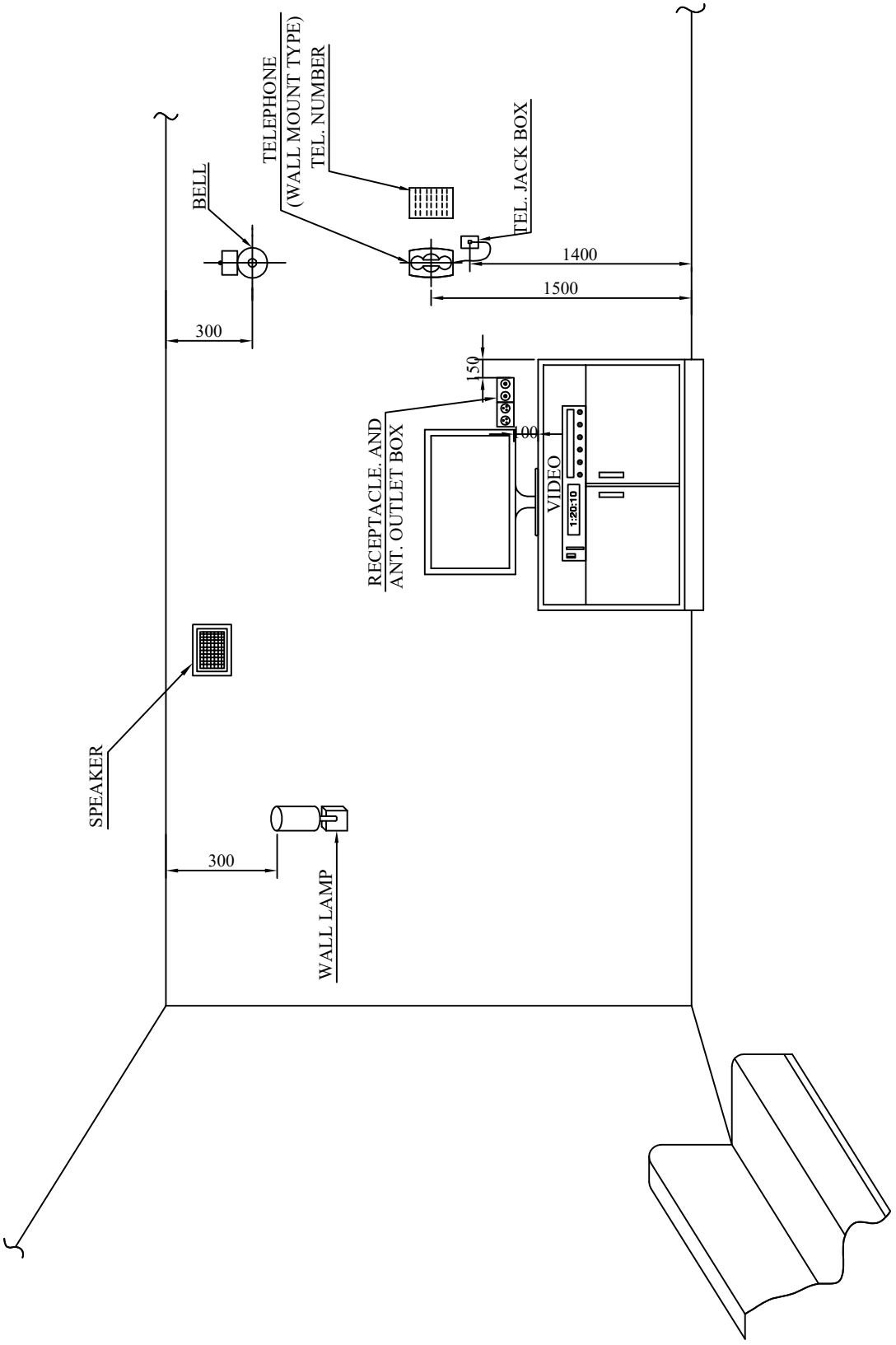
(MESS & DAY ROOM)



NOTE:- THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

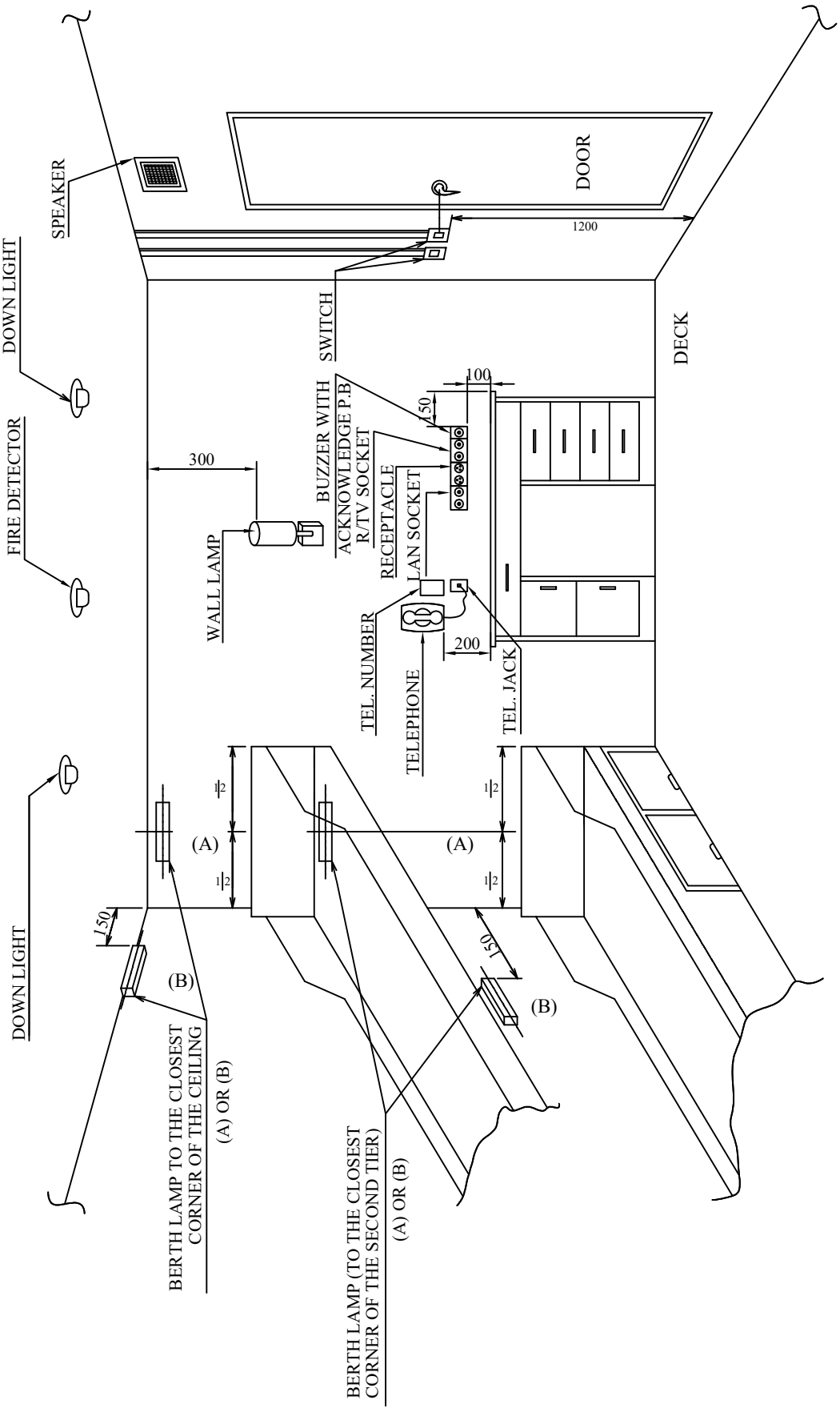
	GENERAL REFERENCE	PART NO: 08.07	31 / 63
	TYPICAL LAYOUT-TYPE "D"	DRG NO: 037-K5700200	

(MESS & DAY ROOM)



NOTE:- THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

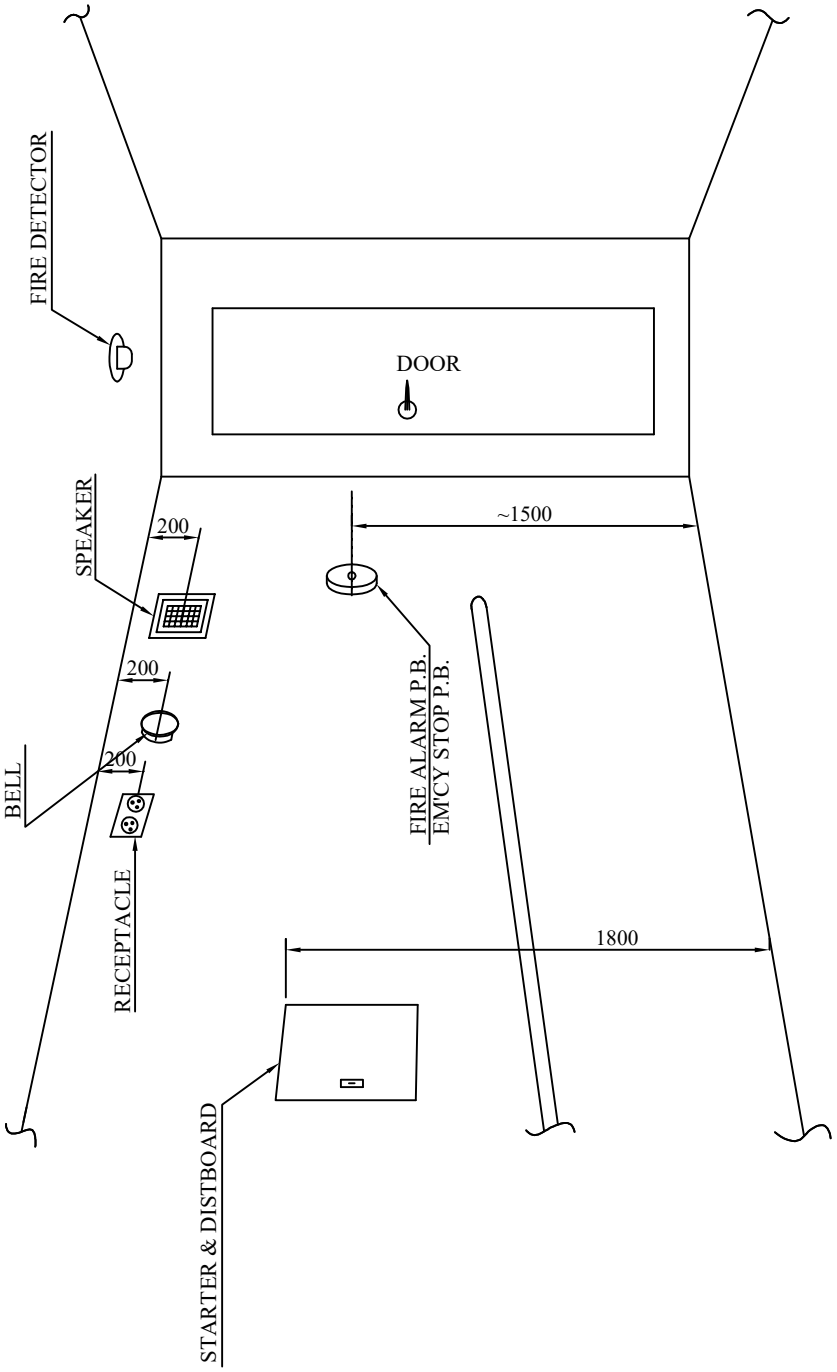
	GENERAL REFERENCE	PART NO: 08.08	32/63
	TYPICAL LAYOUT-TYPE "E"	DRG NO: 037-K5700200	



THE BERTH LAMP SHALL BE FITTED AT POSITION (A) OR (B).

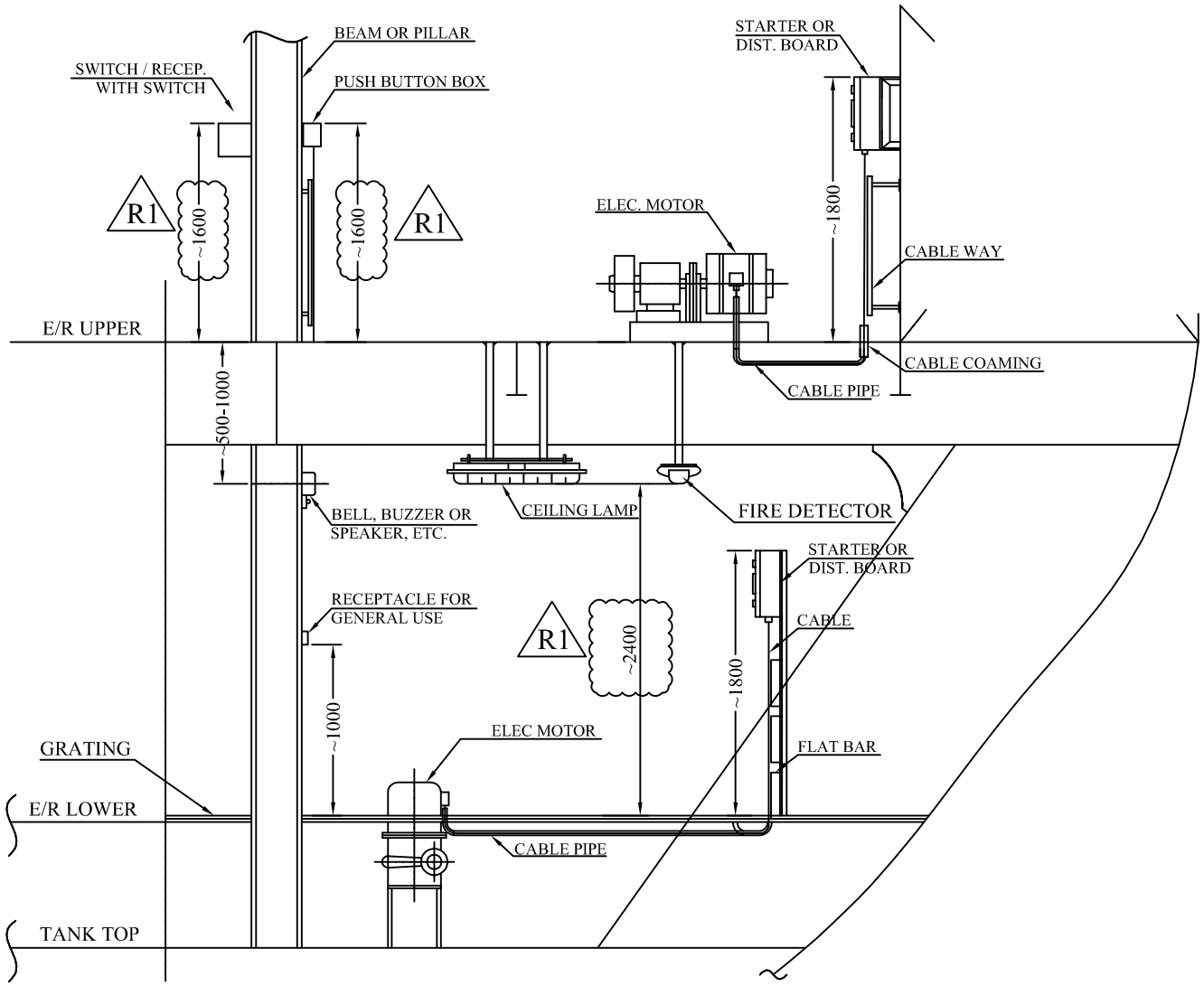
NOTE:- THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

	GENERAL REFERENCE	PART NO: 08.09	33 / 63
	APPARATUS IN ACCOM. PASSAGE-TYPICAL LAYOUT	DRG NO: 037-K5700200	



NOTE:- THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS BEST SUITING THE LOCATION.

	GENERAL REFERENCE	PART NO: 08.10	34 / 63
	TYPICAL LAYOUT ENGINE ROOM	DRG NO: 037-K5700200	



NOTE:- FLOOR LEVEL CAN BE TAKEN AS CHEQUERED PLATE LEVEL,ONLY IF THERE IS CHEQUERED PLATE;
THESE ARE GENERAL REFERENCE OF ELECTRICAL EQUIPMENTS INSTALLATION BEING USED
AS A GUIDE LINE. THE ACTUAL FITMENT MAY VARY ACCORDING TO THE REQUIREMENTS
BEST SUITING THE LOCATION.

	GENERAL REFERENCE	PART NO: 08.11	35 / 63
	CABLE PENETRATION	DRG NO: 037-K5700200	

WHILE ELEC. CABLE INSTALLATION IS CARRIED OUT, IT BECOMES ESSENTIAL THAT ELEC. CABLES HAVE TO BE PENETRATED THROUGH THE HULL STRUCTURE, FOR INSTANCE; BULKHEAD, STEEL WALL, DECK, WEB BEAM ETC.

WITH FOLLOWING CONCEPT.

1. CABLE PENETRATION TO BE MADE AND INSTALLED, NOT TO DAMAGE ELEC. CABLES.

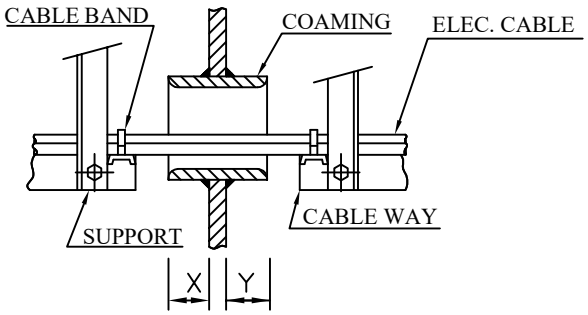
2. WHERE CABLES PASS THROUGH WATER TIGHT, FIRE PROOF AND GAS TIGHT BULKHEADS OR DECKS, PROPER PENETRATION METHOD TO BE APPLIED NOT TO AFFECT THE INTEGRITY OF SUCH BULKHEADS OR DECK. .

FOLLOWING FIGURES INDICATE TYPICAL METHOD OF CABLE PENETRATION RESPECTIVELY.

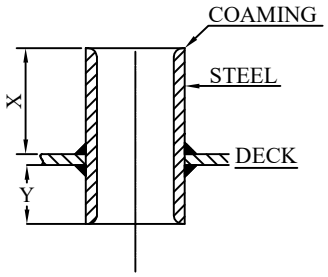
1) FOR NON-WATERTIGHT PENETRATION.

IN CASE THAT ELEC.CABLES PASS THROUGH NON CLASSIFIED STRUCTURE, I.E. NON-GASTIGHT, NON-FIRETIGHT OR NON WATERTIGHT, BELOW METHODS SHALL BE APPLIED.

A)BULKHEAD PENETRATION



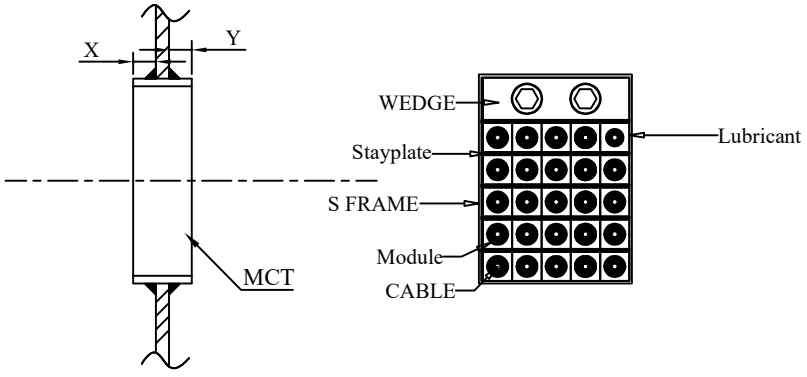
B) DECK PENETRATION



2) WATER TIGHT BULKHEADS/DECKS PENETRATION

I. BULKHEAD PENETRATION

A) MULTI CABLE TRANSIT (MCT)

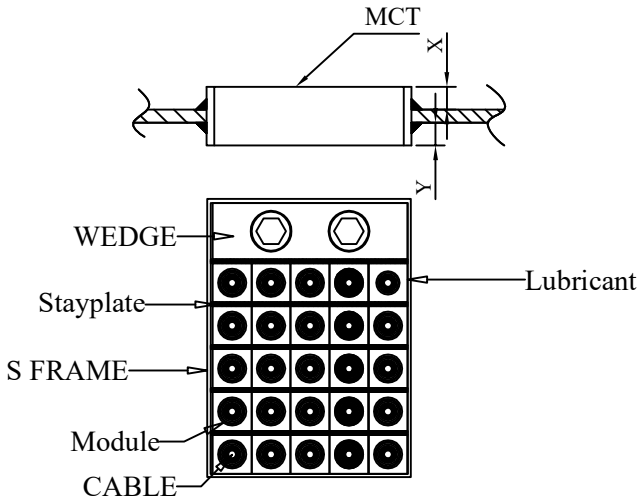


X,Y DIMENSIONS WILL BE AS INDICATED IN THE FIT. ARRG. DRG.

	GENERAL REFERENCE	PART NO: 08.12	36/63
	CABLE PENETRATION	DRG NO: 037-K5700200	

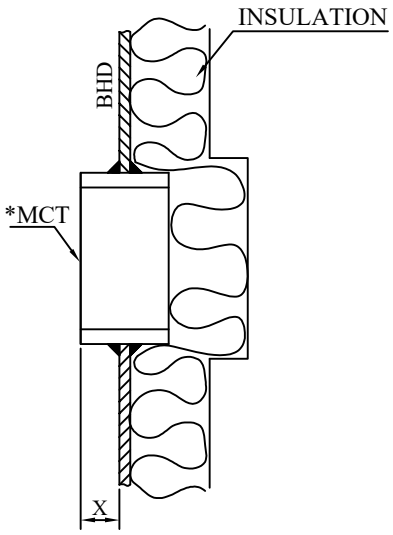
II. DECK PENETRATION

A) MULTI CABLE TRANSIT (MCT)

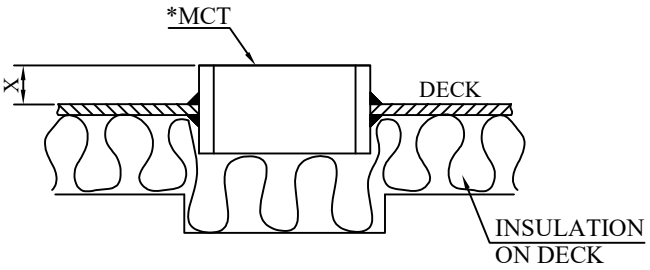


III.) IN CASE OF INSULATION / FLOATING FLOOR

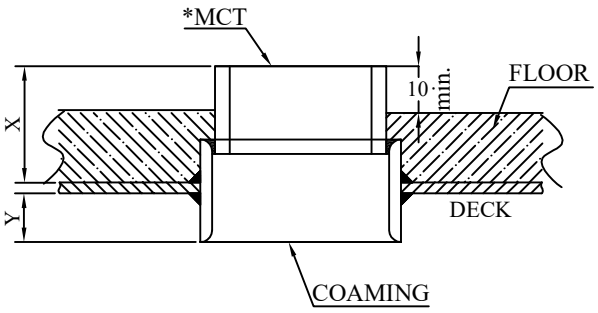
A. BULKHEAD PENETRATION



II. DECK PENETRATION-1



II. DECK PENETRATION-2



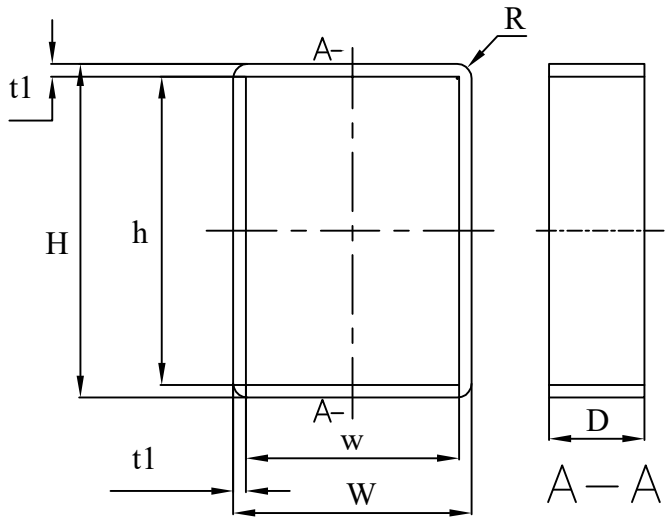
* MCT FIXING IS AS PER THE FIT. ARRG. DRG.

B.) INSULATION TO BE PROVIDED OVER MCT AS REQUIRED BY THE TYPE APPROVAL CERTIFICATE DETAILS

COAMING END TO BE FITTED 10MM FROM THE HEAT RESISTING SURFACE.

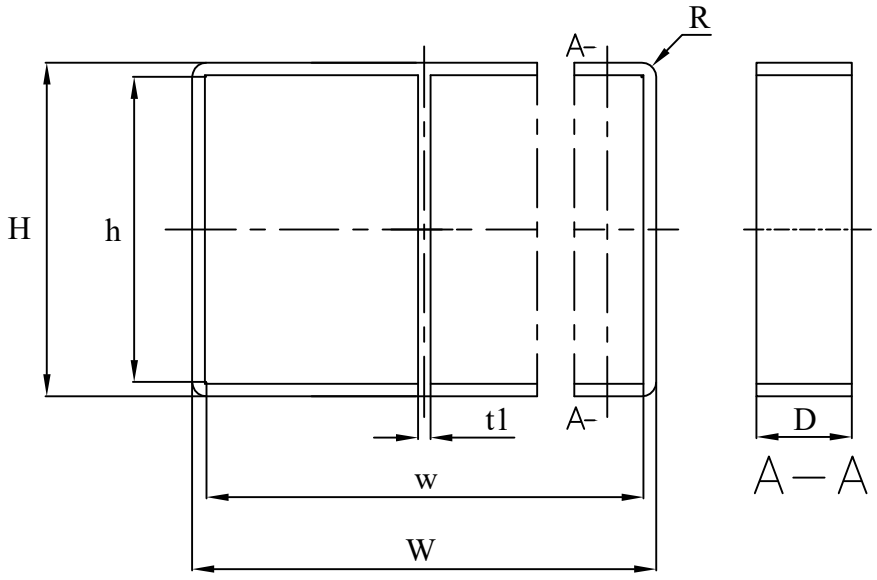
X,Y DIMENSIONS WILL BE AS INDICATED IN THE FIT. ARRG. DRG.

	GENERAL REFERENCE	PART NO: 08.12	37/63
	MCT FRAME	DRG NO: 037-K5700200	



SZx1

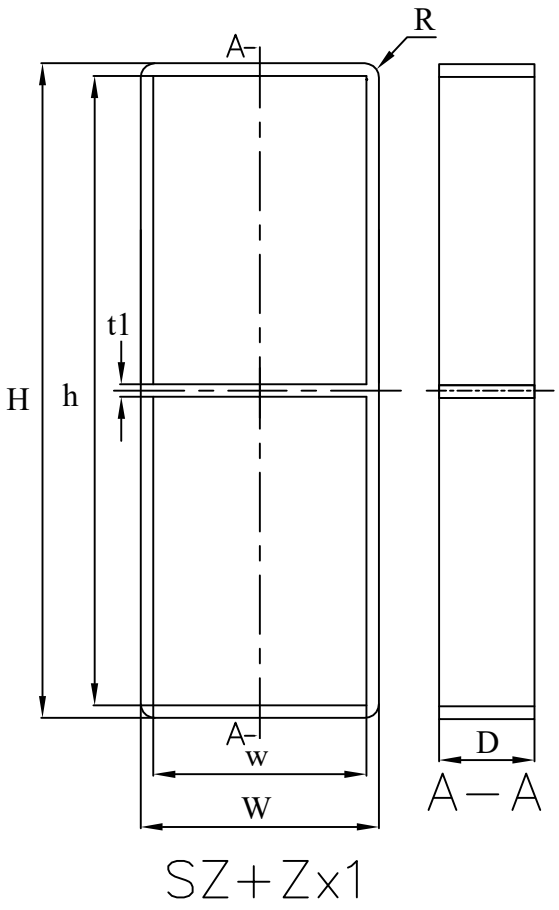
Z=Frame size
N=Number of Horizontal openings



SZxN

Pos	h	w	D	t1	t2	R
mm	H-20	W-20	60	10	20	R 10

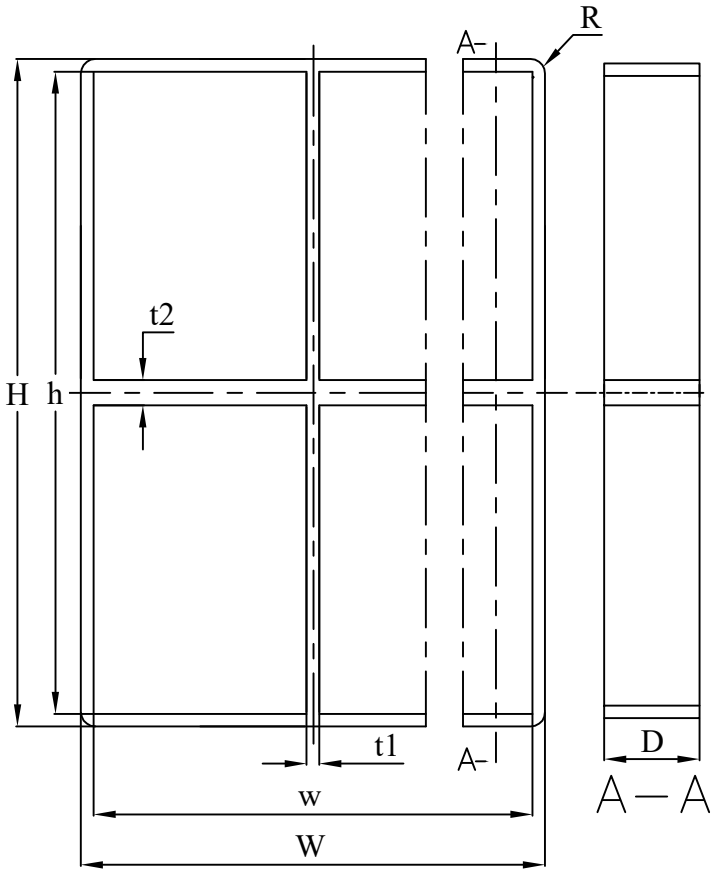
	GENERAL REFERENCE	PART NO: 08.12	38 / 63
	MCT FRAME	DRG NO: 037-K5700200	



SZ+Zx1

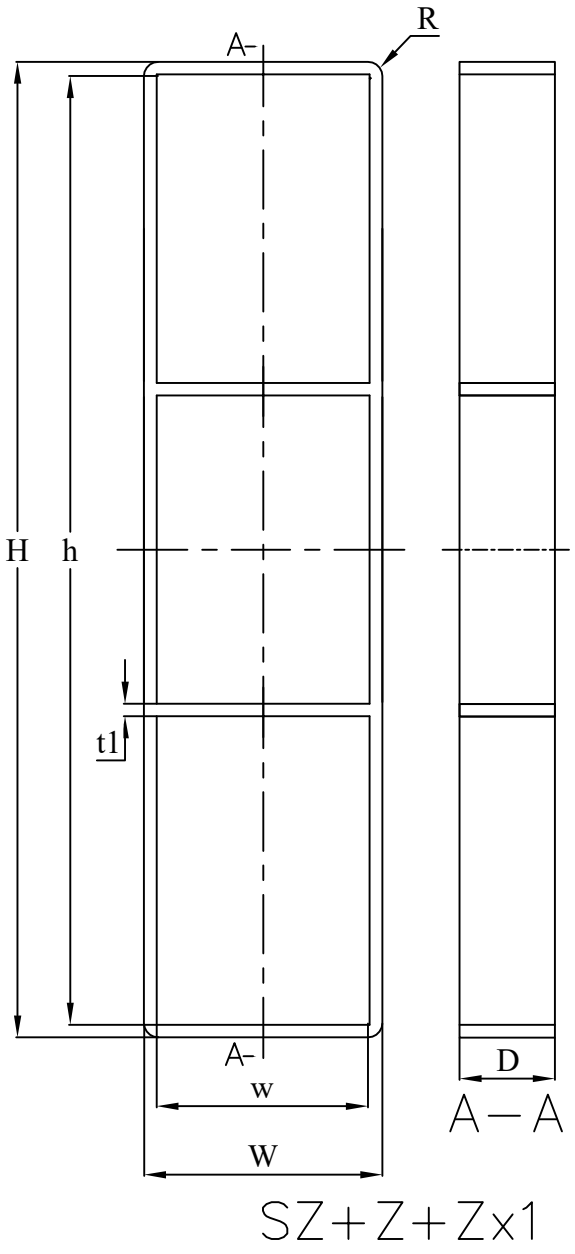
Z=Frame size
N=Number of Horizontal openings

Pos	h	w	D	t1	t2	R
mm	H-20	W-20	60	10	20	R 10



SZ+ZxN

	GENERAL REFERENCE	PART NO: 08.12	39/63
	MCT FRAME	DRG NO: 037-K5700200	

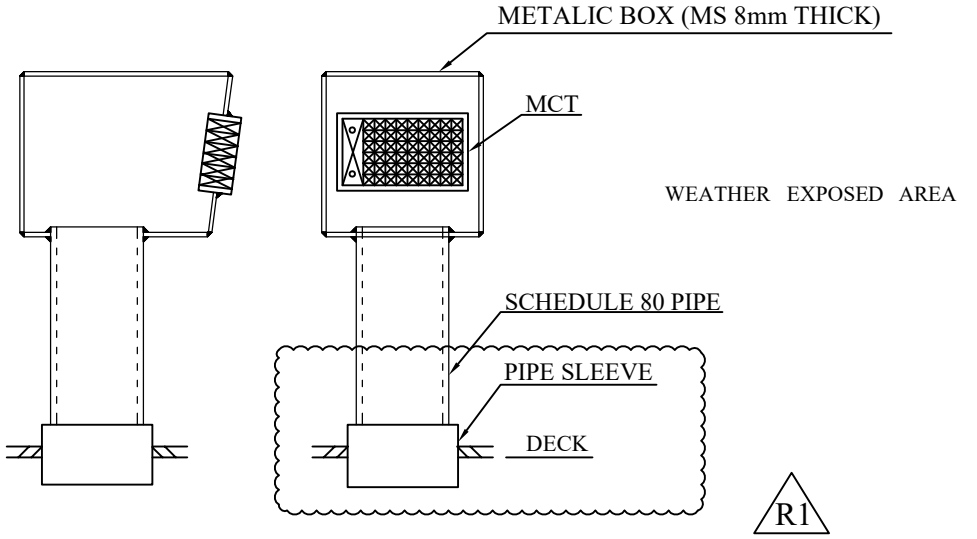


Z=Frame size

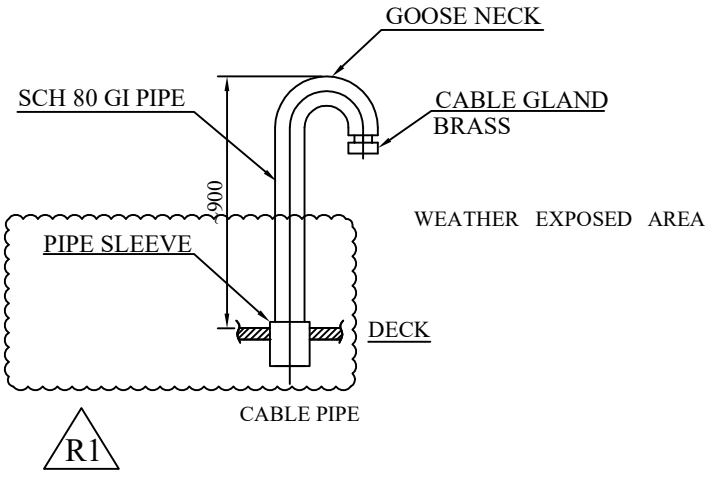
Pos	h	w	D	t1	t2	R
mm	H-20	W-20	60	10	20	R 10

	GENERAL REFERENCE	PART NO: 08.13	40 / 63
	CABLE PENETRATION TO WEATHER EXPOSED AREA	DRG NO: 037-K5700200	

CABLE PENETRATION PIPE



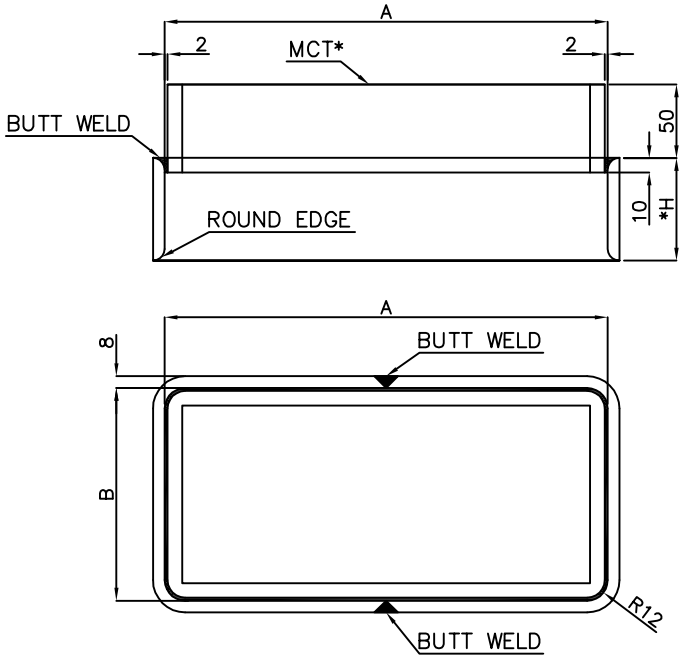
GOOSE NECK



* CAN BE USED MCT FOR MULTIPLE CABLE INSTALLATION

	GENERAL REFERENCE	PART NO: 08.14	41/63
	CABLE COAMING WITH MCT	DRG NO: 037-K5700200	

CABLE COAMING WITH MCT IS USED WHERE FLOATING FLOOR IS THERE IN DECK



MATERIAL: 8 THICK STEEL PLATE

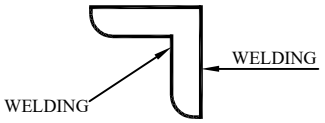
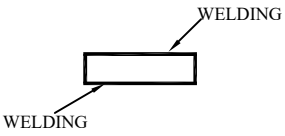
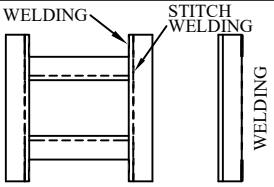
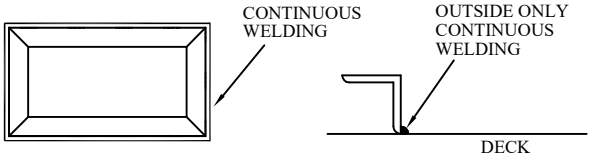
PIECE MARK	DIMENSIONS		MCT	REMARKS
	A	B		
DCS2x1_H	125	145	S2x1	DECK PENETRATION
DCS4X1_H	184	145	S4x1	– do –
DCS6x1_H	242	145	S6x1	– do –
DCS6x2_H	242	275	S6x2	– do –
DCS8x1_H	302	145	S8x1	– do –
DCS8x2_H	302	275	S8x2	– do –
DCS6+6x1_H	470	145	S6+6x1	– do –
DCS8+8x1_H	590	145	S8+8x1	– do –

* "H" DEPENDS UPON THE THICKNESS OF THE FLOATING FLOOR.

	GENERAL REFERENCE	PART NO: 08.15	42/63
	WELDING METHOD	DRG NO: 037-K5700200	

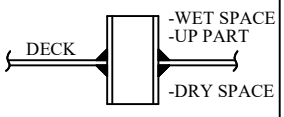
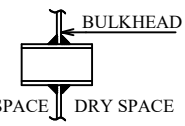
1. THE SUPPORT FOR ELECTRIC EQUIPMENT SUCH AS CABLE HANGER, ELECTRIC LIGHTING, STARTER, PANEL TO BE WELDED AS FOLLOWS.

1) ALL AREA (DRY SPACE, WEATHER & WET SPACE ETC.)

ITEM	WELDING METHOD	WELDING		APPLICATION AREA
		LEG LENGTH	METHOD	
ANGLE TYPE SUPPORT		t < 8 : 3.5 t ≥ 8 : 4.5	BOTH SIDE FULL WELDING	ALL AREA
FB TYPE SUPPORT		t< 8 : 3.5 t ≥8 : 4.5	BOTH SIDE FULL WELDING	ALL AREA
DIRECT WALL TYPE SEAT		t< 8 : 3.5 t≥ 8 : 4.5	ENDSIDE BOTH WELDING OUTSIDE STITCH WELDING	ALL AREA
DECK MOUNTING TYPE SEAT (MSB, ECC, ETC-)				WHEEL HOUSE ENGINE CONTROL RM & SIMILAR SPACE ENGINE S/G RM OPEN AREA AND SIMILAR SPACE

2. WELDING FOR CABLE PENETRATION PIECE

THE CABLE PENETRATION PIECES FITTED TO INNER DECK OR BULKHEAD INCLUDING "A" OR "B" CLASS FIRE DIVISION ARE WELDED ON DECK BOTH SIDES AS FOLLOWING.

TYPE	INTERNAL DECK	INTERNAL BULKHEADS
COAMING & COLLAR		

R1

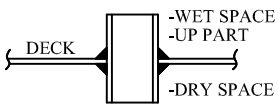
3. PADS TO BE PROVIDED FOR FOLLOWING ELECTRICAL EQUIPMENT SEATS & CABLE TRAY SUPPORTS

1. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, CABLE WAY SUPPORTS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.

2. IF THE STIFFNERS/GIRDERS NOT AVAILABLE, EQUIPMENT SEATS ARE TO BE WELDED TO THE DECK/BHD, DOUBLER PLATES ARE TO BE PROVIDED.

	GENERAL REFERENCE	PART NO:	42A / 63
	WELDING METHOD	DRG NO: 037-K5700200	

3. WELDING FOR CABLE PENETRATION PIECE
THE CABLE PENETRATION PIECES FITTED TO INNER DECK OR BULKHEAD INCLUDING "A" OR "B" CLASS FIRE DIVISION ARE WELDED ON DECK BOTH SIDES AS FOLLOWING.

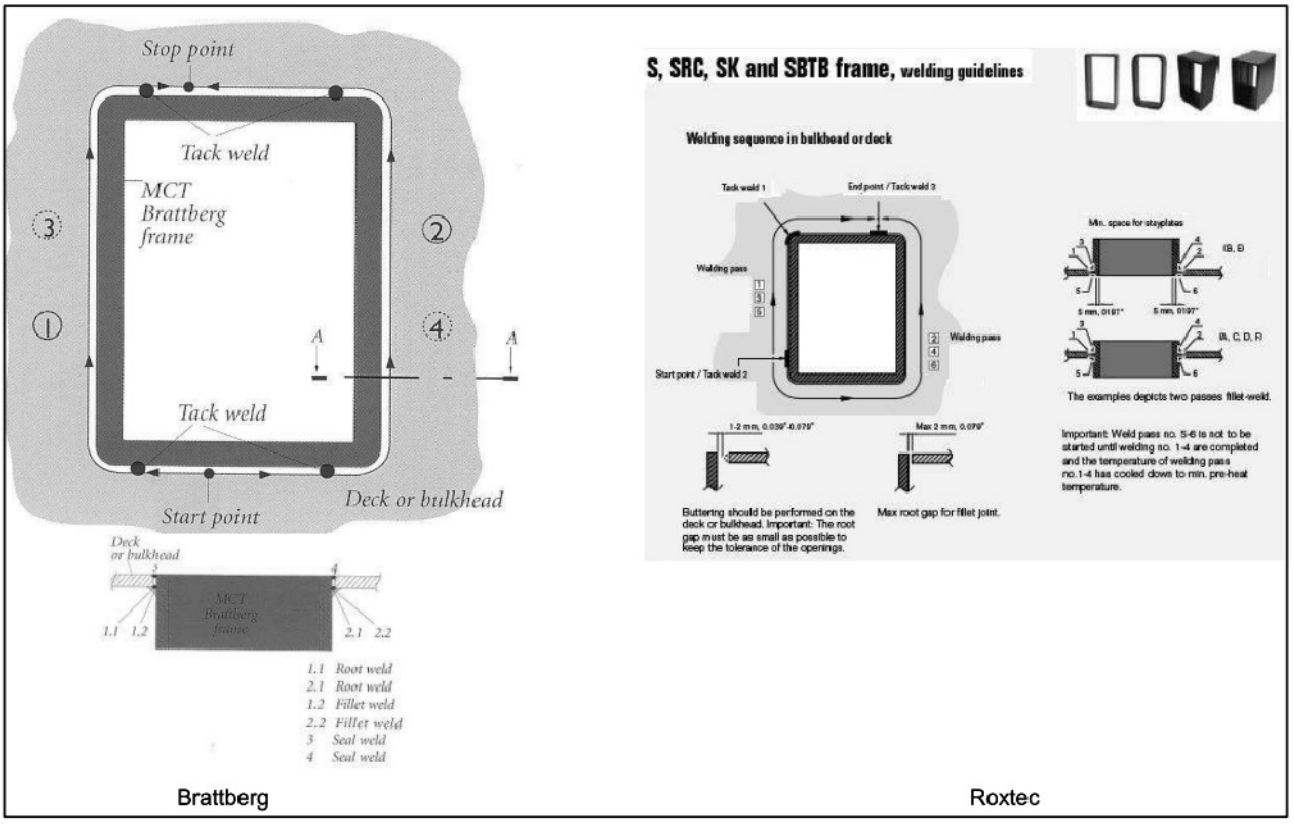
TYPE	INTERNAL DECK	INTERNAL BULKHEADS
COAMING & COLLAR		

4. WELDING FOR MCT FRAMES

2.5.1.2 Welding instructions

Another issue which is very important to take into account are the instructions for welding such MCT frames.

If the welding instructions are not followed there might be a change that the frame is deformed. In that case the penetration cannot be fully closed and tightened. All penetrations have to be through welded at both sided.

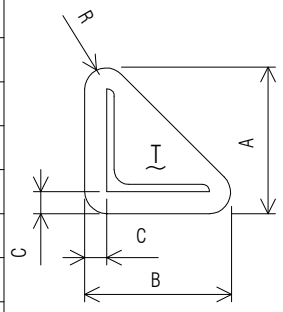


R1

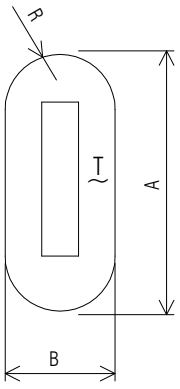
	GENERAL REFERENCE	PART NO: 08.16	43/63
	PAD DETAILS	DRG NO: 037-K5700200	

SCOPE:
THIS STANDARD COVERS PAD FOR CABLE RACK SUPPORTS AND GENERAL USE.
1. SHAPE AND DIMENSIONS.
Shall be as shown in following table.
2. MATERIAL
Steel plate IS 1079

ANGLE SUPPORT PAD DIMENSION

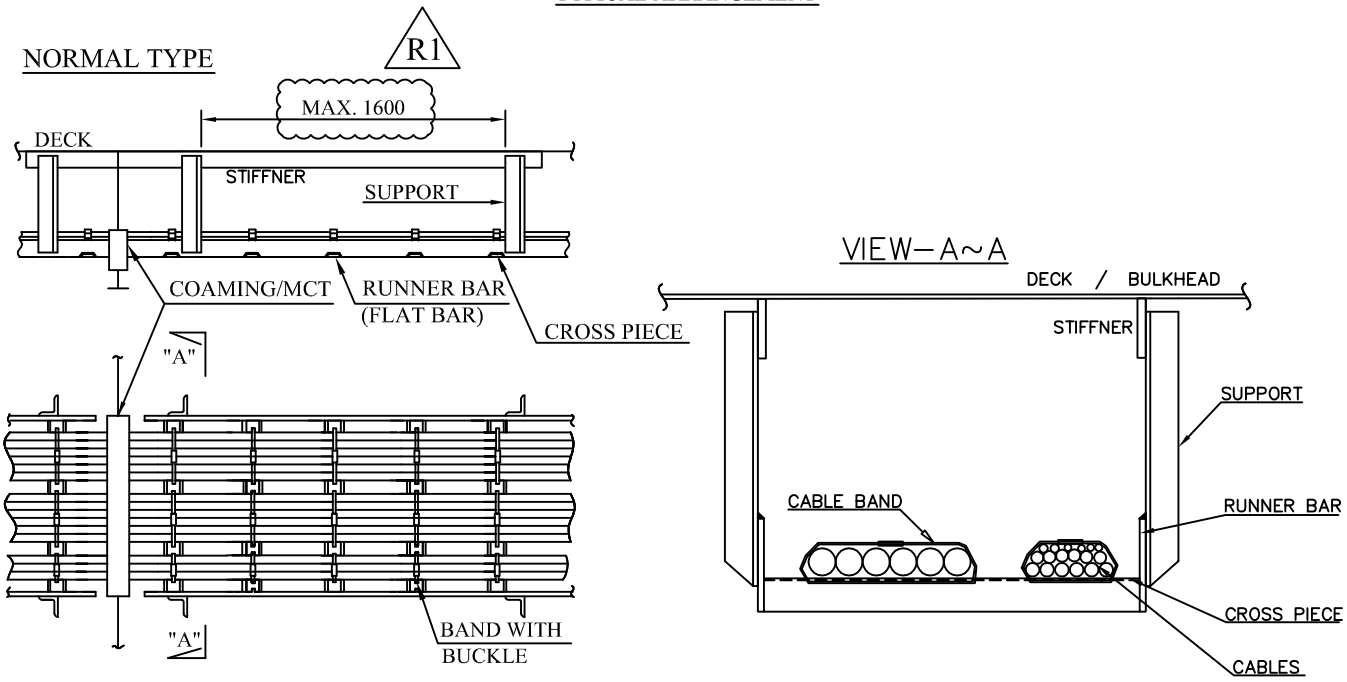
TYPE		DIMENSION					WEIGHT (Kg/M)	ANGLE DIMENSION
PIECE MARK	SKETCH	A	B	C	R	T		
L1		55	55	12	10	6	0.09	30X30X5, 30X30X3
L2		65	65	12	15	6	0.15	40X40X3, 40X40X5, 40X40X6
L3		70	70	12	15	6	0.17	45X45X5, 45X45X6
L4		75	75	12	15	6	0.20	50X50X6, 50X50X4
L5		85	85	12	15	6	0.24	60X60X6
L6		90	90	12	15	8	0.43	65X65X8, 65X65X6
L7		95	95	12	15	8	0.47	70X70X8
L8		100	100	12	15	8	0.53	75X75X9, 75X75X6, 75X75X8
L9		105	105	12	15	8	0.60	80X80X8
L10		115	115	12	15	12	0.93	90X90X10,90X90X7
L11		125	125	12	15	12	1.10	100X100X10
L12		155	155	12	15	12	1.70	130X130X12, 130X130X9
L13		175	175	12	15	12	2.16	150X150X15, 150X150X12

FLATBAR SUPPORT PAD DIMENSION

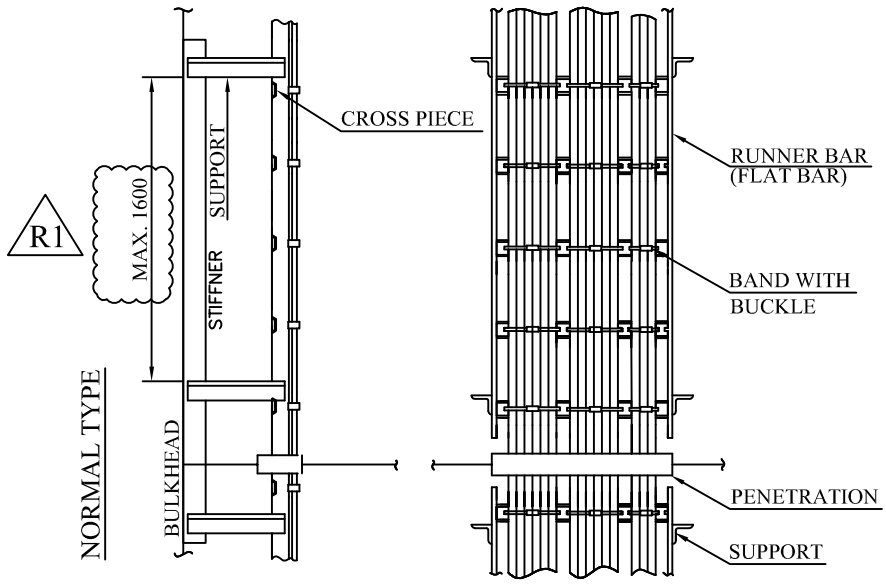
TYPE		DIMENSION				WEIGHT (Kg/M)	FLATBAR DIMENSION
PIECE MARK	SKETCH	A	B	R	T		
G1		60	32	16	6	0.09	26X6 FB
G2		70	32	16	6	0.10	38X4.5,35X6,38X6,40X6 FB
G3		80	32	16	6	0.11	50X6 FB
G4		100	32	16	6	0.14	65X6,65X8FB
G5		100	32	16	6	0.14	75X6
G6		140	38	16	6	0.24	100X6FB
H2		90	38	19	10	0.24	50X10FB
H3		110	38	19	10	0.30	65X10FB
H4		120	38	19	10	0.33	75X10FB
J2		100	50	25	12	0.42	50X12,50X16,50X19FB
J3		120	50	25	12	0.51	65X12,65X16,65X19FB
J4		130	50	25	12	0.56	75X12FB
J5		140	50	25	12	1.61	90X12FB
J6		150	50	25	12	1.66	100X12,100X10FB

	INSTALLATION OF CABLE WAY	PART NO: 09.01	44/63
	HORIZONTAL CABLE RACK	DRG NO: 037-K5700200	

TYPICAL ARRANGEMENT

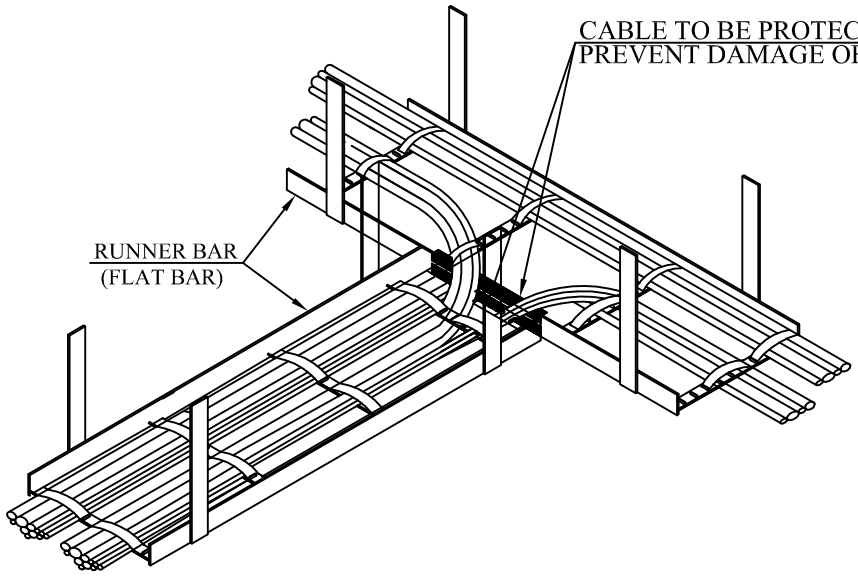


VERTICAL TYPE CABLE RACK



	INSTALLATION OF CABLE WAY	PART NO: 09.02	45/63
	TURNING METHOD OF MAIN CABLE WAY (TYPICAL)	DRG NO: 037-K5700200	

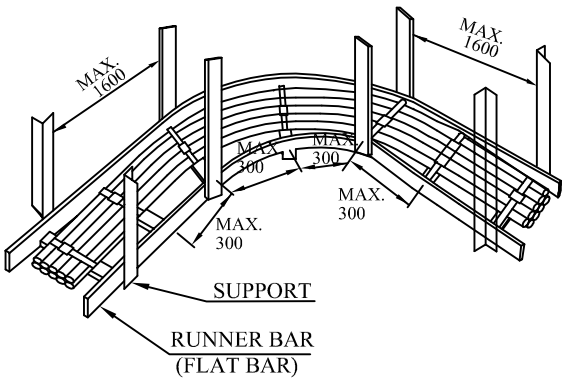
TURNING METHOD OF MAIN CABLE WAY



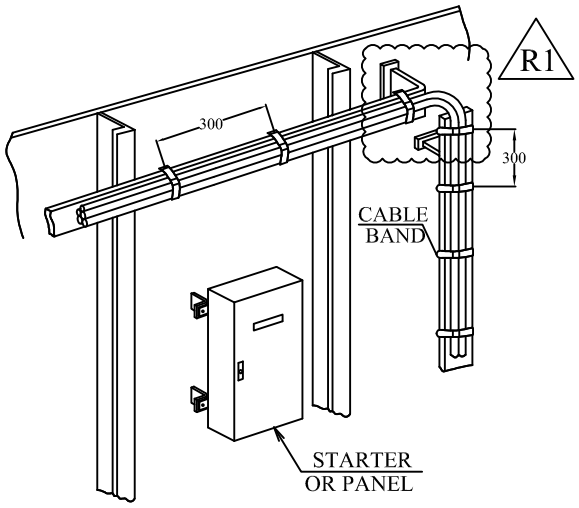
WHERE CABLE WAY CURVED

THE CABLE SHALL BE INSTALLED ON ADEQUATE HANGER SUPPORT AS SHOWN ON FOLLOWING FIGURE.

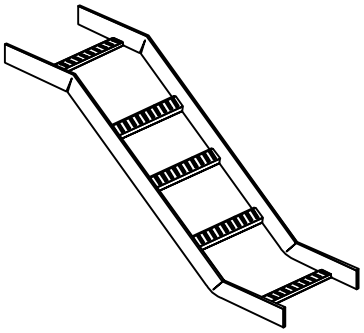
BENDING RADIUS OF HANGER ROUTE TO BE AS PER CABLE MAKERS DETAILS.



CURVED & BRANCH CABLE WAY

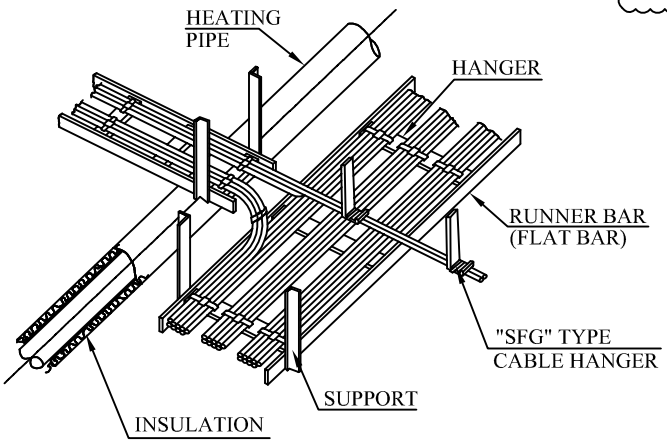


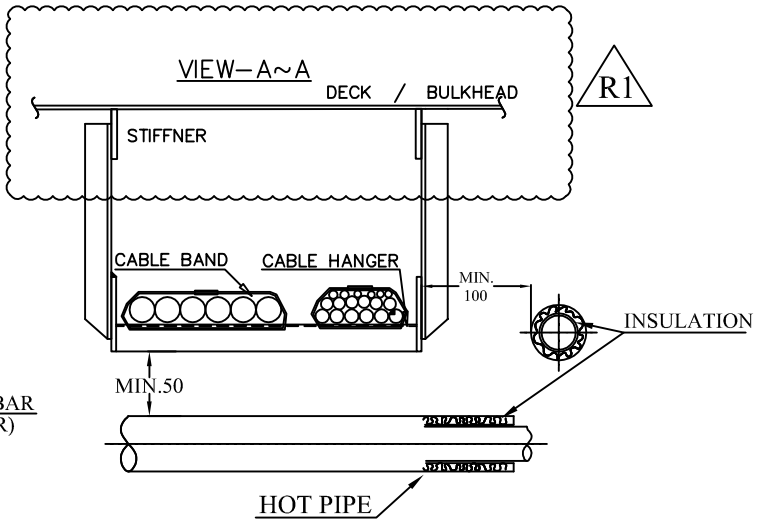
METHOD FOR CABLE WAY BENDING ~45°



	INSTALLATION OF CABLE WAY	PART NO: 09.03	46 / 63
	CABLE WAY IN NEAR HOT PIPES	DRG NO: 037-K5700200	

DISTANCE FROM HOT PIPE

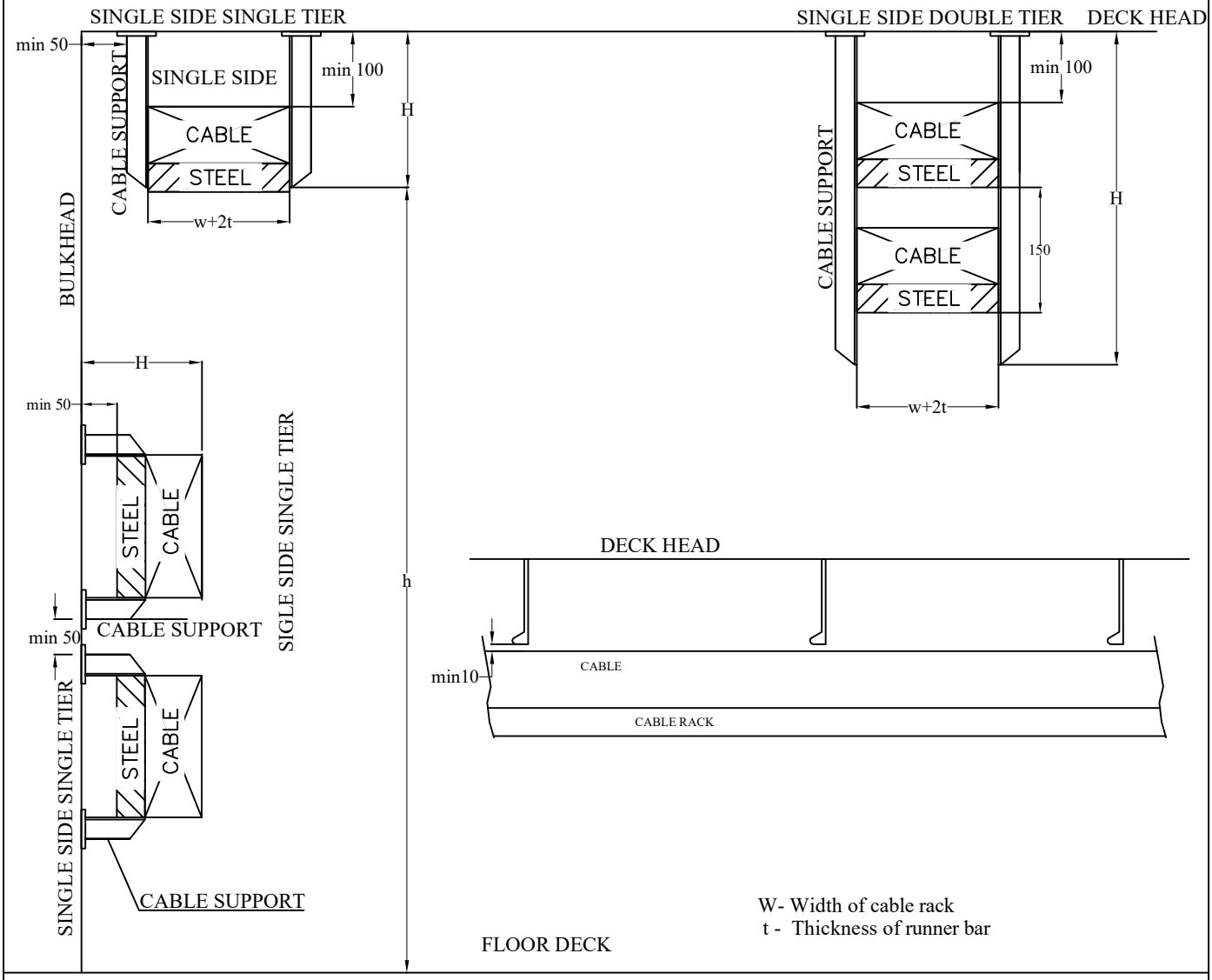




NOTE

1. IN CASE THAT CABLES RUN ACROSS THE HEATING, STEAM & EXH. GAS PIPE, THE DISTANCE TO BE KEPT NOT LESS THAN 50mm AND IN CASE OF RUNNING PARALLEL, THE DISTANCE TO BE KEPT NOT LESS THAN 100mm.

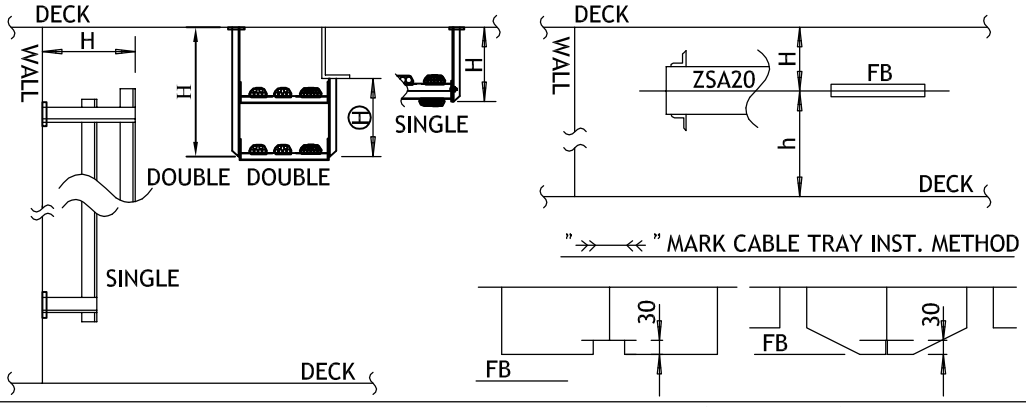
	INSTALLATION OF CABLEWAY	**PART NO: 09.04**	47 / 63
	INSTALLATION METHOD OF CABLE WAY	**DRG NO: 037-K5700200**	



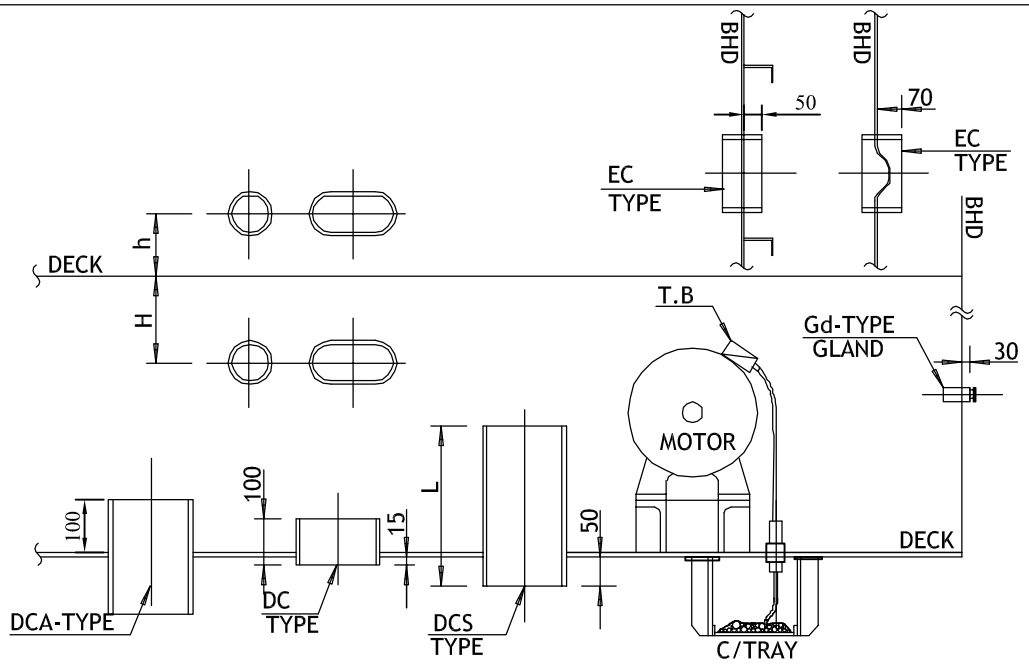
	INSTALLATION OF CABLEWAY	PART NO: 09.05	48 / 63
	STANDARD HEIGHTS	DRG NO: 037-K5700200	

STANDARD HEIGHTS

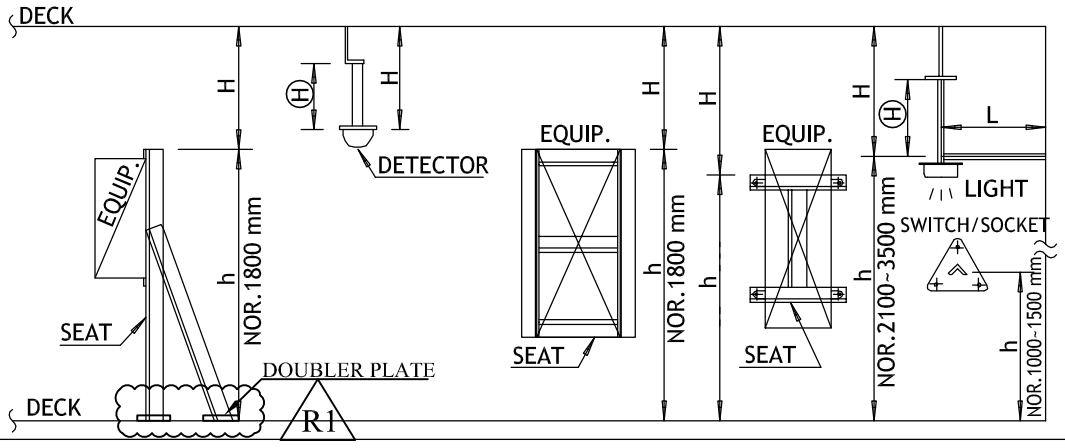
CABLE HANGER



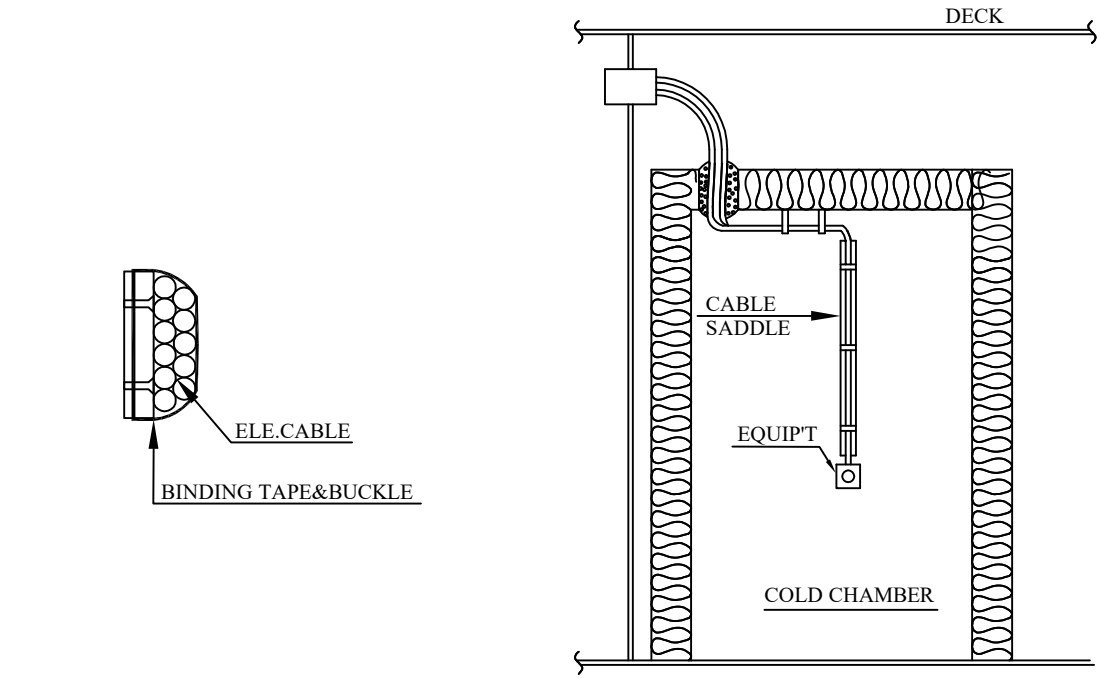
COAMING & GLAND

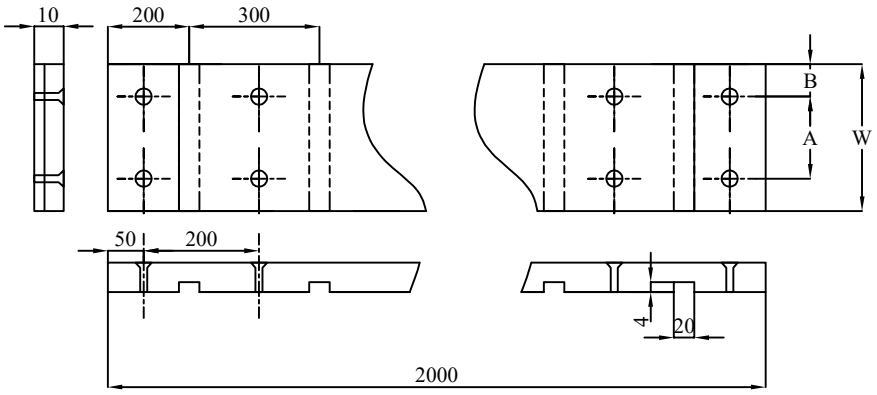


SEAT

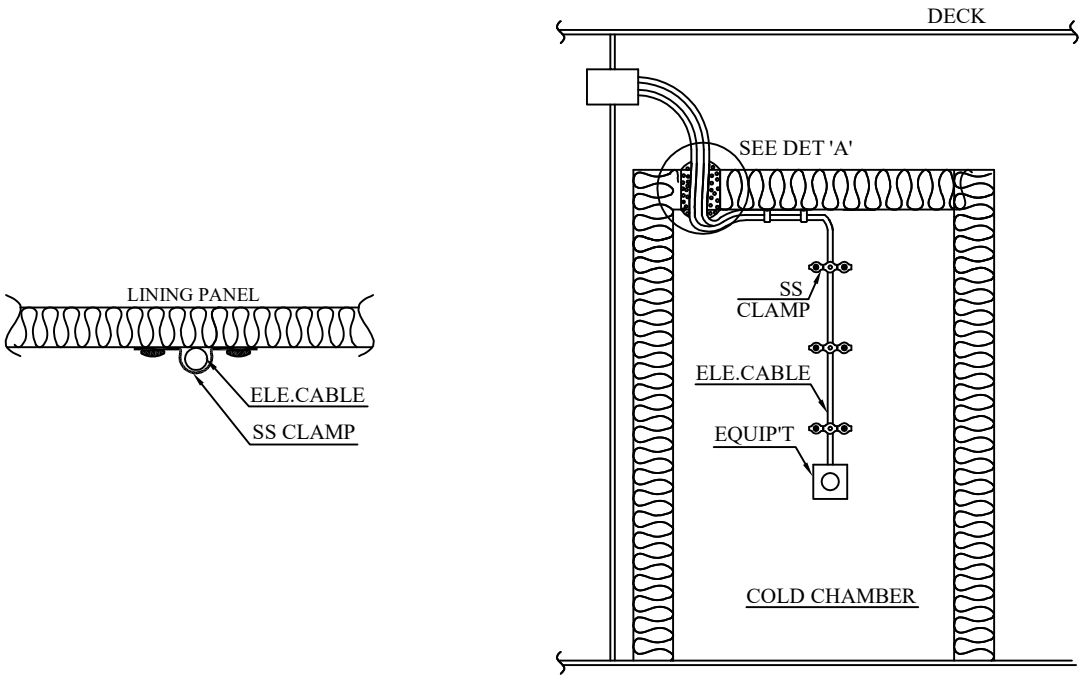


	INSTALLATION OF CABLE WAY REFRIGERATION CHAMBER	**PART NO: 10.01**	49 / 63
	CABLE WAY- NYLON TYPE	**DRG NO: 037-K5700200**	

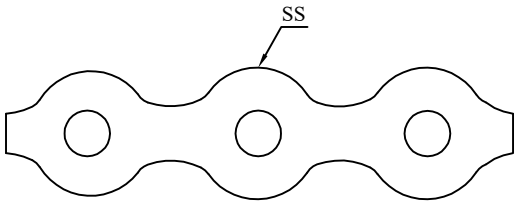


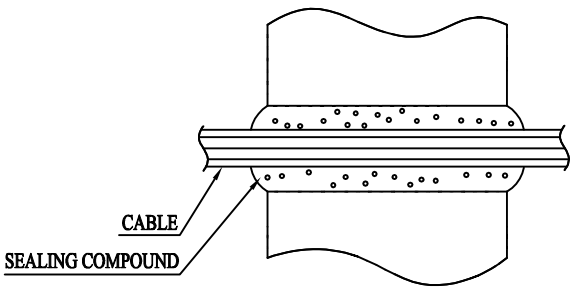


	INSTALLATION OF CABLE WAY REFRIGERATION CHAMBER	PART NO: 10.02	50 63
	CABLE WAY- STAINLESS STEEL CLAMP TYPE	DRG NO: 037-K5700200	



1. STAINLESS STEEL CLAMP

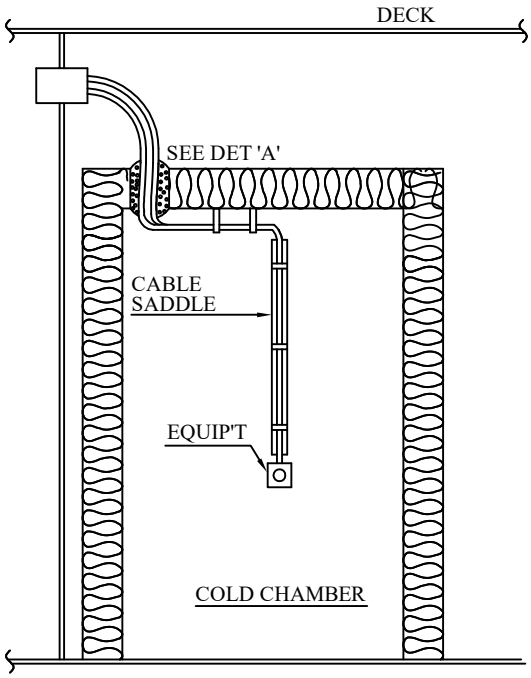




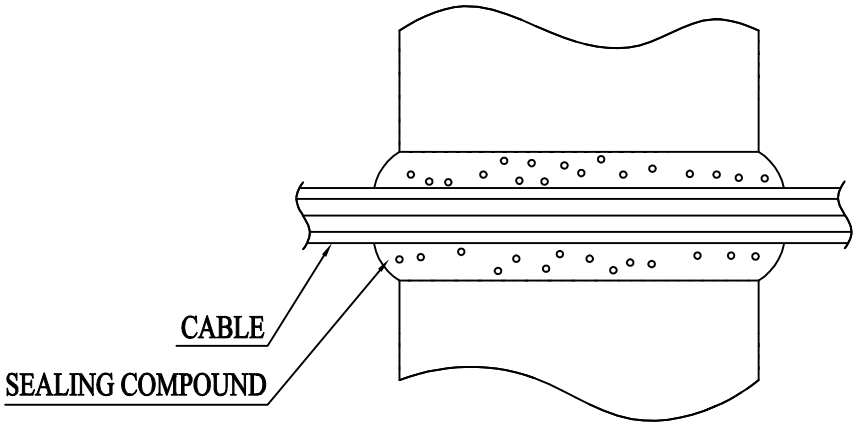
DETAIL 'A'

INSTALLATION METHOD

	INSTALLATION OF CABLE WAY REFRIGERATION CHAMBER	**PART NO: 10.03**	**51 / 63**
	INSULATION PENETRATION	**DRG NO: 037-K5700200**	



INSTALLATION METHOD

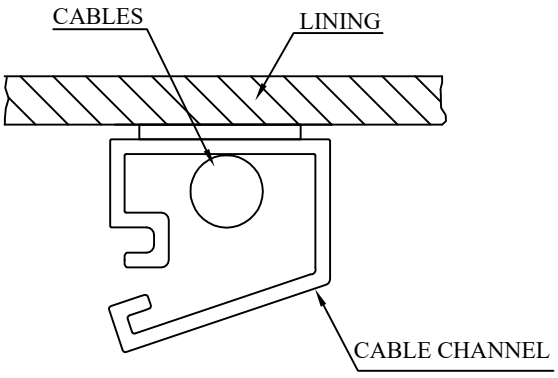


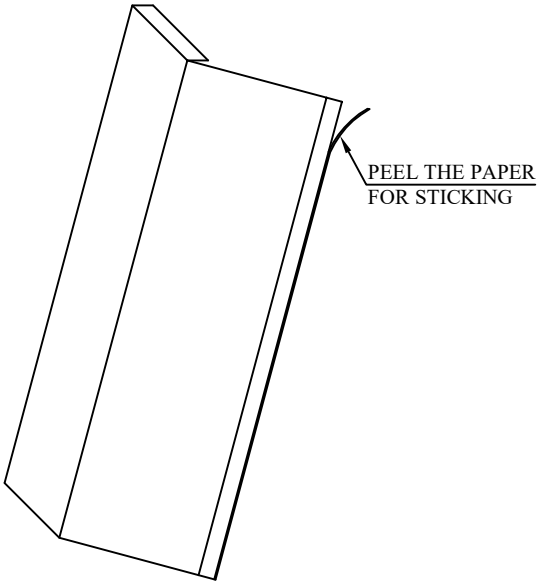
DETAIL 'A'

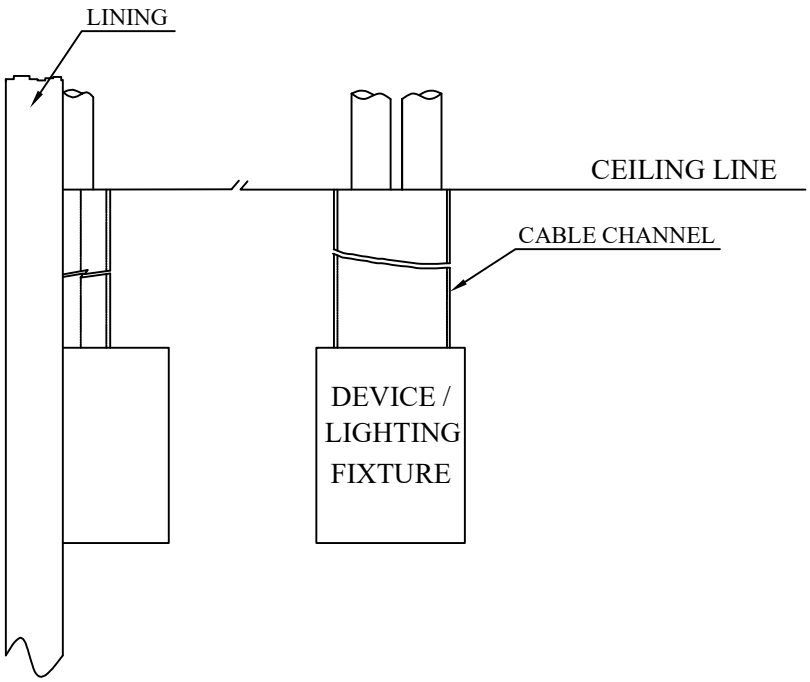
	INSTALLATION OF CABLE	PART NO: 11.01	52/63
	CABLE CHANNEL	DRG NO: 037-K5700200	

CABLE CHANNEL (STICKING TYPE)

Plastic cable channel or accommodation panelling channels shall be used for covering cables in accommodation spaces where cables can not be concealed.



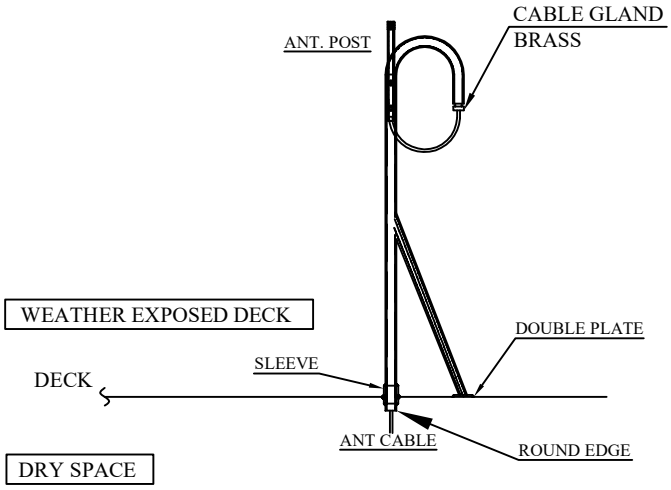


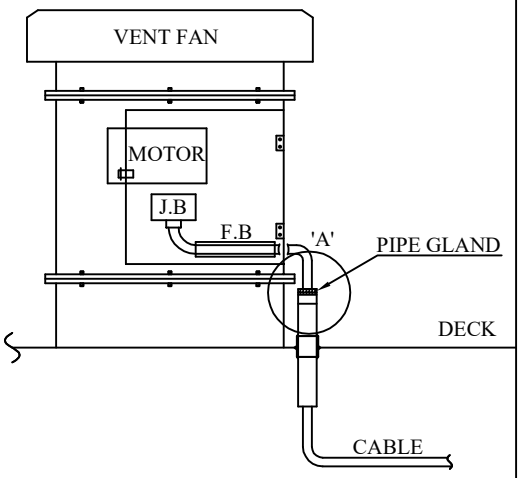


CHANNELS SHOULD BE FREE FROM SCRATCHES
IMPRESSIONS ETC TO BE SUPPLIED IN FINE FINISH.

	INSTALLATION OF CABLE	PART NO: 11.02	53/63
	BRANCHED CABLE- WEATHER EXPOSED AREA	DRG NO: 037-K5700200	

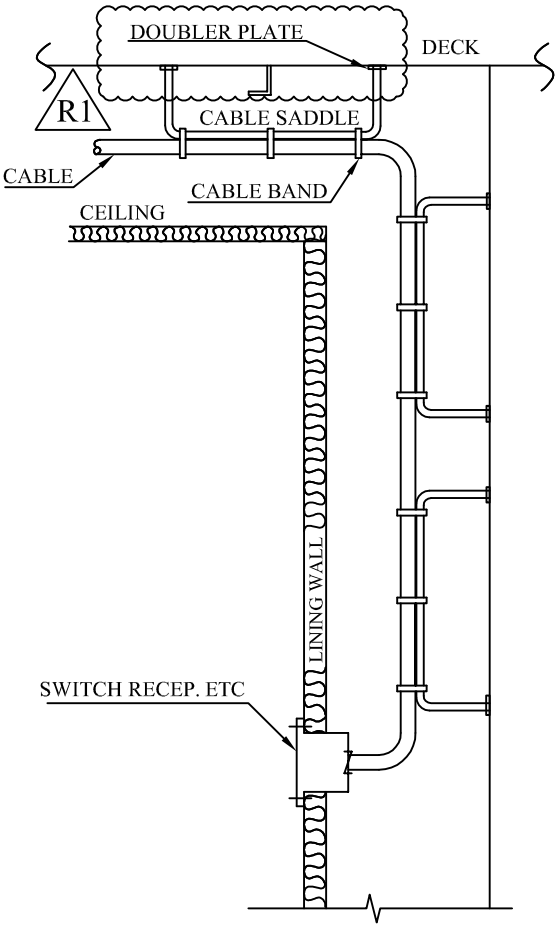
2. ANTENNA CABLE AT WEATHER EXPOSED AREA



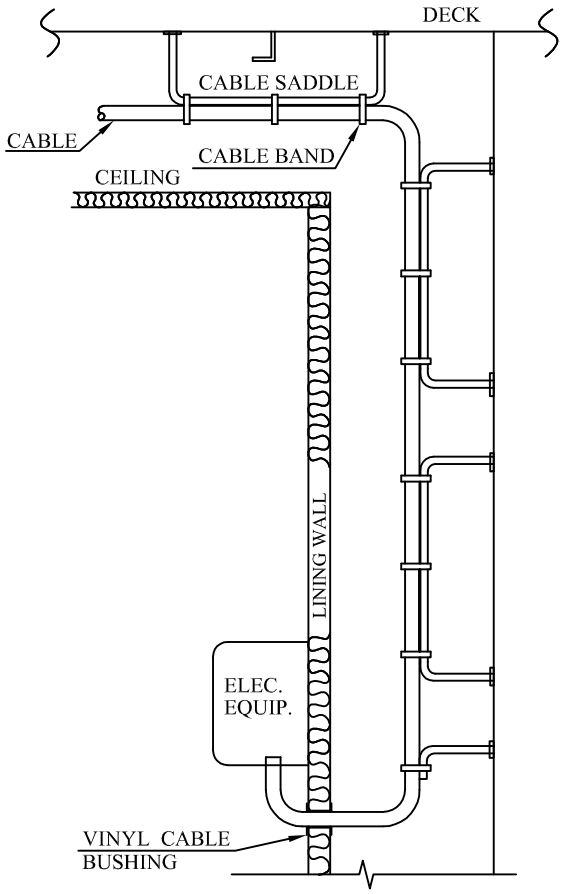


	INSTALLATION OF CABLE	PART NO: 11.03	54/63
	BRANCHED CABLE - ACCOM. SPACE	DRG NO: 037-K5700200	

1. BRANCH CABLE WAY BETWEEN STEEL BULKHEAD AND LINING WALL

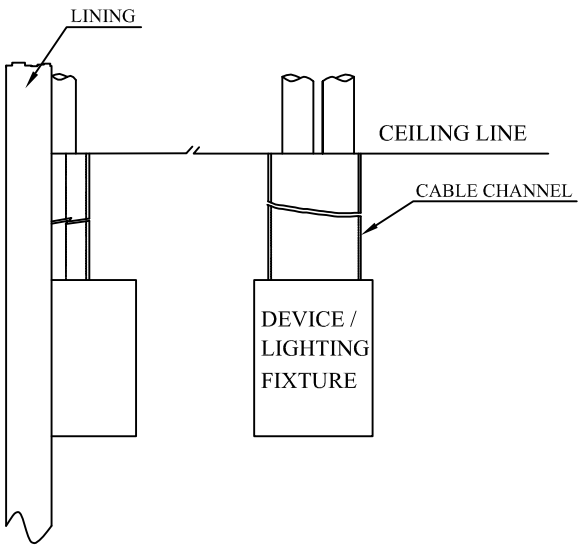


FLUSH TYPE EQUIP

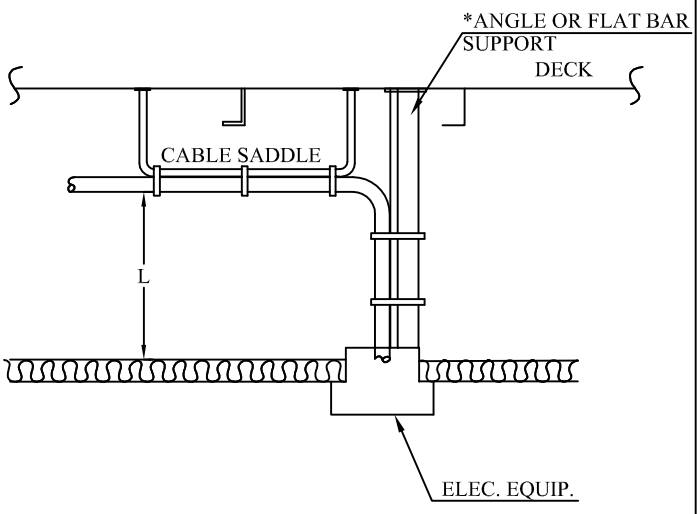


SURFACE TYPE

2. BRANCH CABLE WAY IN LINING PANEL



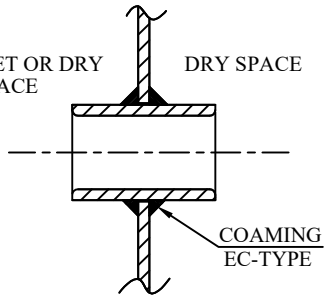
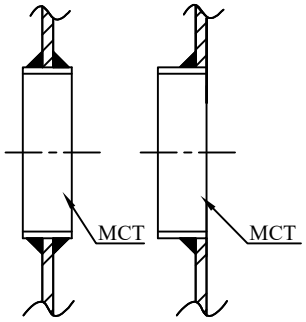
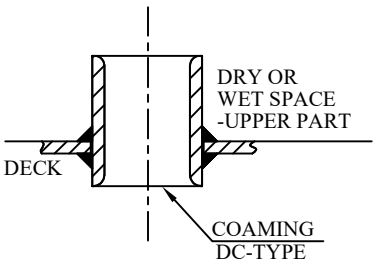
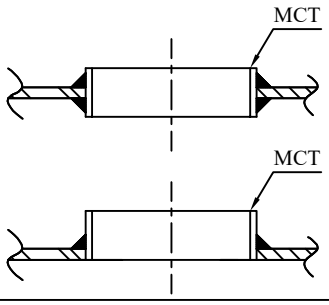
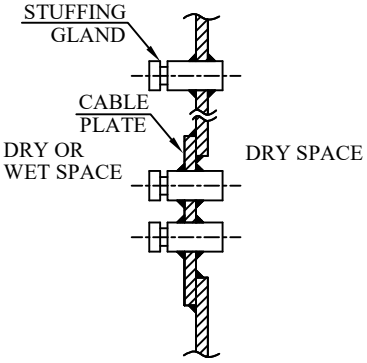
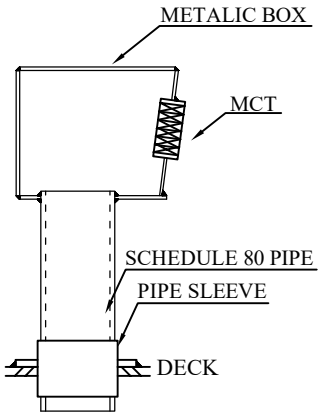
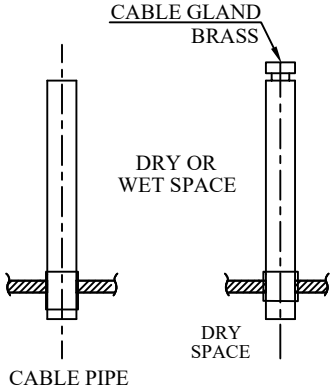
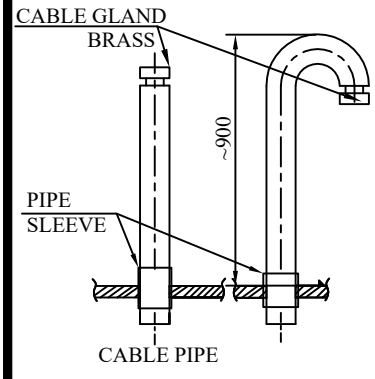
3. BRANCH CABLE WAY IN CEILING



*IF 'L' IS MORE THAN 500 MM,ONLY CEILING PANEL SUPPORT CAN BE USED FOR SUPPORTING CABLES.

	INSTALLATION PRACTICE ON PENETRATIONS	PART NO: 12.01	55/63
	INSTALLATION METHOD OF CABLE COAMING	DRG NO: 037-K5700200	

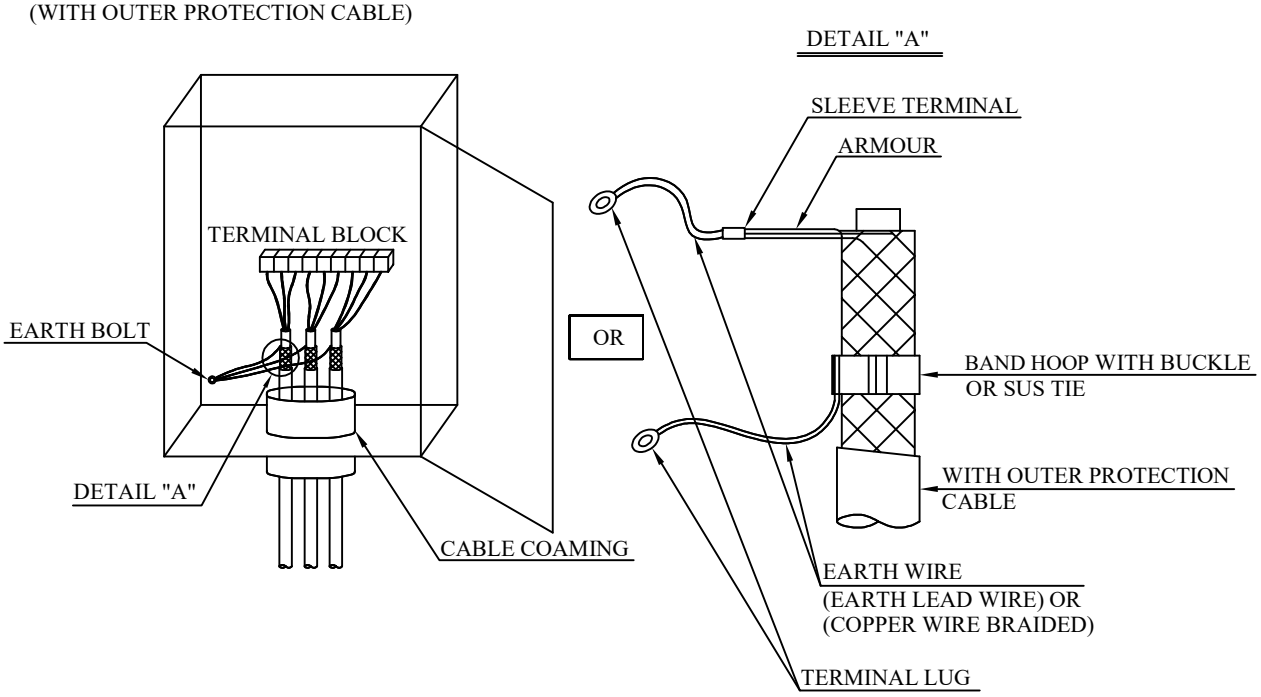
ALL FILLET WELDING (SIDE OF WELD = MINIMUM 4.0mm)

TYPE	BOTH SIDES		BOTH SIDES	
	FIG	AREA	FIG	AREA
GIRDER BEAM/ BHD		ACC. E/R NWT BHD		WT BHDS / DECKS (A60) CLASS DIVISION
DECK		ACC. E/R NWT DECKS		WT BHDS / DECKS (A60) CLASS DIVISION
DECK BULKHEAD GIRDER BEAM		ACC. E/R (A,B) CLASS DIVISION WEATHER EXPOSED AREA WT BHDS / DECKS (A60) CLASS DIVISION		WEATHER EXPOSED AREA
DECK (CABLE PIPE)		ACC. E/R (A,B) CLASS DIVISION		WEATHER EXPOSED AREA

	INSTALLATION PRACTICE ON EARTHING	PART NO: 13.01	56 / 63
	GENERAL DESCRIPTION	DRG NO: 037-K5700200	

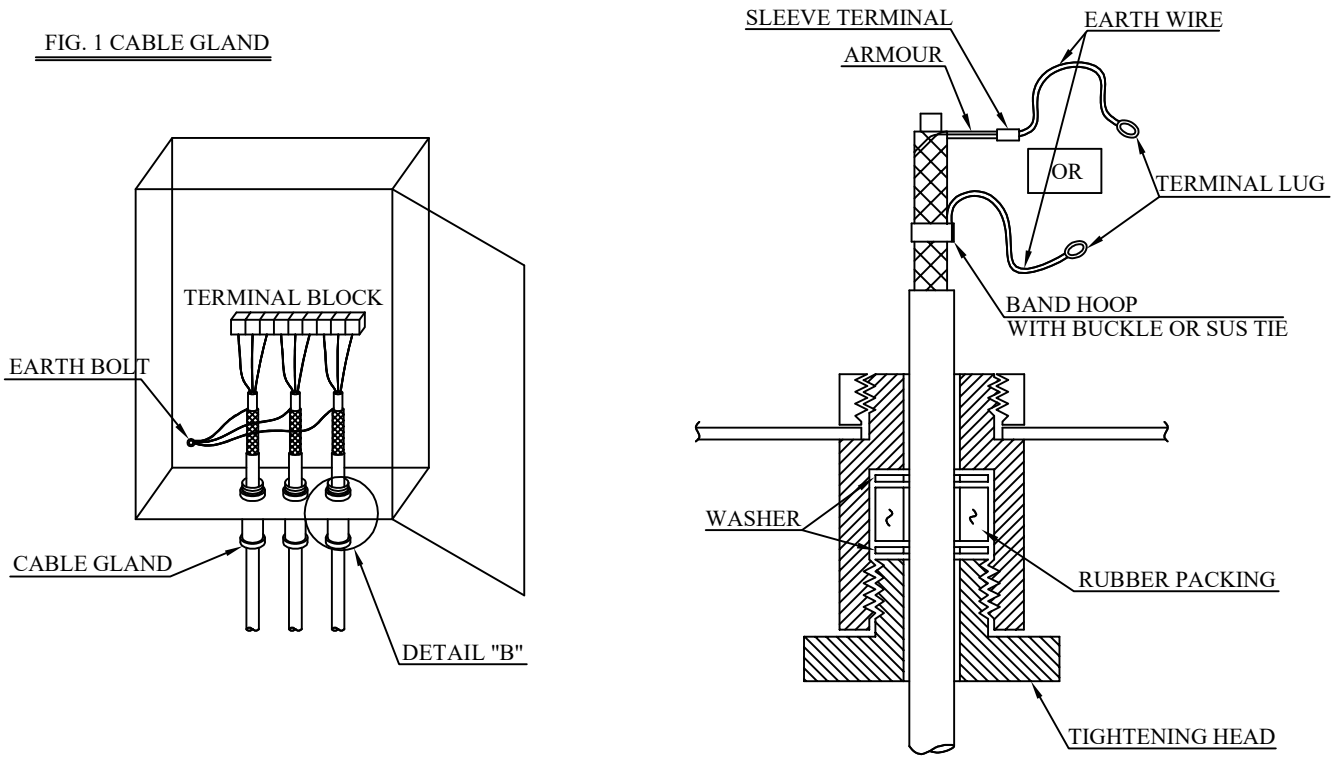
1) EARTHING METHOD OF CABLE COAMING SIDE

FIG. 1 CABLE COAMING
(WITH OUTER PROTECTION CABLE)



2) EARTHING METHOD OF CABLE GLAND SIDE(WITH OUTER PROTECTION)

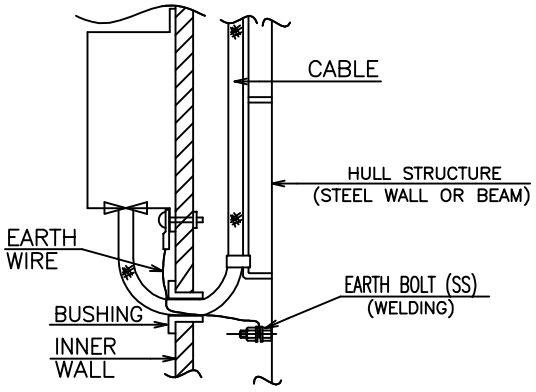
FIG. 1 CABLE GLAND



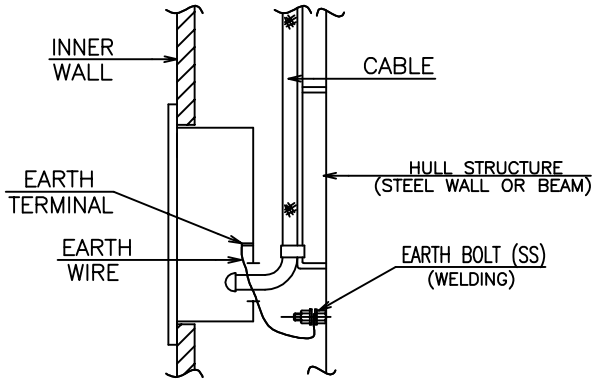
	INSTALLATION PRACTICE ON EARTHING	PART NO: 13.01	57 / 63
	GENERAL DESCRIPTION	DRG NO: 037-K5700200	

3) EARTHING METHOD OF EQUIPMENT INSTALLED ON PANELLING.
EARTHED BY SEPARATE EARTH CONDUCTOR IN CABLE OR FOLLOWING METHOD.

EARTHING METHOD OF
SURFACE TYPE EQUIPMENT

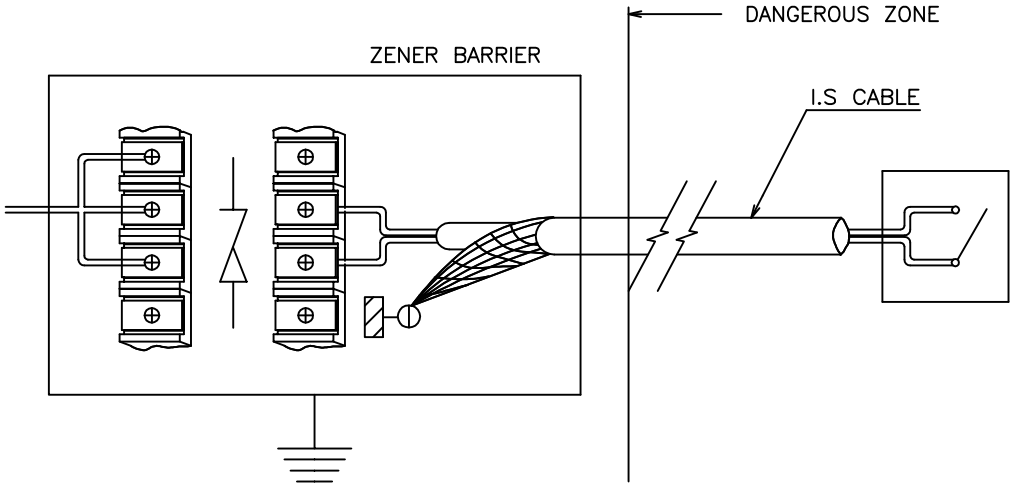


EARTHING METHOD OF
FLUSH TYPE EQUIPMENT



NOTE ; EARTH PIECE FOR EARTH WIRE MAY BE FITTED ON THE STEEL SEAT OF EQUIPMENT OR CABLE TRAY AND HULL STRUCTURE.

4) CABLES BELONG TO INTRINSICALLY SAFE CIRCUITS SHALL HAVE THEIR SCREENING (OR ARMOURING) EARTHED GENERALLY ONLY IN ONE LOCATION ACCORDING REQUIREMENTS OF INTRINSICALLY SAFE BARRIERS MANUFACTURERS.



5) EARTHING WIRE METHOD.

i) NON CURRENT CARRYING METAL PARTS OF ELECTRIC EQUIPMENT ARE EARTHED THROUGH CONDUCTORS I.E, EARTH WIRES(EARTHING LEAD WIRE WITH GREEN/YELLOW PVC COATING OR COPPER WIRE BRAIDED).

ii) FOR MAIN SWITCHBOARD, GROUP STARTER PANELS OR OTHER PANELS,EACH ONE(1) PIECE AND EARTHING WIRE SHOULD BE PROVIDED FOR EACH PANELS.

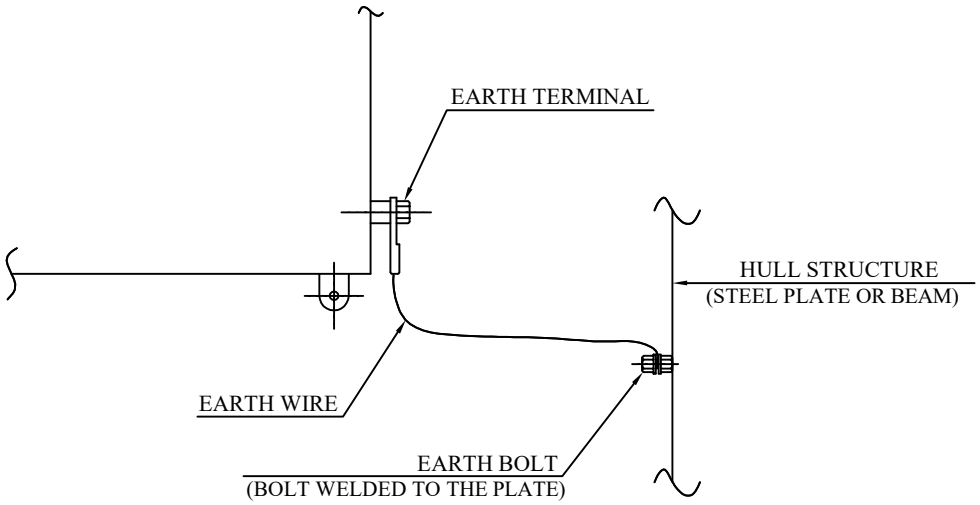
iii) WHERE AN EARTH TERMINAL IS PROVIDED ON THE EQUIPMENT, EARTH PIECE SHOULD BE FITTED CLOSE TO ON EARTH TERMINAL.

iv) SIZE OF EARTHING WIRE

SIZE OF EARTHING-LEAD WIRE SHOULD BE APPLIED IN ACCORDANCE WITH THE SIZE OF MAIN CABLE FOR EQUIPMENT AS INDICATED IN TABLE 1.

TABLE -1

ARRANGEMENT OF EARTH CONDUCTOR	CROSS-SECTION(Q) OF ASSOCIATED CURRENT CARRYING CONDUCTOR (ONE PHASE OR POLE)mm^2	MINIMUM CROSS-SECTION OF COPPER EARTHING CONDUCTOR
1. A) INSULATED EARTH CONDUCTOR IN CABLE FOR FIXED INSTALLATION.	$Q \leq 16$	Q
B) COPPER BRAID OF CABLE FOR FIXED INSTALLATION. C) SEPARATELY INSULATED EARTH CONDUCTOR FOR FIXED INSTALLATION.	$16 < Q$	1/2 OF THE CURRENT CARRYING CONDUCTOR BUT NOT LESS THAN $16mm^2$



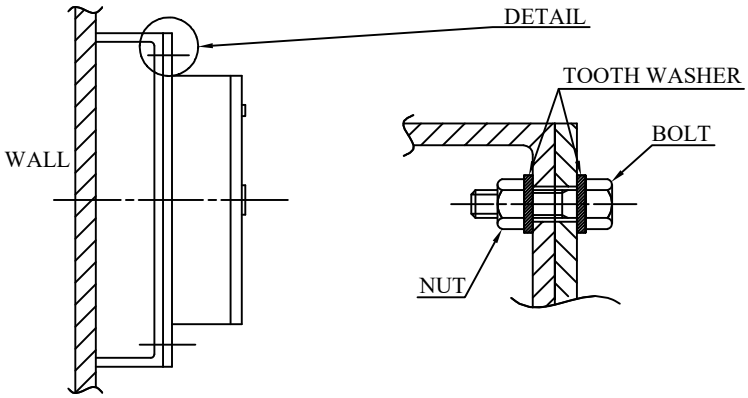
NOTE ; EARTH BOLT FOR EARTH WIRE MAY BE FITTED ON THE STEEL SEAT OF EQUIPMENT, CABLE TRAY OR HULL STRUCTURE.

	INSTALLATION PRACTICE ON EARTHING	PART NO: 13.01	59 / 63
	GENERAL DESCRIPTION	DRG NO: 037-K5700200	

6) METALLIC CONTACT METHOD.

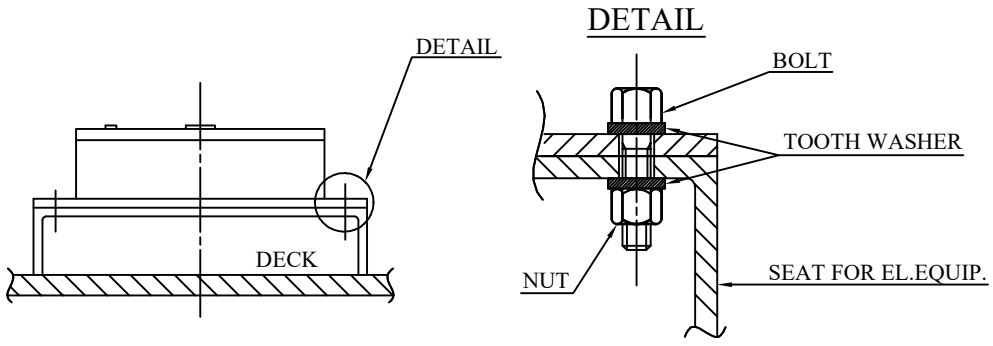
i) METHOD THAT METAL FRAMES OR ENCLOSURES OF ELECTRICAL EQUIPMENT ARE IN METALLIC CONTACT WITH VESSEL'S STRUCTURE.

ii) EARTHING METHOD OF EQUIPMENT INSTALLED ON STEEL WALL.



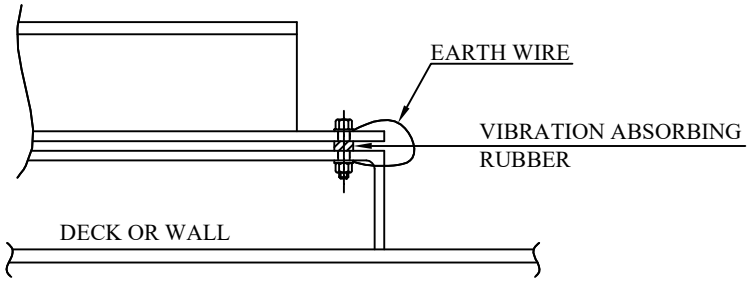
NOTE ; 1 POINT SHALL BE EARTHED.

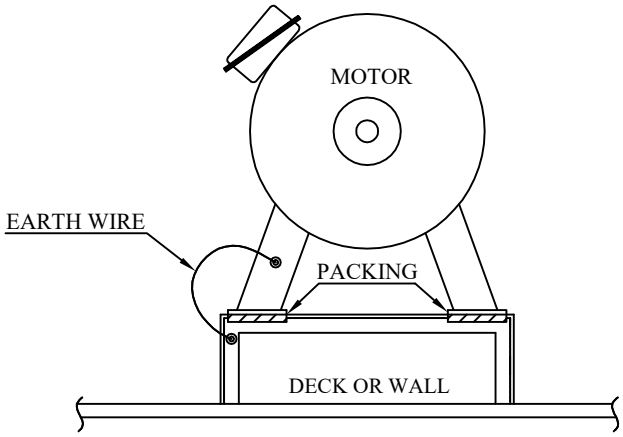
iii) EARTHING METHOD OF EQUIPMENT INSTALLED ON STEEL DECK.



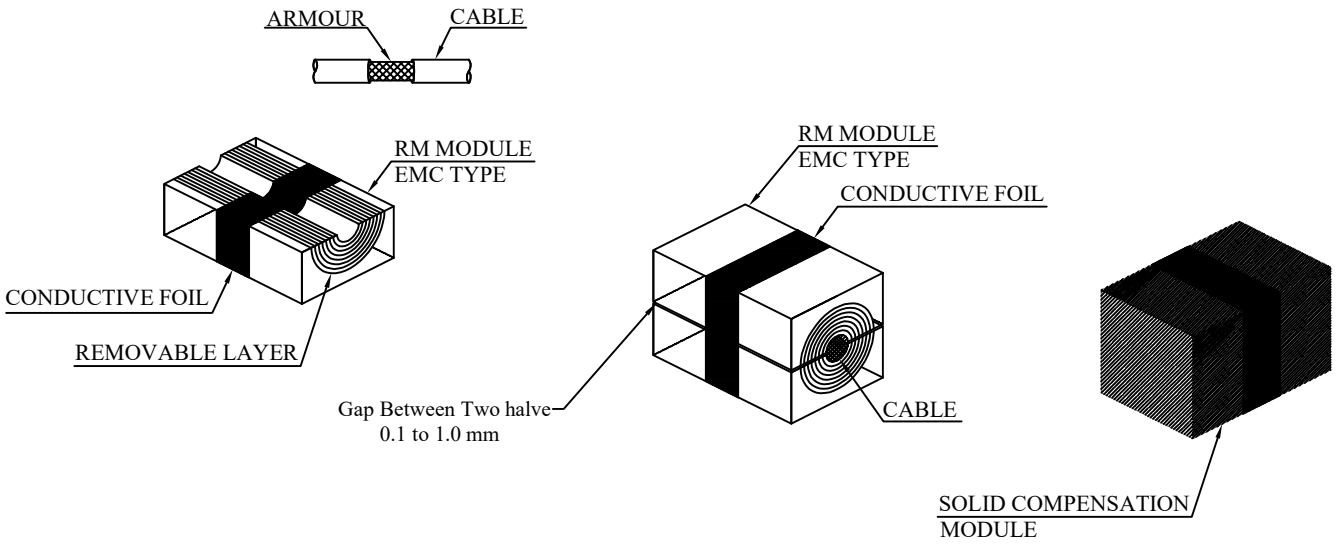
NOTE ; 1 POINT SHALL BE EARTHED.(TOOTH WASHER)

iv) EARTHING FOR AN EQUIPMENT WITH VIBRATION ABSORBING RUBBER OR CORROSION PREVENTING PACKING.





	MCT EMC MODULE	PART NO: 13.02	61/63
	CABLE PENETRATION	DRG NO: 037-K5700200	



EARTHING INSIDE MCTS

. The Module contains a conductive foil which establishes a full 360 degree low transfer impedence contact with the cable screen. Do not lubricate the conductive foil.

	INSTALLATION METHOD FOR LIGHTING FIXTURE	PART NO: 14.01	62/63
	DECK MOUNTING TYPE	DRG NO: 037-K5700200	

DECK MOUNTING

APPLICATION

- ACCOMMODATION
- CASING
- FOR SIGHT GLASS LIGHTING
- LOW VIBRATION AREA
- E/R FLOOR UNDER GRATING
- ESCAPE TRUNK ETC

APPLICATION OF FITTING LEG

L ≥ 1000 50x50x3t EA

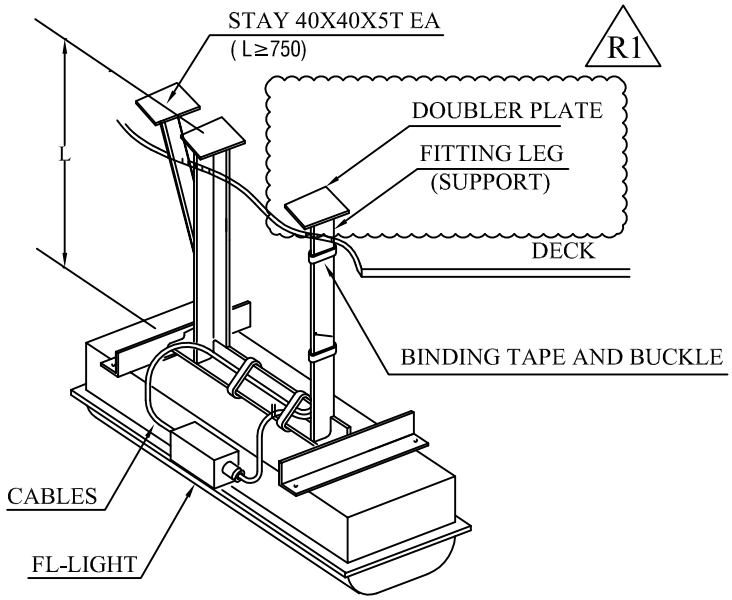
1000 > L 40x40x5t EA

APPLICATION OF STAY

- L≤ 750: NO STAY
- L>750:40X40X5T EA

DECK MOUNTING

L : LIGHTING SUPPORT LENGTH



NOTE: LIGHT FITTING BELOW MAIN DECK AND IN MACHINERY AREA TO BE MOUNTED WITH VIBRATION ARRESTING RUBBER SUSPENTION

	INSTALLATION METHOD FOR LIGHTING FIXTURE	PART NO: 14.02	63 / 63
	WALL MOUNTING TYPE	DRG NO: 037-K5700200	

WALL MOUNTING

APPLICATION

- ACCOMMODATION
- CASING
- FOR SIGHT GLASS LIGHTING
- LOW VIBRATION AREA
- E/R FLOOR UNDER GRATING
- ESCAPE TRUNK ETC

APPLICATION OF FITTING LEG

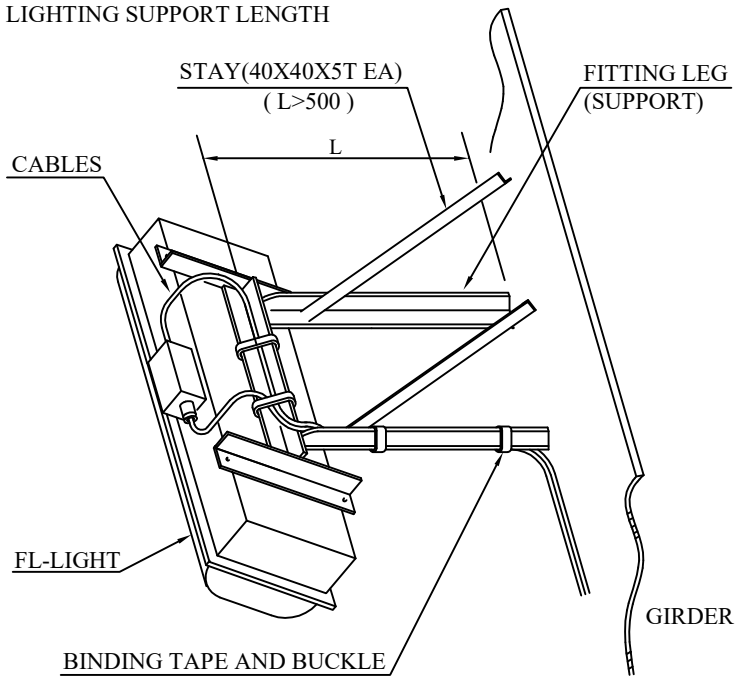
40x40x5t EA

APPLICATION OF STAY

- L≤ 500: NO STAY
- L>500: 40X40X5T EA

WALL MOUNTING

L : LIGHTING SUPPORT LENGTH



NOTE: LIGHT FITTING BELOW MAIN DECK AND IN MACHINERY AREA TO BE MOUNTED WITH VIBRATION ARRESTING RUBBER SUSPENTION

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APPENDIX J

MCT Installation Checklist

Roxtec

Installation checklist for Roxtec rectangular transits

Checkpoints

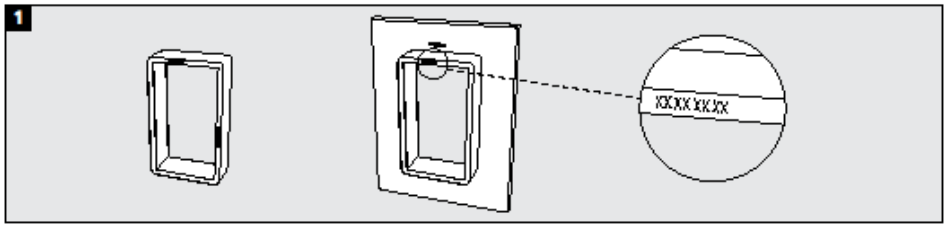
Correct installation

Incorrect installation

Important

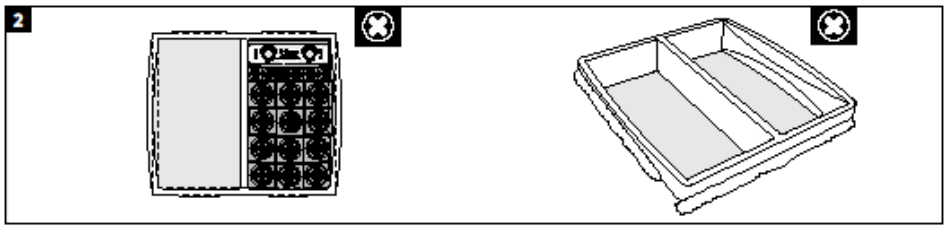
These lists of installation checkpoints can be used to visually assess a Roxtec cable/pipe transit sealing system installation. The check is performed to visually verify the correctness of an installation, not a commissioning or functional inspection. The verifications shall be performed and evaluated with the understanding that not all installation errors can be visually detected, even if it is a great help in the quality assurance work. The installation check is limited to those areas and sections of the installation to which reasonable access is both available and permitted at the date of checking. The scope of these installation checkpoints is limited to the transit (frame, modules, stayplates and wedge). Consequently, it does not cover the attachment of the transit to the structure in question, e.g. insulation required, nor the correctness, quality or routing of cables/pipes. If possible, perform the installation check from both sides of the transit.

1

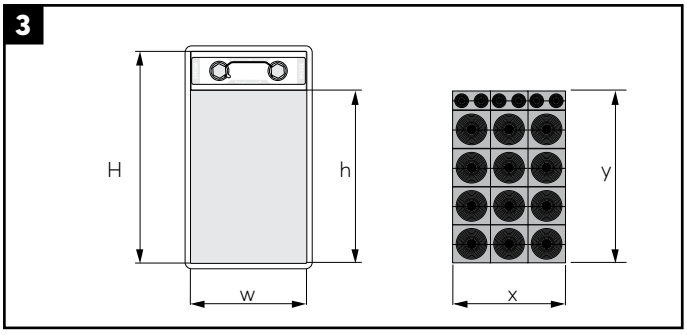


Verify that an original Roxtec frame is used. An original Roxtec frame is identified by a Roxtec marking or a frame serial number marking. Frames have the marking or label on the front face.

2



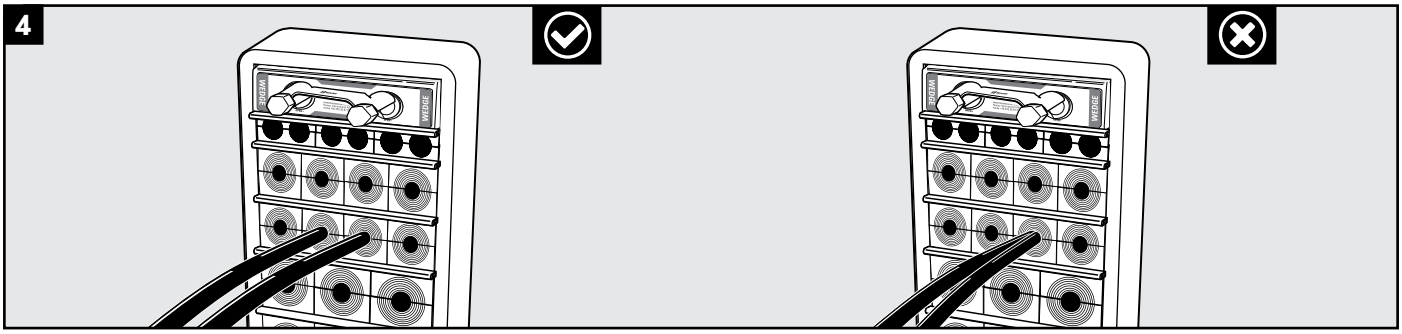
Check that the transit and packing system have no mechanical damages. Also check surface protection and welds if applicable. For welds, see Roxtec welding guidelines.



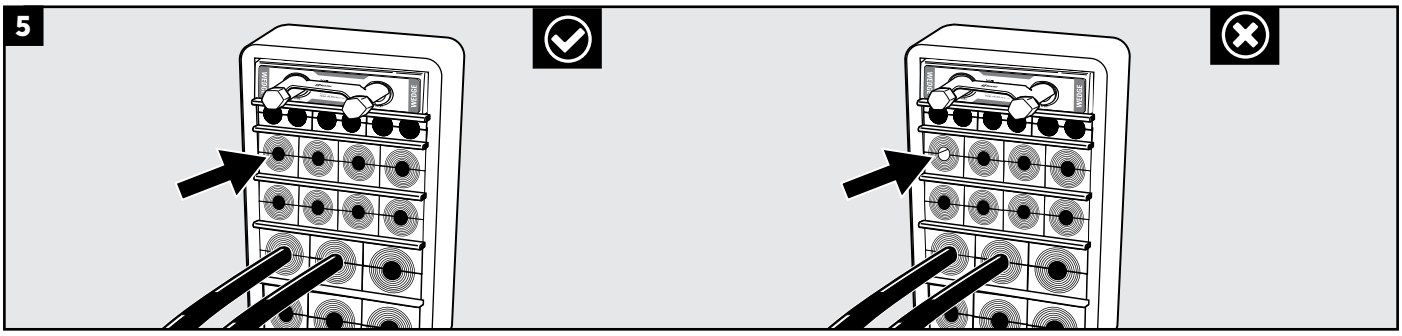
Verify the correct utilization of the entire packing space. The total width (x) and total height (y) of the installed modules shall correspond to the packing width (w) and packing height (h) of the frame.

S	H	w	h
1	101	60	60
2	101	120	60
3	160	60	120
4	160	120	120
5	218	60	180
6	218	120	180
7	278	60	240
8	278	120	240

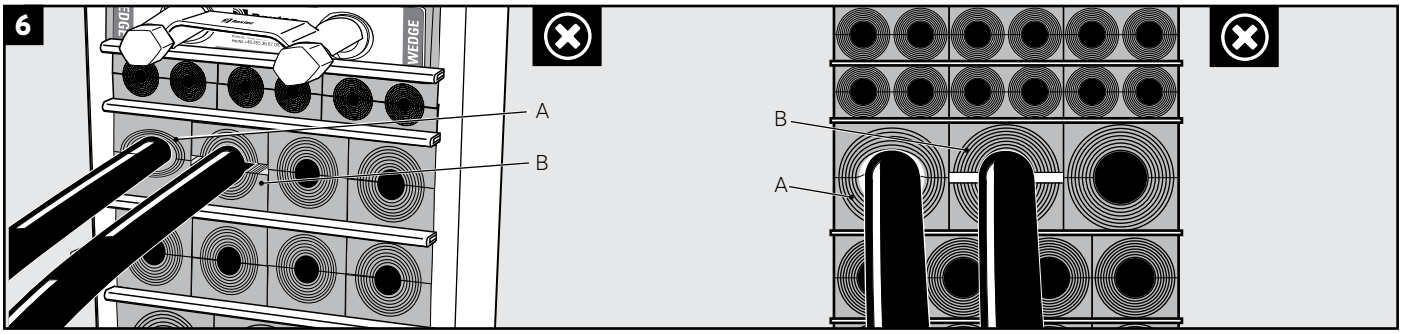
S = Frame size
H = Frame height
w = Packing width
h = Packing height



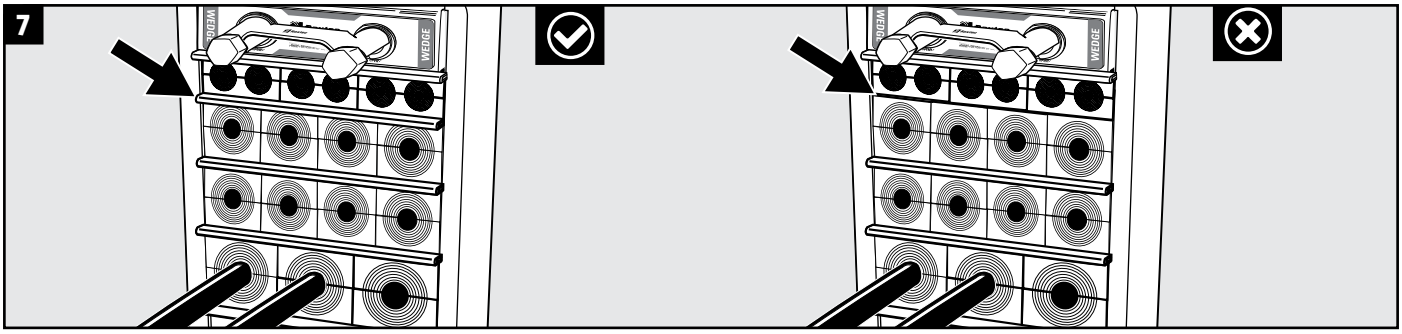
Check that only one cable/pipe passes through each module or opening in a module.



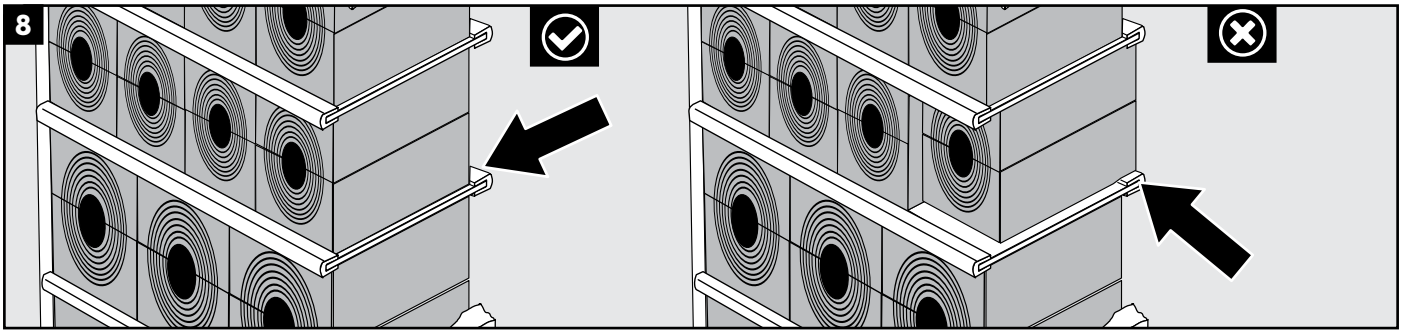
Check that no center cores are missing.



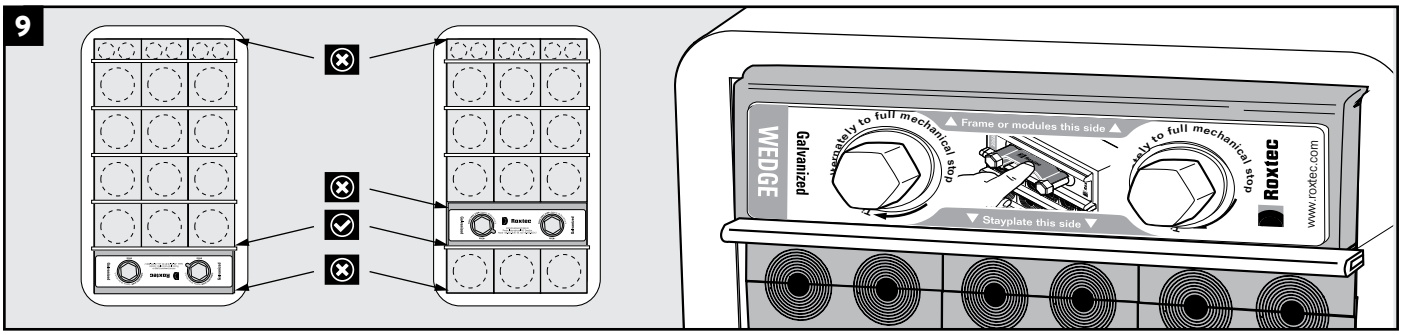
A = Too many layers removed. B = Not enough layers removed. Check that there are no visible gaps between cables/pipes and module halves after compression. Maximum one layer difference is allowed between module halves within the same module.



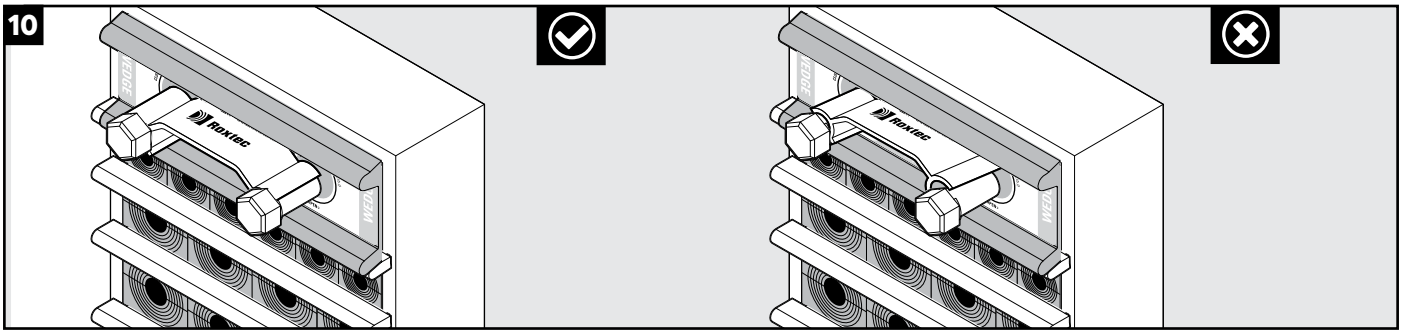
Check that each consecutive row of modules is divided by a stayplate.



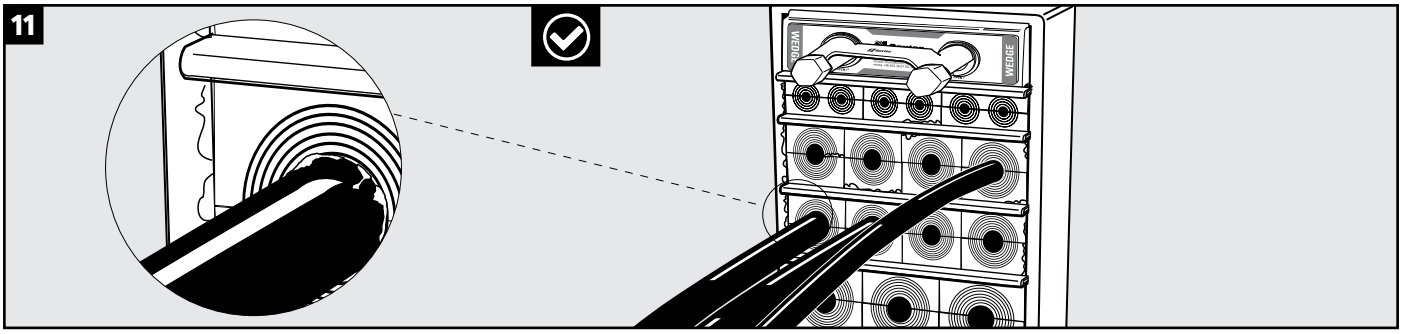
Check that all modules are installed between the edges of the stayplates.



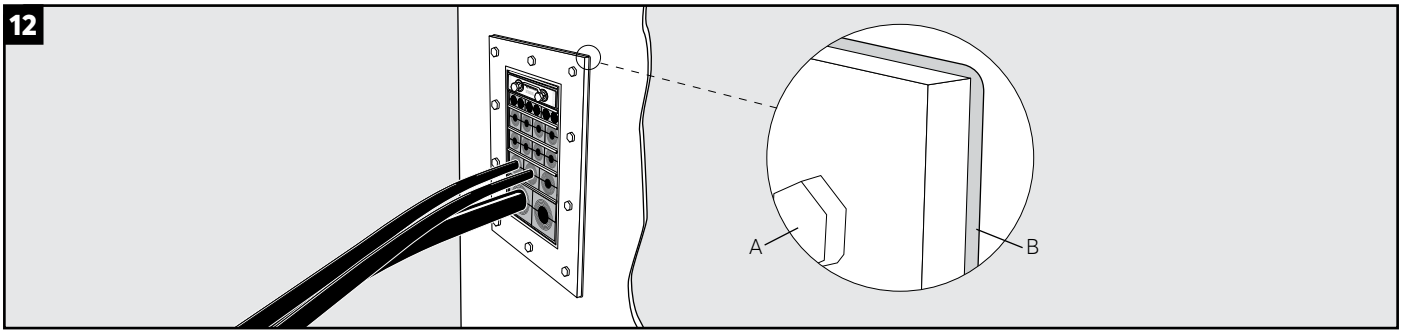
Verify that the stayplates have correct positions and that the wedge has correct orientation.
No stayplate shall be installed between modules and the frame or between the wedge and the frame. The wedge shall be orientated according to the label on the wedge front side or printed text on the upper and lower faces of the unit.



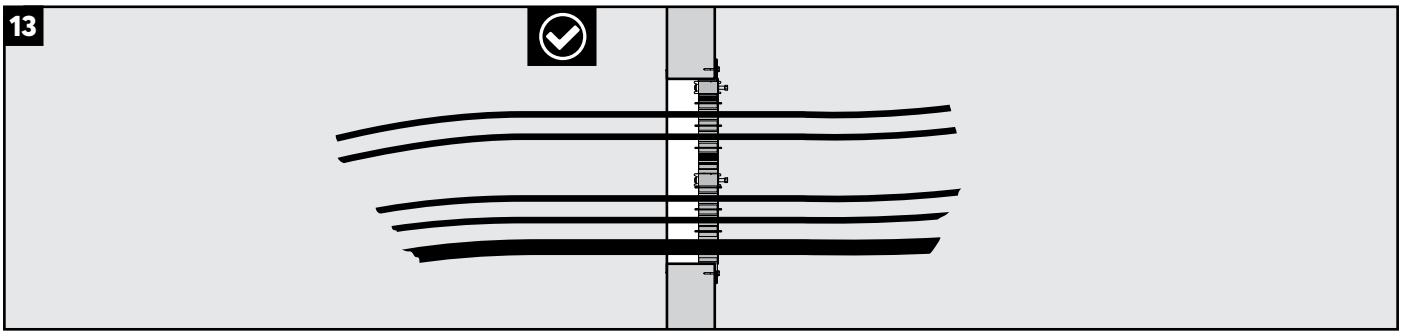
Verify that the wedge is fully tightened.
The wedge is fully tightened if the wedge clip is installed and fits behind the bolt heads.



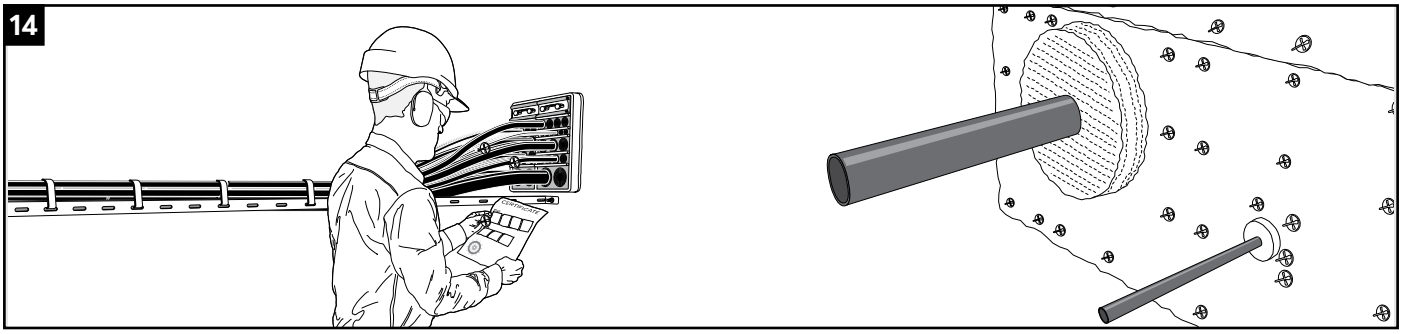
Check that the frame and the modules have been lubricated. Excess lubricant shall be visible directly after installation.



Make sure that bolted frame types are sealed to the structure. All attachment points (A) shall be used and the gasket (B) shall be visible.



Make sure that cables go straight through the frame.



Check additional installations, if applicable.

Note

- If possible, take an overlook at the other side of the transit.
- Check additional installations according to certification requirements, e.g. insulation.

Installation checklist for rectangular transits

Project/object:

Date:

Transit name:

Full name:

Frame type:

Company:

Opening:

Signature:

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10
C1	C2	C3	C4	C5	C6	C7	C8	C9	C10

Checkpoint	Activity	OK	Not OK
1	Verify that an original Roxtec frame is used.		
2	Check that the transit and packing system have no mechanical damages.		
3	Verify the correct utilization of the entire packing space.		
4	Check that only one cable/pipe passes through each module or opening in a module.		
5	Check that no center cores are missing.		
6	Check that there are no visible gaps between cables/pipes and module halves after compression.		
7	Check that each consecutive row of modules is divided by a stayplate.		
8	Check that all modules are installed between the edges of the stayplates.		
9	Verify that the stayplates have correct positions and that the wedge has correct orientation.		
10	Verify that the wedge is fully tightened.		
11	Check that the frame and the modules have been lubricated.		
12	Make sure that bolted frame types are sealed to the structure.		
13	Make sure that cables go straight through the frame.		
14	Check additional installations, if applicable.		

Notes:

Doc No: DOC-003808 rev. A

Disclaimer

"The Roxtec cable entry sealing system ("the Roxtec system") is a modular-based system of sealing products consisting of different components. Each and every one of the components is necessary for the best performance of the Roxtec system. The Roxtec system has been certified to resist a number of different hazards. Any such certification, and the ability of the Roxtec system to resist such hazards, is dependent on all components that are installed as a part of the Roxtec system. Thus, the certification is not valid and does not apply unless all components installed as part of the Roxtec system are manufactured by or under license from Roxtec ("authorized manufacturer"). Roxtec gives no performance guarantee with respect to the Roxtec system, unless (I) all components installed as part of the Roxtec system are manufactured by an authorized manufacturer and (II) the purchaser is in compliance with (a), and (b), below.

(a) During storage, the Roxtec system or part thereof, shall be kept indoors in its original packaging at room temperature.

(b) Installation shall be carried out in accordance with Roxtec installation instructions in effect from time to time.

The product information provided by Roxtec does not release the purchaser of the Roxtec system, or part thereof, from the obligation to independently determine the suitability of the products for the intended process, installation and/or use.

Roxtec gives no guarantee for the Roxtec system or any part thereof and assumes no liability for any loss or damage whatsoever, whether direct, indirect, consequential, loss of profit or otherwise, occurred or caused by the Roxtec systems or installations containing components not manufactured by an authorized manufacturer and/or occurred or caused by the use of the Roxtec system in a manner or for an application other than for which the Roxtec system was designed or intended.

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APPENDIX K

EMC Management Control Document

Royal IHC

IHC Systems B.V.

General design

EMC management control document

Systems project number	SH037
Systems document number	101000-0006
Systems document revision	01
Systems document status	Released for Approval
Systems document type	I130
Document from	Systems
Supplier document number	
Supplier document revision	
Client vessel number	SH037
Client document number	0110.TS004
Client component number(s)	

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Document information.

Document	Information
Number of pages Document File name Author Supplier	56 SH037-101000-0006-1-I130.docx F. Verschuuren IHC Systems
Owner vessel Name vessel Yard	DCI Dredge Brahmaputra IHC / CSL

Document history

Revision	Date	Status	Description
1	14-6-2022	For information	

Approval

Name	Role	Date	Signature
F. Verschuuren	Author	14-6-2022	
F. Verschuuren	Quality Control	14-6-2022	
T. van Buren	Approval	14-6-2022	

Table of Contents

Bibliography:

1. SH037-106000-0005-Z290, Record abbreviations
2. SH037-880000-0002-E030, Cable Selection Philosophy

Standards:

The electrical systems and components shall be designed, manufactured, wired, assembled and tested in accordance with the principal characteristics set forth herein and of compliance with all applicable standards. The supplier shall be responsible for the construction of the electrical equipment which complies with the following referenced laws, rules and regulations listed below. In case of any conflict between the mentioned standards, the IEC standard should be applied.

As a reference for the development of this document, we have used the following documents:

- IEC 60092 Electrical Installations on Ships
- IEC 61439 Low Voltage Switchgear and Control Assemblies
- IEC 61800 Adjustable Speed Electrical Power Drive Systems
- IEC 61140 Protection Against Electric Shock
- IEC 60533 Electromagnetic Compatibility for electric installations on board ships
- IEC 60945 Maritime navigation and radio communication equipment (EMC part)
- Rules and Regulations for the classification of Ships

Definitions and abbreviations.

Bonded	Mechanical interconnection of conductive parts to maintain a common electrical potential
Conductor	Wire or combination of wires suitable to carry electrical current
Equipotential bonding	Provision of electric connections between conductive parts intended to achieve equipotentiality
Exposed conductive part	Conductive part which can be touched and which is normally live but it can became live when basic insulation fails
Extraneous conductive part	Conductive part not forming part of the electrical installation and liable to introduce an electric potential
Fault current	Electrical current that flows through a circuit during fault condition
Live parts	Conductor or conductive part intended to be energized in normal operation
Main earthing bar	Bar or terminal provided for connection of PE conductors, equipotential bonding
PE	Protective earth (ground)
Protective conductor	Refer to PE
VSD	Variable Speed Drive
EMC	Electric Magnetic Compatibility
IE	Instrument Earth

1. Introduction

IHC electrical installations must comply with the standards and rules concerning EMC in marine installations. Consequently, a guideline is needed for standardization and to guarantee the quality of IHC electrical installations.

This guideline is intended for designers, panel integrators, installation companies, cable routers etc.

1.1 Purpose of this document

This document describes measures for a proper Earthing and EMC design. That means that devices should work without causing electromagnetic disturbance to other devices. Likewise, devices should be equipped with electromagnetic disturbance immunity.
This document provides also information to properly implement protective earthing (grounding) on board of ships. Protective earthing is necessary to improve electrical safety by indirect contact by means of low impedance earthing and bonding between metallic parts when an earth fault occurs.

This document will further meet the following objectives:

- Standardize design
- Ensure that standards and possible certifications are met
- Ensure reliability
- Improve quality
- Supplier recommendations for EMC guidelines and earthing and grounding rules

1.2 General

Ship's equipment and systems can be subjected to various kinds of electromagnetic disturbances conducted by power or control lines or directly by the radiated environment. The types and levels of disturbances depend on the particular conditions in which the system, the subsystems or the equipment are installed and have to operate.
Electromagnetic compatibility (EMC) denotes the capability to operate several electrical and electronic components together and next to each other within a certain environment without any disturbing interference.

1.3 EMC philosophy

The guideline in Annex C of IEC 60533 is followed to achieve an acceptable EMC environment.
The general procedure is:

The aim of this annex is to support the manufacturer responsible for the overall performance of the ship in achieving the EMC of the system. Since EMC is a quality related feature, it is necessary to treat it in the same way as general quality assurance.

Depending on the complexity of the system, EMC management needs to control and monitor the following activities for achieving EMC:

1. Establishing EMC requirements for equipment;
2. Planning and performing EMC measures;
3. Checking EMC measures on equipment;
4. Checking implementation and effectiveness of EMC measures in the system;
5. Ensuring EMC measures remain effective during the system's lifetime.

2. **Power distribution systems**

Earthing systems are there for two reasons:

1 Personnel safety: The primary goal of an earthing system is to assure personnel safety and protection of installations from dangerous discharges, voltages and currents.

Avoiding of electric shock risk (indirect contact).

2 Electro Magnetic Compatibility (EMC): The secondary goal is to serve a common voltage reference and to contribute to the mitigation of disturbances in installations with sensitive and interconnected electronic and electrical systems. Providing a low impedance path to ground for insulation fault currents.

The IEC standards describe three main distribution systems, the TT, TN and the IT system. These systems can be divided in earthed and insulated systems. The distribution systems generally used on board are described in the following paragraphs.

2.1 Insulated Distribution System (IT)

The insulated neutral distribution system is the most common used power systems on ships. This system is mainly used in the main distribution.

In IT systems, the power source is intentionally not connected to the earth. But in fact, there is a connection to the ground due the stray capacitances. In case of an insulation fault occurs, the developed fault current will be very low.

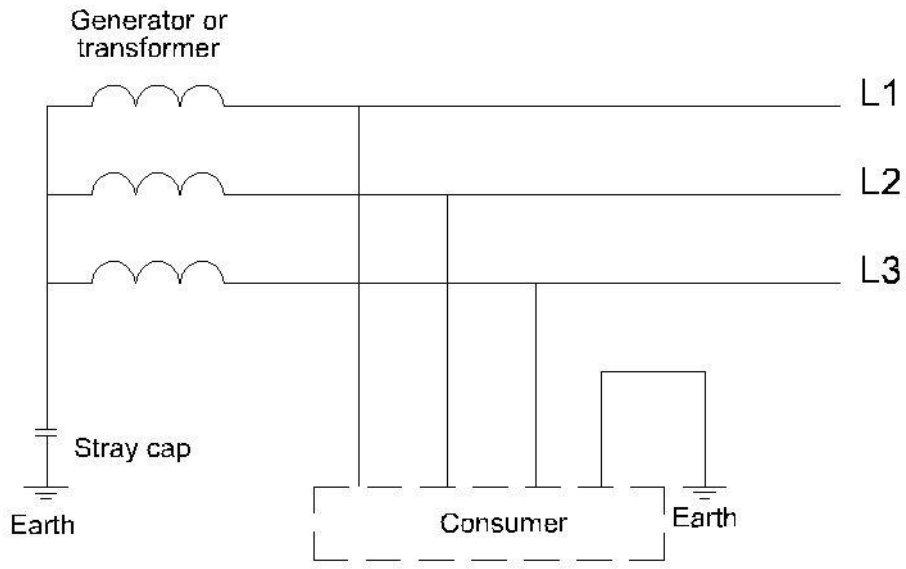


Figure 1 IT distribution system

One of the main advantages of this system is the continuity of service and very low fault currents. Although, this fault current does not present a risk, it must be detected, tracked and eliminated before a second fault occurs.

With an IT system the equipment is earthed to the ship's hull, with a TN-S system a PE-core in the cable must be provided.

2.2 Earthed Distribution System (TN-S)

In grounded distribution systems the neutral of the distribution system is connected to the ground. This system presents several advantages such as automatic detection in case of fault current and a stable phase reference to the ground. For marine applications, however, it is not the most suitable system to be applied to the entire electrical power system due the following factors:

- Instant disconnection in case of an insulation fault; as result it will not guarantee the continuity of service.
- Fault current can be large and consequently cause damage or risk of explosion.

On electrical ship installations this system is quite frequently used in combination with the IT system on the low voltage systems in the range from 110 – 230V. It is mostly supplied from a phase to neutral source like a transformer. General this system supplies small power consumers, lighting and ship accommodation.

Main advantages:

- Automatic detection and disconnection of fault circuit
- 2-pole circuit breaker protection is not necessary.

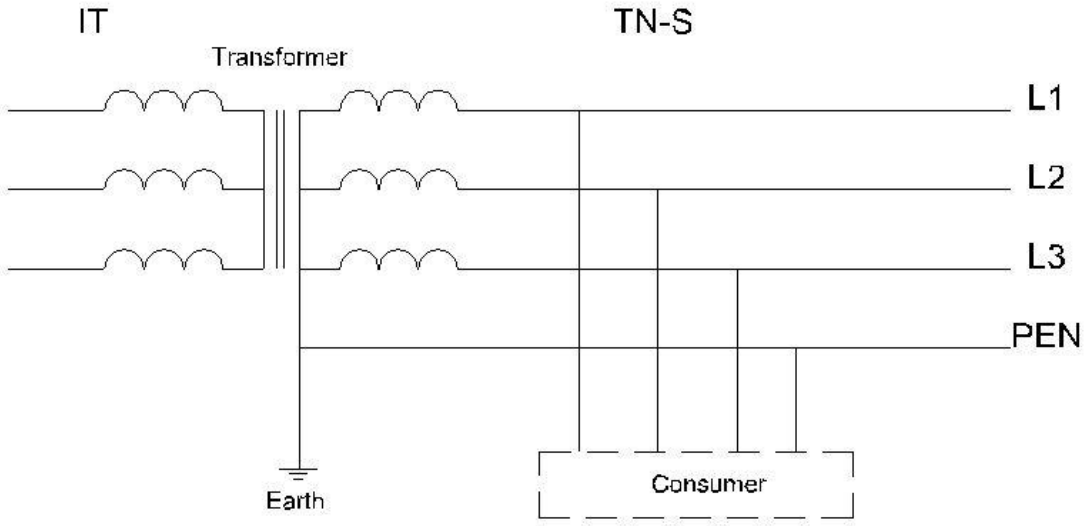


Figure 2 TN S distribution system

3. **Basic IHC earthing principles**

This chapter describes how to connect the earthing system of equipment.

3.1 Main principles

All electrical cabinets must contain a Protective Earth provision, connected to the metal enclosure and the protected ground.
If there are any cables which require an IE bar, an IE-bar shall be installed isolated from the enclosure, connected to the PE-bar.

PE Protective Earth
IE Instrumental Earth

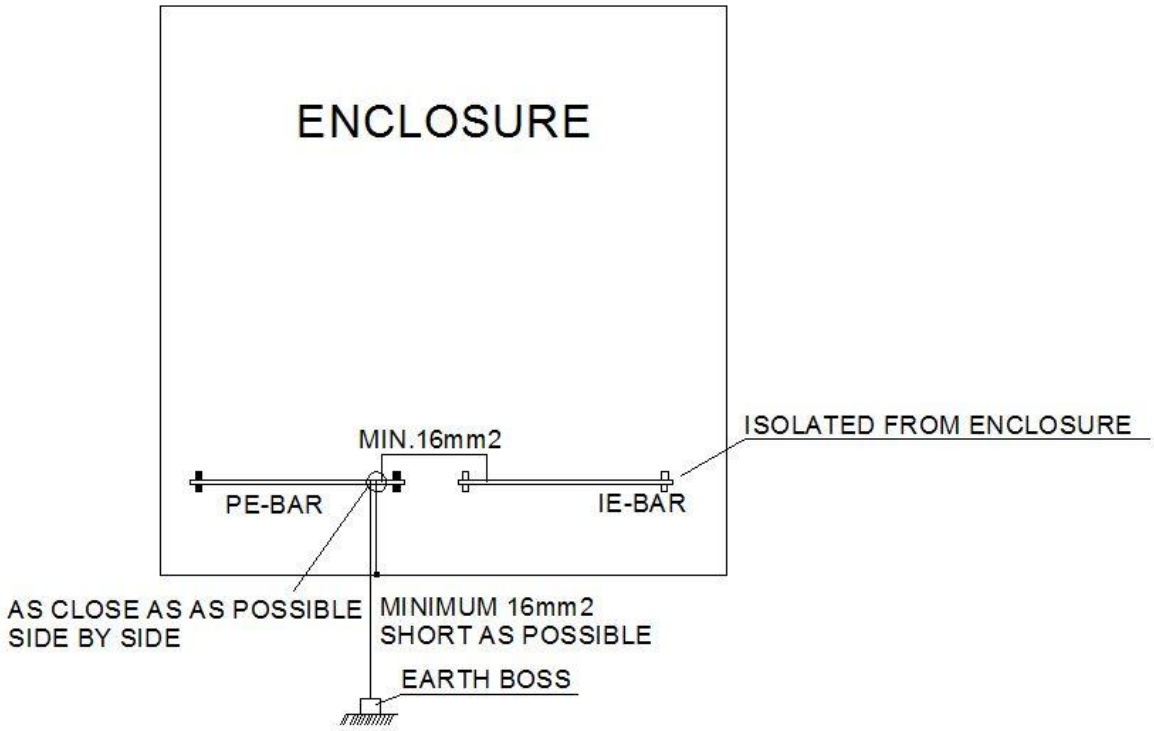


Figure 3 Basic IHC Systems earthing – main principle

3.2 Earthing connections

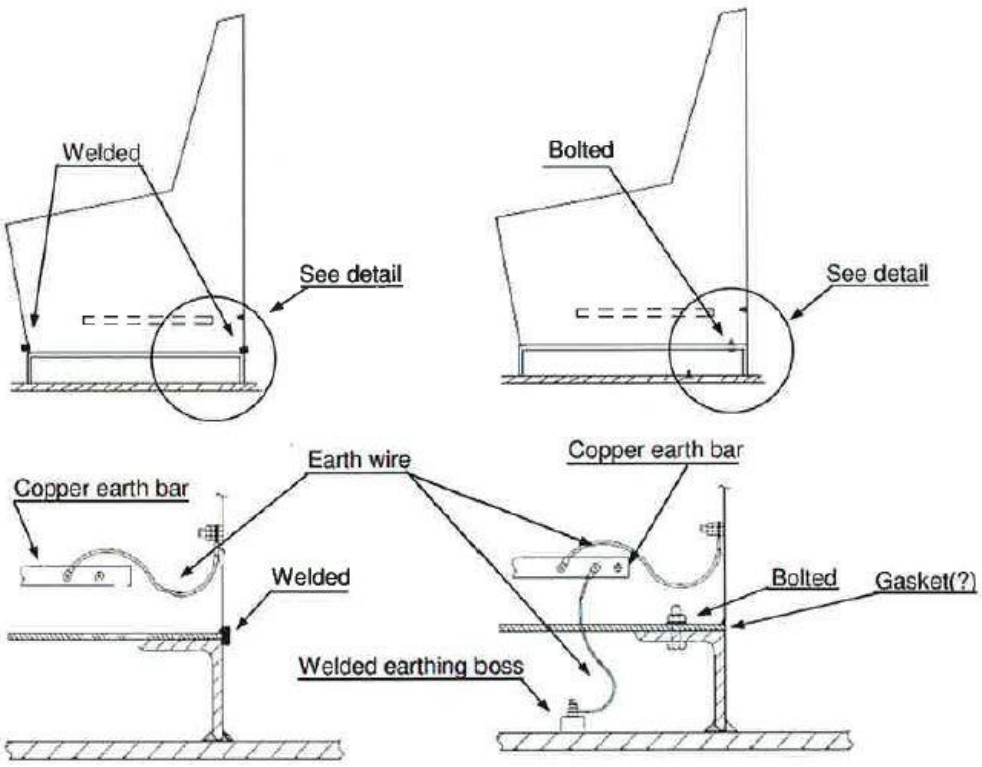


Figure 4 Principle of earthing steel enclosures

3.2.1 Welded earthing connections

Enclosures of electric systems welded to the ship's structure and where a low earthing resistance is confirmed do not require any other safety earthing provision. It's common practice to weld the frames of deck mounted parts directly to the ship's foundation. This may only be considered when welds are continuously. In all other cases earth bosses to be used

3.2.2 Mechanical earthing connections

A mechanical earthing connection can be made with the following methods:
Bolt is welded to the ship's structure.
Thread is available in the ship's structure
An earth wire is realised to the bridge with a bolt/nut connection
Just a bolt/nut connection with washer is NOT to be considered as a safety earthing.

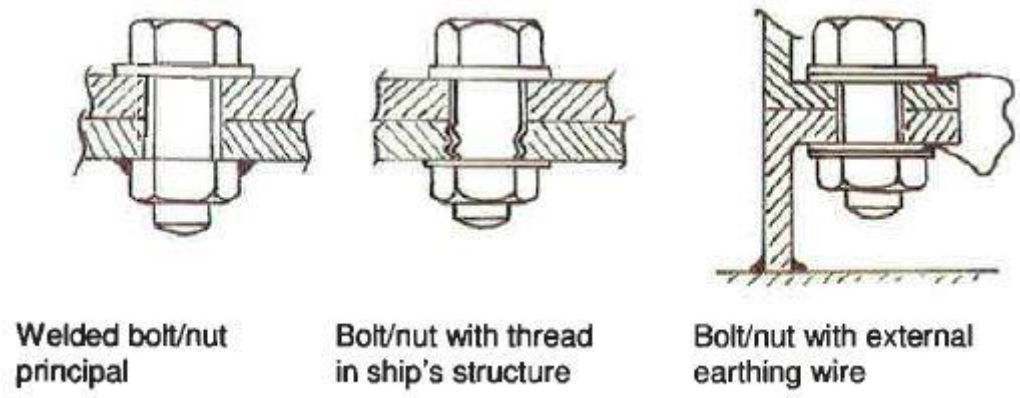


Figure 5 Mechanical earthing methods

3.3 PE-bar

1. All metal parts of field equipment must be connected to the PE system.
2. All shields of shielded power cables shall be connected to the PE-bar.
3. The braid armour shall be covered with yellow/green sleeves.
4. The PE-bar shall be marked with a PE-label.
5. Enclosures not welded to the ship's structure to be earthed according to table 1 chapter 3.7 to an earth boss welded on the structure.
6. Main structural earth boss shall be minimum M8.

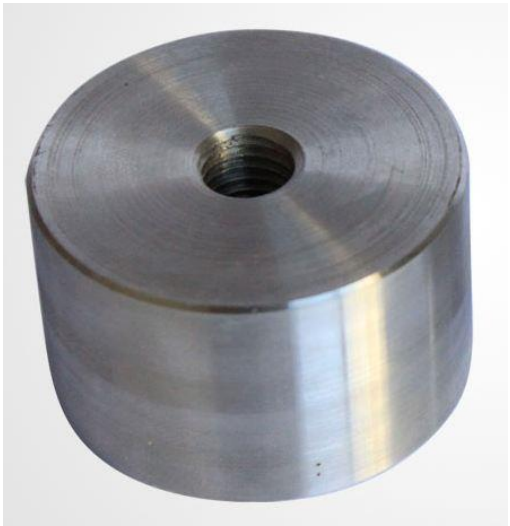


Figure 6 Earth boss.

3.4 IE-bar

1. The IE-bar shall be the earth reference for instrumentation and telecommunication 0 volt reference.
2. The IE-bar shall be isolated from the enclosure and connected to the PE-bar by a jump of 16mm2

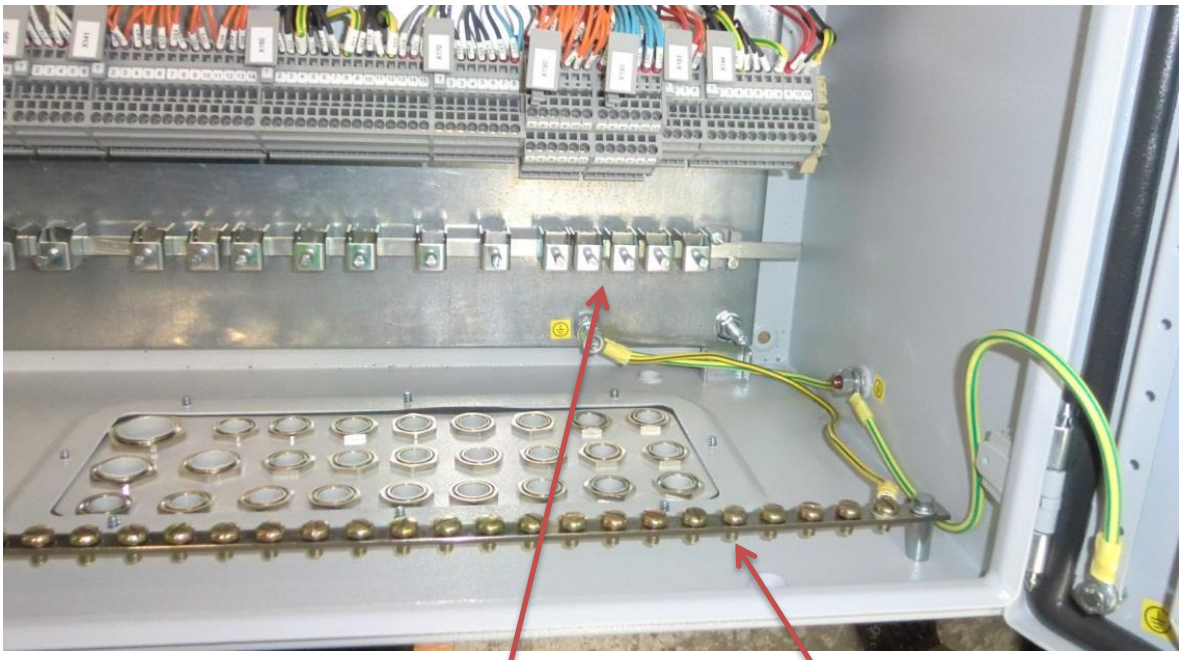


Figure 7 Example of 360-degree earthing.

In all enclosures shall be placed a PE earth bar and if necessary an IE bar shall be placed.

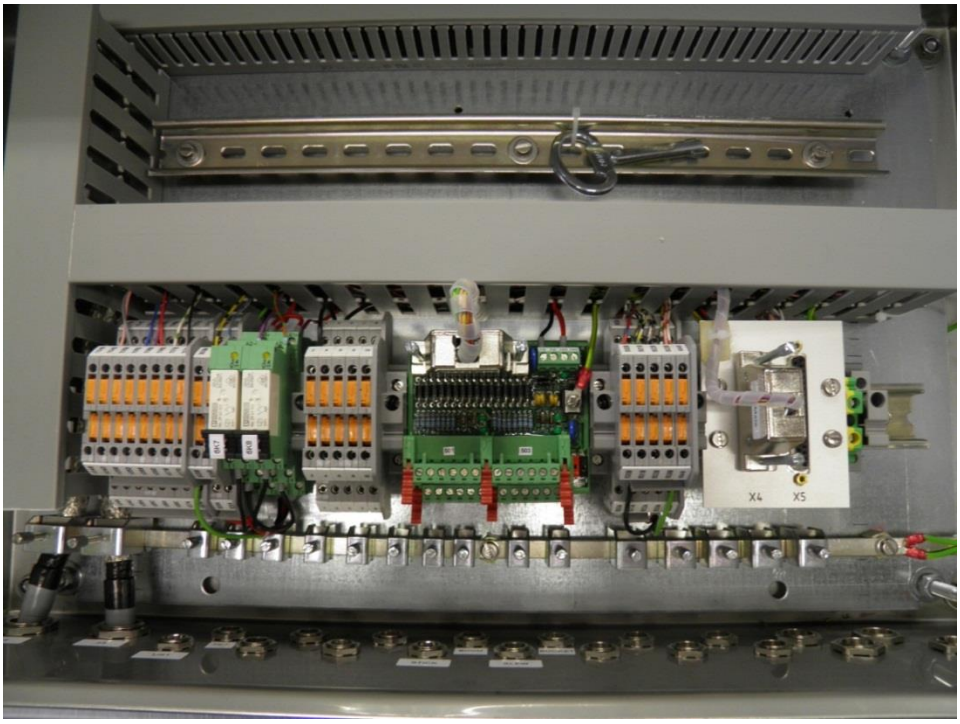


Figure 8 Example of 360-degree earthing.

3.5 General requirements

1. Distribution systems must be designed as primary goal to provide electrical safety and to limit the damage to the installations by occurrence of a fault current.
2. Unless otherwise specified, ships shall be equipped with insulated neutral distribution system.
3. All exposed and extraneous conductive parts must connect to the ground (hull).

Accessible conductive parts must be equipped with provisions against the risk of electrical shock hazards whether in normal operation, or if an insulation fault occurs.

3.6 Earthing requirements

1. All earthing connections shall be clearly visible for inspection.

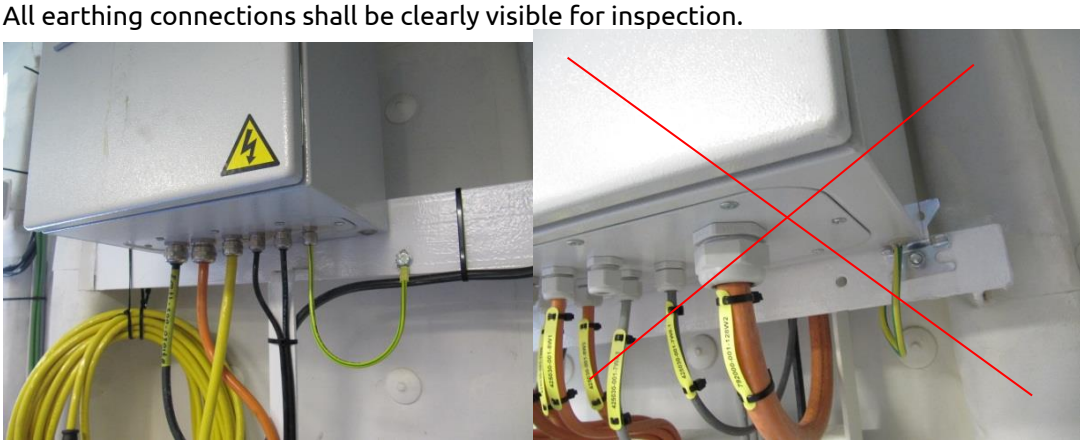


Figure 9 Clearly visible earthing connection.

2. All metal parts foreseen with equipment ≥ 50V shall be earthed to the hull.
3. It's not allowed to connect more than 2 cable lugs under one connection.

Figure 10 Good earthing connection, central stud cabinet as central distribution point.

3.7 Cross section PE conductor

The sizes of earth conductors and equipment earth connections will be executed as stated in the table below (in accordance with IEC 60092-352 3.3 table 2):

Table 1 Size of earth conductor

Arrangement of earth conductor		Cross-section Q of associated current carrying conductor (One phase or pole) mm²	Minimum cross-section of earth conductor
1	i) Insulated earth conductor in cable for fixed installation. ii) Copper braid of cable for fixed installation according to 8.2 of IEC 60092-350. iii) Separate, insulated earth conductor for fixed installation in pipes in dry accommodation spaces, when carried in the same pipe as the supply cable. Iv) Separate, insulated earth conductor when installed inside enclosures or behind covers or panels, including earth conductor for hinged doors as specified in IEC 60092-203.	Q ≤ 16	Q
		Q > 16	50 % of the current-carrying conductor, but not less than 16 mm²
2	Uninsulated earth conductor in cable for fixed installation, armour or copper braid and in metal-to metal contact with this.	Q ≤ 2,5	1 mm²
		2,5 < Q ≤ 6	1,5 mm²
		Q > 6	Not permitted
3	Separately installed earth conductor for fixed installation other than specified in 1 iii) and 1 iv).	Q < 2,5	Same as current-carrying conductor subject to min. 1,5 mm² for stranded earthing connection or 2,5 mm² for unstranded earthing connection
		2,5 < Q ≤ 120	50 % of current-carrying conductor, but not less than 4 mm²
		Q > 120	70 mm²
4	Insulated earth conductor in flexible cable.	Q ≤ 16	Same as current-carrying conductor
		> 16	50 % of current-carrying conductor, but minimum 16 mm²

3.8 Equipotential bonding

All conductive parts, including metallic non-carrying current parts must be direct connected with the ground so that the exposed conductive parts and the extraneous conductive parts will be kept at the same potential.
If an insulation fault occurs there will not be a difference of potential between simultaneously accessible conductive parts, consequently no electric shock hazards.
Measures to be taken:

1. Grounding conductor must have a sufficiently low impedance path to the ground.
2. Grounding conductors must not be connected to any disconnection device.
3. Grounding conductors must be in an easy manner recognized by its location, size, shape or marking whether an insulated or bare conductor.
4. Grounding conductors, PE connections must be capable to withstand corrosion and expected thermal or mechanical stresses.
5. Conductive exposed parts must be individually connected with the ground.
6. Doors or covers containing carrying-current components must be bonded.
7. Each coupled cabinets (cubicles) must be equipped with a collective earth bar and connected to the earth bush.
8. Paint and/or coatings must be removed from the contact points. Also a serrated washer is allowed.
9. When necessary, electrically conductive grease must be used to avoid corrosion between the contact points.

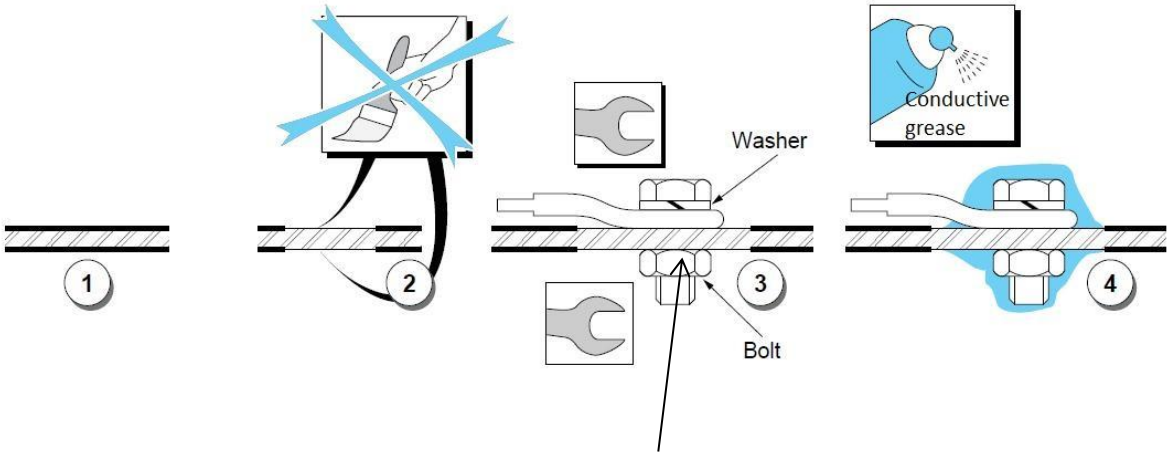


Figure 11 grease applied to protect against corrosion.

10. Galvanized fixing components are recommended.
11. Exposed conductive parts must be individual connected to earthing system.

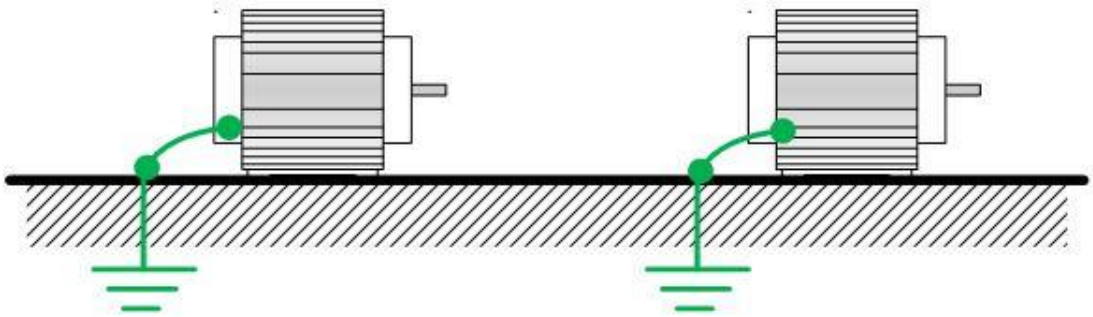
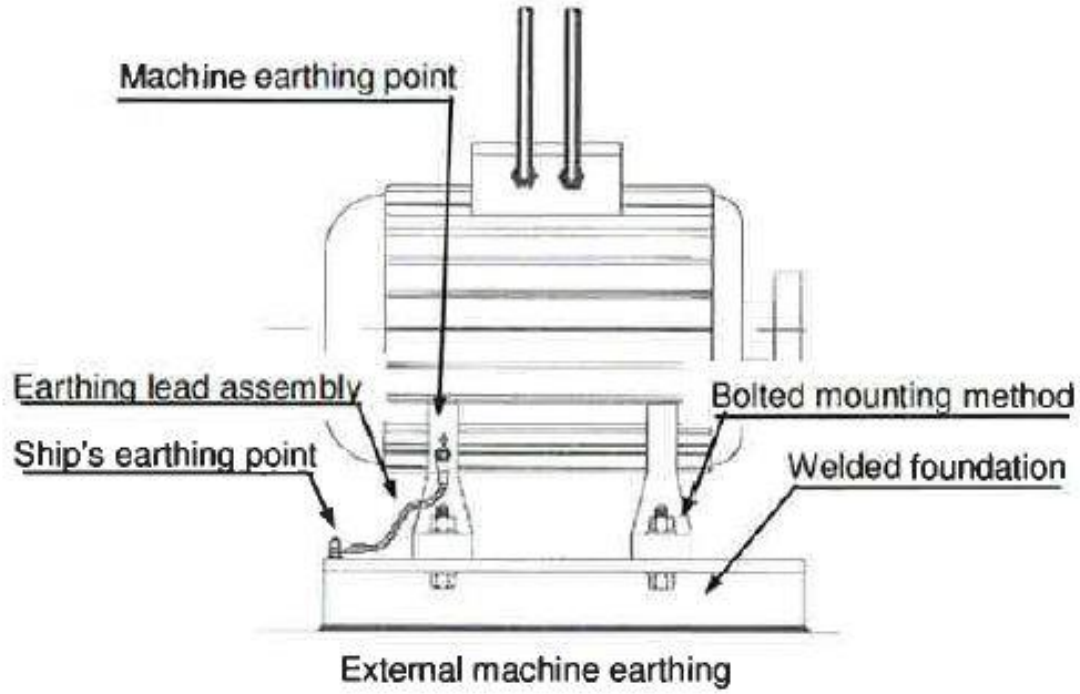


Figure 12 Equipment individual earthed



12. Green-and-yellow must be the only color combination for identifying the protective conductor.
13. In case that the whole length of the conductor is not possible to be colored green-and-yellow, adhesive tape (bi-colored green-and-yellow) must be applied on both end of the cables.

Figure 13 green-and-yellow colored conductor, left with adhesive tape, right whole conductor colored.

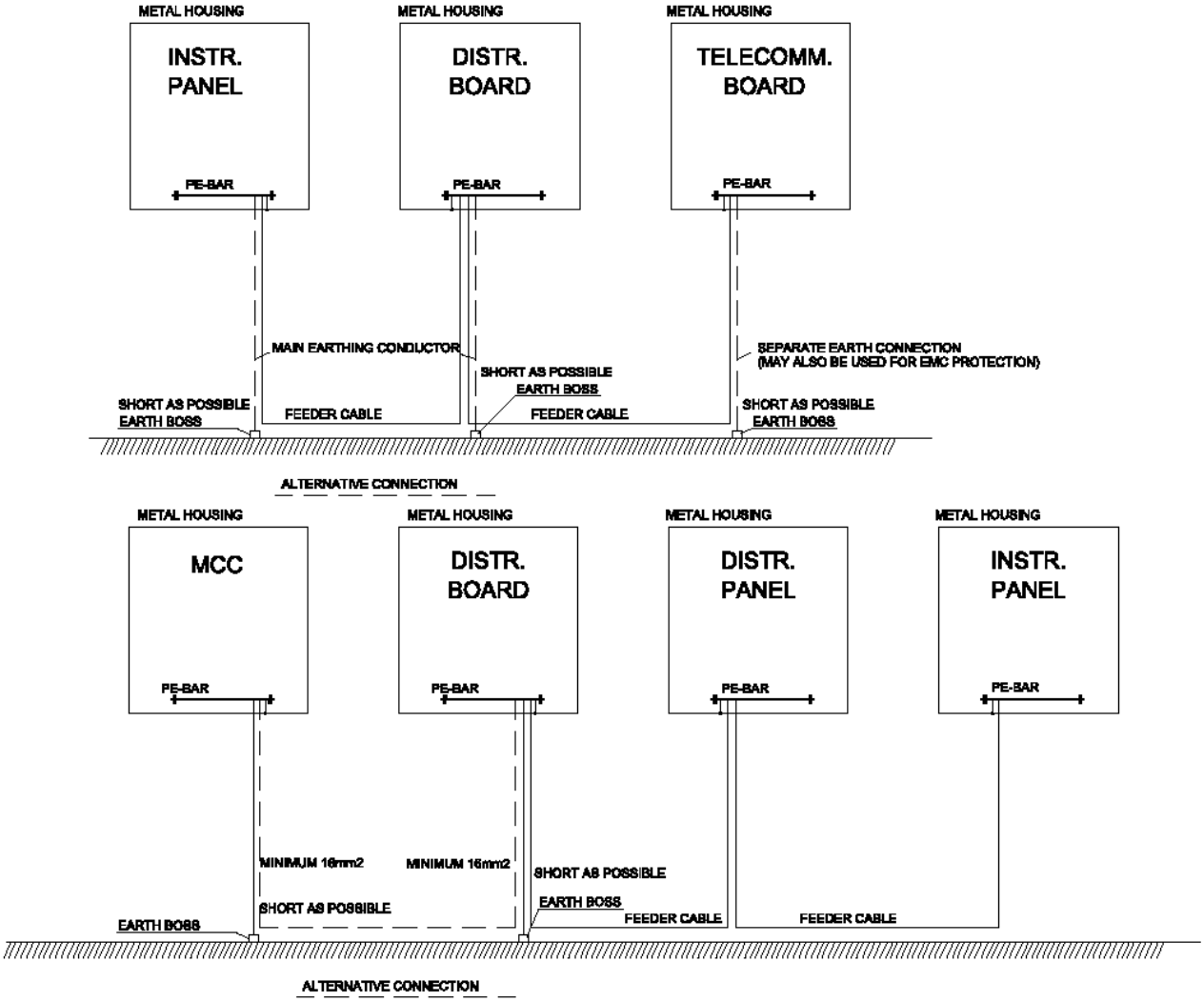


Figure 14 Earthing of cabinets.

4. Cable segregation and routing

4.1 Cable trays

Cable trays provide an earth connection and they must be properly earthed. Cable trays must be welded together and to the ship.
Cable tray's used in control panels, distribution panels etc. shall be earthed to the PE-bar.

4.2 Cable arrangement.

To reduce the magnetic field its preferred to mount the power cables according below table.

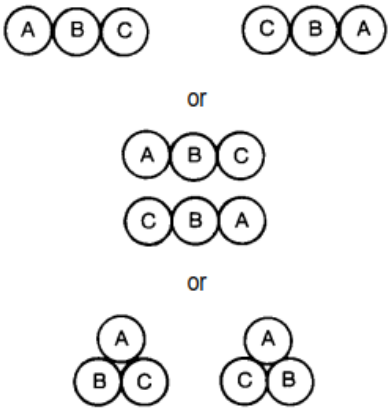
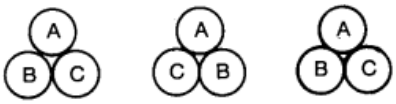
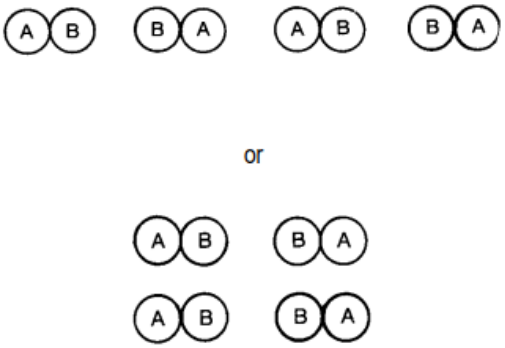
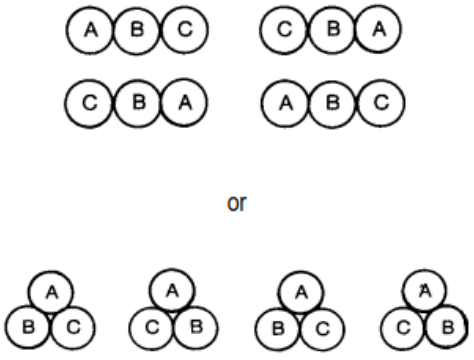
	Single Phase	Three Phase
Two Conductors per Phase		
Three Conductors per Phase	Not Recommended	
Four Conductors per Phase		

Figure 15 Preferred cable arrangement indicated in red

4.3 Cable routing

The installation requirements of the equipment manufacturer, including cable selection and cable routing should be adhered to.

Basically, all cables outside the ship's structure should be metal sheathed, metal braided, or otherwise adequately screened.

Independently of the system they belong to, cables in category S1 up to and including category S4 may be bundled per category.

Cables belonging to category S1, S4 and S5 should be affixed to a metal surface (deck, bulkhead or cable duct). The metal cable ducts should not be insulated from bulkheads.

Only between HV and LV cables 300mm distance is recommended. However, this distance may be reduced to 250mm when a separation plate is used.

Cable category	Cables for	Level	Emission / immunity rating	Cable type	Applicable standard
S1	Power supply Lighting	10 V to 1000 V	Potentially disturbing	Below deck: non screened; above deck: screened	IEC 60092-350 IEC 60092-353
S2	Analogue and digital signals Telephone signals Loudspeaker signals Control signals Alarm signals Encoder data signals	0,1 V to 230 V	Sensitive	Screened twisted pairs, screened power cable, Encoder+pair screened	IEC 60092-374 IEC 60092-375 IEC 60092-376
S2-i	Intrinsic safe		Sensitive	Screened twisted pair	
S3	Radio receiver signals TV receiver signals Video signals	0,1 mV to 500 mV	Extremely sensitive	Coaxial	IEC 60096-1
S4	High-power transmission signals Pulsed high-power signals High powered semiconductor converter	10 V to 1000 V	Extremely disturbing	Coaxial; screened power	Special cable
				Screened EMC	IEC 60092-350 IEC 60092-353
S5	High Voltage	Above 1000V	Extremely disturbing	Own cable tray	IEC xxxxx
S6	High Voltage – EMC	Above 1000V	Extremely disturbing	Own cable tray	IEC xxxxx
-	Fibre optics				

Table 2 Signal cables and cable categories.

4.4 Cable segregation

Cable segregation into categories according to different signal types, and cable installation with intermediate free spaces should be used as major preventive measure.
We will use the recommendations of IEC60533 (chapter B.2.5).

1. Single cables or bundles of cables of different categories which run parallel for distances exceeding 1 m should be installed with an intermediate free space as much as practical possible between the different categories of cables.
2. Single cables or bundles of cables of different categories which cross each other must cross each other with an angle of 90 degrees.

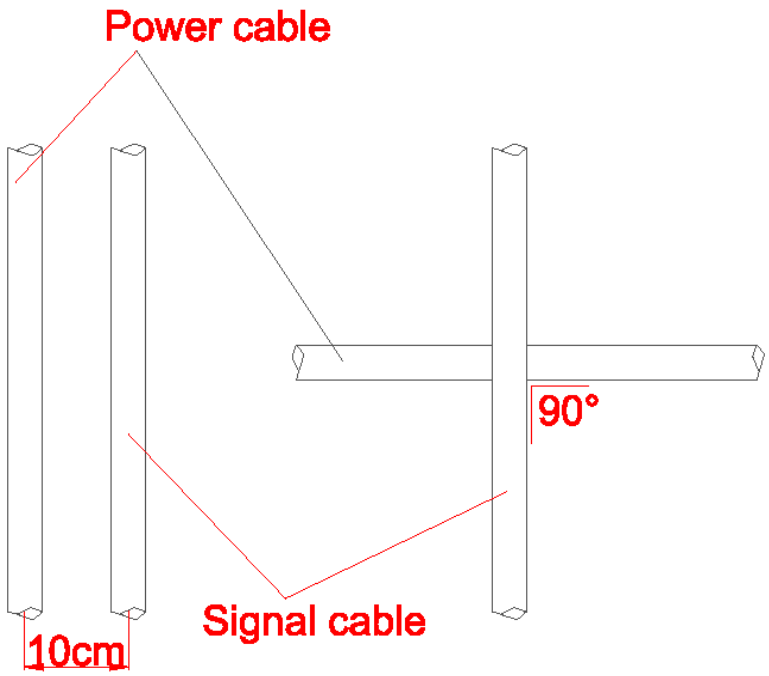


Figure 16 Cable segregation of different categories

Where it is impossible to meet the segregation requirements, cables with high shielding effectiveness (coverage >90%) should be used, or cable bundles should be laid in metal pipes or conduits.

The pipes or conduits should have a minimum thickness of 1 mm if not otherwise specified. If a cable runs through a metal pipe or conduit, further segregation with regard to the other categories is not necessary.

Filling rate must be limited to 40% of conductor cross section.

It is recommended to install the cables close to the metallic ship structure or on metallic cable trays.

5. Cable entry's

5.1 Cable gland solution

There are two cable gland solutions:

1- Non-EMC cable gland
2- EMC cable gland

5.1.1 Non-EMC cable gland

Figure 17 Cable gland example non EMC

To be used for standard cable entrance.
For example: lighting armatures, Local Distribution Panels, Power Distribution Panels etc.

5.1.2 EMC cable gland

Figure 18 Cable gland example EMC

How to connect the cables into the enclosure with EMC cable glands:

1 Remove the cable insulation to ensure good electrical connection with the gland.
2 Pull the cable into the gland.

   Make sure that the cable is entering the gland straight to avoid any bending forces on the gland.

3 Power cable: drain wire/loop shall be connected to PE-bar inside the enclosure in addition to EMC connection inside the gland.

   Signal cable: For pass through glands, cut the braid armour/screen inside the enclosure and finish the cable with heat shrink or insulation tape.

To be used when mentioned in the project or vendor specifications.

5.2 MCT Solution

There are two MCT solutions

1- Non-EMC type
2- EMC type

5.2.1 Non-EMC MCT solution

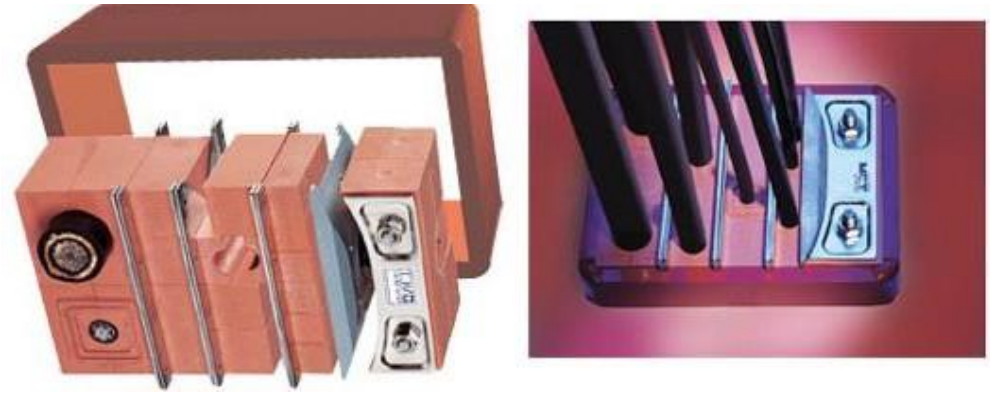


Figure 19 MCT example non-EMC

How to connect the cables into the enclosure with non-EMC MCT solution:

1 Pull the cable trough the MCT and connect loop/screens according to the section

To be used when watertight or fire resistance cable entrance is required.

5.2.2 EMC MCT solution

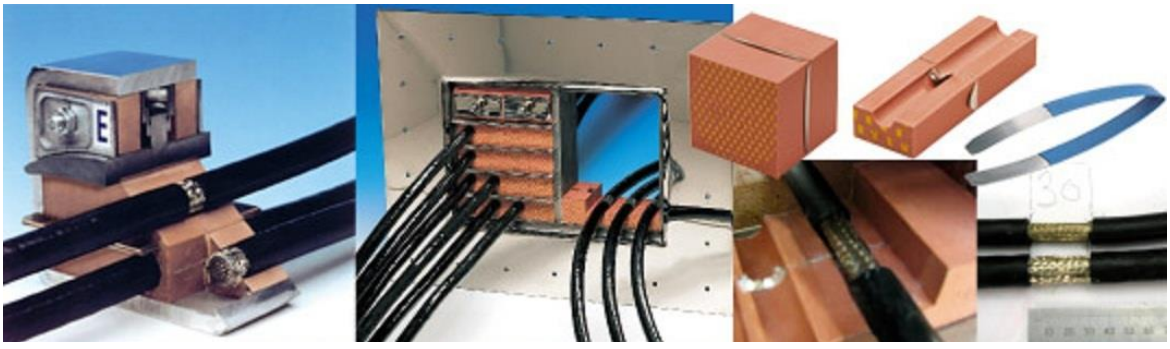


Figure 20 MCT example EMC

How to connect the cables into the enclosure with non-EMC MCT solution:

1 Pull the cable trough the MCT.
2 Remove the cable insulation and install the EMC modules on the cable.
3 Attach the exterior screen to the EMC module (360 degrees earthing) and install the EMC module inside the MCT.
4 Attach heat shrink on the cable inside the enclosure

To be used when mentioned in the project or vendor specifications when EMC cable entrance is required.

6. Termination of cable screens

This chapter describes how to connect cables to the earthing system, separated in non-EMC and EMC entry.

6.1 Power cable

6.1.1 Non-EMC entry

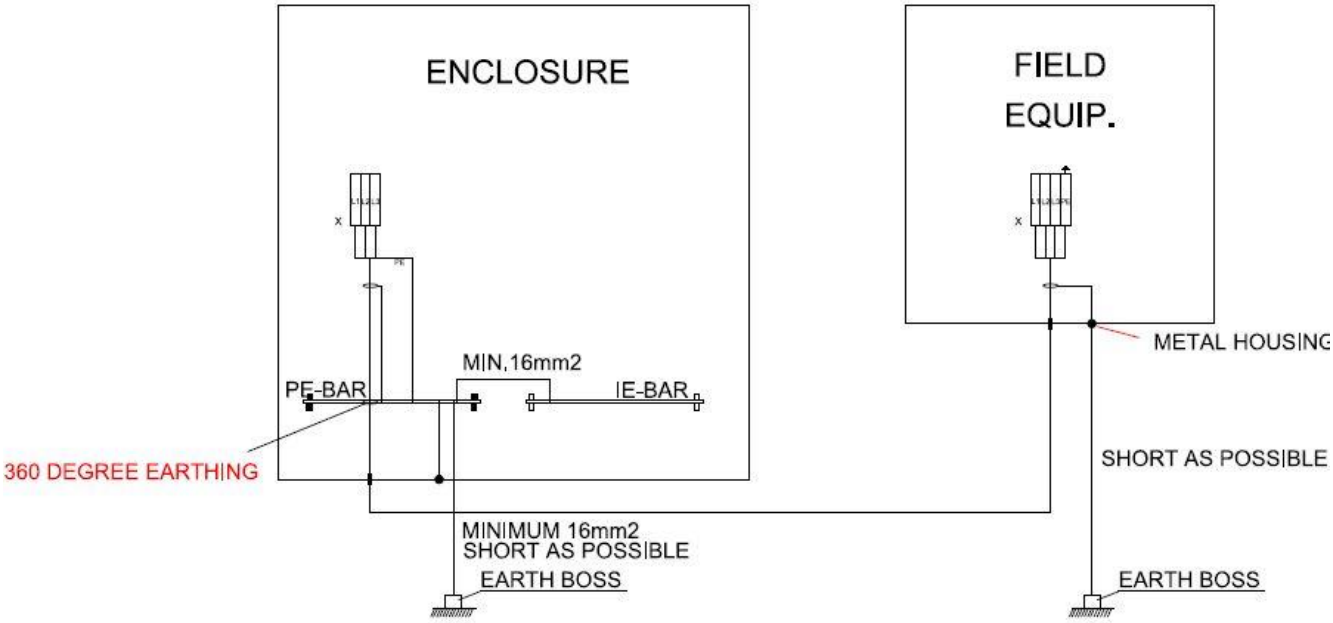


Figure 21 Power cable connection non-EMC entry

For power cable: the cable shield or armour shall be connected to PE-bar both inside the enclosure and on the field equipment. The earth conductor shall be sized as specified in paragraph 3.7.
For power cables where the braid armour does not have sufficient cross section, the equipment must be earthed through a separate conductor in the cable.

How to connect the power cables with cable shield or armour:

1. Connect the overall shield or armour to the PE-bar inside the enclosure with a 360-degree earth connection.
2. The separate earth conductor shall be connected to the PE-bar inside the enclosure.
3. Earth conductor shall be coloured yellow/green.
4. Overall screen to connect to the PE bar using a Loop to be foreseen of a yellow/green tubing.

Preferred earthing in the enclosure at the PE bar is with a 360degree earthing.

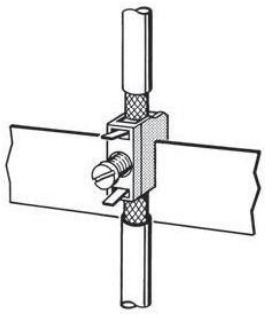


Figure 22 360degree earthing.

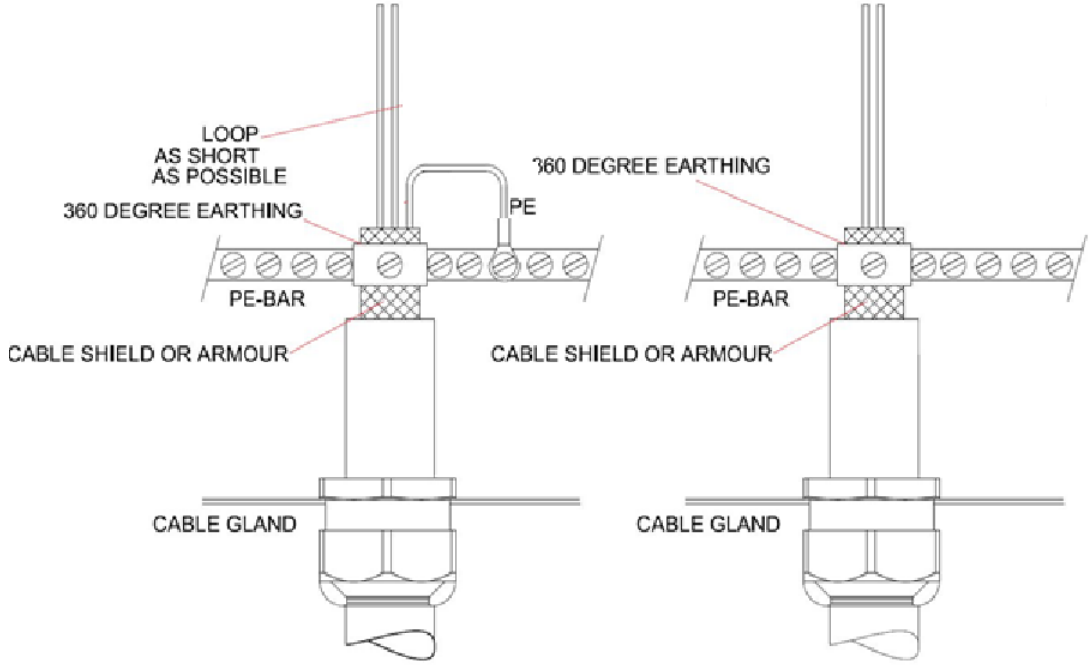


Figure 23 Detail power cable with cable shield or armour,

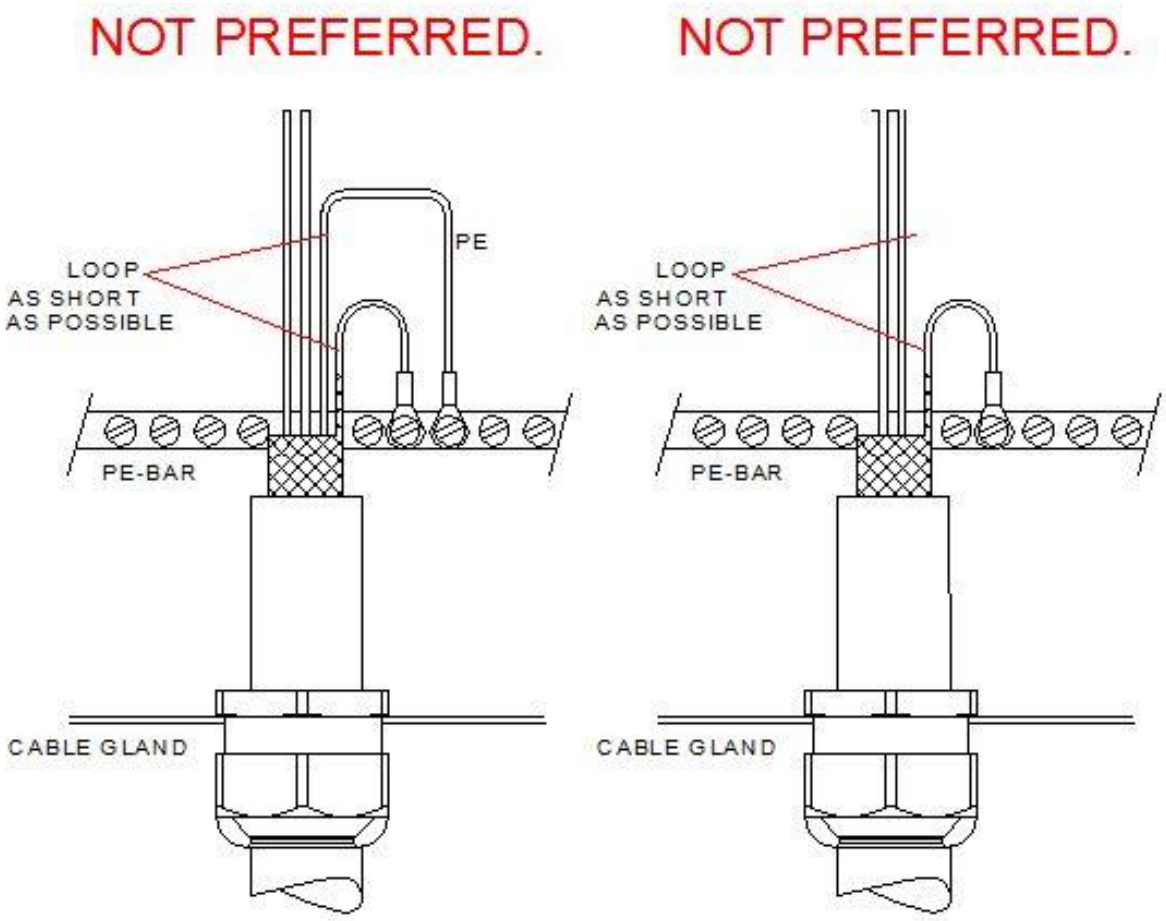


Figure 24 Detail power cable with cable shield or armour NOT preferred.

6.1.2 EMC entry

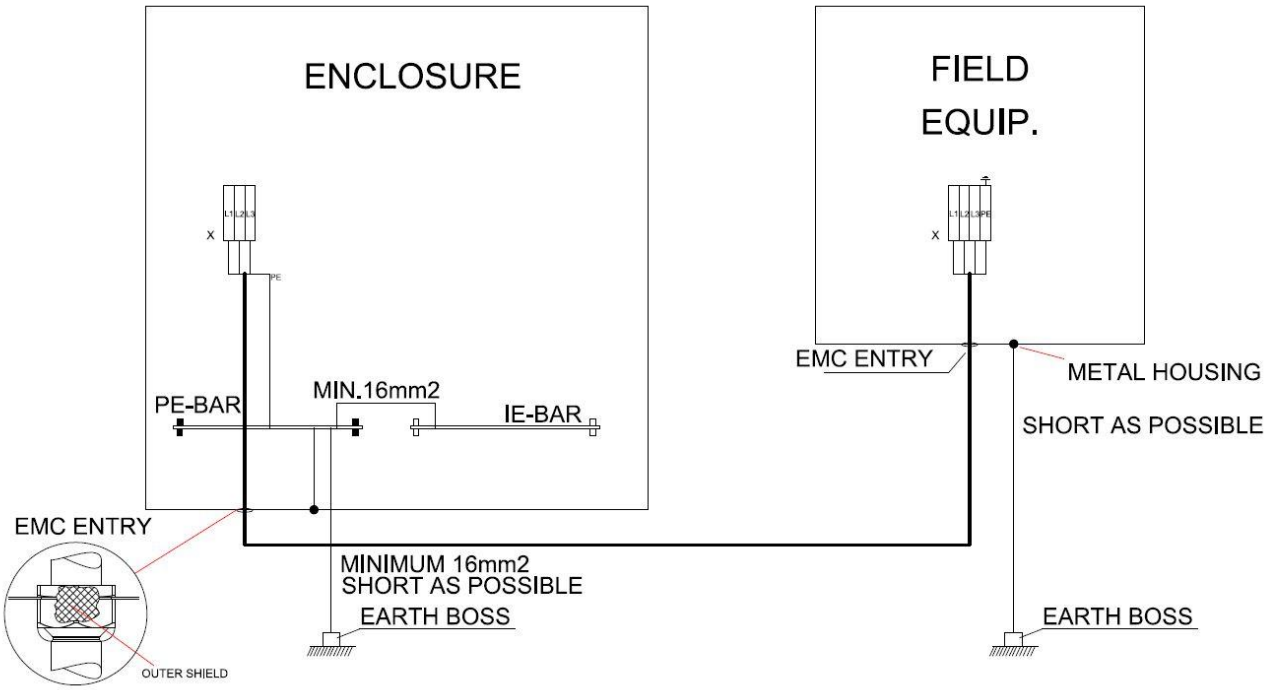


Figure 25 Power cable connection EMC entry.

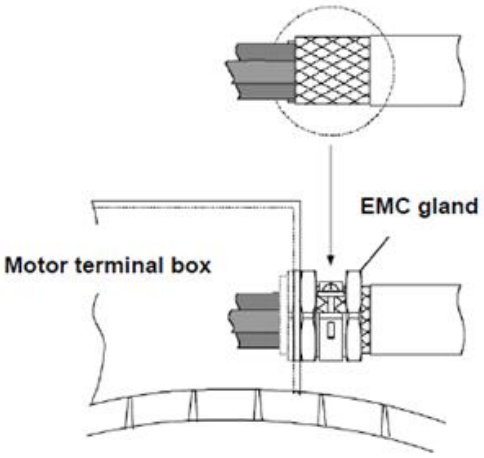


Figure 26 Detail of cable inlet with EMC cable gland at the field equipment.

6.1.2.1 EMC entry with an EMC gland

For power cable: the cable shall be connected to PE-bar both inside the enclosure and on the field equipment. The earth conductor shall have an equal square size as the largest conductor in the power cable.

How to connect the cables with separate earth conductor:

1. Connect the outer shield to EMC cone in the cable gland.
2. The separate earth conductor shall be connected to the PE-bar inside the enclosure.
3. Earth conductor shall be coloured yellow/green.

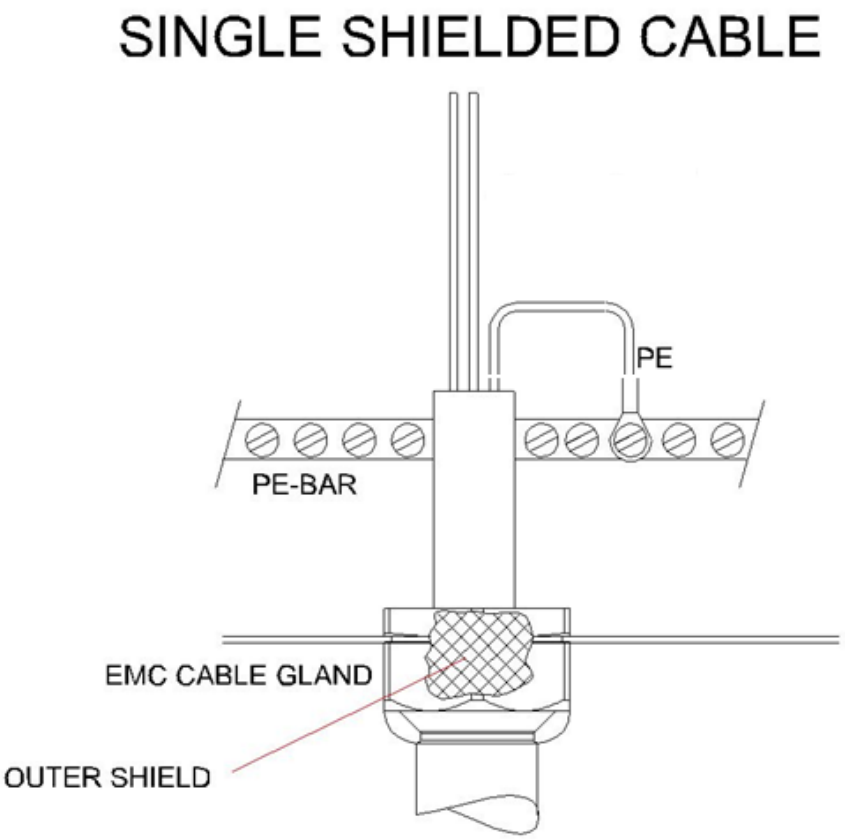


Figure 27 Detail power cable connection EMC entry single shielded cable.

6.1.2.2 EMC entry with a MCT frame

How to connect the cables with separate earth conductor:

1. Connect the outer shield to EMC Cable block from the MCT frame.
2. The separate earth conductor shall be connected to the PE-bar inside the enclosure.
3. Earth conductor shall be coloured yellow/green.

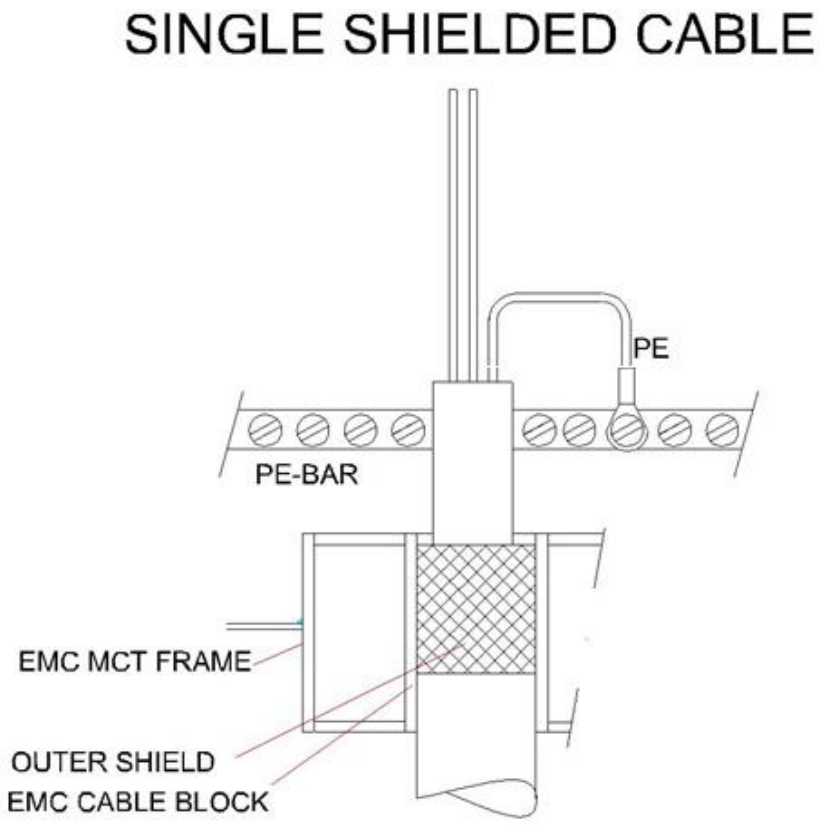


Figure 28 Detail power cable connection EMC –MCT frame entry single shielded cable.

6.2 Instrument cable with overall shield

6.2.1 Non-EMC entry

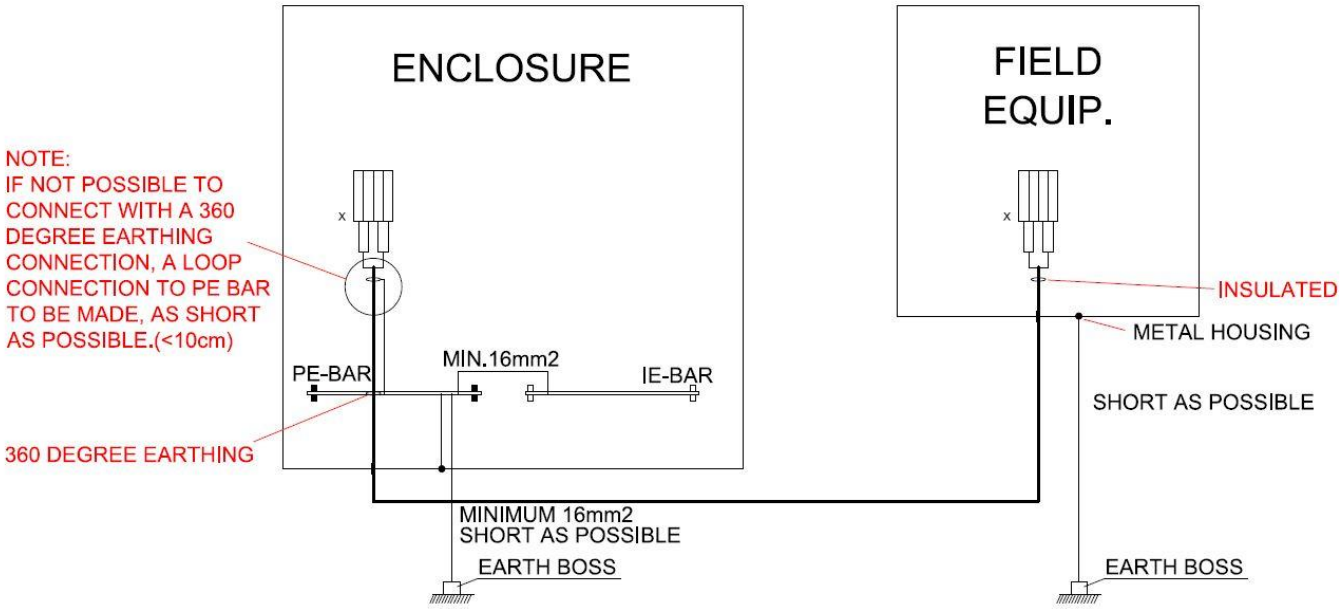


Figure 29 Instrument cable with overall shield/braiding connection non-EMC entry.

Overall shield shall be connected to the PE-bar in the cabinet enclosure.

How to connect the cables with overall shield/braiding in the enclosure:

1. Attach the overall shield to the PE-bar (360-degree earthing)
2. If the 360-degree earthing is not possible use a loop (as short as possible).

How to connect the cables with overall screen in the field equipment:

1. Unless otherwise specified, the screen should be insulated in the field equipment
2. If specified by the supplier of the field equipment, that both sides of the screen must be connected to the earth. This must be done by entrance of the equipment or with a short loop(<10cm) connected to the earth connection.

6.2.2 EMC entry

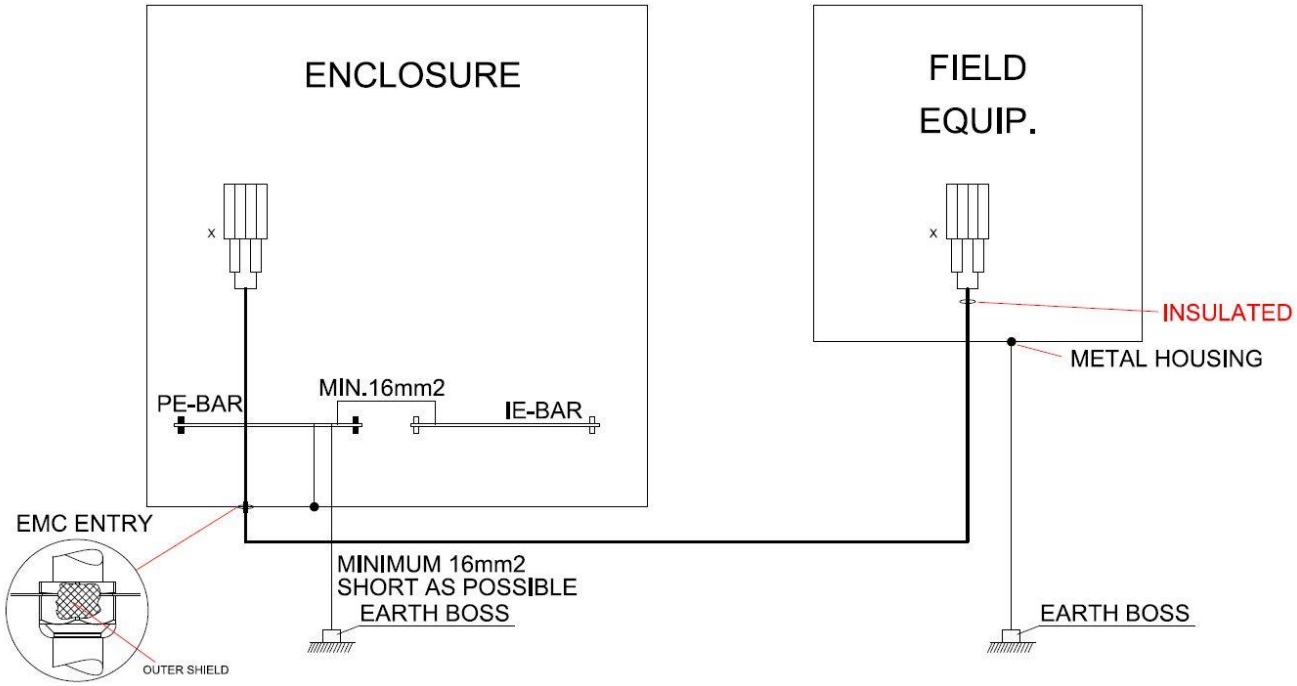


Figure 30 Instrument cable with overall shield/braiding connection EMC entry

How to connect the cables with overall shield:

1. Attach the overall shield to the cone of the EMC cable gland instead of the PE-bar.

How to connect the cables with overall screen in the field equipment:

1. Unless otherwise specified, the screen should be insulated in the field equipment
2. If specified by the supplier of the field equipment, that both sides of the screen must be connected to the earth. This must be done by entrance of the equipment or with a short Loop (<10cm) connected to the earth connection.

6.3 Instrument cable with overall and pair shield

6.3.1 Non-EMC entry

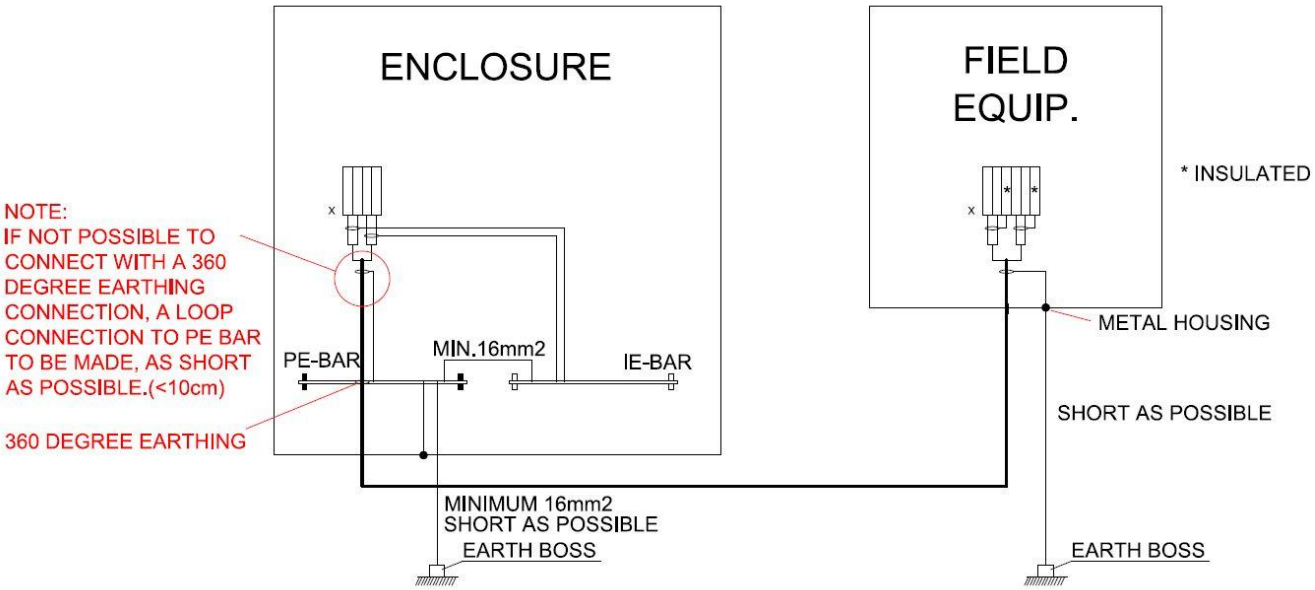


Figure 31 Instrument cable with overall shield and pair shield connection non-EMC entry.

Overall shield shall be connected to the PE-bar and the pair shield shall be connected to the IE-bar.

How to connect the cables with overall shield/braiding:

1. Attach the overall shield to the PE-bar (360-degree earthing)
2. If the 360-degree earthing is not possible use a Loop (as short as possible)
3. The inner (pair) shields to attached to the IE-bar.

How to connect the cables with overall screen in the field equipment:

1. Unless otherwise specified, the screen should be insulated in the field equipment
2. If specified by the supplier of the field equipment, that both sides of the screen must be connected to the earth. This must be done by entrance of the equipment or with a short Loop (<10cm) connected to the earth connection.

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6.4 EMC Entry

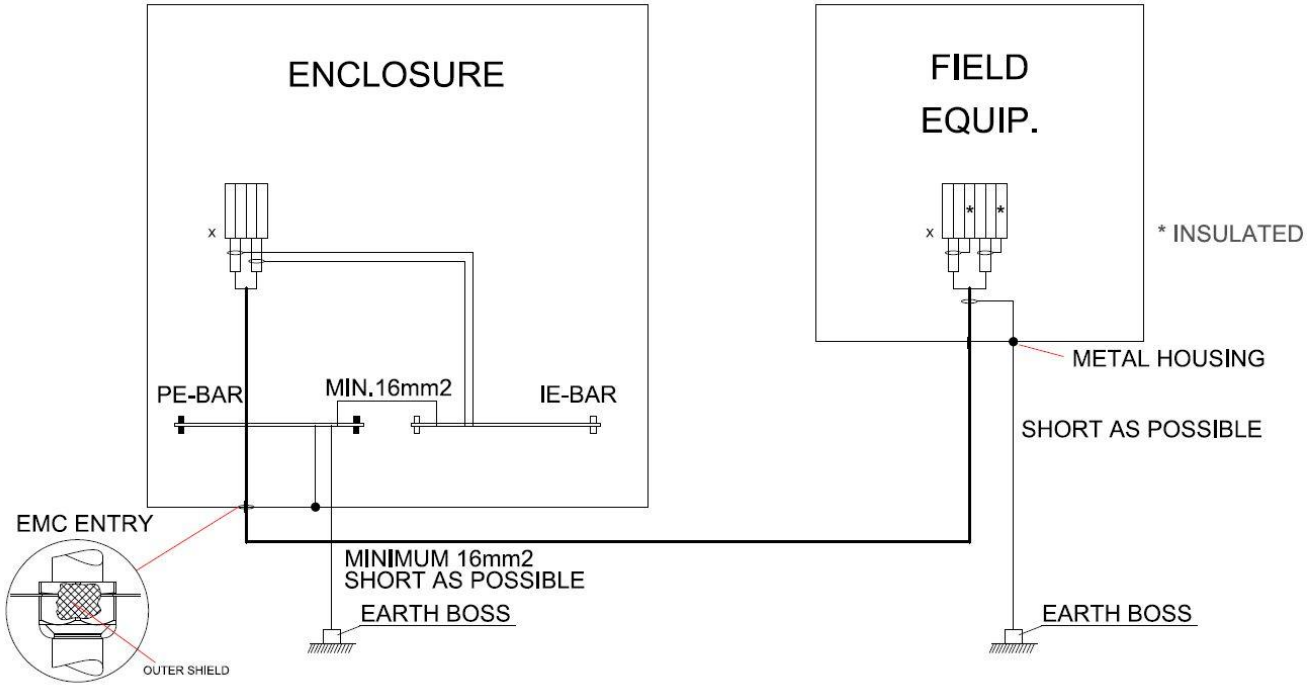


Figure 32 Instrument cable with overall shield connection EMC entry.

Overall shield shall be attached to the EMC cone in the cable gland and the pair shield shall be connected to the IE-bar.

How to connect the cables with overall shield/braiding:

1. Attach the overall shield to cone of the EMC cable gland, instead of the PE-bar.
2. The pair shields to attached to the IE-bar.

How to connect the cables with overall screen in the field equipment:

1. Unless otherwise specified, the screen should be insulated in the field equipment
2. If specified by the supplier of the field equipment, that both sides of the screen must be connected to the earth. This must be done by entrance of the equipment or with a short Loop (<10cm) connected to the earth connection.

6.5 Cable connections in Junction Boxes

For detailed connection in Junction boxes we refer to the IHC Systems typicals for junction boxes.

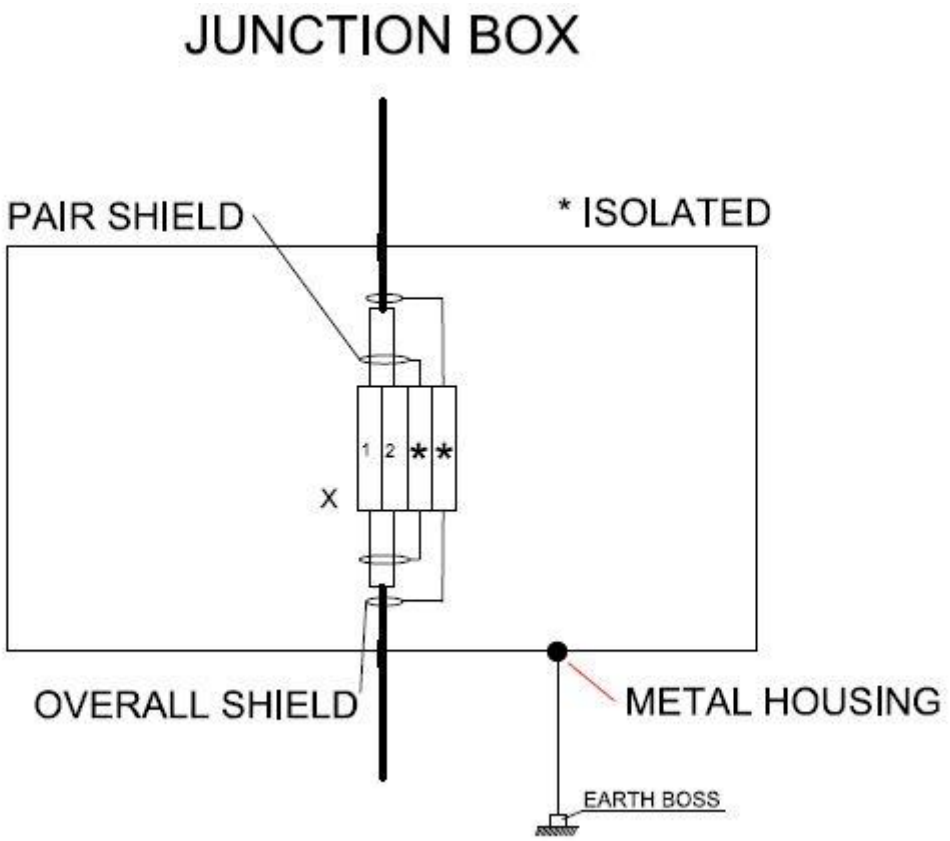


Figure 33 Connection in a junction box. Non-EMC entry

In case of metal housing the housing to be earthed.
Al the cable cores connected inside the enclosure as a Loop. If there are more PE terminals in a junction box they can all have the same earth potential.

Non-EMC Junction Box.
How to connect the cables with separate earth conductor:

1. The PE-core shall be connected to the PE-terminal.
2. The overall shield shall be connected to an isolated terminal.
3. If there are pair shield they shall be connected to an isolated terminal.

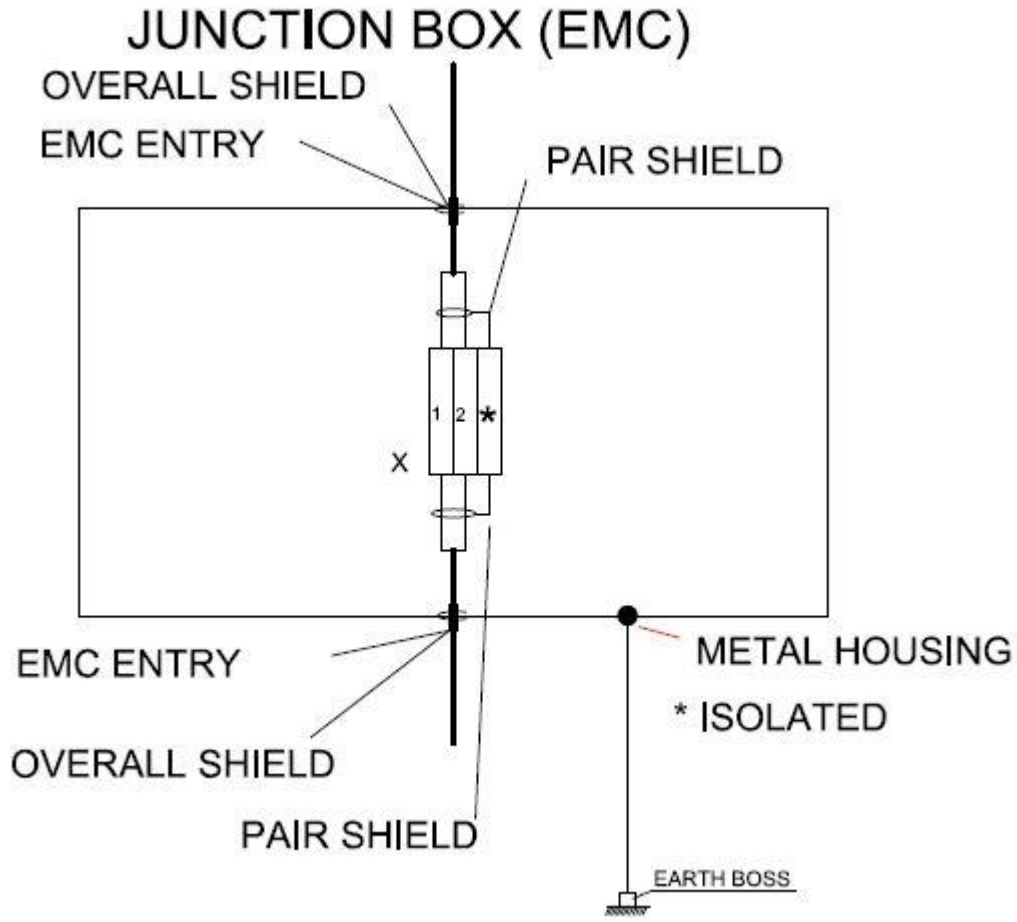


Figure 34 Connection in a junction box EMC entry

EMC Junction Box.

1. The PE-core shall be connected to the PE-terminal.
2. The overall shield shall be connected to the EMC cone of the cable gland.
4. If there are pair shields they shall be connected to an isolated terminal.

Terminals of signal cables to keep away as far as possible from terminals of power cables.

6.6 Spare conductors

Spare conductors in instrument cables should be connected in the field equipment to the earth. Spare conductors in the enclosure to be connected to spare terminals and to the PE bar.

If there are no spare terminals left in the cabinet, all spare conductors shall be covered with y/gn sleeves and marked with relevant cable number and connected to the relevant earth bar.

7. **Earthing of communication equipment**

For the earthing of communication equipment, the regulation of the manufacturer shall be followed. If not mentioned a ground litz is preferred.

Figure 35 grounding of communication equipment with a ground litz.

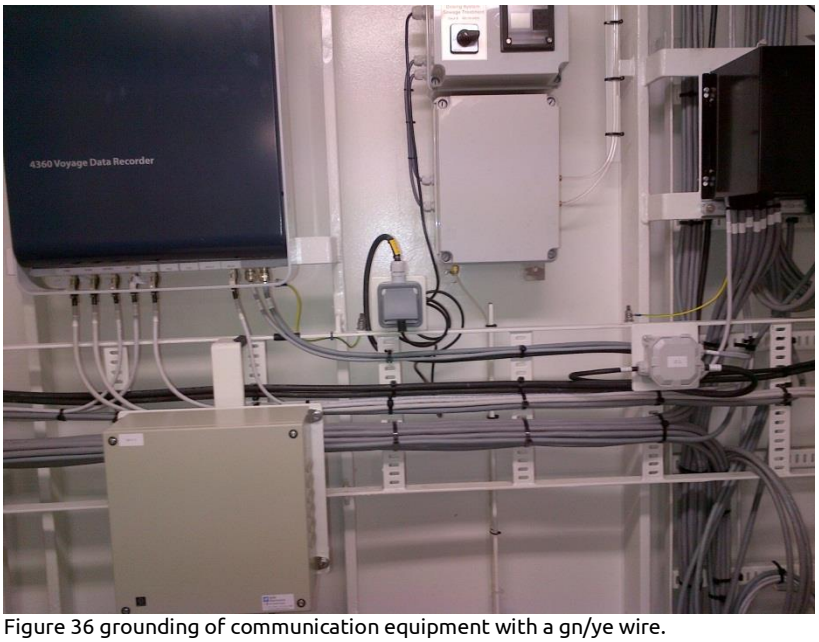


Figure 36 grounding of communication equipment with a gn/ye wire.

8. Field bus systems

For earthing of special equipment such as field bus systems the guide line for earthing and/or EMC requirements from the manufacturer has to be followed.

8.1 Profibus

The braided shields of all PROFIBUS cables entering the cabinet should be earthed with metal clamps as close as possible to the point of entry to the cabinet. This is because the cable screen can carry noise into a cabinet it can disrupt sensitive electronic equipment. Earthing the screen close to the point of entry minimizes this problem.

Figure 37 360-degree earthing is preferred.

Try to avoid parallel routing of PROFIBUS cables and internal cabinet wiring, even with cables of the same category. Try to maintain separation distances, but where cables of different categories must cross, they should do so right angles.
In order for the screen to be effective at high frequencies, ***the screen must be earthed at both ends of the cable***. Sometimes, however the local earth at different parts of the plant can be at significantly different potential, which can lead to current passing along the cable screen. ***Such screen current is to be avoided since it can lead to interference pickup.***

The network screen must never be used for potential equalization.

8.2 Industrial Ethernet / Profinet

For Ethernet based communication systems,
use screened twisted-pair cables throughout the system. The shields of these cables need to have an adequate density to meet the legal requirements regarding noise emission and immunity.

Always contact the shields of bus cables at both ends. The legal requirements for noise emission and noise immunity in the system (CE marking) can only be achieved when the shields make contact at both ends.
Secure the shield of the bus cable to the connector casing.
it is advisable to remove the insulation of the shielded cable and to establish contact on the shield/PE conductor bar.
Possible solution is the use of a DIN rail module.

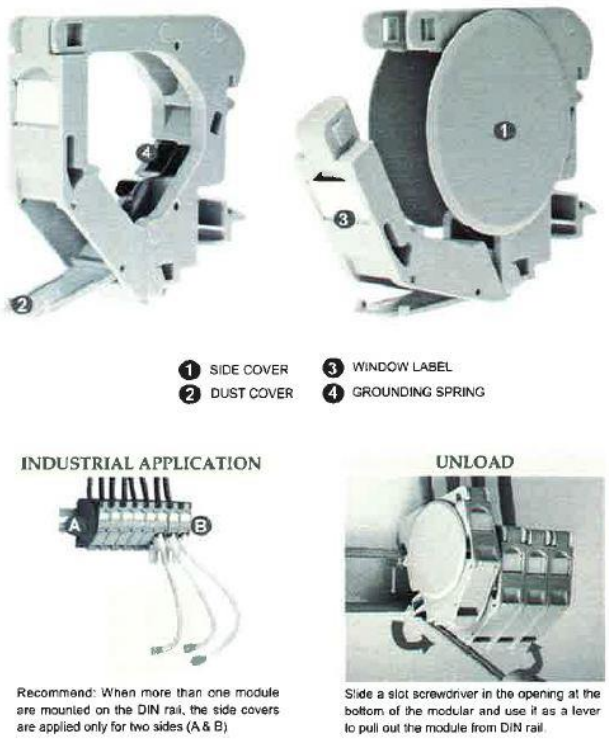


Figure 38 DIN Rail module for Ethernet cable.

For communications between external systems, the use of fibreoptic cables is generally recommended. Due to the optical transmission principle, fibreoptic cables are not affected by electromagnetic interference. Measures for equipotential bonding and for overvoltage protection are unnecessary with fibreoptic cables.

9. EMC design

9.1 General

When EMC requirements are fulfilled on an installation or a system, devices will have the capability to function properly in an electromagnetic environment and they should not cause interference in such a way that it would affect the proper function of other devices.

Source of interferences:

- Environment
- Cables
- Power supplies
- Frequency converters
- Coils for contactors
- Braking module

9.2 EMC reduction

9.2.1 Openings in electrical cabinets

As a general rule, holes or openings e.g. ventilation holes, open doors, must be avoided as much as possible on the cabinet enclosures, otherwise it will undo the shielding effect of the cabinet. Consequently, electromagnetic fields will be radiated inside the cabinet and vice-versa.

9.2.2 Outside cables

For outside cables it's preferred to have a minimum distance outside the structure.
If this is not possible then it's recommended to install the cable in a metal tube.

Figure 39 Outside cables NOT preferred

Figure 40 Minimum distance outside cable

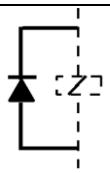
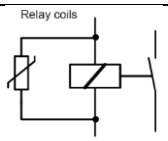
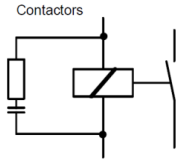
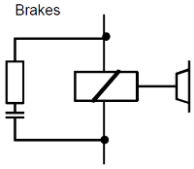
9.2.3 Supplies

Transformers with static shield between the primary and secondary winding are recommended when these are direct connected to the frequency converter. The static shield must be earthed.

9.2.4 Suppression circuits

Coil inductances e.g. relays, contactors generate (high) induction voltages during disconnection of the currents. To avoid high transient voltages, suppression elements can be applied to the circuits. The suppression elements also prevent the interference coupling paths between the coils and e.g. parallel running cables. Interference suppressors must be connected directly on each coil, or kept the distance as short as possible.

Table 3 Suppression circuits

SUPPRESSION MEASURE		APPLICATION
Freewheel diode circuit		Diode suppresses the surge voltage. Suitable for DC voltages.
Varistor circuit		A voltage dependent resistance limits the voltage across the switch. Suitable for AC/DC voltages.
RC circuit	 	RC circuit to reduce the surge voltage. Suitable for AC voltages.

9.3 Electric components

Electric components should be installed according the instructions of the manufacturer.
This equipment shall be installed in the original housing as it was tested to be sure the required compatibility is maintained.

9.4 Variable Speed Drive Cabinets

One of the most effective ways to comply the EMC requirements on a system/installation is the implementing of an EMC zone concept. Hereby, sources of interference must be physically separated from the sensitive equipment and grouped in zones according to the degree of interference or sensitivity.

This concept is highly recommended in electrical cabinets. Pulsed modulated voltage made in the inverter module causes radiation of high-frequency fields in the motor feeder cables. Additionally, the pulsed modulated voltage produces charging and discharging of the parasitic capacitances. Therefore, an interference current flows back to its source following the path with least resistance. To avoid interference currents on the installation, measures must be taken. The most important measures are described.

1. Incoming cables connected to the frequency converter input terminals must be shielded. Additionally, both ends of the cable shielding must be connected to the grounding bar.
2. Input power cables and motor cables must be separated, refer to Figure 41
3. Components with a metallic housing must be connected to the ground. Also other metallic parts such as mounting plates or support frames must be connected to the ground.
4. Motor cable must be shield bonded at both ends with a solid 360° contact.
5. Roll springs can be used to connect the motor cable screen to the earth bar. The earth lead should be as short as possible.
6. Differentiate between protective earth and HF bonding
7. HF bonding, typically, should consist of flat braided " litze"
8. To maximise contact, it should be clamped, otherwise bolted.
9. Preferably on 2 positions on bigger motors.

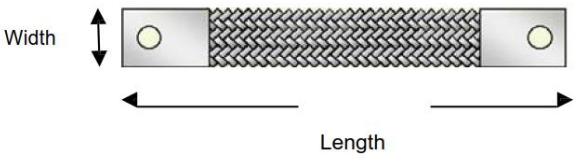


Figure 41 Example of a litze

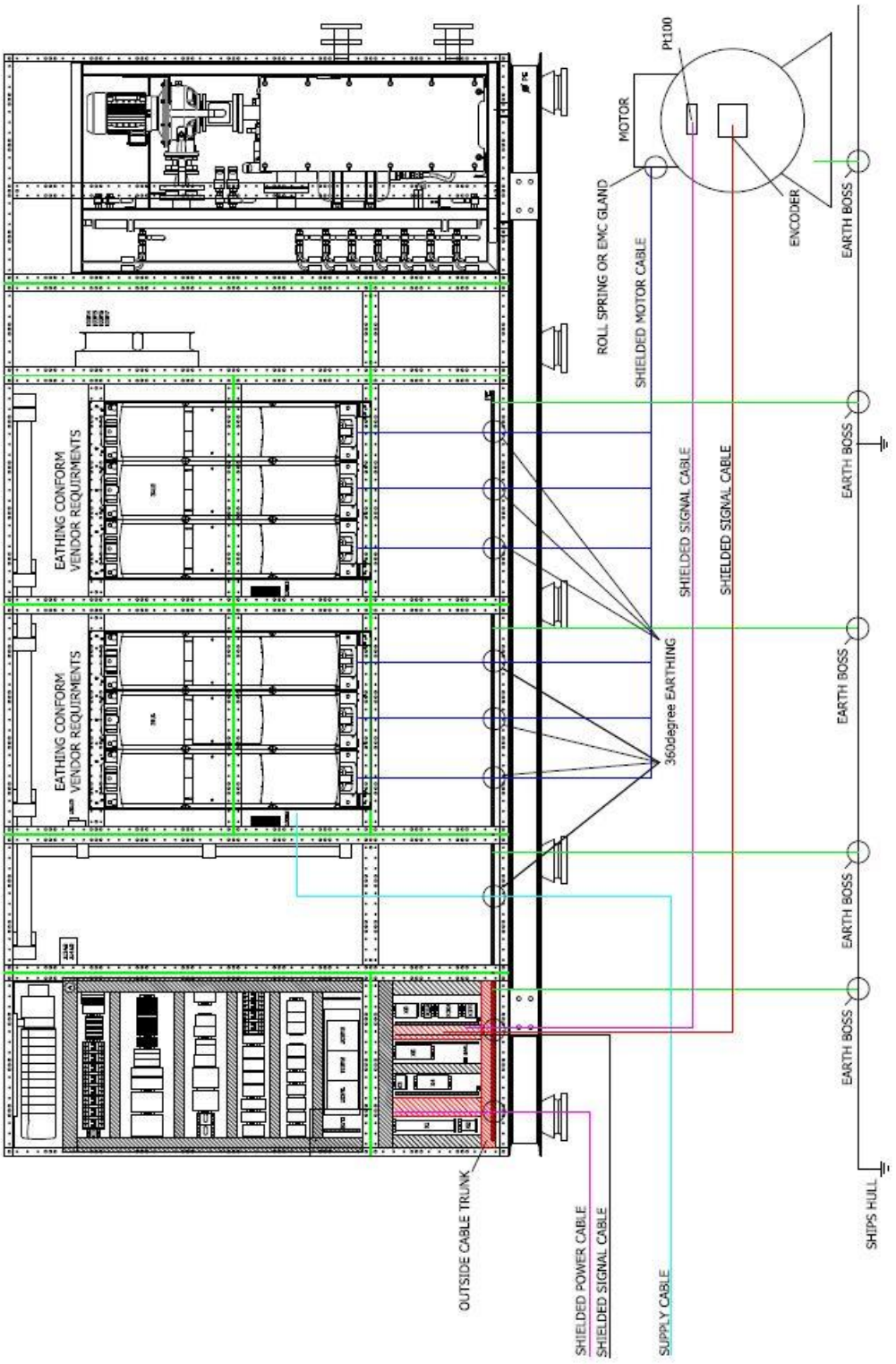


Figure 41 - cable connection VSD cabinet

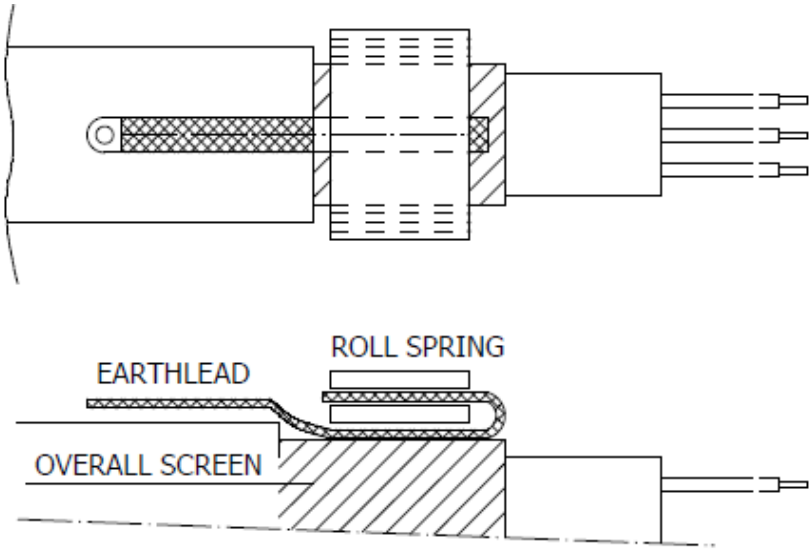


Figure 42 shield connection motor cables inverter side

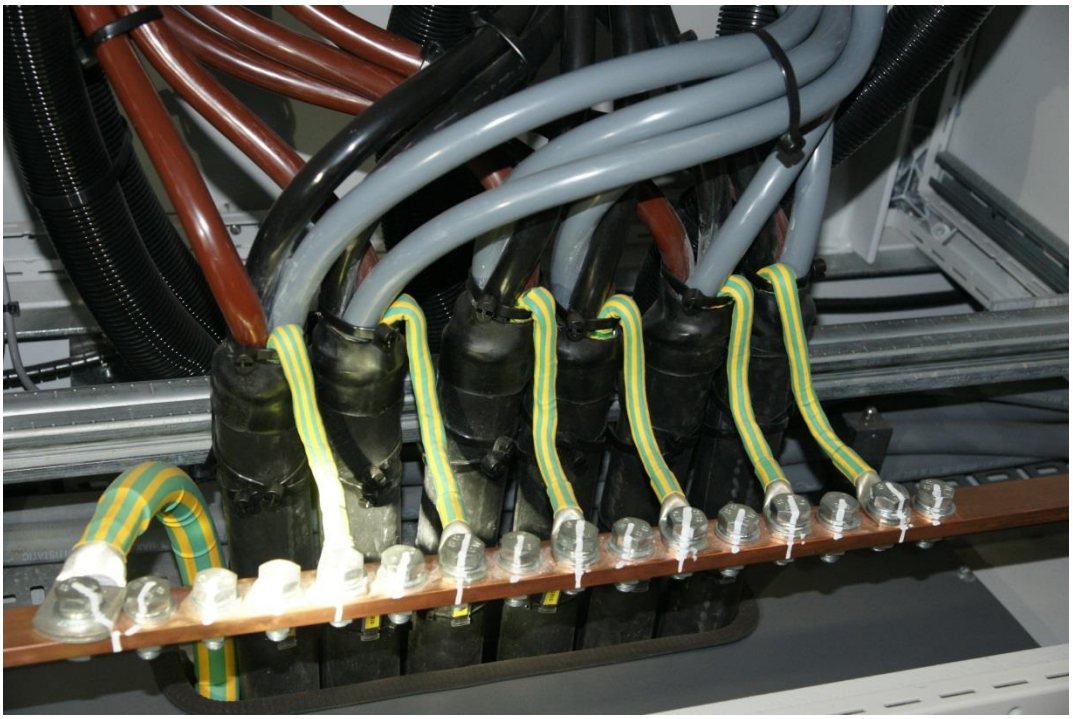


Figure 43 Cables connected with roll springs to PE bar

10. Signal cables must enter the cabinet only from one side.
11. When for example an external 24V power supply is needed, each frequency converter must have its own external power supply.
12. PLC and other control components must be fed from a different power supply than that of the frequency converter.
13. If 8. cannot be met, an isolating transformer is recommended, it will isolate the PLC and other control components from the line supply.
14. Shield bonding of brake cables is recommended.
15. Grounding strips are recommended instead of earth cables between the cabinet housing and cabinet door.
16. Earth connection must be kept as short as possible.

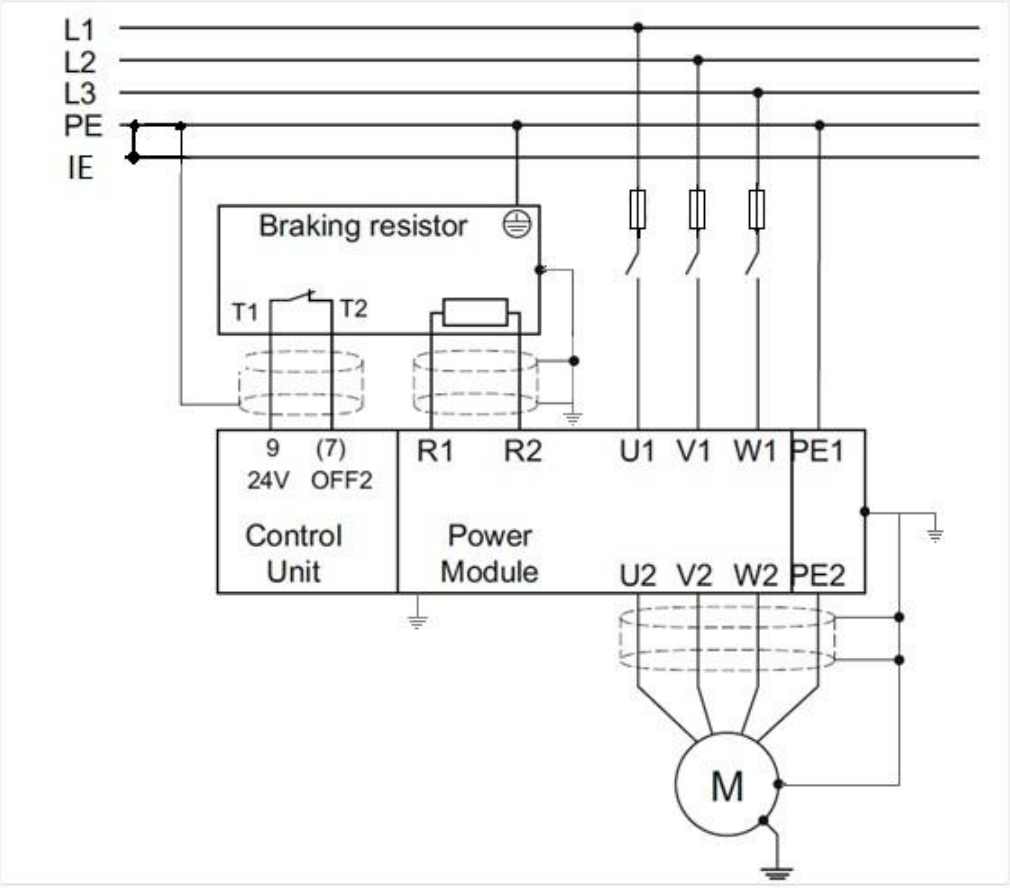


Figure 44 Earthing braking resistor.

13. Braking resistor cables must be shielded and connected to the earthing. The connection cables (to the converter) must be shielded and also connected to the earthing.

10. **Cables**

10.1.1 Cables general

Cables must be selected and routed according the type and strength of signal they transport.
Therefore, suppliers have to state what signal group their cables belong to.
Suppliers to advice what type of cable should be used and how it should be routed in relation to other cables and equipment.
To reduce interference its recommended to let cables directly into the structure

10.1.2 What cable to use

1	PT100	-	TPOS, FLEX-OS Xx3x0,75
2	Encoder HTL/TTL	-	TPOS, FLEX-OS
3	Encoder SSI	-	OSPS, FLEX-OS
4	4-20mA Signal	-	TPOS, FLEX-OS 2x2x0,75
5	Power cable high voltage	-	HV
6	Power cable medium voltage	-	MV, MVL
7	Power cable	-	OS, NS
8	Outgoing freq.converter	-	OS-EMC
9	Fire/smoke detector	-	OS
10	Outside equipment (Non-comm.)	-	OS, OS-EMC
11	Data	-	CAT5, CAT6, CAT7, CANBUS FIBER-MM, FIBER-SM
12	Communication, Radar etc.	-	Supplier recommandation.
13	Proximity switch	-	TPOS 2x2x0,75

Remark: use of fire-resistant cable is explained in the ships classification rules and depends on cable routing and fire and safety plan.

10.1.3 Cable connection details power cables

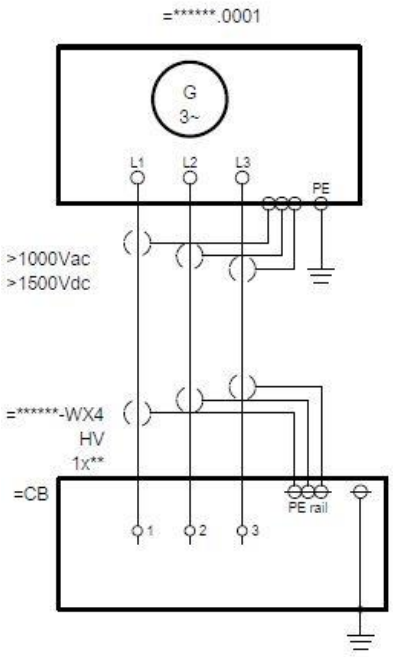


Figure 45 High voltage connection

Cable types: High voltage cables.

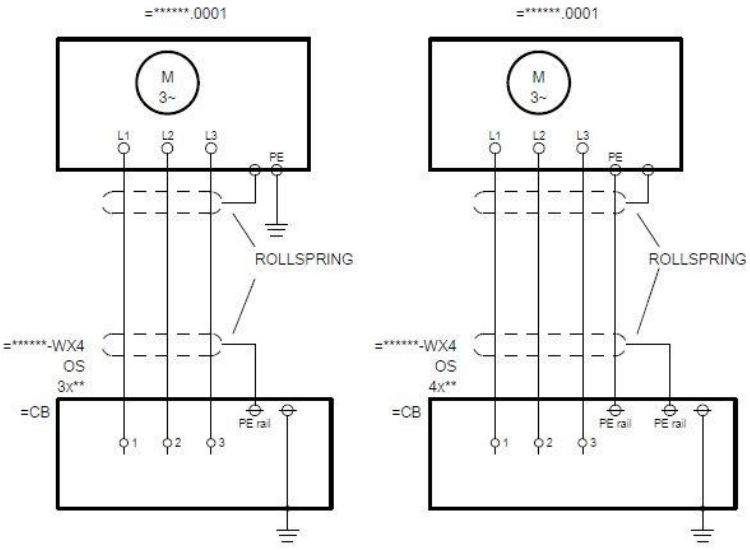


Figure 46 Power consumers

Cable types: Overall Screened, Flexible Screened cable
For frequency controllers Overall, screened electromagnetic compatibility cable

10.1.4 Cable connection details signal cables

Keep the cable shield as close as possible to the terminals/connections.

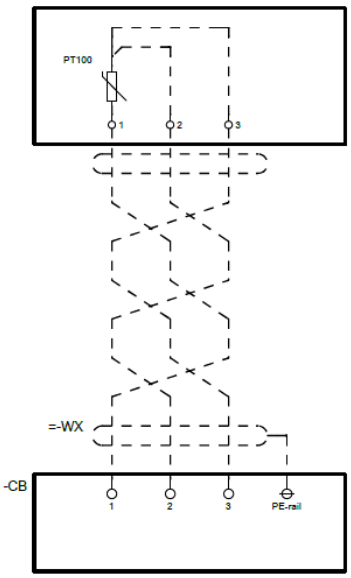


Figure 47 PT100 connection with a TPOS, 3x0,75 cable

Cable types: Twisted Pair Overall Screened.

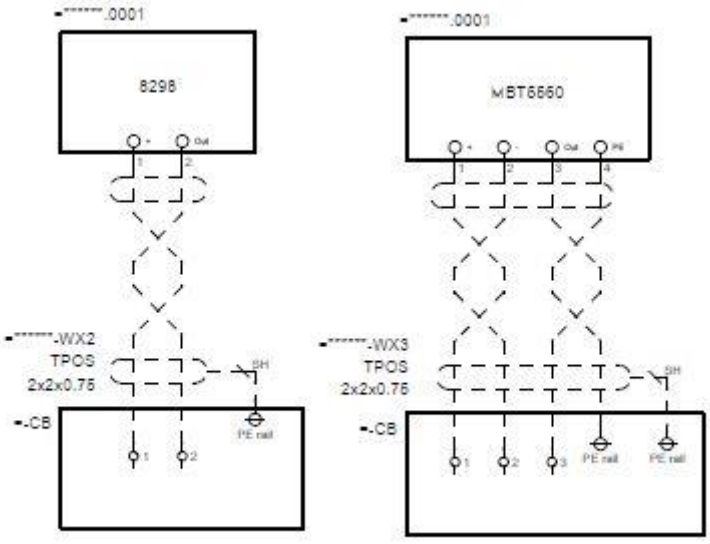


Figure 48 Transmitters (4-20mA out)

Cable types: Twisted Pair Overall Screened, Flexible Screened cable

Cable types: Twisted Pair Overall Screened, Flexible Screened cable, Overall screened and Pair Screened cable

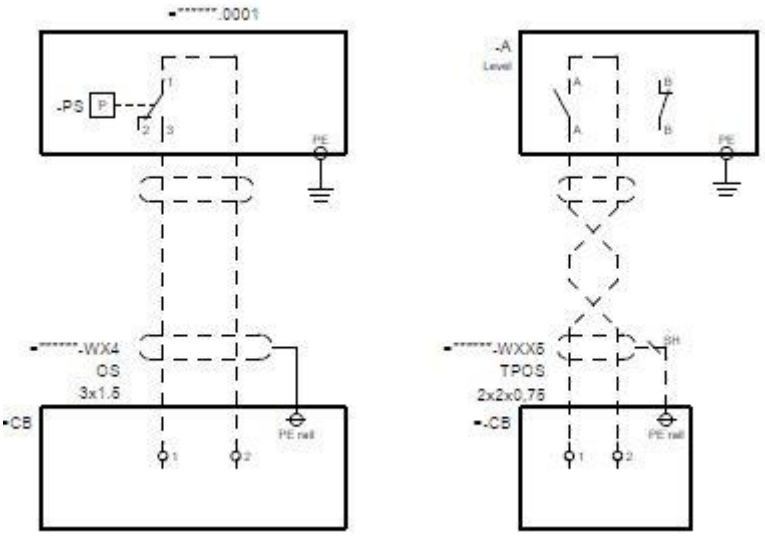


Figure 49 Connection switching equipment

Cable types: Twisted Pair Overall Screened, Flexible Screened cable, Overall Screened

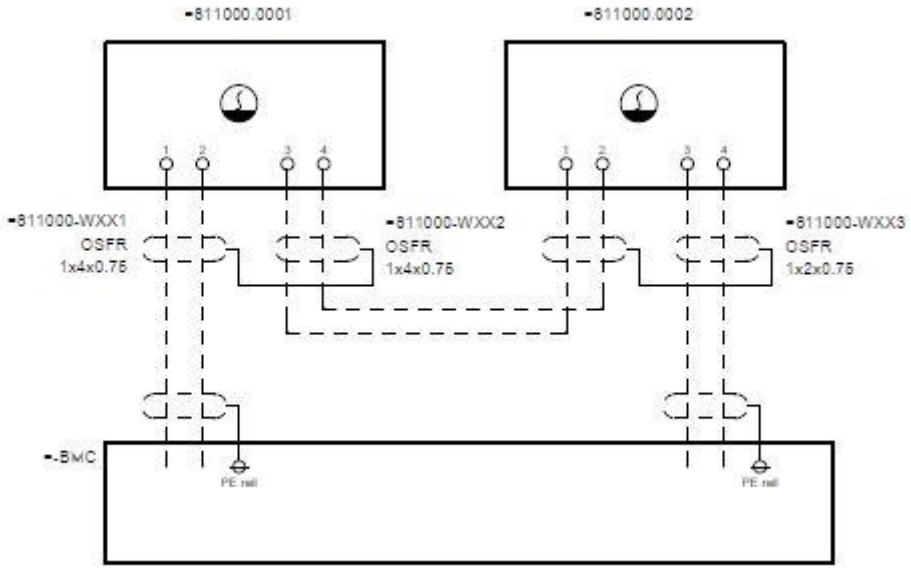


Figure 50 Fire detection system

Cable types: Overall Screened Fire Resistant.

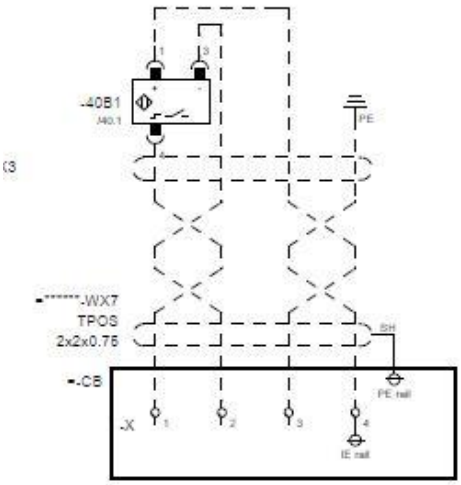


Figure 51 Proximity sensor

Cable types: Twisted Pair Overall Screened, Flexible Screened cable, Overall Screened

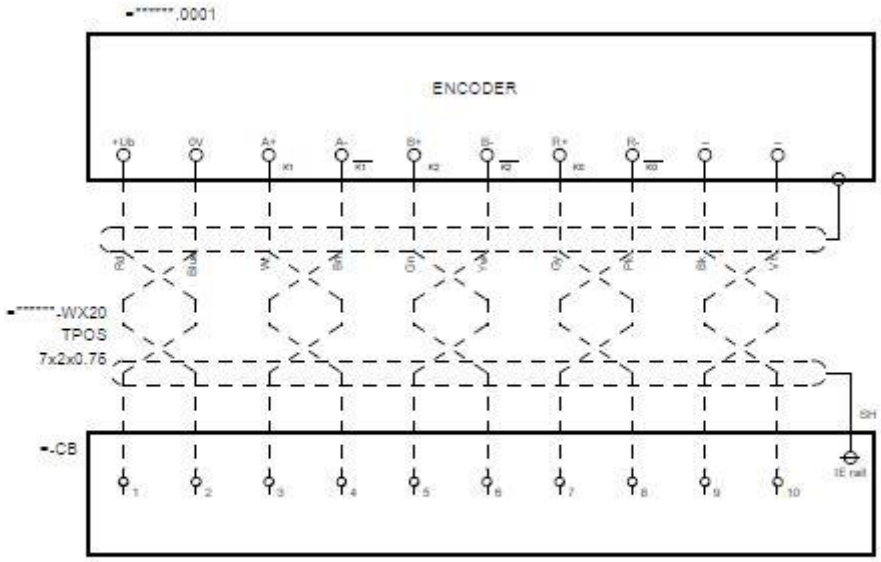


Figure 52 HTL/TTL Encoder

Cable types: Twisted Pair Overall Screened

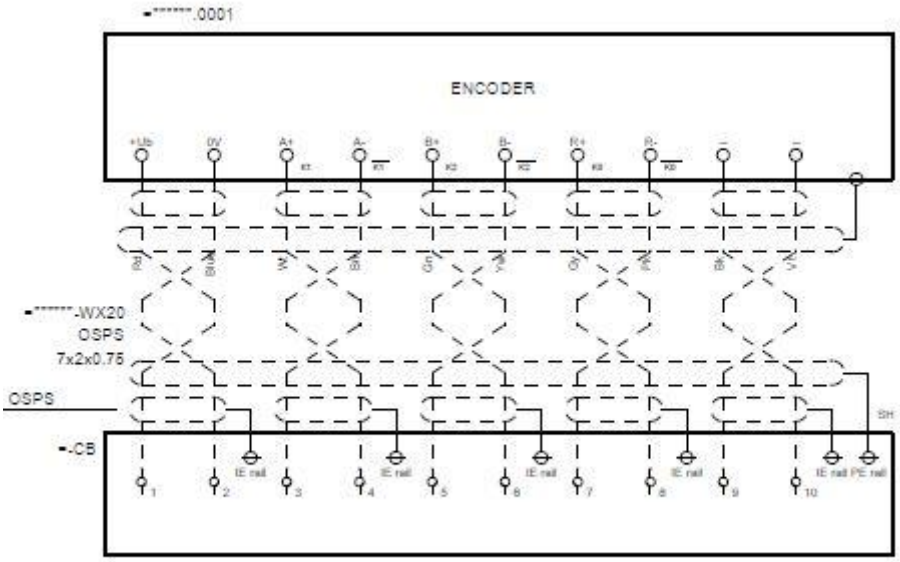


Figure 53 SSI Encoder

Cable types: Overall Screened Pair Screened

11. **Atex**

11.1.1 Zones

Explosion zones sometimes gets defined.

1) As ships are having engines running on LNG
2) Offshore vessels with well intervention equipment

All equipment located in these zones must comply to standards to prevent explosion. This can be done by limiting the energy and/or shielding. Equipment should be certified according zoned and category as per below.

Types of protection to electrical equipment

Protection principles	Types of protection	Flammable material	Category 1 EPL a Very high level of protection	Category 2 EPL b High level of protection	Kategorie 3 EPL c Normal level of protection
All	General requirements EN IEC 60079-0	Gas/vapour (G) dust (D)	+	+	+
Protection principle ensures that an ignition source cannot arise.	Increased safety Ex e EN IEC 60079-7	Gas/vapour (G)	–	Ex eb	Ex ec
	Optical radiation interlocked with optical breakage EN IEC60079-28	Gas/vapour (G) dust (D)	–	Ex op sh	–
Protection principle prevents an ignition source becoming effective.	Intrinsic safety Ex i EN IEC 60079-11 EN IEC 60079-25 systems	Gas/vapour (G) dust (D)	Ex ia	Ex ib	Ex ic
	Inherently safe optical radiation EN IEC 60079-28	Gas/vapour (G) dust (D)	Ex op is	–	–
Protection principle prevents the potentially explosive atmosphere reaching the ignition source.	Encapsulation Ex m EN IEC 60079-18	Gas/vapour (G) dust (D)	Ex ma	Ex mb	Ex mc Ex n*
	Oil immersion Ex o EN IEC 60079-6	Gas/vapour (G)	–	Ex ob	Ex oc
	Pressurised enclosure Ex p EN IEC60079-2(G) / -4(D)	Gas/vapour (G) dust (D)	–	Ex pxb, pyb	Ex pzc
	Protection using enclosure Ex t EN IEC 60079-31	Dust (D)	Ex ta	Ex tb	Ex tc
	Protected optical radiation EN IEC 60079-28	Gas/vapour (G) dust (D)	–	Ex op pr	–
Protection principle prevents propagation of flames using an enclosure.	Flameproof enclosure Ex d EN IEC 60079-1	Gas/vapour (G)	Ex da	Ex db	Ex dc Ex n*
	Powder filling Ex q EN IEC 60079-5	Gas/vapour (G)	–	Ex q	–

* Requirements for explosion-protected devices for Zone 2/22 are to some extent only treated as Ex n type of protection in the standard EN IEC 60079-15.

Application in hazardous area

Zone 0/20 Zone 1/21 Zone 2/22	Zone 1/21 Zone 2/22	Zone 2/22

Figure 545 ATEX zone listing

For this purpose intrinsically safe equipment / cabling is developed.. Usually identified with blue colouring.

On the junction between safe area and hazardous area IS barriers are normally used to protect a device inside the hazardous location.

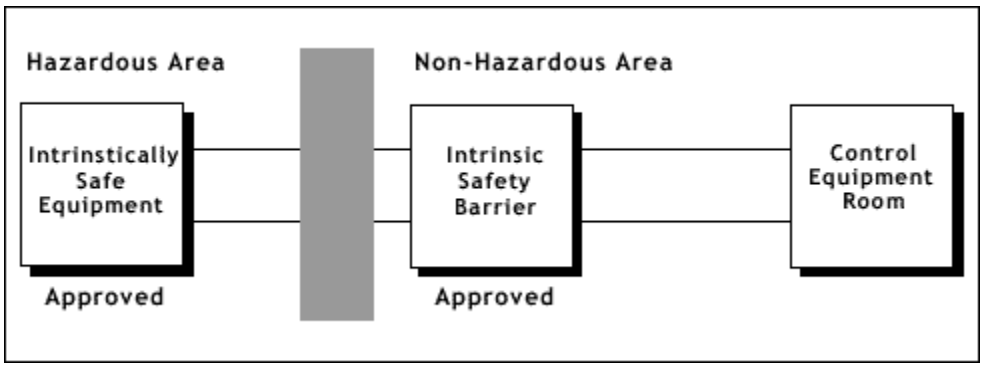


Figure 556 IS barrier use

11.1.2 General

Electrical installations in hazardous areas are to comply, as far as applicable, with IEC 60079-14.
The installation is to comply with any special conditions that may apply to the safe use of the electrical apparatus, particularly, any stated in the installation instructions of the apparatus.

11.1.3 Installation of cables

All cables, other than those of intrinsically-safe circuits, installed in zone 0, zone 1 areas are to be sheathed with at least one of the following:

(1) a non-metallic impervious sheath in combination with braiding or other metallic covering;
(2) copper or stainless-steel sheath (for mineral insulated cables only).

Cables of intrinsically-safe circuits are to have a metallic shielding with at least a nonmetallic external impervious sheath. Where intrinsically-safe circuits may be subjected to disturbances by magnetic or electric fields, special attention is to be given to transposition or other means so that these fields do not adversely affect the intrinsic safety of the circuit.

The use of flexible cables for movable electrical equipment is to be restricted. Where they are necessary, transportable and portable electrical equipment are to have cables with a heavy polychloroprene or other equivalent synthetic elastomeric sheath, cables

with a heavy tough rubber sheath, or cables having an equally robust construction. The conductors are to be stranded and are to have a minimum cross-sectional area of 1.0 mm^2.

All metallic protective coverings of power and lighting cables, other than single-core cables for circuits rated in excess of 20A, passing through a hazardous zone, or connected to equipment in such a zone, are to be earthed at their both ends. The metallic covering of all other cables is to be earthed at least at one end (e.g. control or instrument cables).

11.1.4 Connection of cables

Cables are to enter an explosion protected enclosure only by means of a gland (in accordance with regulation 16 of IEC60079-0) or equivalent device capable of maintaining the integrity of the enclosure

The connection of cables to all other apparatus are to be made in accordance with the relevant type of protection.

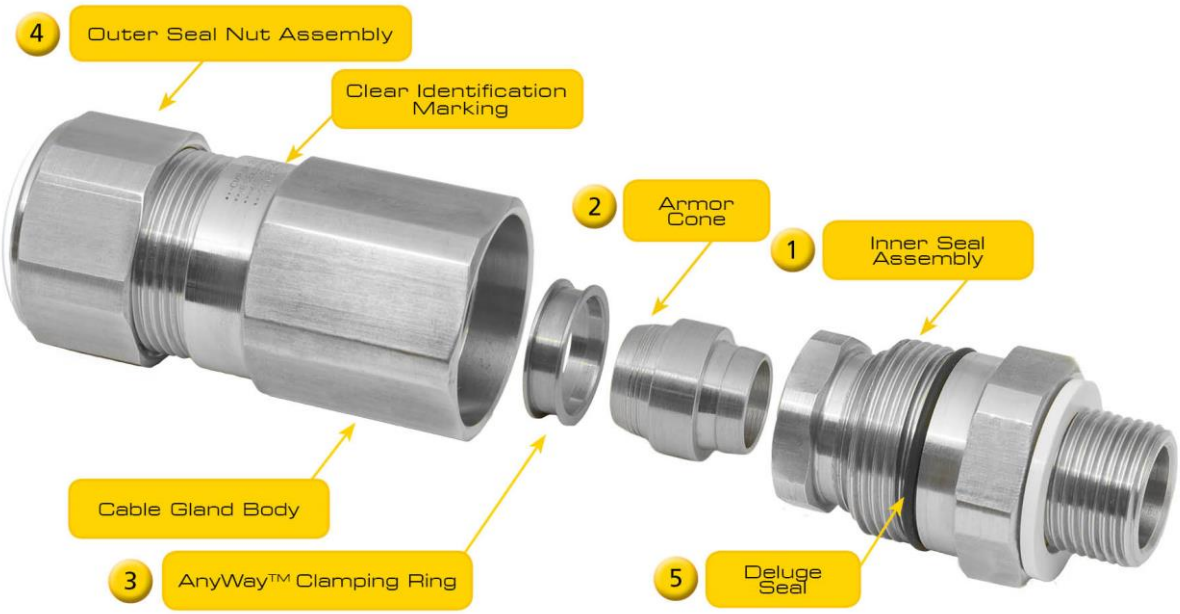


Figure 567 Example EX cable gland

Cable runs in hazardous areas are to, where practicable, be uninterrupted. Where discontinuities cannot be avoided, the joint is to be made in an enclosure with a type of protection appropriate to the requirements for the location such as flameproof enclosure. Cable joints are permitted to be in zones 1 and 2. Except for intrinsically-safe circuits, cable joints are not permitted to be in zone 0.

COCHIN SHIPYARD LTD

APPENDIX L

Installation Details of Heat Tracing System

Electric Heat Tracing

The following installation procedures are suggested guidelines for the installation of a electric heat tracing system[1]. Individuals installing these products are responsible for complying with all applicable safety and health guidelines. Proper personal protective equipment, or PPE, should be utilized during installation. Contact if you have any additional questions.

Applications . . .

1. Electric heat tracing cables are used for freeze protection or temperature maintenance of piping, tanks and instrumentation. This set of instructions covers typical piping applications. For installation details on tanks and instrumentation, refer to the Installation Guides
2. Heat tracing cables may be installed in ordinary (nonclassified) and hazardous (classified) locations depending on the specific cable options and approvals[2].

The National Electric Code and Canadian Electrical Code require ground-fault protection be provided for electric heat tracing.

Complete Electric Heat Tracing System . . .

A complete electric heat tracing system will typically include the following components:

1. Electric heat tracing cable[3] (self-regulating, power-limiting, parallel constant watt or series constant watt).
2. Power connection kit.
3. RTD sensor or control thermostat[4].
4. In-line/T-splice kit (permits two or three cables to be spliced together).
5. Cable end termination.
6. Attachment tape (use on 12" intervals or as required by code or specification).
7. "Electric Heat Tracing" label (peel-and-stick label attaches to insulation vapor barrier on 10' intervals or as required by code or specification).
8. Thermal insulation[5] and vapor barrier (by others).

The absence of any of these items can cause a system to malfunction or represent a safety hazard.

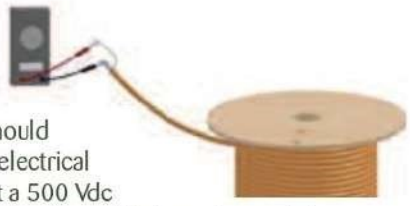
Illustration A: Typical Heat Tracing Installation

heat scale
Trace Heating Expertise

Electric Heat Tracing

Upon Receiving, Cable . . .

1. Upon receiving heating cable, check to make sure the proper type and output have been received. All flexible cables have the catalog number, voltage rating and watt output printed on the jacket.
2. Visually inspect cable for any damage incurred during shipment. The heating cable should be tested to ensure electrical integrity with at least a 500 Vdc megger between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc. Minimum resistance should be 20 megohms. Connect the positive lead of the megger to the cable bus wires and the negative lead to the metallic braid. **(Record 1 on Cable Testing Report.)**



3. Store in dry location.

Before Installing Cable . . .

1. Be sure all piping and equipment to be traced is completely installed and pressure tested.
2. Surface areas where heat tracing is to be installed must be reasonably clean. Remove dirt, rust and scale with a wire brush and oil and grease films with a suitable solvent.

Initial Installation . . .

1. Locate the cable on the lower quadrant of the pipe at the 4 or 8 o'clock position. If accessibility is a problem the cable may be installed at the 10 or 2 o'clock position. Temperature sensor should be located at least 90° from all heating cables. Refer to Illustration B for Heating Cable vs. Sensor Location.
2. Begin temporary installation at the proposed end-of-circuit location and lay out heating circuit on the pipe, allowing extra cable for the power connection and for any splice locations[3]. Refer to Illustration C for temporary installation.
3. Make heating cable allowances for valves, flanges, elbows and supports as per the applicable drawings and table on pages 3 and 4 of these installation procedures.

Illustration B: Heating Cable vs. Sensor Location

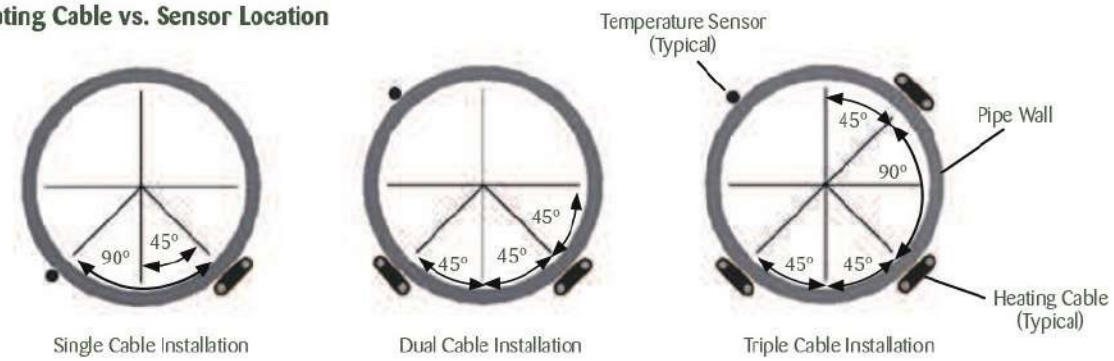
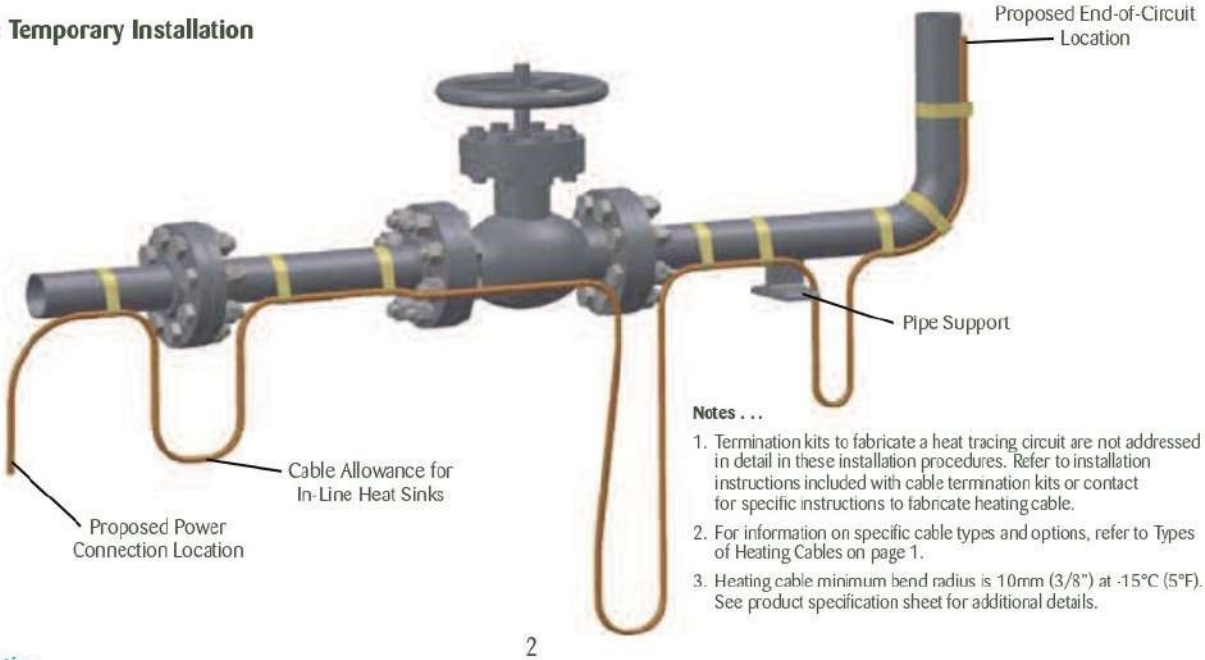


Illustration C: Temporary Installation



Notes . . .

1. Termination kits to fabricate a heat tracing circuit are not addressed in detail in these installation procedures. Refer to installation instructions included with cable termination kits or contact for specific instructions to fabricate heating cable.
2. For information on specific cable types and options, refer to Types of Heating Cables on page 1.
3. Heating cable minimum bend radius is 10mm (3/8") at -15°C (5°F). See product specification sheet for additional details.

Electric Heat Tracing

Installation on Elbows, Supports and Flanges . . .

1. Install heating cable in accordance with Illustrations D, E and F below. Secure heating cable to piping using attachment tape.
2. Elbows: Locate the cable on the outside radius of an elbow to provide sufficient heat to compensate for the added piping material. Secure the cable to the pipe on each side of the elbow with attachment tape.
3. Pipe Supports: Insulated pipe supports require no additional heating cable. For uninsulated supports, allow two times the length of the pipe support plus an additional 15" (40 cm) of heating cable.
4. Flanges: Allow cable to be looped around pipe on each side of and adjacent to the flange. Heating cable must maintain contact with flange when bending around pipe flanges to compensate for additional heat loss.
5. Refer to the product specifications sheet for minimum bend radius for the specific cable type. Do not exceed bend radius when completing installation.

Illustration D: Pipe Elbow

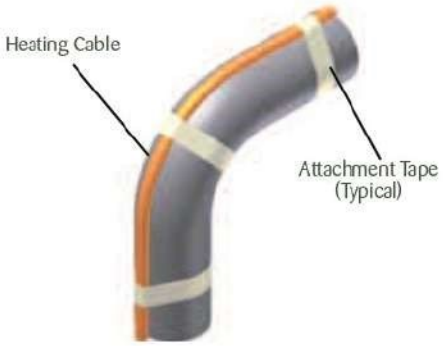
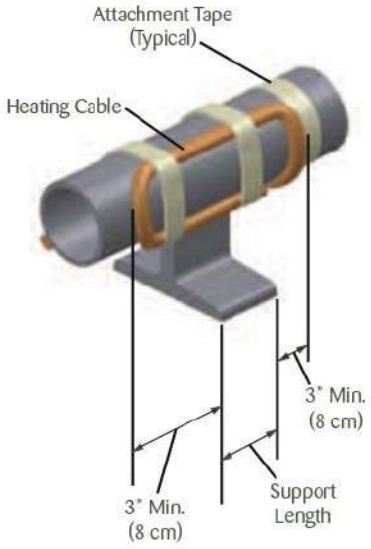
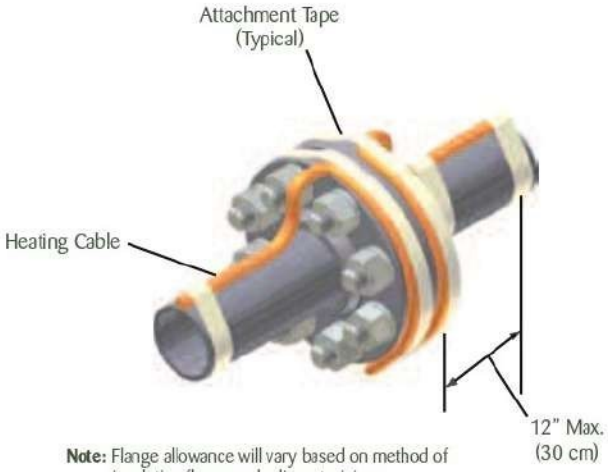


Illustration E: Pipe Support



Circuit Layout on Support

Illustration F: Pipe Flange



Note: Flange allowance will vary based on method of insulating flange and adjacent piping.

Electric Heat Tracing

Installation on Valves and Pumps . . .

1. Install heating cable in accordance with Illustrations G and H below. Secure heating cable to piping using attachment tape.
2. Additional cable is required to provide extra heat at valves, pumps and miscellaneous equipment to offset the increased heat loss associated with these items. Refer to Table 1 for estimated cable requirements for installation on typical valves and pumps. Allowances shown in Table 1 are for 150 pound valves. More cable is required for higher rated valves. Refer to heat trace isometric drawing for project specific allowances.
3. Install heating cable on valves and pumps utilizing a looping technique (this allows the valve or pump to be removed if required). Crossing constant watt heating cable over itself should be avoided.
4. Refer to the product specifications sheet for minimum bend radius for the specific cable type. Do not exceed bend radius when completing installation.

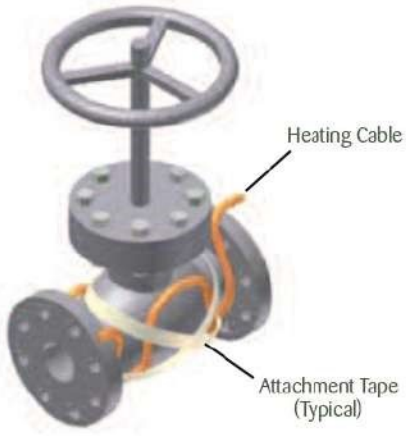
Table 1: Valve and Pump Allowances[1]

Pipe Size	Valve Allowance			Pump Allowance		Flange Allowance
	Screwed or Welded	Flanged	Butterfly	Screwed	Flanged	
½"	6"	1'	0	1'	2'	1' 3"
¾"	9"	1' 6"	0	1' 6"	3'	1' 6"
1"	1'	2'	1'	2'	4'	1' 6"
1¼"	1' 6"	2'	1'	3'	4' 6"	2' 0"
1½"	1' 6"	2' 6"	1' 6"	3'	5'	2' 0"
2"	2'	2' 6"	2'	4'	5' 6"	2' 3"
3"	2' 6"	3' 6"	2' 6"	5'	7'	2' 3"
4"	4'	5'	3'	8'	10'	2' 9"
6"	7'	8'	3' 6"	14'	16'	3' 3"
8"	9' 6"	11'	4'	19'	22'	3' 9"
10"	12' 6"	14'	4'	25'	28'	4' 3"
12"	15'	16' 6"	5'	30'	33'	5' 0"
14"	18'	19' 6"	5' 6"	36'	39'	5' 6"
16"	21' 6"	23'	6'	43'	46'	6' 0"
18"	25' 6"	27'	6' 6"	51'	54'	6' 6"
20"	28' 6"	30'	7'	57'	60'	7' 3"
24"	34'	36'	8'	68'	72'	8' 3"
30"	40'	42'	10'	80'	84'	10' 0"

Note . . .

1. The valve allowance given is the total amount of additional cable to be installed on the valve. If multiple tracers are used, total valve allowance may be divided among the individual tracers. The total valve allowance may be alternated among tracers for multiple valves in a heat trace circuit. Allowances are for 150 pound valves. More cable is required for higher rated valves. Refer to heat trace isometric drawing for project specific allowances.

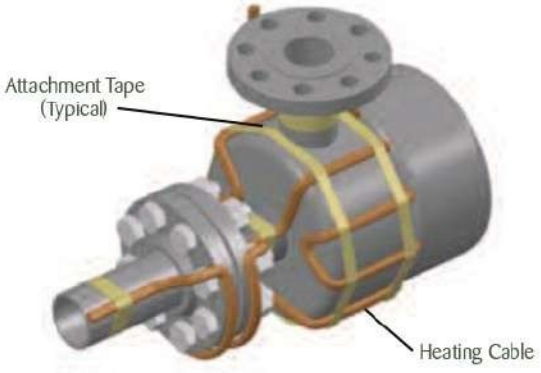
Illustration G: Typical Valve Detail



Heating Cable Serpentined on Valve

Circuit Layout on Valve

Illustration H: Typical Pump Detail



Heating Cable Serpentined on Pump

Circuit Layout on Pump

Electric Heat Tracing

Completing the Installation . . .

1. Begin final cable attachment by securing the end-of-circuit termination kit and working back toward the power supply. Refer to Illustration I.
   - Flexible heating cables are to be installed using attachment tape. Circumferential bands of tape should be installed at 12" (30 cm) intervals to keep the cable in proper contact with the pipe. Refer to Table 2 below to calculate the number of rolls of attachment tape required based on the pipe diameter[1].
   - If applicable, refer to installation details provided with the project drawings or contact Thermon for additional information regarding installation.
2. In addition to the circumferential tape requirements, a continuous covering of aluminum foil tape may be required when:
   - Spray or foam[2] thermal insulation is applied.
   - Heat tracing nonmetallic piping.
3. Complete splice connections (if required) in accordance with the installation instructions provided with the splice kit.
4. Before making power connections, The heating cable should be tested to ensure electrical integrity with at least a 500 Vdc megger between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc. Minimum resistance should be 20 megohms. **(Record 2 on Cable Testing Report.)**
5. Install power connection kit in accordance to the detailed installation instructions provided with the kit.
6. Secure temperature sensor (if required) to pipe utilizing attachment tape. Locate temperature sensor as shown on page 6.

Notes . . .

1. Table 2 assumes circumferential bands every 12" (30 cm) along the length of the process piping.
2. Verify exposure temperature of heating cable versus curing temperature of insulation.

Illustration I: Final Cable Attachment

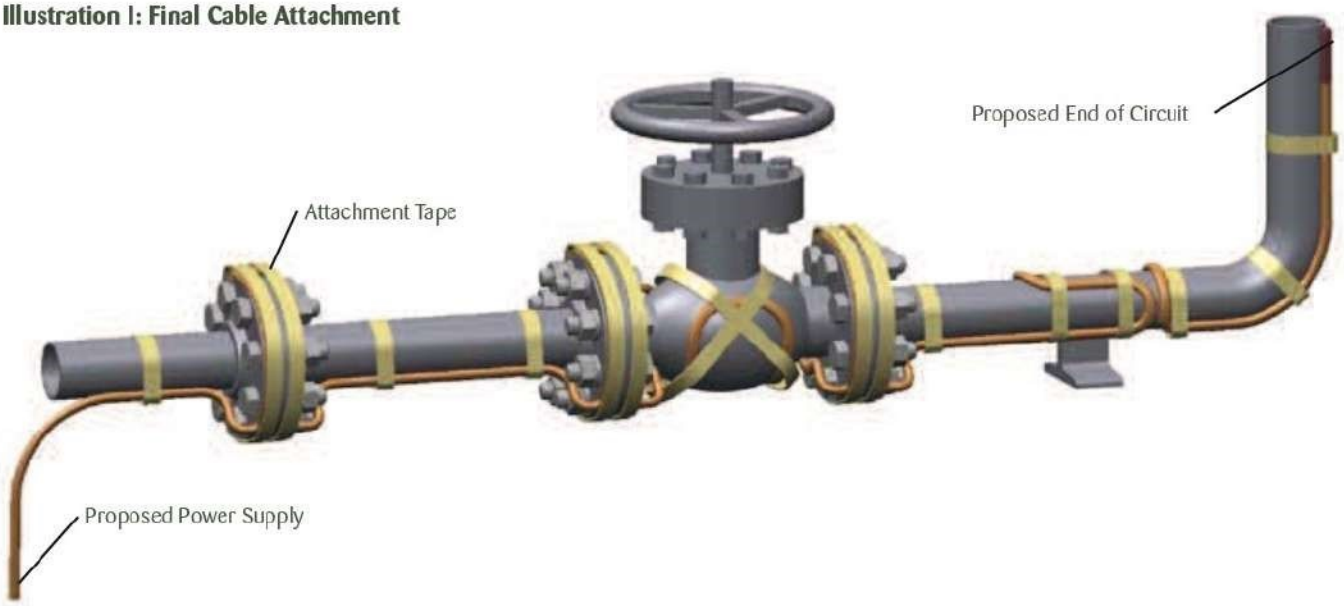


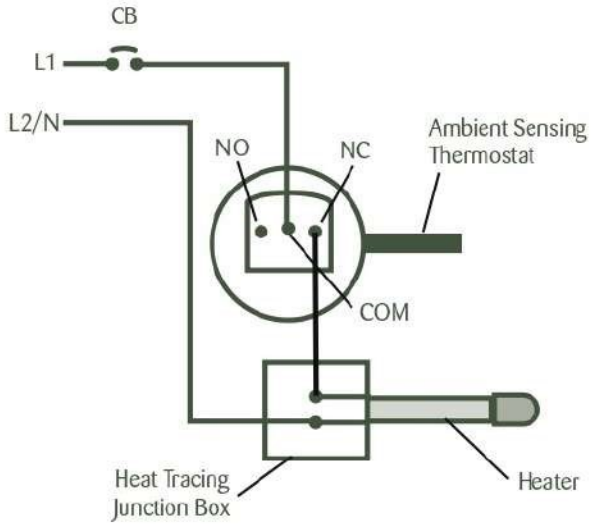
Table 2: Attachment Tape (Value Represents Approximate Linear Pipe Length Allowance Per Roll)

Tape Length	Pipe Diameter in Inches															
	½"-1"	1¼"	1½"	2"	3"	4"	6"	8"	10"	12"	14"	16"	18"	20"	24"	30"
36 yd	130'	115'	110'	95'	75'	65'	50'	40'	35'	30'	26'	23'	21'	19'	16'	13'
60 yd	215'	195'	180'	160'	125'	105'	80'	65'	55'	50'	43'	38'	35'	31'	27'	22'

Electric Heat Tracing

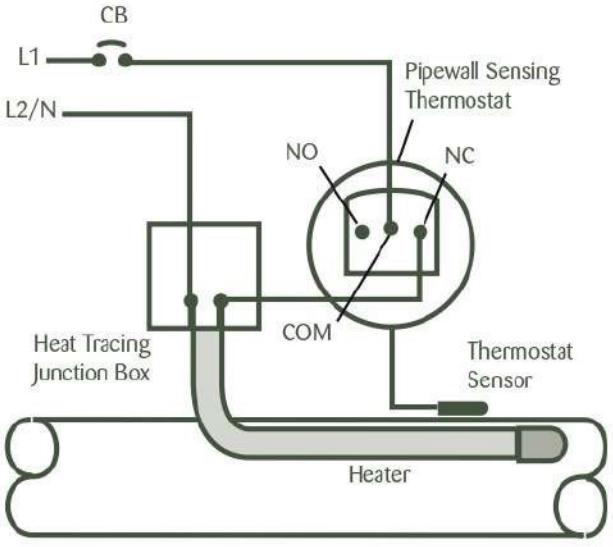
Final Connections . . .

1. Follow the circuit fabrication instructions for the specific cable type. Power connection and end-of-circuit termination kits are designed for each type of cable; substitutions should not be made.
2. For ambient controlled power, the heating circuit should be connected directly to the switched power feed wiring.



(SPDT Thermostat Shown)

3. For pipewall sensing thermostatic control, the heating circuit is to be connected in series with the control contacts as shown below. The pipewall sensing thermostat may require more than one support point.



(SPDT Thermostat Shown)

Thermal Insulation . . .

1. **The need for properly installed and well-maintained thermal insulation cannot be overemphasized.** Without insulation, heat losses are generally too high to be offset by a conventional heat tracing system.
2. In addition to piping and in-line equipment such as pumps and valves, all heat sinks must be properly insulated. This includes pipe supports, hangers, flanges and, in most cases, valve bonnets.
3. Regardless of the type or thickness of insulation used, a protective barrier should be installed. This protects the insulation from moisture intrusion, physical damage and helps ensure the proper performance of the heat tracing system. Seal around all penetrations through the thermal insulation.
4. After the installation of the thermal insulation and weather barrier but BEFORE ENERGIZING THE HEATING CIRCUIT, the megohmmeter test should be repeated. This should call attention to any damage to the heating cable that may have occurred during the insulation installation. **(Record 3 on Cable Testing Report)**
5. Apply caution labels to insulation weather barrier at required intervals along pipe

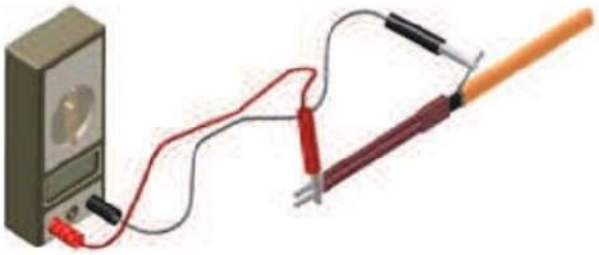
Final Inspection and Documentation . . .

1. It is recommended that the circuit be temporarily energized so that the volts, amps, pipe temperature and ambient temperature may be recorded. This information may be of value for future reference and should be maintained for the historical operating data log **(Record 4 on Cable Testing Report).**
2. Stabilized design can be used for self-regulating heating cables to assign a lower T-class through the use of the Thermon CompuTrace software or Thermon Engineering.
3. Stabilized design can be used for power-limiting and constant watt heating cables without a limiting device to determine the T-class through the use of the Thermon CompuTrace software or Thermon Engineering.
4. A sample historical operating data log form is included in the Electric Heat Tracing Maintenance and Troubleshooting Guide, Thermon Form TEP0066).

The National Electric Code and Canadian Electrical Code require ground-fault protection be provided for branch circuits supplying electric heat tracing.

Cable Testing Report

1. Refer to Installation Procedures, for general installation procedures, requirements and guidelines.
2. Upon receiving heating cable, check the cable to make sure the proper type and output have been received. All flexible cables have the catalog number, voltage rating and watt output printed on the outer jacket.
3. Visually inspect cable for any damage incurred during shipment. The heating cable should be tested to ensure electrical integrity with at least a 500 Vdc megger between the heating cable bus wires and the heating cable metallic braid.
   IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc. Minimum resistance should be 20 megohms. **(Record 1 on Cable Testing Report.)**

   A. Connect the positive lead of the megger to the cable bus wires.

   B. Connect the negative lead of the megger to the metallic braid.

   C. Energize the megger and record the reading. Readings between 20 megohms and infinity are acceptable. Readings below 20 megohms may mean the electrical insulation has been damaged. Recheck the heating cable for physical damage between the braid and the heating element; small cuts or scuffmarks on the outer jacket will not affect the megger reading unless there was actual penetration through the braid and dielectric insulation jacket.
4. Once the installation is complete, but prior to installation of thermal insulation, recheck the heating cable with at least a 500 Vdc megger between the heating cable bus wires and the heating cable metallic braid. IEEE 515 recommends that the test voltage for polymer insulated heating cables be 2500 Vdc should be 20 megohms. **(Record 2 on Cable Testing Report.)**
5. After the thermal insulation is installed, the megohmmeter test should be repeated. Minimum resistance should be 5 megohms. **(Record 3 on Cable Testing Report.)**
6. After the thermal insulation is installed and power supply is completed, record the panel and circuit breaker information. Ensure all junction boxes, temperature controllers, cable glands, etc. are properly secured. Set the temperature controller (if applicable) to the manual setting and apply rated voltage to the heat tracing circuit(s) for 5 minutes. Record the ambient temperature, measure and record the circuit(s) voltage and current. **(Record 4 on Cable Testing Report.)**

NOTE: To ensure the heating cable warranty is maintained through installation, the testing outlined on this sheet must be completed on the installed heating cables, and the test results recorded and mailed/faxed