



## **SECTION-1**

### **Scope, Bill of Quantities and Specific Technical Requirement**

#### **1.1 SCOPE**

This technical specification covers the requirements of design, manufacture, inspection and testing at manufacture's works, proper packing and delivery to site of **Cable Tray Supports (Bolt table type), Cable Trays(Ladder type), Fittings and Accessories** complete with all erection/fixing hardware required for installation of the material conforming to this specification.

The specification comprise of following section 1, Section 2 & Section 3. In case of any discrepancies between the requirements mentioned under different Sections, order of precedence shall be in the same order as listed above.

No deviation from the requirements specified in various clauses of this specification shall be allowed. A certificate to this effect shall have to be furnished along with the offer.

The equipment is required for the following project:

Name of the Customer : Tamilnadu Generation and Distribution Corporation (TANGEDCO)

Name of the Project : 2 x 660 MW Udangudi STPP (Stage-I)

#### **1.2 BILL OF QUANTITIES**

The bill of quantities shall be as per Annexure - A: BILL OF QUANTITY.

Note: The quantity for individual item may vary up to any extent, however total quantity or PO Value may vary by +/- 30% during contract execution stage, whichever is higher.

#### **1.3 SPECIFIC TECHNICAL REQUIREMENTS**

(a) Cable Tray Support (Bolt table type) and Fittings:

Sl. No.	Particulars	Requirements
1)	Applicable Standards	a) IS: 2062 For Structural steel. b) IS: 1079 For hot rolled carbon steel sheet and strip. c) IS: 1730 For dimensions for steel sheet and strip. d) IS: 1363 Hexagon head bolts, screws and nuts. e) IS: 5 For colours of paint.



		<p>f) IS: 6005 For surface pre-treatment.</p> <p>g) IS: 2629 For hot dip galvanising of steel.</p> <p>h) IS: 2633 For testing of zinc coating.</p> <p>i) IS: 6745 For determining of mass of zinc coating.</p> <p>j) IS: 1852 For Rolling and Cutting Tolerances of hot rolled steel products.</p> <p>k) IS:513 For cold rolled low carbon steel sheet &amp; strip</p> <p>l) IS:1367 For requirement for Bolt, screw and Studs</p> <p>m) IS: 816 Code of practice for use of metal arc welding for general construction of mild steel.</p> <p>n) IS:4759 Specification for hot-dip zinc coatings on structural steel and allied products</p> <p>o) IEC: 61537 cable tray system</p>
2)	Cable Tray Support and Fittings	<p>a) Tray support type: Boltable type</p> <p>b) Material: Hot/ Cold Rolled MS sheet steel for channel and channel portion of cantilever arms</p> <p>c) Thickness: 2.5 mm</p> <p>d) Length: Standard length of 6 meters</p> <p>e) Fabrication: At works</p> <p>f) Construction: Conforming to reference drawings attached</p> <p>g) Make: SAIL/TISCO/RINL/JINDAL STEEL/JINDAL ISPAT/BHUSAN STEEL/ESSAR/LLOYD/IISCO or authorized re-rollers of SAIL</p>
3)	Surface Treatment (Galvanization)	<p>a) Pre-treatment: As per IS 2629 prior to galvanisation</p> <p>b) Type Hot dip galvanization</p> <p>c) Applicable Standard: IS 2629</p> <p>d) Minimum thickness: 86 microns (minimum)</p> <p>e) Min. weight of Zinc deposit: 610 gms per square meter</p> <p>f) Tests for galvanizing:</p> <p>i) Weight of zinc coating as per IS : IS 6745</p> <p>ii) Thickness of zinc coating as per IS : IS 4759</p> <p>iii) Uniformity of zinc coating as per IS : IS 2633</p> <p>iv) Adhesion as per IS: IS 2629</p>

**Notes:**

1. Cable trays shall be ladder type for power & control cables as per technical particulars and reference drawings as specified above. Minor fabrication detail changes which do not affect the material/ dimensional aspect of the equipment, shall be subject to BHEL/owner's approval without any commercial implication.
2. All finished galvanized MS structural members for cable tray supports shall be free from sharp edges, corners, burs & unevenness.
3. Necessary fasteners, fixing hardware shall be provided with each cable tray support accessory as



specified in enclosed drawings.

4. All welded joints shall be smooth enough to provide a good appearance and shall not cause any injury to working personnel or any damage to the cable laid directly on it. All welding work shall be done by skilled personnel.

**(b) Cable Trays (Ladder), Fittings and Accessories:**

Sl. No.	Particulars	Requirements
1)	Applicable Standards	a) IS: 1079 For hot rolled carbon steel sheet and strip. b) IS: 1730 For dimensions for steel sheet and strip. c) IS: 1363 Hexagon head bolts, screws and nuts. d) IS: 2629 For hot dip galvanising of steel & surface pre-treatment. e) IS: 2633 For testing of zinc coating. f) IS: 6745 For determining of mass of zinc coating. g) IS: 1367 (Part-XIII) Galvanised Coating on threaded Fasteners. h) IS: 1852 For Rolling and Cutting Tolerances of hot rolled steel products. i) IS: 9595 For Thickness of Welding.
2)	Cable Trays, Fittings and Accessories	a) Material : Hot Rolled Mild Steel b) Type : Ladder Type (power and control cables) c) Standard Length of Straight Length of Cable Trays: 2.5 m d) Standard Width (mm) : 750, 600, 300, 150 e) Construction : Conforming to enclosed drawing f) Bending Radius of Accessories (in mm): 600 mm g) Tolerance in length/ Width / Height: + /- 2 mm h) Thickness of the finished product shall not be less than 2.0mm i) Fittings: brackets, elbows, bends, reducers, tees, crosses etc. j) Accessories: Side coupler plates & Tray covers (Side Coupler Plates shall be provided as part of cable tray & accessories supply with bolts, nuts, washers etc.) k) Hardware: Bolts, nuts, washers, GI straps and hook etc. l) Sheet thickness before Hot Dip Galvanisation i) For cable trays & Accessories: 2.0 mm ii) For Coupler plate: 2.0 mm iii) For tray cover: 1.6 mm iv) Tolerance in Thickness : + /- 0.2mm As per IS: 1852 l) Make: SAIL/TISCO/RINL/BHUSAN/JINDAL STEEL/JINDAL



		ISPAT/ESSAR/LLOYD/IISCO/SAIL or authorized re-rollers of SAIL
3)	Surface Treatment (Galvanization)	a) Pre-treatment : IS 2629 before galvanisation b) Type : Hot dip galvanisation c) Applicable Standard : IS 2629 d) Minimum thickness : 86 microns (minimum) for 2.0 mm thick product & 1.6 mm thick product e) Min. weight of Zinc deposit: 610 grams per square meter for 2.0 mm thick product & 1.6 mm thick product f) Tests for galvanizing : (i) Weight of Zinc Coating as per IS 6745. (ii) Thickness of Zinc Coating as per IS 4759. (iii) Uniformity of Zinc Coating as per IS 2633. Uniformity of coating – The coating of any article shall withstand four 1 minute dips in standard copper sulphate solution without the formation of an adherent red spot of metallic copper upon the basic Metal. (iv) Adhesion Test as per IS 2629. (v) Visual inspection The quality of cadmium/zinc plating on items with screw threads shall be inspected visually and shall be free from visible defects such as unplanted areas, blisters and modules. (vi) In addition, the plating thickness shall be determined microscopically/chemically or electronically.
4)	Requirement of Coupler Plates, Bolts, Washers & Hardware for Cable Tray Section	For Cable Tray section of standard length (2.5mtrs) b) Coupler Plates (4nos.) c) Nuts (16nos.) d) Washers (32nos.) e) Bolts (16nos.) Based on above, quantities for above items shall be calculated for offered lot.

1. Cable trays shall be ladder type for power & control cables as per technical particulars and reference drawings as specified in this specification. Minor fabrication detail changes which do not affect the material/ dimensional aspect of the equipment, shall be subject to BHEL/owner's approval without any commercial implication.
2. Coupler plates shall be provided for connecting tray ends to other straight trays, horizontal elbows, vertical elbows, tees, cross, reducers etc.
3. Cable trays shall be complete with all necessary hot dip galvanized sheet steel accessories such as coupler plates and associated nuts, bolts, washers, hangers, clamps, etc. Also horizontal / vertical bends, horizontal / vertical Tee, Reducers, Horizontal cross-pieces, protective covers shall be supplied along with straight runs in order to take care of cable tray alignments in

different routes.

4. All fittings like horizontal/ vertical elbow, horizontal crosspiece, reducer, horizontal tee, etc. should be pre-fabricated. Each fitting shall be provided with 4 nos. hot dip galvanized side coupler plates & associated bolts, nuts and washers on each side.
5. Necessary fasteners shall be provided along with each length of cable tray as specified in drawings enclosed.
6. The width of the tray covers, if applicable, shall be suitable for the width of trays. Suitable bolting arrangement shall be supplied for attaching the cover to the cable trays, elbows, reducers, tees etc. as per the drawing enclosed.
7. All welded joints shall be smooth enough to provide a good appearance and shall not cause any injury to working personnel or any damage to the cable laid directly on it. All welding work shall be done by skilled personnel.

#### **1.4 TYPE TESTING**

The bidder shall submit the type tests reports for the tests conducted on the equipment identical or similar to those to be supplied under this contract and the test(s) should have been conducted at an independent laboratory not earlier than five (5) years from the date of technical bid opening. If any type test report is found to be technically unacceptable, such type test(s) shall be conducted by the bidder without any cost and delivery implication to BHEL/TANGEDCO.

Cable tray support system (boltable type) shall be proven type and type tested design confirming the requirements of section-2, however type testing shall be repeated as mentioned in section-2 and shall be subjected to BHEL/TANGEDCO approval.

#### **1.5 QUALITY PLAN**

The successful bidder shall submit the QP for BHEL/ TANGEDCO approval after award of contract. In case bidder has reference QP agreed with TANGEDCO, same can be submitted for specific project after award of contract for BHEL/ TANGEDCO's approval. There shall be no commercial implication to BHEL on account of QP approval.

All materials shall be procured, manufactured, inspected and tested by vendor/ sub-vendor as per approved quality plan.

The supplier shall perform all tests necessary to ensure that the material and workmanship conform to the relevant standards and comply with the requirements of the specification. Charges for all these tests for all the equipment & components shall be deemed to be included in the bid price.

#### **1.6 INSPECTION & TESTING**

Before being fitted on the equipment, all components shall be subjected to routine tests at the Contractors factory, provided by the relevant IEC/IS standards. A detailed test report proving the



successful passing of such tests shall be provided.

Prior to dispatch, the routine & acceptance tests shall be carried out on each item in accordance with the applicable IEC/IS & approved QP and the material shall be offered for final inspection by BHEL and TANGEDCO in accordance with agreed quality plan with 3 weeks advance information. The charges for these shall be deemed to be included in the equipment price.

## **1.7 PACKING**

The material shall be packed in such a way to ensure protection against damage during transit and storage for prolonged period (min. 1 year) in coastal environment. The packing should prevent corrosion of material.

## **SECTION-2**

### **Equipment Specification**

#### **2.1 TECHNICAL REQUIREMENTS**

##### **2.1.1 Cable Trays**

1. Cable trays shall be ladder type for power and electrical control cables and perforated type for signal cables, prefabricated, made out of hot / cold rolled mild steel sheets complete with matching fittings, accessories and hardware as required. Cable trays shall be with standard width of 150 mm, 300 mm, 450 mm, 600 mm, 750 mm and 900 mm and standard lengths of 2.5 metre or more. Minimum thickness of mild steel sheets used for fabrication of cable trays and fittings shall be 2 mm. For ladder trays, rung spacing shall be 250 mm maximum. The thickness of side coupler plates shall be minimum 2 mm and of tray covers shall be minimum 1.6 mm.
2. Separate cable trays shall be provided for the following cables:
  - HT Cables
  - LT power cables
  - Electrical Control cables
  - Signal cables
  - Fiber optic cables
3. Cable trays shall be designed to cater to a load of minimum 75 kg/m.
4. Cable trays shall be complete with matching fittings and accessories (like elbows, bends, reducers, tees, crosses, side coupler plates, etc.) and hardware (like bolts, nuts, washers, etc.) as required. At both the ends of cable trays, four holes shall be provided for fixing side coupler plates. All the slots and coupler holes shall be machine punched.
5. Cable trays, fittings and accessories and covers shall be hot dip galvanized. Fasteners like bolts, nuts; screws washers etc. shall also be hot dip galvanized. Thickness of galvanizing shall be not less than 610 grams/sq.m.
6. For branch cabling routes involving fewer cables, sheet steel galvanized cable trough of size 50/75/100 mm shall be provided.
7. Cable tray covers shall be provided for horizontally laid outdoor trays, on top most trays. It shall be prefabricated made out of hot/cold rolled mild steel sheets, complete with hardware as required. Special clamps shall be provided for fixing tray covers without drilling holes on trays.



### 2.1.2 Cable Tray Support System

1. Cable tray supports shall be of prefabricated preformed sections of sheet steel, bolted type and shall be hot dip galvanized.
2. Cable tray support system shall be similar or equivalent to "Unistrut make". Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of following two types:
  - Single channel strut support for supporting cable trays on one side
  - Double channel strut support for supporting cable trays on both sides
3. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardware such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc.
4. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardware fittings and accessories shall be prefabricated factory galvanised.
5. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. of the components shall not be allowed. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation.
6. The main support channel and cantilever arms shall be fabricated out of minimum 2.5 thick rolled steel sheets conforming to IS.
  - Cantilever arms of required length to match cable tray width. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position.
  - The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only.
  - Main support channels may be supplied in any suitable lengths to minimize the wastage. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified.
7. Thickness of galvanizing on steel sections shall be not less than 610 gm/sq.m on all steel sections.





8. Horizontally running cable trays shall be clamped by bolting to cantilever arms at an interval of 1500 mm for outdoor and 2000 mm for indoor locations. Vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 1500 mm. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000 mm.
9. The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm.

## 2.2 TESTS

Equipment offered shall be type tested and proven type. Tests shall be carried out for galvanizing thickness of trays and supports. Load test shall be carried out for trays and supports.

**Load Test for Cable trays shall be carried out as follows:**

A 2.5 metre straight section of each type of cable tray shall be simply supported at the two ends. A uniformly distributed load of 100 kg per meter shall be applied along the length of tray. The maximum deflection at mid span shall not exceed 7 mm.

## 2.3 DRAWINGS & DOCUMENTS

The following drawings and documents shall be submitted for approval during detail engineering stage.

S. no.	Document	Requirement
1.	General arrangement drawings for trays and fittings	Required for technical clearance of manufacturing
2.	General arrangement drawings for support system	
3.	Technical data sheet	
4.	Test reports	Document required before material inspection
5.	Installation details	
6.	Manufacturing quality plan	

## 2.4 REFERENCE DOCUMENTS

PE-DG-435-507-E006 Rev01, page 1 to 26 of 26: INSTALLATION DETAILS FOR CABLE TRAY SUPPORT SYSTEM

PE-DG-435-507-E005 Rev02, page 1 to 14 of 34: TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES

0350-215-PVE-B-001 Rev00, page 18 of 21: Z-CLAMP FOR FIXING OF EARTH FLAT

0350-215-PVE-B-001 Rev00, page 20 of 21: PVC END CAP



### **SECTION – 3**

## **PROJECT DETAILS AND GENERAL SPECIFICATIONS**

Refer document Project Details and General Specifications – TB-400-316-000-Rev 01 (15 Pages).

## SECTION 3

### PROJECT DETAILS AND GENERAL SPECIFICATIONS

#### 3.0 GENERAL

This section stipulates the General Technical Requirements under the contract and will form an integral part of the Technical Specification.

The provisions under this section are intended to supplement general requirements for the materials, equipment and services covered under other sections and are not exclusive. However in case of conflict between the requirements specified in this section and requirements specified under other sections, the requirements specified under respective sections shall hold good.

#### 3.1 SITE INFORMATION

SL.NO.	DESCRIPTION	
<b>3.1</b>	<b>PROJECT INFORMATION</b>	
	a) Customer	Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
	b) Project	400kV GIS at 2 x 660 MW Udangudi STPP (Stage-I)
	c) Project location	
	i) Country	India
	ii) State	Tamil Nadu
	iii) Administrative district	Thoothukudi
	iv) Next Big cities to site	Thoothukudi (approx.. 45 kms from site)
	v) Road access	East Coast Road- State high way (176)
	vi) Nearest Railway Station	Thiruchendur (approx.. 12 kms from site)
	vii) Nearest Airport	Vaigai (approx.. 60 kms from site)
	viii) Nearest Harbour	Tuticorin (approx.. 45 kms from site)
<b>3.2</b>	<b>SITE CONDITIONS</b>	
3.2.1	Ambient Air Temp.	
	a) Maximum dry bulb	41°C

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	temp. (max.) °C	
	b) Minimum dry bulb temp. (min.) °C	17 <sup>0</sup> C
	Design ambient temperature	50 <sup>0</sup> C
3.2.2	<b>Relative humidity</b>	
	Mean Maximum humidity (Summer)	84 %
	Mean Minimum humidity (Summer)	62 %
	Maximum humidity (Monsoon)	97%
	Minimum humidity (Monsoon)	45%
3.2.3	<b>Rain fall</b>	
	Annual rainfall (Maximum)	718.2 mm
	Annual rainfall (Minimum)	384.1 mm
	Twenty four (24) Hour max	138.2 mm
3.2.4	<b>High Flood Level</b>	
	High Flood Level for site	RL 2.450 m
3.2.5	<b>Wind</b>	
	Mean Wind Speed (max)	39 m/sec (As per IS: 875)
	Wind direction	North, North east, North west, East
3.3	<b>Seismic intensity</b>	
	Seismic Intensity	As per IS:1893 Latest
	Zone	II

### 3.2 INSTRUCTION TO BIDDERS

The bidders shall submit the technical requirements, data and information as per the technical data sheets, provided in Section-4.

The bidders shall furnish catalogues, engineering data, technical information, design documents, drawings etc fully in conformity with the technical specification.

It is recognized that the Manufacturer may have standardized on the use of certain components, materials, processes or procedures different than those specified herein. Alternate proposals offering similar equipment based on the manufacturer's standard practice will also be considered provided such proposals meet the specified designs, standard and performance requirements and are acceptable to the Purchaser. Unless brought out clearly, the Bidder shall be deemed to conform to this specification scrupulously.

### **3.3 STANDARDS**

The works covered by the specification shall be designed, engineered, manufactured, built, tested and commissioned in accordance with the Acts, Rules, Laws and Regulations of India.

The equipment to be furnished under this specification shall conform to latest issue (with all amendments) of specified standards.

In addition to meeting the specific requirement called for in Sections 1 and 2 of the Technical Specification, the equipment shall also conform to the general requirement of the applicable standards, which shall form an integral part of the specification.

The Bidder shall note that standards mentioned in the specification are not mutually exclusive or complete in themselves, but intended to complement each other.

When the specific requirements stipulated in the specifications exceed or differ from those required by the applicable standards, the stipulation of the specification shall take precedence.

Other internationally accepted standards, which ensure equivalent or better performance than that specified in the standards referred, shall also be accepted. The bidder shall submit copies of such standards.

In case governing standard for the equipment is different from IS or IEC, the salient points of difference shall be clearly brought out in the offer along with English language version of standard or relevant extract of the same. The equipment conforming to standards other than IS/IEC shall be subject to Purchaser's / owner's approval.

The bidder shall clearly indicate in his bid the specific standards in accordance with which the works will be carried out.

### **3.4 SERVICES TO BE PERFORMED BY THE EQUIPMENT BEING FURNISHED**

All equipment shall also perform satisfactorily under various other electrical, electro mechanical and meteorological conditions of the site of installation. All equipment shall be able to withstand all external and internal mechanical, thermal and electro mechanical forces due to various factors like wind load, temperature variation, ice & snow, (wherever applicable) short circuit etc for the equipment.

### **3.5 ENGINEERING DATA**

#### **3.5.1 Drawings**

The Supplier shall necessarily submit all the drawings/ documents unless anything is waived. The Supplier shall submit drawings/ design documents/ data/ test reports/manuals as may be required for the approval of the purchaser. All drawings submitted by the Manufacturer including those submitted at the time of bid shall be in sufficient detail to indicate the type, size, arrangement, material description, Bill of Materials, weight of each component, break-up for packing and shipment, the external connections, fixing arrangement required. The dimensions required for installation and interconnections with other equipment and materials, clearances and spaces required for installation and interconnections between various portions of equipment and any other information specifically requested in the specifications.

Each drawing submitted by the Manufacturer shall be clearly marked with the name of the Purchaser, the unit designation, the specifications title, the specification number and the name of the Project. If standard catalogue pages are submitted, the applicable items shall be indicated therein. All titles, noting, markings and writings on the drawing shall be in English. All the dimensions should be in metric units.

Further work by the Manufacturer shall be in strict accordance with these drawings and no deviation shall be permitted without the written approval of the Purchaser, if so required.

The review of these data by the Owner will cover only general conformance of the data to the specifications and documents, interfaces with the equipment provided under the specifications, external connections and of the dimensions which might affect substation layout. Owner may not indicate a thorough review of all dimensions, quantities and details of the equipment, material, any devices or items indicated or the accuracy of the information submitted. This review and /or approval by the Owner shall not be considered by the Manufacturer, as limiting any of his responsibilities and liabilities for mistakes and deviations from the requirements, specified under these specifications and documents.

All manufacturing and fabrication work in connection with the equipment prior to the approval of the drawings shall be at the Manufacturer's risk. The Manufacturer may make any changes in the design which are necessary to make the equipment conform to the provisions and intent of the Contract and such changes will again be subject to approval by the Purchaser. Approval of Manufacturer's drawing or work by the Purchaser shall not relieve the manufacturer of any of his responsibilities and liabilities under the Contract.

All engineering data submitted by the Manufacturer after final process including review and approval by the Owner shall form part of the Contract Document and the entire works performed under these specifications shall be performed in strict conformity, unless otherwise expressly requested by the Owner in Writing.

The title block of drawings shall contain the following information incorporated in all contract drawings

Title block for project:

<b>1. Customer :</b> Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
<b>2. Consultant :</b> DESEIN PRIVATE LIMITED, DESEIN HOUSE, NEW DELHI
<b>3. Project :</b> 400kV GIS at 2 x 660 MW Udangudi STPP (Stage-I)
<b>4. Contract No./LOA No. :</b> Lr.No.CE/Proj.II/SE/C/UTPP/EE/E/LOI/D.179/2017, dt.07.12.2017
<b>5. Main Contractor :</b> Bharat Heavy Electricals Limited
<b>6. BHEL Order No. &amp; Date :</b>

### 3.5.2 Documentation

Document Distribution Schedule - After Placement of Order:

S. No.	Stage	No. of copies	
i)	Submission of Data sheets Datasheet, drawings, documents, write-ups, calculation, test reports, Preliminary	13	As per agreed schedule
ii)	Resubmission of above, if required	13	As per agreed schedule
iii)	Final approved documents	13	As per agreed schedule
iv)	Instruction manuals for erection and O&M	6	As per agreed schedule
v)	As built drawings including O &M manual -Hard copy -Soft copy in CD/Pendrive	13 6	As per agreed schedule

#### NOTES:

- a) The manufacturer may note that all re-submissions must incorporate all comments given in the prior submission by the Purchaser. Adequate justification for not incorporating the same must be submitted, failing which the submitted documents may be returned.

### 3.5.3 Format of Documentation

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- a) All engineering documents and drawings shall be of international "A" series sizes, that is, A0, A1, A2, A3 and A4.
- b) Two set of CD/ pendrive containing all the drawings in Auto CAD shall also be supplied in addition to hard copies. Soft copy of all documents shall be supplied in a CD/pendrive in PDF format.
- c) Grouped documents shall be provided by size A4, with the inclusion of bigger size drawings which, however, have to be folded as Size A4.

**3.5.4 Instruction manuals and operating manuals**

The Supplier shall provide Instruction & Maintenance Manuals for each part of the Plant and Equipment included in the Works and Operating Manuals for each Station.

The Instruction Manuals and Operating Manuals shall be arranged in an organized library adequately cross referenced to facilitate issuing clauses of the manuals as required by the work i.e. erection instructions shall be required before operating & maintenance instructions.

All Manuals provided by the Supplier shall be fully detailed and specifically prepared for the Works and equipment provided. General manuals not specifically required for the work shall not be acceptable.

The instruction manuals shall at least contain:

- a) A general description of all components
- b) Storage instructions
- c) Erection instructions
- d) Pre-commissioning Instruction:
- e) Material and part list.
- f) Design clearances and settings
- g) Complete sets of drawings as finally issued
- h) Operating Instructions:
- i) Routine and Preventive Maintenance instructions with material requirement for each site
- j) Preventive Maintenance Schedule.
- k) Replacement instruction for all equipment

The operation manuals shall at least contain:

- a) Operator oriented functional descriptions of the equipment.
- b) Operator oriented description of the protection and control systems
- c) Description of the equipment auxiliary systems
- d) Fault finding and diagnostic tools
- e) User software interface tools for modification/augmentation etc.



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Notes:

The supplier may please note that all resubmissions must incorporate all comments given in the earlier submission by the Owner/Purchaser or adequate justification for not incorporating the same must be submitted failing which the submission of documents is likely to be returned.

If after the commissioning and initial operation of the substation, the instruction manuals require any modifications/ additions/changes, the same shall be incorporated and the updated final instruction manuals shall be submitted by the Supplier to the Owner/Purchaser.

The Supplier shall furnish to the Owner/Purchaser, catalogues of spare parts also.

### **3.6 QUALITY ASSURANCE PROGRAMME**

This section contains general requirements for inspection of material, parts, equipment and workmanship during manufacture, assembling to demonstrate compliance with specification, codes and standards to ensure overall reliability of product operation and performance.

The Owner and/or authorized Representatives shall, at any time, be allowed free and ready access to the Contractor's premises and those of his suppliers as well as to the site installation and the Contractor has to make the items available for the purpose of inspection of the specified equipment components and obtaining information as to the progress of the work. Failure on the part of the Owner, at this or any other time, to discover or reject materials or work which do not meet specified requirements shall not be deemed an acceptance thereof nor a waiver of defects therein.

The approval of the Owner shall not prejudice the right to reject equipment if it does not give complete satisfaction in service.

To ensure that the equipment and services under the scope of this Contract, whether manufactured or performed within the Manufacturer's Works or at his Sub-manufacturer's premises or at the Purchaser's site or at any other place of Work, are in accordance with the specifications, the Manufacturer shall adopt a suitable quality assurance programme to control such activities at all points, as necessary.

Before manufacture commences and not later than 45 days after award of contract, the Contractor shall submit an outline of his proposed inspection program, which shall include all major stages during manufacturing. The inspection and test program shall include for the various items the designation No., name of equipment, part of equipment, the kind of test, test standard, company which carries out the test, place, date and witnesses by the Contractor, third party or Owner's Representative. The detailed manufacturer's quality assurance plan shall be subject to approval after award of contract.

The Owner will return a copy of the Contractor's proposed inspection program indicating those inspection stages for which notification is required. Notification shall be by Fax or email in a format to be agreed and shall be sent prior to the intended test. If the Owner intends to be represented at the test he will provide at least 24 hours' notice and if his representative does not attend on the notified date, an alternative date has to be informed by the Owner.

A quality assurance programme of the manufacturer shall generally cover the following:

- (a) Manufacturer's organisation structure for the management and implementation of the proposed quality assurance programme;
- (b) Documentation control system;
- (c) Qualification data of bidder's key personnel;
- (d) The procedure for purchases of materials, parts components and selection of sub-Manufacturer's services including vendor analysis, source inspection, incoming raw material inspection, verification of material purchases etc.
- (e) System for shop manufacturing and site erection controls including process controls and fabrication and assembly control;
- (f) Control of non-conforming items and system for corrective actions;
- (g) Inspection and test procedure both for manufacture and field activities;
- (h) Control of calibration and testing of measuring instruments and field activities;
- (i) System for indication and appraisal of inspection status;
- (j) System for quality audits;
- (k) System for authorising release of manufactured product to the Purchaser
- (l) System for maintenance of records;
- (m) System for handling storage and delivery; and
- (n) A quality plan detailing out the specific quality control measures and Procedures adopted for controlling the quality characteristics relevant to each item of equipment furnished and/or services rendered. The Purchaser or his duly authorised representative reserves the right to carry out quality audit and quality surveillance of the system and Procedure of the Manufacturer/his vendors quality management and control activities.

### **3.7 Quality Assurance Documents**

The Manufacturer shall be required to submit all Quality Assurance Documents as stipulated in the quality plan at the time of purchaser's inspection of equipment/material.

### **3.8 TYPE TESTING, INSPECTION, TESTING & INSPECTION CERTIFICATE**

All equipment being supplied shall conform to type tests and shall be subject to routine and acceptance tests in accordance with requirements stipulated under respective sections. Purchaser reserves the right to witness any or all the tests. The

Manufacturer shall intimate the Purchaser the detailed programme about the tests at least three (3) weeks in advance in case of domestic supplies & six (6) weeks in advance in case of foreign supplies. The Manufacturer shall also submit type test procedure for approval of the Purchaser.

In the event of any discrepancy in the test reports i.e. any test report not acceptable due to any design/manufacturing changes (including substitution of components) or due to non-compliance with the requirement stipulated in the technical specification or any/all additional type tests not carried out, Such test shall be conducted fresh without any additional cost implication to the Purchaser.

The price of conducting all tests and additional type tests is deemed to be included in Bid price. In case any bidder indicates that he shall not carry out a particular test, his offer shall be considered incomplete and shall be liable to be rejected.

Inspection may be made at any stage of manufacture, dispatch or at site at the option of the Purchaser and the equipment if found unsatisfactory due to bad workmanship or quality, material is liable to be rejected.

The Purchaser or Inspector shall, within fifteen (15) days from the date of inspection as defined herein, give notice in writing to the Manufacturer, of any objection to any drawings and all or any equipment and workmanship which in his opinion is not in accordance with the Contract. The Manufacturer shall give due consideration to such objections and shall either make the modifications that may be necessary to meet the said objections or shall confirm in writing to the Purchaser/ inspector giving reasons therein, that no modifications are necessary to comply with the Contract.

When the factory tests have been completed at the Manufacturer's works, the Purchaser/inspector shall issue a certificate to this effect within fifteen (15) days after completion of tests but if the tests are not witnessed by the Purchaser/inspector, the certificate shall be issued within fifteen (15) days of receipt of the Manufacturer's Test certificate by the Engineer/ Inspector. Failure of the Purchaser/inspector to issue such a certificate shall not prevent the Manufacturer from proceeding with the Works. The completion of these tests or the issue of the certificate shall not bind the Purchaser to accept the equipment should it, on further tests/ after erection, be found not to comply with the Contract. The equipment shall be dispatched to site only after approval of test reports and issuance of MICC by the Purchaser.

In all cases where the Contract provides for tests whether at the premises or at the works of the Manufacturer or of any Sub-Contractor, the Manufacturer except where otherwise specified shall provide free of charge such items as labour, materials, electricity, fuel, water, stores, apparatus and instruments as may be reasonably demanded by the Purchaser /Inspector or his authorised representative to carry out effectively such tests of the equipment in accordance with the Contract and shall give

facilities to the Purchaser Inspector or to his authorised representative to accomplish testing.

The inspection by Purchaser and issue of Inspection Certificate thereon shall in no way limit the liabilities and responsibilities of the Manufacturer in respect of the agreed quality assurance programme forming a part of the Contract.

The Purchaser reserves the right for getting any field tests not specified in respective sections of the technical specification conducted on the completely assembled equipment at site. The testing equipment for these tests shall be provided by the Purchaser.

### **3.9 MATERIALS AND WORKMANSHIP**

Equipment materials and components shall be new, of high grade and good quality and be to the latest engineering practice. The material and workmanship throughout shall be in accordance with the purpose for which they are intended. Each component shall be designed to be consistent with its duty.

All the information concerning materials or components to be used in manufacturing, machinery, equipment, materials and components supplied, installed or used shall be submitted for approval. Without such approval the supplier shall run risk of subsequent rejection. The cost as well as time delay associated with such rejection shall be borne by the supplier.

### **3.10 COLOUR SCHEME**

The Supplier shall propose a colour scheme for the equipment for the approval of the Employer. The decision of the Employer shall be final. However, the finishing colour shall be RAL 7035 for all Control panels/ MCC/ Switchgear panels. The scheme shall include:

- Finishing colour of Indoor equipment
- Finishing colour of Outdoor equipment
- Finishing colour of various auxiliary system equipment including piping
- Finishing colour of various building items.
- Finishing colour of all cubicles.

All steel structures, plates etc shall be painted with non-corrosive paint on a suitable primer. The galvanised structures in the switchyard shall not be painted. However galvanised structures in other areas may require painting for aesthetic reasons.

### **3.11 PACKING AND STORAGE**

Packing specification shall be submitted for BHEL/customer approval after award of contract.

All the equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. On request of the purchaser, the manufacturer shall also submit packing details/associated drawing for any equipment/ material at a later date, in case the need arises. While packing all the materials, the limitation from the point of view of availability of Railway wagon sizes in India should be taken into account. The manufacturer shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. Any demurrage, wharf age and other such charges claimed by the transporters, railways etc shall be to the account of the manufacturer. Purchaser takes no responsibility of the availability of the wagons.

All coated surfaces shall be protected against abrasions, impact, discoloration and any other damages. All exposed threaded portions shall be suitably protected with either a metallic or a non-metallic protecting device.

Supplier shall ensure that equipment shall be properly packed, blocked, padded, coated and protected so that it is not damaged due to possible mishandling. Storage requirements shall be clearly defined by the supplier. Packing shall be such that if required, long time storage (at least 1 year) at site should not deteriorate the performance of the equipment.

### **3.12 NAME PLATE**

Name plates which are to be firmly fixed on all the equipment, buildings and structures shall be provided. For equipment of small size, these are to be fixed on the piping or structure adjacent to the equipment. The contents of nameplate are to include the designation and principal parameters of the equipment.

The nameplate within the field shall be made of a high temperature - resistant metallic sheets, with designation permanently engraved on them. Indoor installed equipments (e.g., panels, cabinets, switchgear, etc.) shall also be labelled by appropriate name plate.

The form, size, base colour and colour of contents of the name plates and prompting plates will be agreed between the Contractor and the Owner. It shall be possible for these to be readily seen by the operator. The designation of warning tags shall be different from that of other tags.

The Equipment identification shall be finalized by vendor in consultation with BHEL/TANGEDCO and should be included in name plates.

### **3.13 CLAMPS & CONNECTORS**

- i) All power clamps and connectors shall conform to IS: 5561, and/or IEC standard and shall be made of materials listed below:

a)	For connecting ACSR conductors	Aluminium alloy casting, conforming to designation A6 of IS: 617 and shall be tested for all tests as per IS:617
b)	For connecting equipment terminals made of copper with ACSR conductors	Bimetallic connectors made from aluminium alloy casting, conforming to designation A6 of IS 617 with 2 mm thick Bimetallic liner and shall be tested as per IS: 617.
c)	For connecting G.I. Shield wire	Galvanised mild steel
d).1	Bolts, nuts & Plain washers.	Electro galvanized for sizes below M12, for others hot dip galvanised
d).2	Spring washers for items 'a' to 'c'	Electro-galvanised mild steel suitable for at least service condition-3 as per IS: 1573

- ii) Equipment shall be supplied with the necessary terminals and connectors, as required by the ultimate design for the particular installation. The conductor terminations of equipment shall be either expansion, sliding or rigid type. The requirements regarding external corona and RIV as specified for any equipment shall include its terminal fittings and the equipment shall be factory tested with the connectors in position. In case the connector is not available then equivalent connector may be used. If corona rings are required to meet these requirements they shall be considered as part of that equipment and included in the scope of Work.
- iii) Where copper to aluminium connections are required, bi-metallic clamps shall be used, which have been properly designed to ensure that any deterioration of the connection is kept to a minimum and restricted to parts which are not current t shall be furnished to the Employer.
- iv) Low voltage connectors, grounding connectors and accessories for grounding all equipment as specified are also included in the scope of Work.
- v) No current carrying part of any clamp shall be less than 10 mm thick. All ferrous parts shall be hot dip galvanised. Copper alloy liner of minimum 2mm thickness shall be cast integral with aluminium body for Bi-metallic clamps. When copper alloy is not cast integral with aluminium body, a bimetallic washer or strip shall be used to meet the functional requirement.
- vi) All casting shall be free from blow holes, surface blisters, cracks and cavities. All sharp edges and corners shall be blurred and rounded off.

- vii) Flexible connectors, braids or laminated straps made for the terminal clamps for bus posts shall be suitable for both expansion or through (fixed/sliding) type connection of IPS Aluminium tube as required. In both the cases the clamp height (top of the mounting pad to centre line of the tube) should be same.
- viii) Clamp shall be designed to carry the same current as the conductor and the temperature rise shall be equal or less than that of the conductor at the specified ambient temperature. The rated current for which the clamp/connector is designed with respect to the specified reference ambient temperature, shall also be indelibly marked on each component of the clamp/connector, except on the hardware.
- ix) All current carrying parts shall be designed and manufactured to have minimum contact resistance.

#### x) TESTS

The following is the list of type tests.

- a) Temperature rise test (maximum temperature rise allowed is 35deg C over 50 deg C ambient)
- b) Short time current test
- c) Dry corona and RIV test
- d) Resistance test and tensile test

### 3.14 GALVANIZING

Galvanizing works shall conform in all respect to B.S. 729, B.S. 3083 and B.S.C.P. 2008 and to DIN 50976 whatever requires the higher quality and shall be performed by the hot dip process, unless otherwise specified. It is essential that details of steel members and assemblies which are to be hot-dip galvanized should be designed in accordance with B.S 4479.

Vent-holes and drain-holes should be provided to avoid high internal pressures and air-locks during immersion, which may cause explosions, and to ensure that molten zinc is not retained in pockets during withdrawal.

Careful cleaning of welds is necessary before welded assemblies are dipped. The welds and the surrounding metal should be cleaned separately, preferably be blast-cleaning, because the usual preliminary pickling cannot be relied on to remove the welding slag.

All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed in accordance with B.S. 4360. All drilling, cutting, welding, forming and final fabrication of unit members and assemblies shall be completed, where feasible, before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from paint, oil, grease and similar contaminants in accordance with DIN 55928, part 4 and DIN 50976. The weight of zinc coating per

unit area has to be noted in the manufacturing documents in accordance with DIN 50976.

The minimum average coating weight shall be as specified in Table 1 of B.S. 729 or Table 2, DIN 50976, whatever requires higher quality.

Structural steel items shall be initially grit-blasted to B.S. 4232, second quality, (Sa 21/2) or by pickling in a bath and the minimum average coating weight on steel sections 5 mm thick and over shall be 610 g/m<sup>2</sup> (DFT = 85μ) .

On removal from the galvanizing bath, the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Galvanized contact surfaces to be joined by high-tensile friction-grip bolts shall be roughened before assembly so that the required slip factor (defined in B.S. 3294, part 1 and B.S. 4604,

part 1) is achieved. Care shall be taken to ensure that the roughening is confined to the area of the mating faces.

Bolts, nuts and washers, including general grade high-tensile friction grip bolts (referred to in B.S. 3139, and B.S.4395 part 1) shall be hot dip galvanized and subsequently centrifuged (according to B.S. 729). Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads oiled to permit the nuts to be finger-turned on the bolt for the full depth of the nut. No lubricant, applied to the projecting threads of galvanized high-tensile friction-grip bolt after the bolt has been inserted through the steelwork, must be allowed to come into contact with the mating faces of the steelwork,. A local remelting of the galvanized parts to achieve the nuts to be finger turned on the bolt is possible in accordance with DIN 50976.

Protected slings must be used for offloading and erection. Galvanized work which is to be stored at the works or on site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanized coating damaged in any way shall be restored in accordance with DIN 55928, part A and DIN 50976 by:

- Cleaning the area of any weld slag rust and other impurities and by thorough wire brushing to give a metallic clean surface.
- Application of suitable number of coats of zinc-rich paint containing more than 90 % w/w of zinc in dried film. The dry film thickness shall exceed at least 50 % the thickness of the desired galvanization. In case of application of a low melting point zinc alloy repair rod, the rods shall be in accordance with DIN1707, the thickness of the alloy shall be at least as of the desired galvanization.

The restored area is not to exceed 1 % of the galvanized surface. Surface restoration of parts in contact with drinking water is not allowed and the quality of the galvanization is to be in accordance with DIN 2444.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc-rich paint.



Connections between galvanized surfaces and copper, copper alloy or aluminum surfaces shall be protected by suitable preferably hydrophobe tape wrappings to the owner's approval.

### **3.15 DEGREE OF PROTECTION**

The enclosures of the control cabinets, Junction boxes and Marshalling boxes, panels etc. to be installed as detailed here under:

The minimum requirements for panels are as follows:

- Installed out door: IP- 55
- Installed indoors in air-conditioned area: IP-32
- Installed in covered area: IP-52
- Installed indoors in non air-conditioned area where possibility of entry of water is limited: IP-41.
- For LT Switchgear (AC & DC distribution Boards): IP-52.

The degree of protection shall be in accordance with IS:13947 (Part-I) / IEC-947 (Part-I) / IS 12063 / IEC 529. Type test report for degree of protection test, on each type of the box shall be submitted for approval

**Annexure - A: BILL OF QUANTITY**

S.NO.	INDENT ITEM DESCRIPTION	DETAIL ITEM DESCRIPTION	UNIT	QTY
1	SUPPLY- TRENCH MATERIAL : CABLE TRAY SUPPORTS - SINGLE CHANNEL	Single Channel support (SC1) of standard length 6 m. (Drawing No. PE-DG-435-507-E006 Rev01 Page 2 of 26)	nos.	348
2	SUPPLY- TRENCH MATERIAL : CABLE TRAY SUPPORTS - DOUBLE CHANNEL	Double Channel support (DC1) of standard length 6 m. (Drawing No. PE-DG-435-507-E006 Rev01 Page 2 of 26)	nos.	10
3	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAY SUPPORTS - CANTILEVER ARM FOR CABLE TRAY 750 MM WIDE	Cantilever arm (CA1) complete with 2 nos. 12 mm dia (M12) bolts with spring nuts and washers, 2 nos. 6 mm dia (M6) pan head screws with long spring nuts and washers suitable for ladder type cable tray 750 mm wide. (Drawing No. PE-DG-435-507-E006 Rev01 Page 3 of 26)	nos.	1
4	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAY SUPPORTS - CANTILEVER ARM FOR CABLE TRAY 600 MM WIDE	Cantilever arm (CA2) complete with 2 nos. 12 mm dia (M12) bolts with spring nuts and washers, 2 nos. 6 mm dia (M6) pan head screws with long spring nuts and washers suitable for ladder type cable tray 600 mm wide. (Drawing No. PE-DG-435-507-E006 Rev01 Page 3 of 26)	nos.	318
5	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAY SUPPORTS - CANTILEVER ARM FOR CABLE TRAY 450 MM WIDE	Cantilever arm (CA3) complete with 2 nos. 12 mm dia (M12) bolts with spring nuts and washers, 2 nos. 6 mm dia (M6) pan head screws with long spring nuts and washers suitable for ladder type cable tray 450 mm wide. (Drawing No. PE-DG-435-507-E006 Rev01 Page 3 of 26)	nos.	1
6	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAY SUPPORTS - CANTILEVER ARM FOR CABLE TRAY 300 MM WIDE	Cantilever arm (CA4) complete with 2 nos. 12 mm dia (M12) bolts with spring nuts and washers, 2 nos. 6 mm dia (M6) pan head screws with long spring nuts and washers suitable for ladder type cable tray 300 mm wide. (Drawing No. PE-DG-435-507-E006 Rev01 Page 3 of 26)	nos.	1
7	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAY SUPPORTS - CANTILEVER ARM FOR CABLE TRAY 150 MM WIDE	Cantilever arm (CA5) complete with 2 nos. 12 mm dia (M12) bolts with spring nuts and washers, 2 nos. 6 mm dia (M6) pan head screws with long spring nuts and washers suitable for ladder type cable tray 150 mm wide. (Drawing No. PE-DG-435-507-E006 Rev01 Page 3 of 26)	nos.	1
8	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - 90° ANGLE FITTING (HL1)	90° Angle fitting (HL1) complete with fixing hardware (Drawing No. PE-DG-435-507-E006 Rev01 Page 4 of 26)	nos.	1721
9	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - CLAMP FOR SINGLE CHANNEL	Clamp for single channel (CC1) complete with 2 nos. 10 mm dia (M10) Anchor bolt & 1 No.12 mm dia (M12) bolts with spring nuts and washers (Drawing No. PE-DG-435-507-E006 Rev01 Page 5 & 13 of 26)	nos.	681
10	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - CLAMP FOR DOUBLE CHANNEL	Clamp for double channel (CC2) complete with 2 nos. 10 mm dia (M10) Anchor bolt & 1 No.12 mm dia (M12) bolts with spring nuts and washers (Drawing No. PE-DG-435-507-E006 Rev01 Page 5 & 13 of 26)	nos.	1
11	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - BASE PLATE FOR SINGLE CHANNEL	Base plate for single channel (BP1) complete with 1 nos. Anchor fastner & 1 No.12 mm dia (M12) bolts with spring nuts and washers (Drawing No. PE-DG-435-507-E006 Rev01 Page 6 of 26)	nos.	178
12	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - BASE PLATE FOR DOUBLE CHANNEL	Base plate for double channel (BP2) complete with 2 nos. Anchor fastner & 2 No.12 mm dia (M12) bolts with spring nuts and washers (Drawing No. PE-DG-435-507-E006 Rev01 Page 7 of 26)	nos.	10
13	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - BEAM CLAMP	Beam Clamp (BC1) complete with fixing hardware (Drawing No. PE-DG-435-507-E006 Rev01 Page 8 of 26)	nos.	1
14	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - TRAY FIXING CLAMP	Tray fixing clamp (TC1) complete with fixing hardware (Drawing No. PE-DG-435-507-E006 Rev01 Page 9 of 26)	nos.	50
15	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - 90° ANGLE FITTING (LA1)	90° Angle fitting (LA1) complete with fixing hardware (Drawing No. PE-DG-435-507-E006 Rev01 Page 10 of 26)	nos.	10



**Annexure - A: BILL OF QUANTITY**

S.NO.	INDENT ITEM DESCRIPTION	DETAIL ITEM DESCRIPTION	UNIT	QTY
16	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - FLAT PLATE TEE FITTINGS	Flat plate Tee Fittings (PF1) complete with fixing hardware (Drawing No. PE-DG-435-507-E006 Rev01 Page 10 of 26)	nos.	10
17	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - FLAT PLATE STRAIGHT FITTING	Flat plate straight fitting (PF2) complete with fixing hardware (Drawing No. PE-DG-435-507-E006 Rev01 Page 10 of 26)	nos.	10
18	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - EARTH FLAT FIXING CLAMP	Earth Flat fixing clamp (Z) complete with fixing hardware (Drawing No. 0350-215-PVE-B-001 Rev00 Page 18 of 21)	nos.	180
19	SUPPLY- TRENCH MATERIAL : CLAMPS AND FITTINGS FOR CABLE TRAY SUPPORTS - PVC END CAP FOR SINGLE CHANNEL	PVC End Cap for single channel (Drawing No. 0350-215-PVE-B-001 Rev00 Page 20 of 21)	nos.	318
20	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY 750 MM WIDE	Ladder type cable tray 750 mm wide, 100 mm high, 2 mm thick (min.) galvanised iron slotted rung 2.5 m long each with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling two trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 2 & 3 OF 34)	nos.	67
21	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY 600 MM WIDE	Ladder type cable tray 600 mm wide, 100 mm high, 2 mm thick (min.) galvanised iron slotted rung 2.5 m long each with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling two trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 2 & 3 OF 34)	nos.	136
22	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY 450 MM WIDE	Ladder type cable tray 450 mm wide, 100 mm high, 2 mm thick (min.) galvanised iron slotted rung 2.5 m long each with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling two trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 2 & 3 OF 34)	nos.	32
23	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY 300 MM WIDE	Ladder type cable tray 300 mm wide, 100 mm high, 2 mm thick (min.) galvanised iron slotted rung 2.5 m long each with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling two trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 2 & 3 OF 34)	nos.	1
24	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY 150 MM WIDE	Ladder type cable tray 150 mm wide, 100 mm high, 2 mm thick (min.) galvanised iron slotted rung 2.5 m long each with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling two trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 2 & 3 OF 34)	nos.	1
25	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY COVER FOR CABLE TRAY 750 MM WIDE	Cable tray cover for Ladder type cable tray 750 mm wide, complete with fixing hardware & accessories as per drawing (Drawing No. PE-DG-435-507-E005 Rev01 Page 5 OF 34)	nos.	23
26	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY COVER FOR CABLE TRAY 600 MM WIDE	Cable tray cover for Ladder type cable tray 600 mm wide, complete with fixing hardware & accessories as per drawing (Drawing No. PE-DG-435-507-E005 Rev01 Page 5 OF 34)	nos.	46
27	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY COVER FOR CABLE TRAY 450 MM WIDE	Cable tray cover for Ladder type cable tray 450 mm wide, complete with fixing hardware & accessories as per drawing (Drawing No. PE-DG-435-507-E005 Rev01 Page 5 OF 34)	nos.	11

**Annexure - A: BILL OF QUANTITY**

S.NO.	INDENT ITEM DESCRIPTION	DETAIL ITEM DESCRIPTION	UNIT	QTY
28	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY COVER FOR CABLE TRAY 300 MM WIDE	Cable tray cover for Ladder type cable tray 300 mm wide, complete with fixing hardware & accessories as per drawing (Drawing No. PE-DG-435-507-E005 Rev01 Page 5 OF 34)	nos.	1
29	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - CABLE TRAY COVER FOR CABLE TRAY 150 MM WIDE	Cable tray cover for Ladder type cable tray 150 mm wide, complete with fixing hardware & accessories as per drawing (Drawing No. PE-DG-435-507-E005 Rev01 Page 5 OF 34)	nos.	1
30	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL TEE FOR CABLE TRAY 750 MM WIDE	Horizontal Tee for Ladder type cable tray 750 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	10
31	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL TEE FOR CABLE TRAY 600 MM WIDE	Horizontal Tee for Ladder type cable tray 600 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	12
32	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL TEE FOR CABLE TRAY 450 MM WIDE	Horizontal Tee for Ladder type cable tray 450 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	4
33	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL TEE FOR CABLE TRAY 300 MM WIDE	Horizontal Tee for Ladder type cable tray 300 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	1
34	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL TEE FOR CABLE TRAY 150 MM WIDE	Horizontal Tee for Ladder type cable tray 150 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	1
35	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - LEFT HAND REDUCER FOR CABLE TRAY 750 MM WIDE TO 600 MM WIDE	Left Hand Reducer for cable tray 750 mm wide to 600 mm Wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	5
36	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - RIGHT HAND REDUCER FOR CABLE TRAY 750 MM WIDE TO 600 MM WIDE	Right Hand Reducer for cable tray 750 mm wide to 600 mm Wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	5
37	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - LEFT HAND REDUCER FOR CABLE TRAY 600 MM WIDE TO 450 MM WIDE	Left Hand Reducer for cable tray 600 mm wide to 450 mm Wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	8

**Annexure - A: BILL OF QUANTITY**

S.NO.	INDENT ITEM DESCRIPTION	DETAIL ITEM DESCRIPTION	UNIT	QTY
38	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - RIGHT HAND REDUCER FOR CABLE TRAY 600 MM WIDE TO 450 MM WIDE	Right Hand Reducer for cable tray 600 mm wide to 450 mm Wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 6 OF 34)	nos.	4
39	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL CROSS FOR CABLE TRAY 600 MM WIDE	Horizontal Cross for Ladder type cable tray 600 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 7 OF 34)	nos.	1
40	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL CROSS FOR CABLE TRAY 450 MM WIDE	Horizontal Cross for Ladder type cable tray 450 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 7 OF 34)	nos.	1
41	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL CROSS FOR CABLE TRAY 300 MM WIDE	Horizontal Cross for Ladder type cable tray 300 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 7 OF 34)	nos.	1
42	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - HORIZONTAL CROSS FOR CABLE TRAY 150 MM WIDE	Horizontal Cross for Ladder type cable tray 150 mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 7 OF 34)	nos.	1
43	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° HORIZONTAL BEND FOR CABLE TRAY 750MM WIDE	90° Horizontal bend for Ladder type cable tray 750mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	20
44	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° HORIZONTAL BEND FOR CABLE TRAY 600MM WIDE	90° Horizontal bend for Ladder type cable tray 600mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	16
45	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° HORIZONTAL BEND FOR CABLE TRAY 450MM WIDE	90° Horizontal bend for Ladder type cable tray 450mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
46	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° HORIZONTAL BEND FOR CABLE TRAY 300MM WIDE	90° Horizontal bend for Ladder type cable tray 300mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
47	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° HORIZONTAL BEND FOR CABLE TRAY 150MM WIDE	90° Horizontal bend for Ladder type cable tray 150mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1

**Annexure - A: BILL OF QUANTITY**

S.NO.	INDENT ITEM DESCRIPTION	DETAIL ITEM DESCRIPTION	UNIT	QTY
48	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (INSIDE) FOR CABLE TRAY 750MM WIDE	90° Vertical bend (Inside) for Ladder type cable tray 750mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	12
49	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (INSIDE) FOR CABLE TRAY 600MM WIDE	90° Vertical bend (Inside) for Ladder type cable tray 600mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	12
50	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (INSIDE) FOR CABLE TRAY 450MM WIDE	90° Vertical bend (Inside) for Ladder type cable tray 450mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
51	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (INSIDE) FOR CABLE TRAY 300MM WIDE	90° Vertical bend (Inside) for Ladder type cable tray 300mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
52	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (INSIDE) FOR CABLE TRAY 150MM WIDE	90° Vertical bend (Inside) for Ladder type cable tray 150mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
53	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (OUTSIDE) FOR CABLE TRAY 750MM WIDE	90° Vertical bend (outside) for Ladder type cable tray 750mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	12
54	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (OUTSIDE) FOR CABLE TRAY 600MM WIDE	90° Vertical bend (outside) for Ladder type cable tray 600mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	12
55	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (OUTSIDE) FOR CABLE TRAY 450MM WIDE	90° Vertical bend (outside) for Ladder type cable tray 450mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
56	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (OUTSIDE) FOR CABLE TRAY 300MM WIDE	90° Vertical bend (outside) for Ladder type cable tray 300mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1
57	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - 90° VERTICAL BEND (OUTSIDE) FOR CABLE TRAY 150MM WIDE	90° Vertical bend (outside) for Ladder type cable tray 150mm wide with 4 nos. coupler plate, 3 mm thick (min.) along with 8 mm dia (M8) bolts with nuts and washers for coupling with trays (Drawing No. PE-DG-435-507-E005 Rev01 Page 8 OF 34)	nos.	1



**Annexure - A: BILL OF QUANTITY**

S.NO.	INDENT ITEM DESCRIPTION	DETAIL ITEM DESCRIPTION	UNIT	QTY
58	SUPPLY- TRENCH MATERIAL : LADDER TYPE TRAY, CABLE TRAYS, FITTINGS AND ACCESSORIES - COUPLER PLATE FOR CABLE TRAY	Coupler plate complete with fixing hardware (Drawing No. PE-DG-435-507-E005 Rev01 Page 3 OF 34)	nos.	48

# INSTALLATION DETAILS FOR CABLE TRAY SUPPORT SYSTEM (BOLTABLE TYPE)

## TATA CONSULTING ENGINEERS LIMITED VENDOR DRAWING STATUS

	CATEGORY	DESCRIPTION
<input type="checkbox"/>	CAT-1	Drawing/documents approved for final distribution. BHEL will proceed with manufacturing/ fabrication/construction.
<input checked="" type="checkbox"/>	CAT-2	Drawing/documents cleared for manufacturing/ fabrication/construction subject to incorporating the comments given. BHEL to resubmit the drawing for Approval in Category - 1. Comments will be marked on the drawing documents.
<input type="checkbox"/>	CAT-3	Drawing document will be corrected as per comment and resubmitted by BHEL for further review/checking.
<input type="checkbox"/>	CAT-4	Drawing document of this category are for information only and not for approval. Information furnished on the document is noted.




Note :

1. It is mandatory to close documents with Code 2 & 3 to Code 1 in agreed contract period or 2 weeks, whichever is lower.
2. Any design changes / modification required to be carried out in Code 4 Drawings / Documents shall be the responsibility of BHEL. BHEL to resubmit reflecting the Design Changes for information.

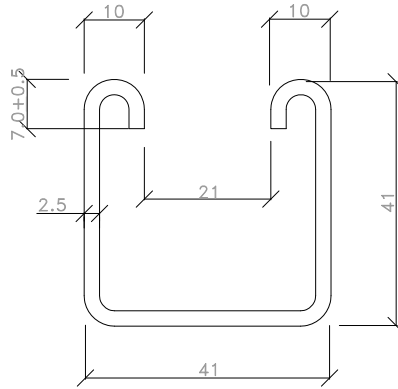
Approval conveyed herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance requirements and conformity of supplies with the Indian Statutory Laws as may be applicable, nor does it limit the purchaser's rights under the contract.

Reviewed by ..... *S.S. Satish* ..... Date 06-09-19

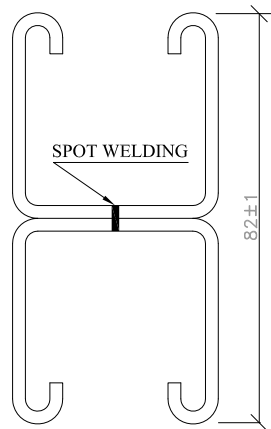
DURING INSTALLATION AT SITE SOME ADDITIONAL DETAILS MAY BE ADDED IN THIS DOCUMENT. HENCE THIS DOCUMENT WILL BE APPROVED IN CAT-1 AFTER ALL INSTALLATION WORK IS COMPLETED AT SITE.

CUSTOMER NAME					TAMIL NADU GENERATION & DISTRIBUTION CORPORATION LIMITED 5TH FLOOR, WESTERN WING, NPKRR, MAALIGAI. 144, ANNA SALAI, CHENNAI-600002.												
CUSTOMER'S CONSULTANT					 <b>TATA Consulting Engineers Limited</b> MUMBAI												
JOB No. 435					2 X 660 MW UDANGUDI TPP-STAGE I												
STATUS CONTRACT																	
DISTRIBUTION																	
TO																	
No. OFF					 BHARAT HEAVY ELECTRICALS LTD POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA					DEPT CODE		NAME		SIGN		DATE	
REV	DATE	ALTD	CHD	APPD	REV	DATE	ALTD	CHD	APPD	E	DRN	SKS	-Sd-				
					01	22.07.19	SKS				DESN	SKS	-Sd-				
											CHD	VY	-Sd-				
											APPD	SL	-Sd-				
1. DOCUMENT REVISED AS PER TCE COMMENTS, REF. NO: TCE: 11403A-EL-VDT-039, dated 13.05.2019					TITLE INSTALLATION DETAILS FOR CABLE TRAY SUPPORT SYSTEM (BOLTABLE TYPE)												
					MPL C&I MSE MAUX ELEC. CIVIL DEPT. SCALE ---												
					SIGN DATE 												
					DRAWING No. PE-DG-435-507-E006												
					SHEET 1 OF 26 REV 01												





SINGLE CHANNEL SC1



DOUBLE CHANNEL DC1

TWO LENGTHS OF SINGLE CHANNEL

SPOT WELDED BACK TO BACK

AT 75MM C/C

NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : HOT ROLLED M.S. AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT  
MATERIAL & ACCESSORIES

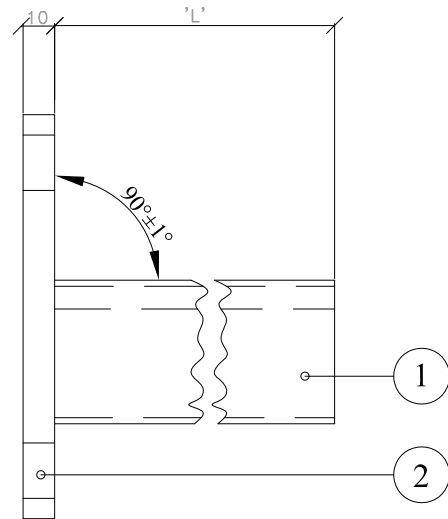
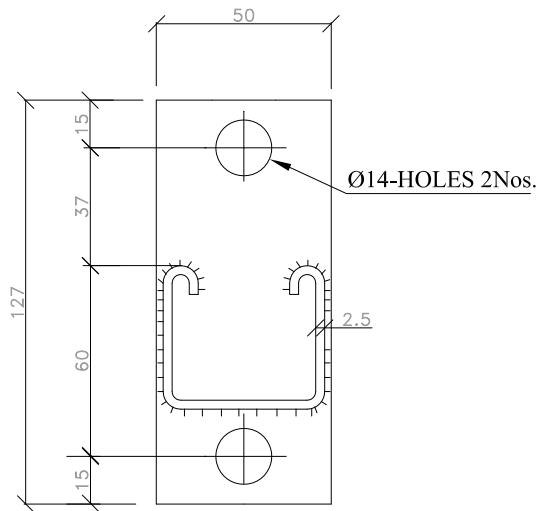


TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

DRG. NO.

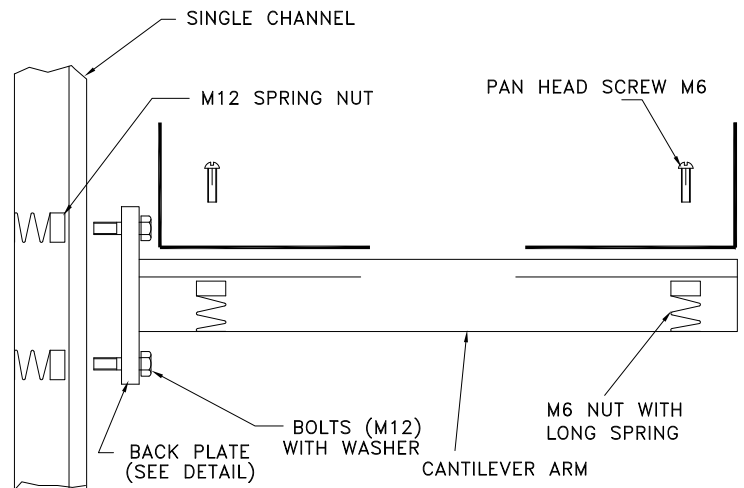
PE-DG-435-507-E006

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### CANTILEVER ARMS

TRAY WIDTH IN MM	CANTILEVER ARM LENGTH (L) IN MM
150	200
300	350
450	500
600	650



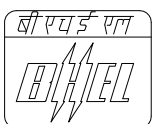
### TYPICAL ASSEMBLY OF CHANNEL SUPPORTS AND CABLE TRAY

*M12 HEX BOLT & WASHER-2NOS.  
M12 SPRING NUTS-2NOS.  
M6 PAN HEAD SCREWS & WASHER-2NOS.  
M6 SPRING NUTS-2NOS.*

### NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. ITEM NO.1 MATERIAL : HOT ROLLED M.S. AS PER IS-2062.
3. ITEM NO.2 MATERIAL : MILD STEEL AS PER IS-2062.
4. FINISH : HOT DIP GALVANISED AS PER IS 2629
5. TOLERANCE ON THICKNESS IS AS PER IS 1852
6. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
7. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

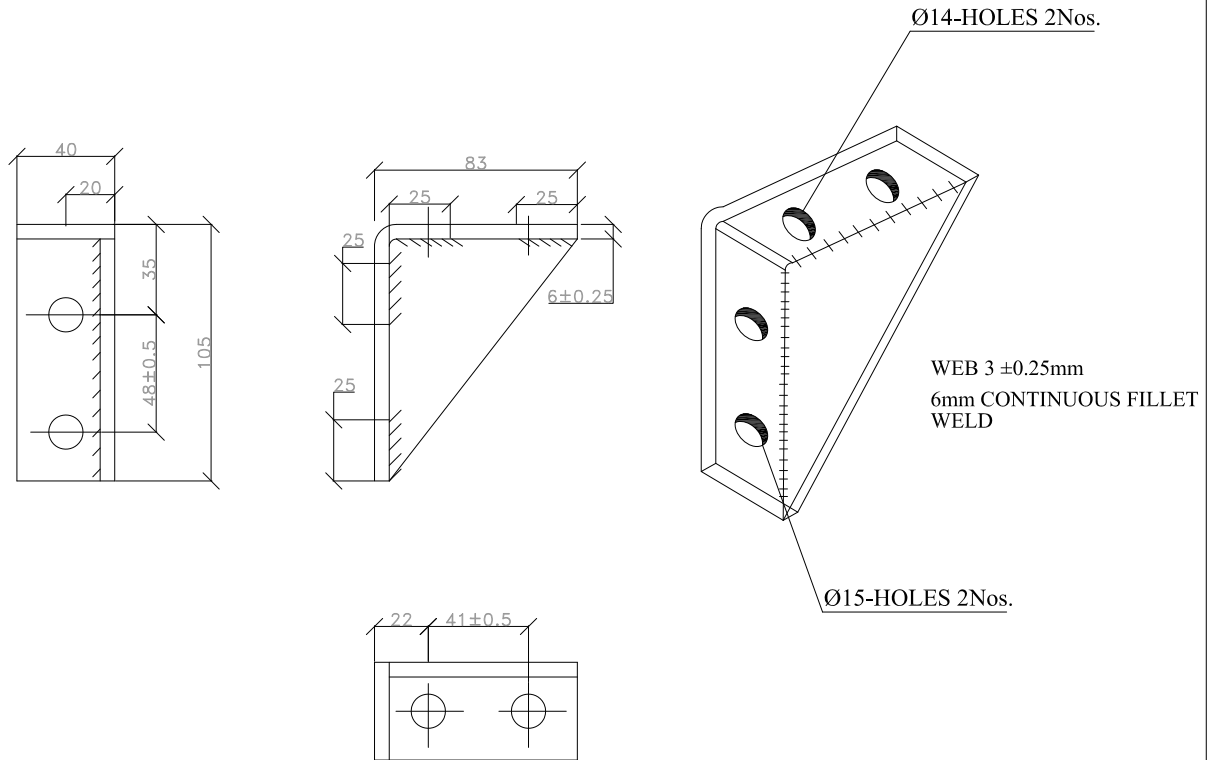
### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES



TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

DRG. NO.  
PE-DG-435-507-E006

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### 90° ANGLE FITTING HL1

*ANCHOR FASTENER-2Nos.  
SPRING NUT & WASHER-2Nos.*

#### NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES

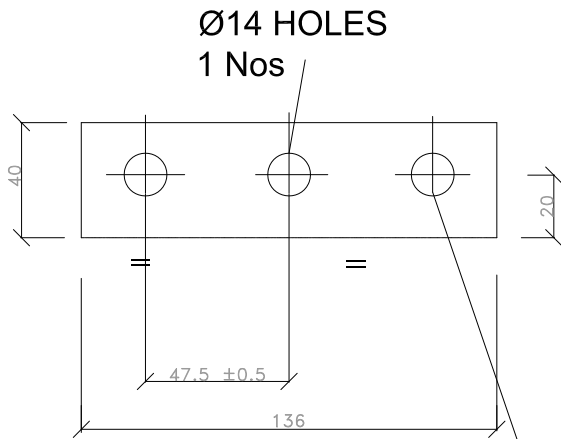
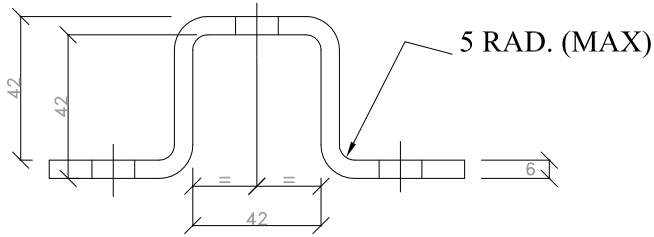
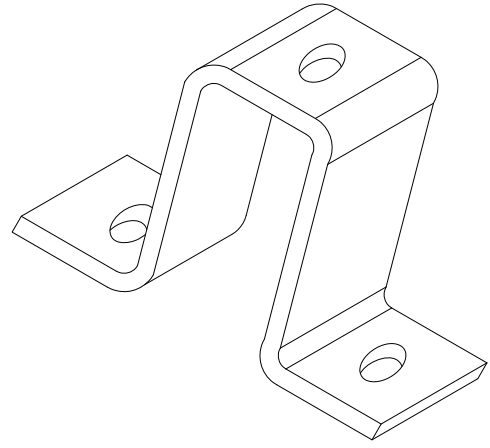
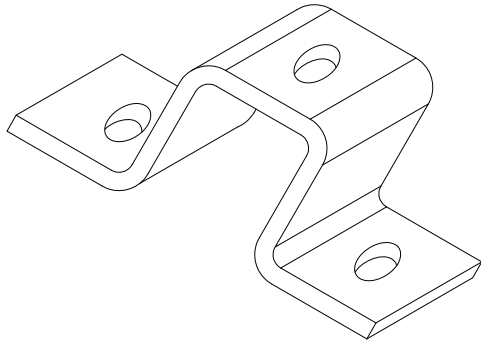


TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

DRG. NO.

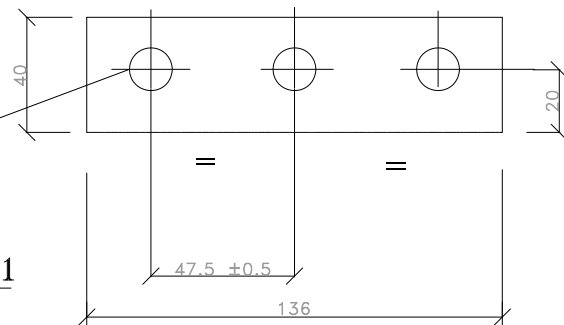
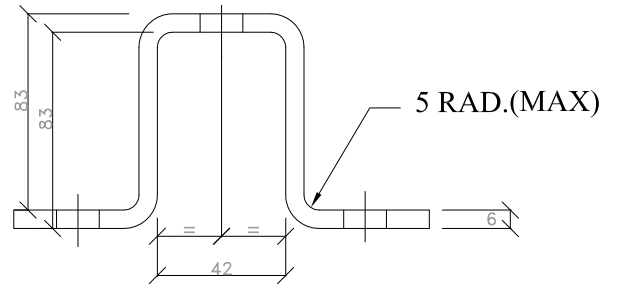
PE-DG-435-507-E006

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Ø14 HOLES  
1 Nos

Ø15 HOLES  
2 Nos



### CLAMP FOR SINGLE CHANNEL CC1

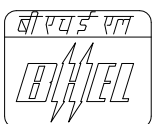
#### NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

### CLAMP FOR DOUBLE CHANNEL CC2

*ANCHOR FASTENER-2NOS.  
SPRING NUT & WASHER-1NO.*

### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES

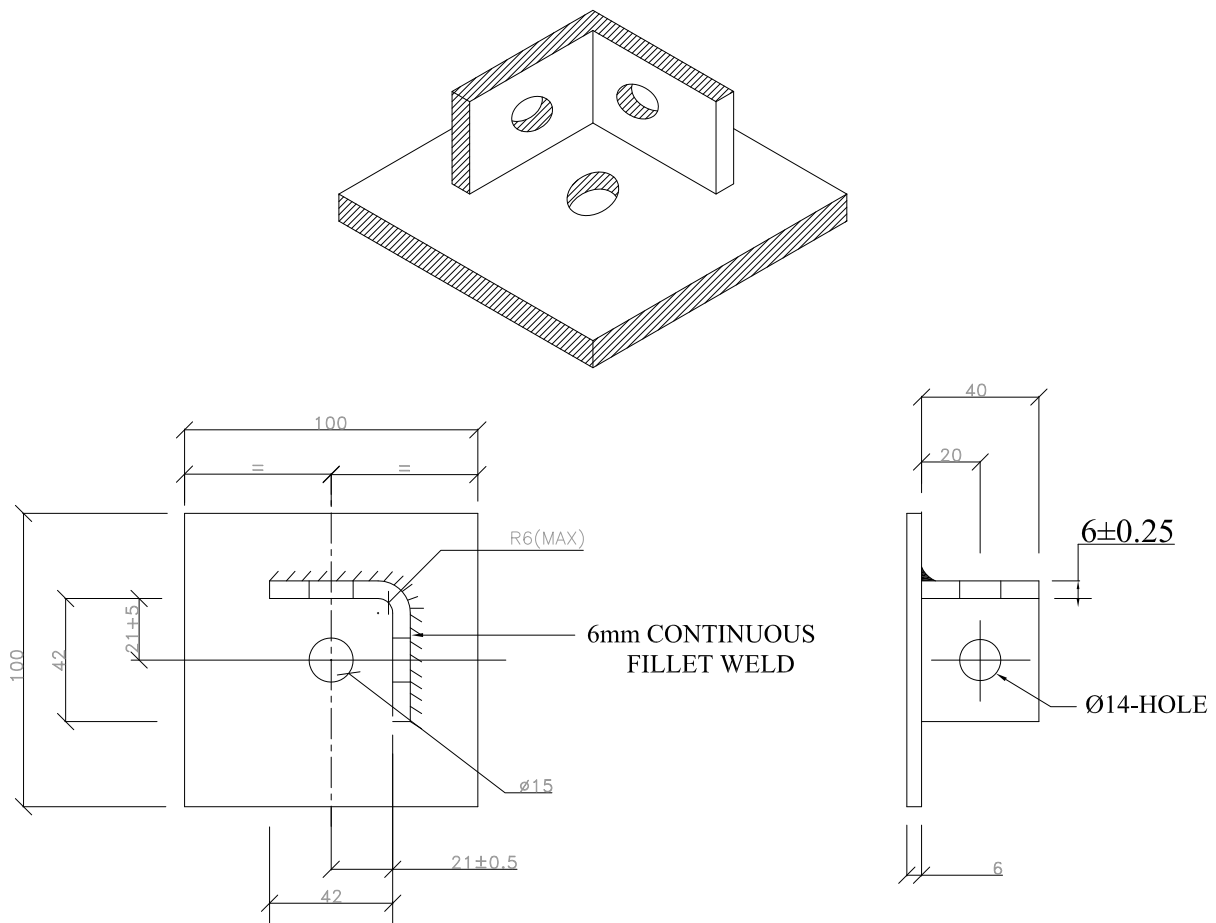


TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

DRG. NO.

PE-DG-435-507-E006

SH 5 OF 26



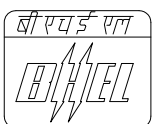
### BASE PLATE FOR SINGLE CHANNEL BP1

#### NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

*ANCHOR FASTENER-1NO.  
SPRING NUT & WASHER-1NO.*

### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES

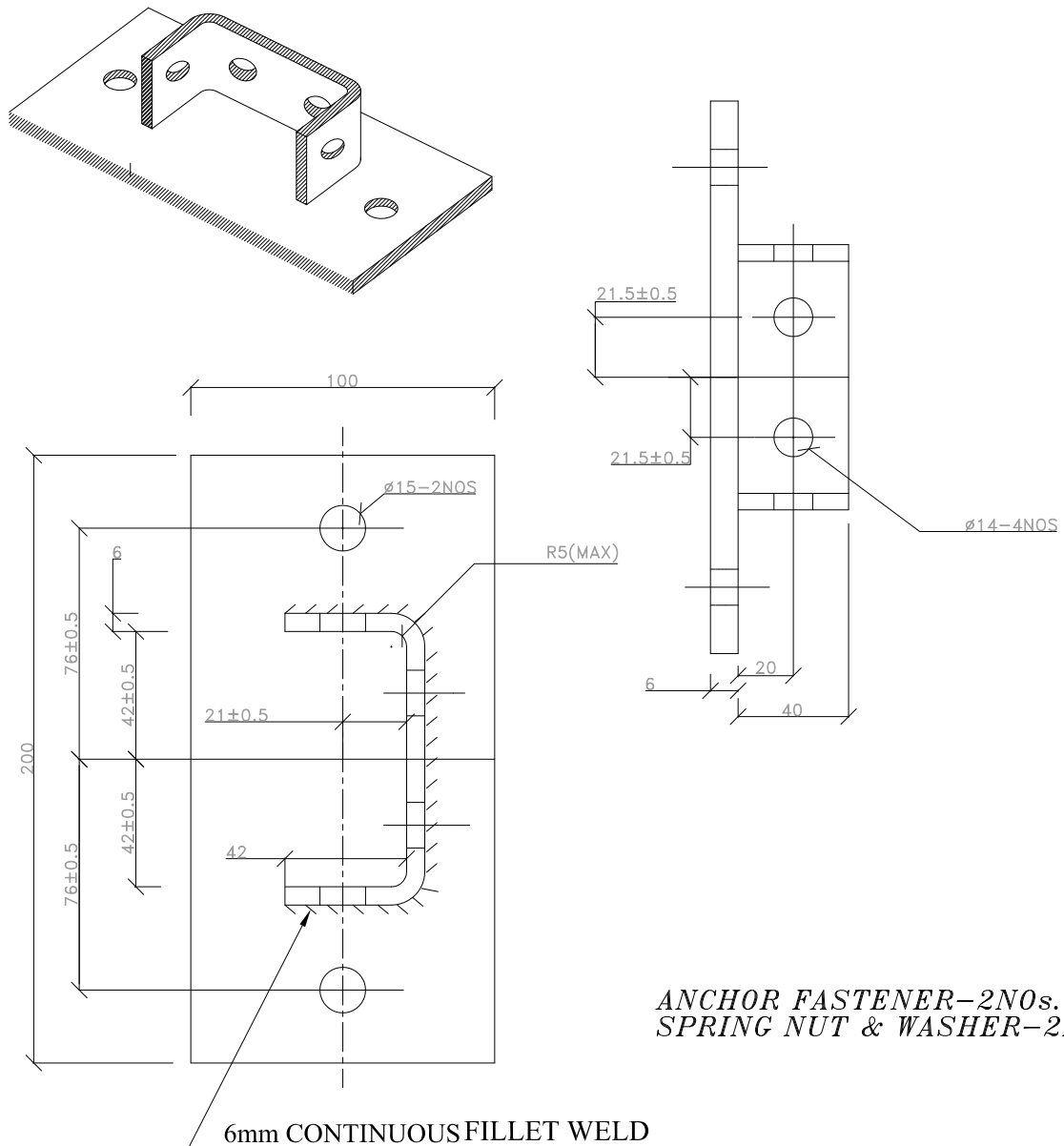


TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

DRG. NO.

PE-DG-435-507-E006

SH 6 OF 26



### BASE PLATE FOR DOUBLE CHANNEL BP2

#### NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES



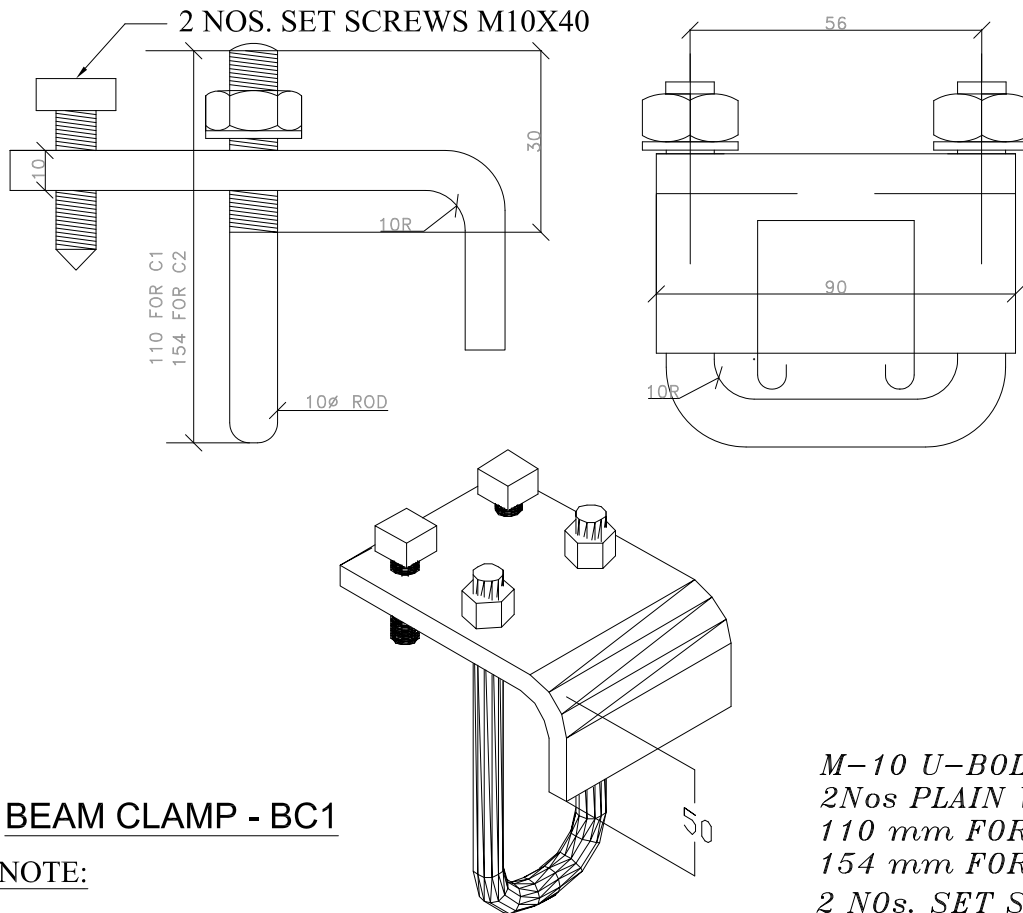
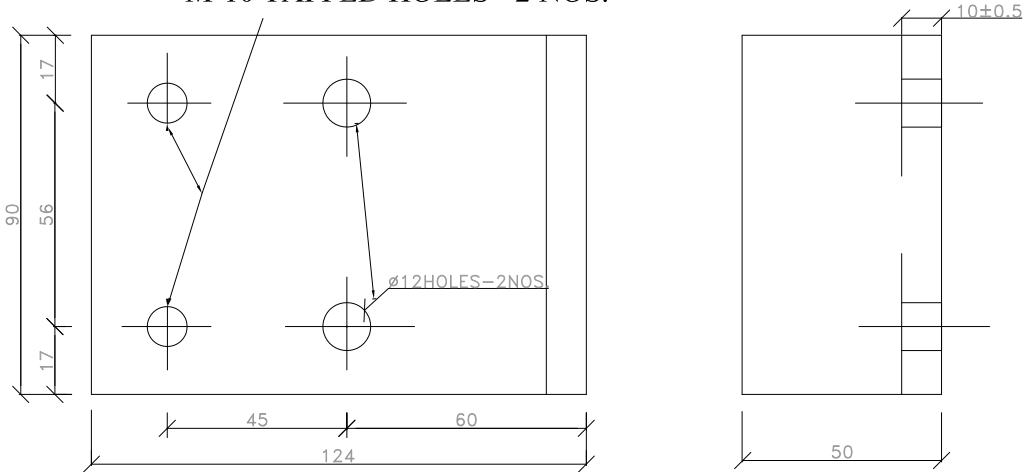
TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

DRG. NO.

PE-DG-435-507-E006

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# M-10 TAPPED HOLES - 2 NOS.



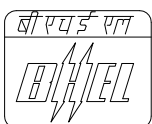
## BEAM CLAMP - BC1

### NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

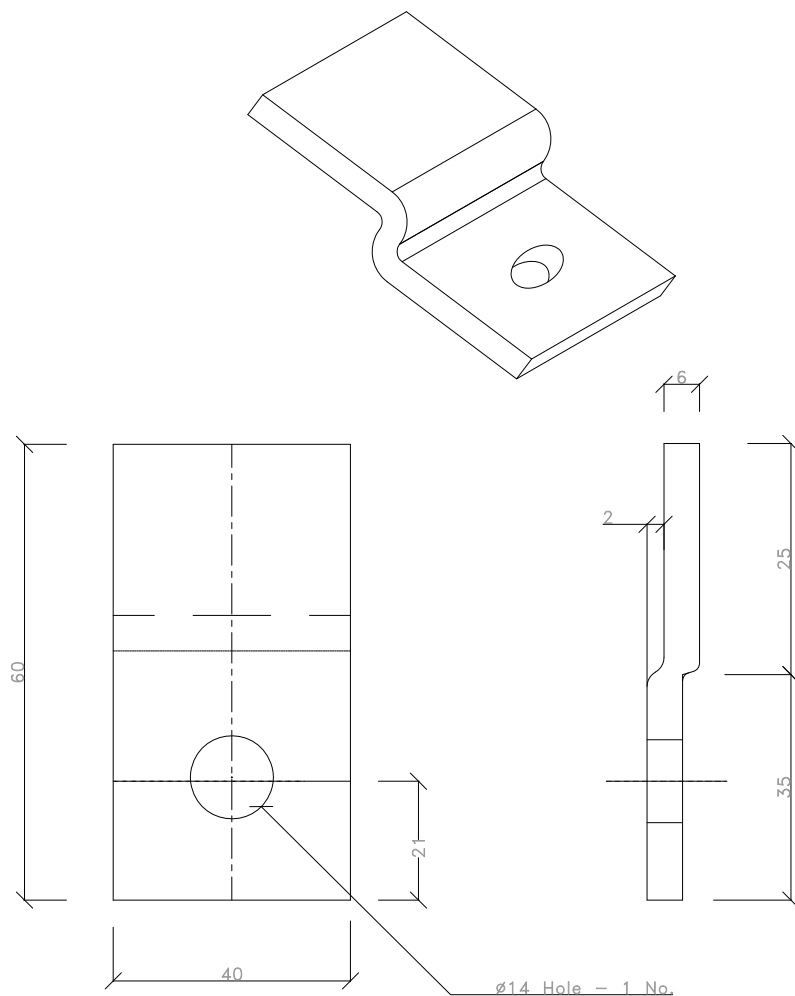
M-10 U-BOLT WITH  
2Nos PLAIN WASHERS & NUTS  
110 mm FOR SC 1  
154 mm FOR DC1  
2 NOS. SET SCREWS M10X40

## TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES



TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

BHEL DRAWING NO.  
PE-DG-435-507-E006



### TRAY FIXING CLAMP - TC1

#### NOTE:

*SPRING NUT & WASHER-1 NO.*

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

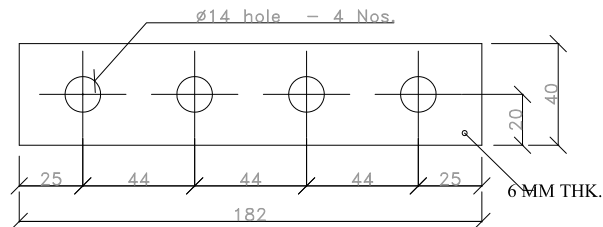
### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES



TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

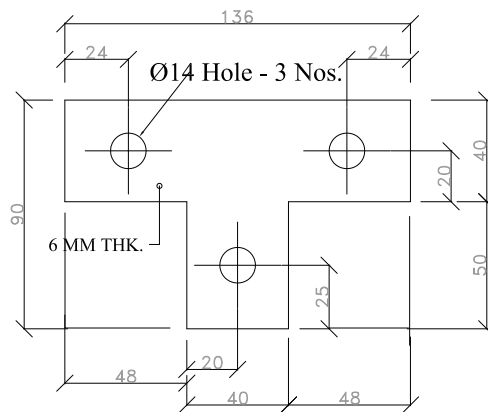
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PE-DG-435-507-E006





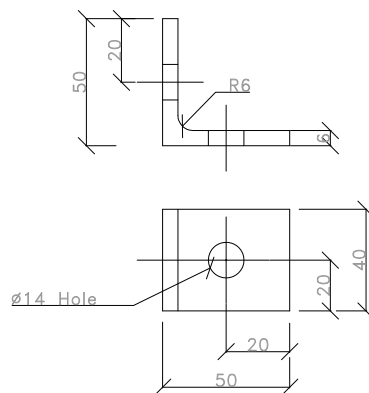
*SPRING NUT & WASHER-4Nos.*

### FLAT PLATE STRAIGHT FITTING PF2



*SPRING NUT & WASHER-3Nos.*

### FLAT PLATE TEE FITTING PF1



*SPRING NUT & WASHER-2Nos.*

#### NOTE:

#### 90° ANGLE FITTING LA1

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : MILD STEEL AS PER IS-2062.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. ALL FABRICATION TOLERANCE AS PER RELEVANT IS.
6. ZINC COATING SHALL BE MIN. 75 MICRON/ 610 G/SQ.M.

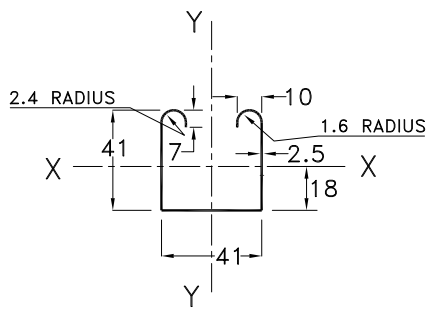
### TYPICAL DETAILS OF BOLTABLE TYPE CABLE TRAY SUPPORT MATERIAL & ACCESSORIES



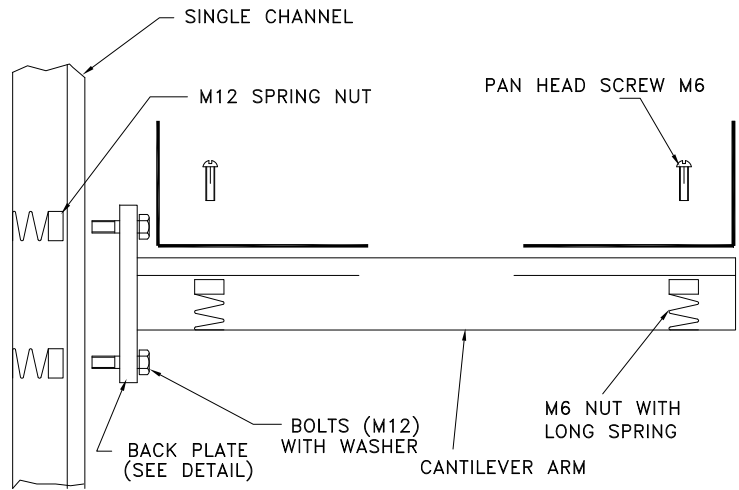
TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT  
SYSTEM

BHEL DRAWING NO.  
PE-DG-435-507-E006

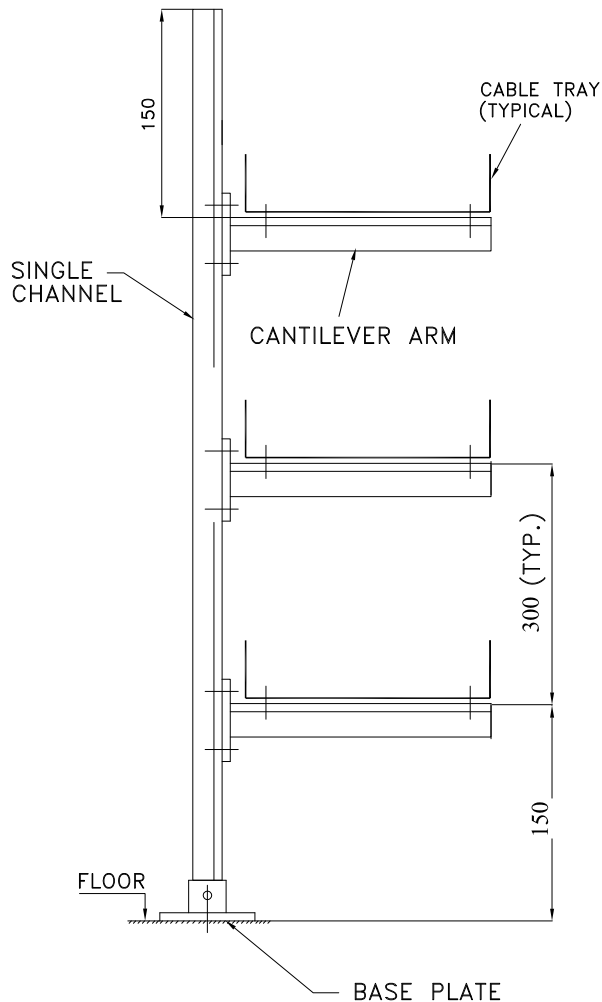




DETAIL OF ITEM-1  
(SINGLE CHANNEL)

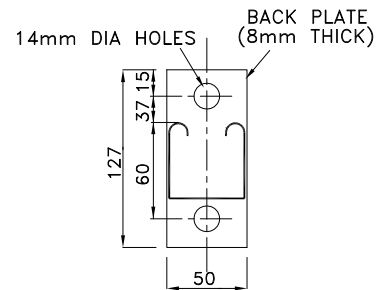


TYPICAL ASSEMBLY OF CHANNEL  
SUPPORTS AND CABLE TRAY

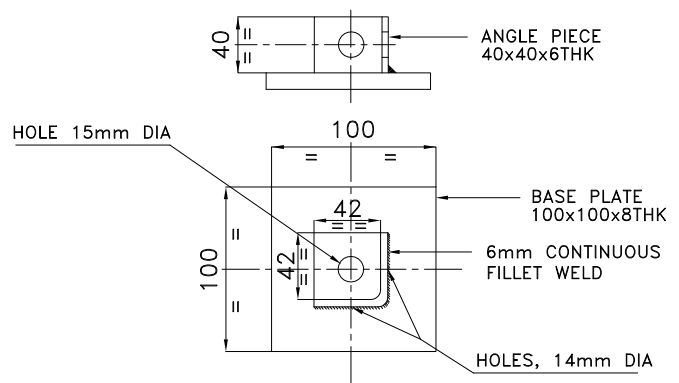


FLOOR SUPPORTED (SINGLE SIDE TYPE)

SEE GENERAL NOTES IN SHEET 17.



END VIEW OF  
(CANTILEVER ARM)



DETAILS OF BASE PLATE  
FOR SINGLE CHANNEL



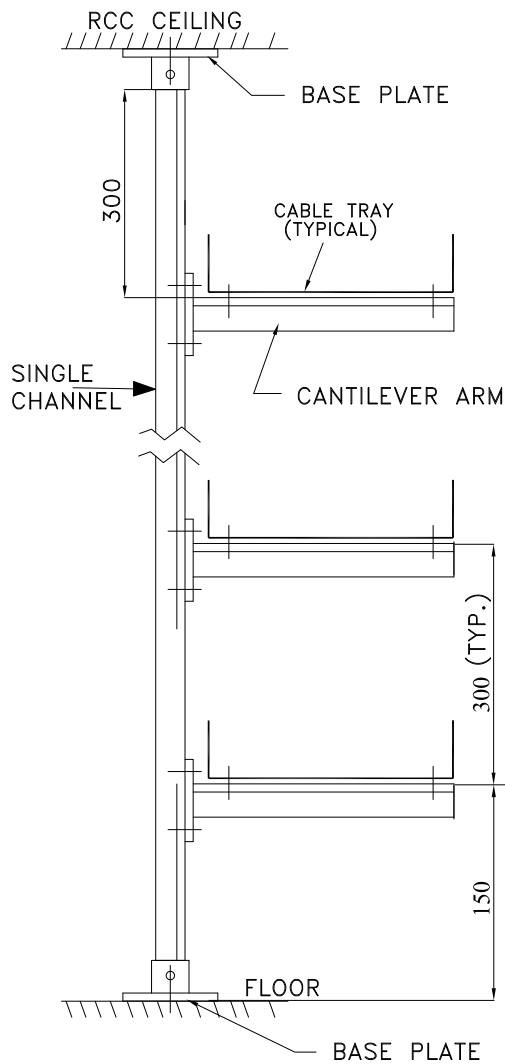
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INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

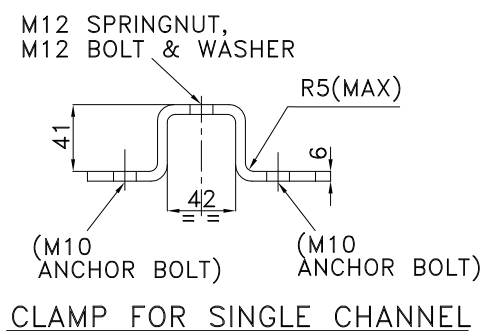
BHEL DRAWING NO.

PE-DG-435-507-E006

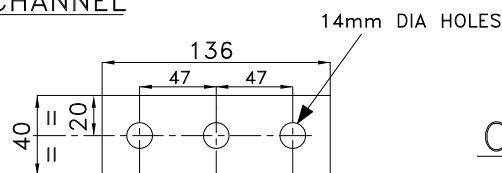
SH 12 OF 26



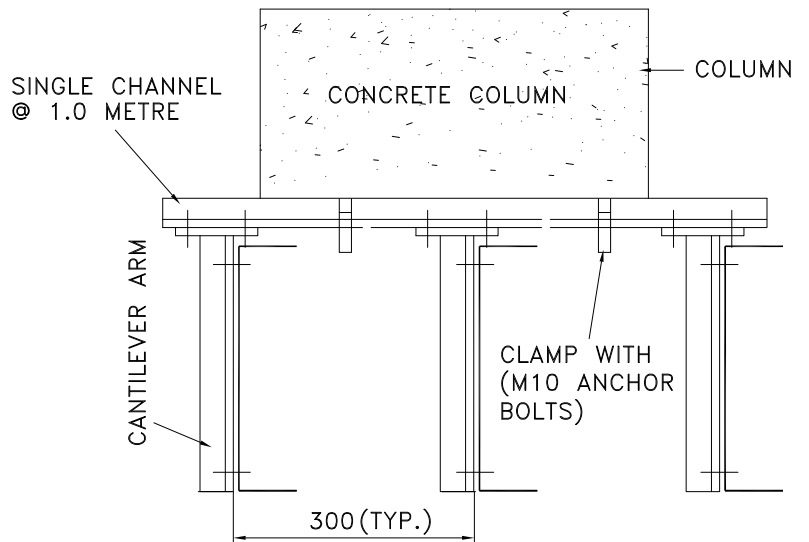
SUPPORTING ARRANGEMENT  
BETWEEN FLOOR AND CEILING  
(SINGLE SIDE TYPE)



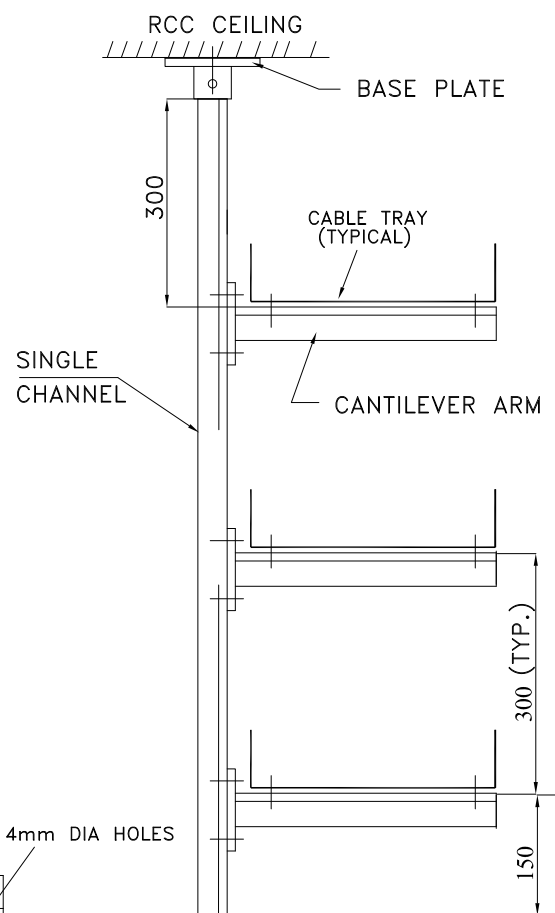
CLAMP FOR SINGLE CHANNEL



SEE GENERAL NOTES IN SHEET 17.



SUPPORT ARRANGEMENT  
FROM BUILDING COLUMN



CEILING SUPPORTED  
(SINGLE SIDE TYPE)



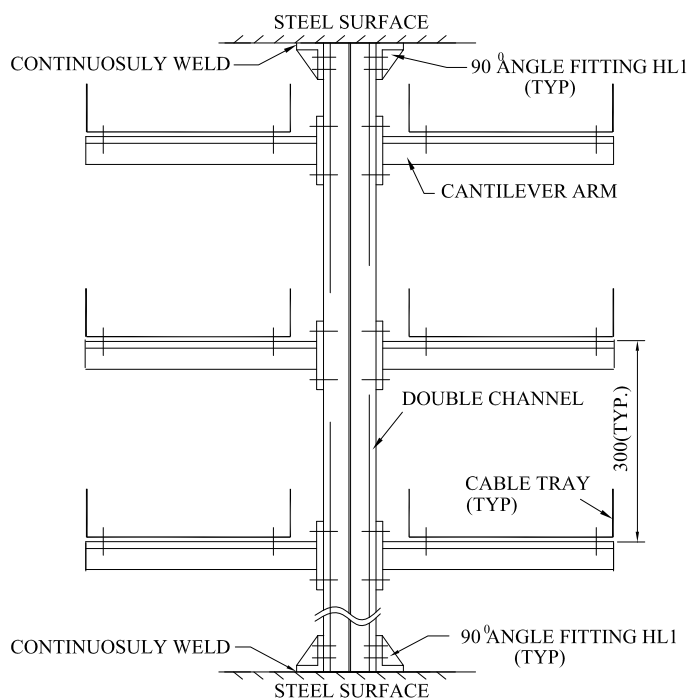
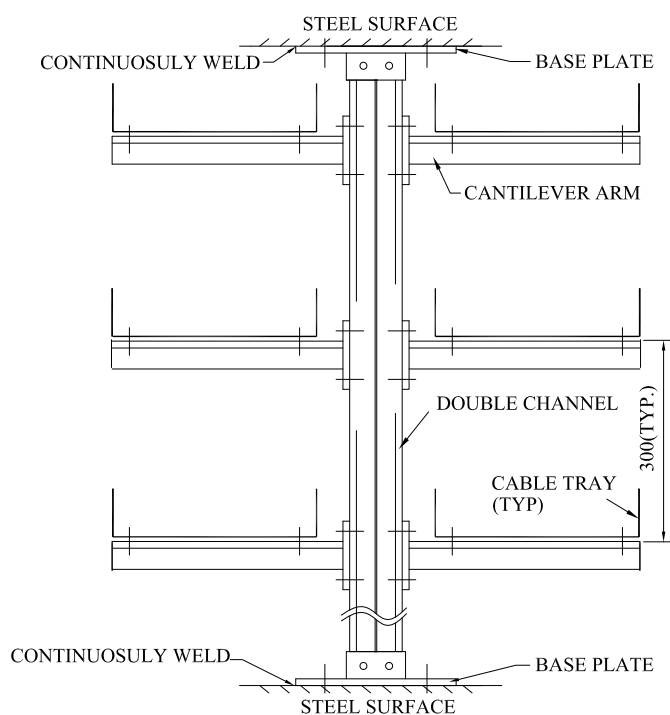
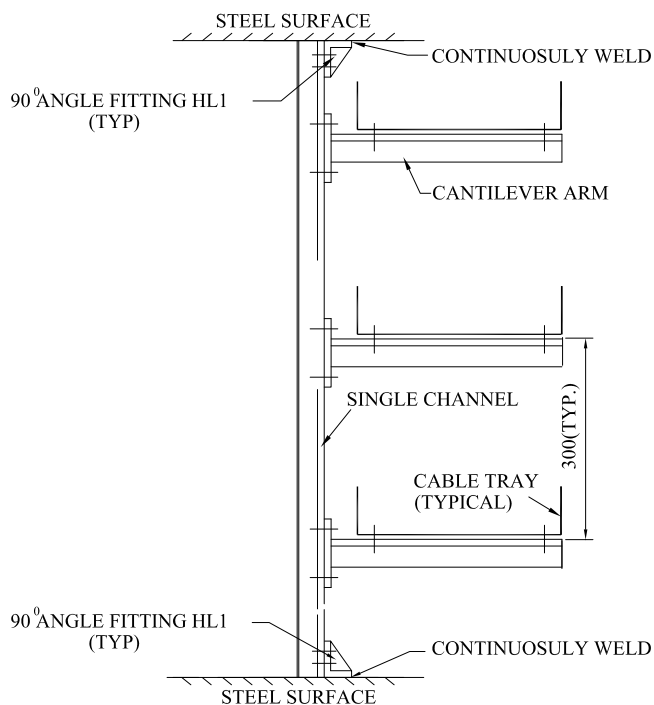
TITLE:

INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 13 OF 26



SUPPORTING ARRANGEMENT  
OF (SINGLE SIDE/DOUBLE SIDE)  
BETWEEN TWO STEEL SURFACE

SEE GENERAL NOTES IN SHEET 17.

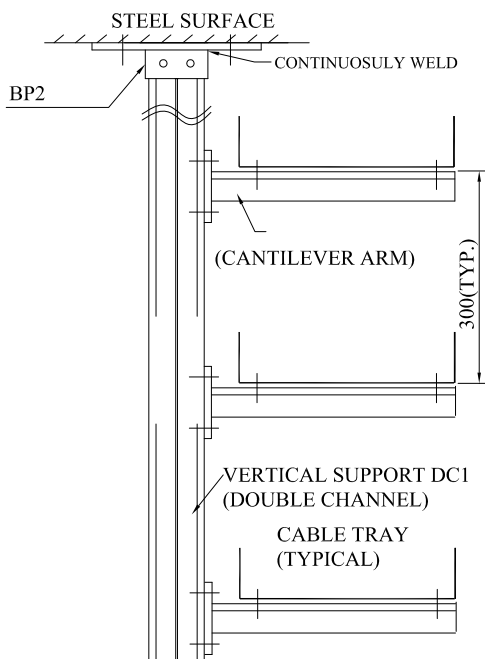


TITLE: INSTALLATION DETAILS FOR  
 CABLE TRAYS SUPPORT SYSTEM

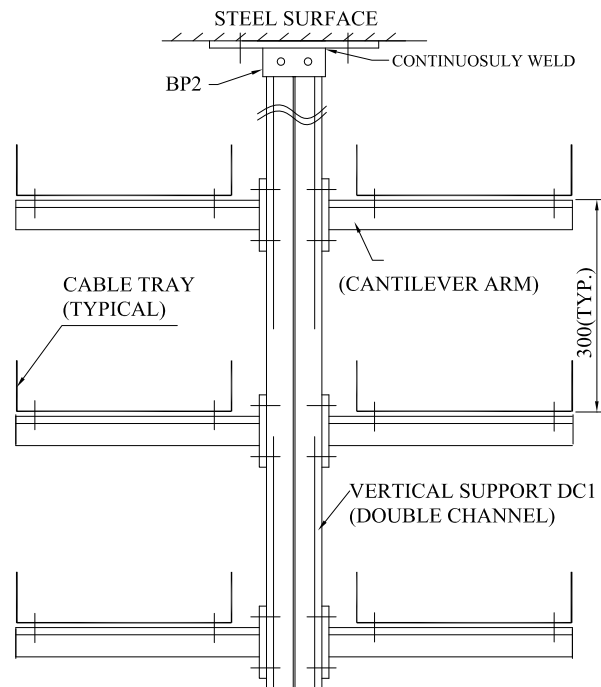
BHEL DRAWING NO.

PE-DG-435-507-E006

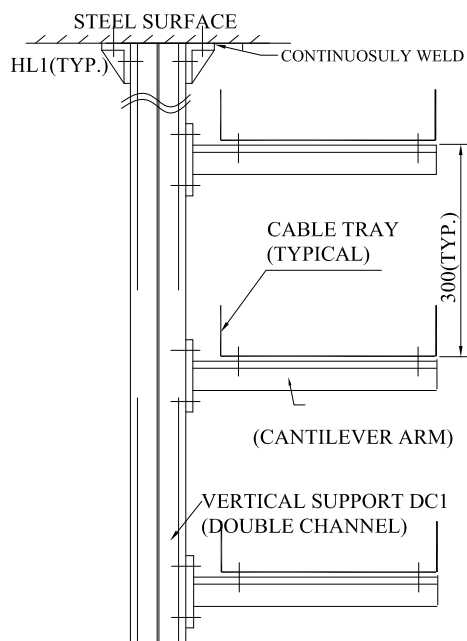
SH 14 OF 26



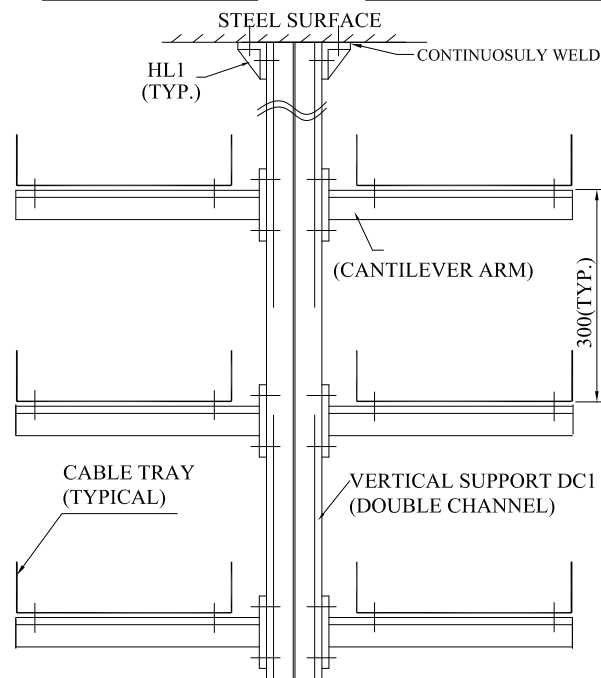
INSTALLATION DETAIL TYPE DS1:  
DOUBLE CHANNEL SUPPORT INSTALLATION  
ONLY TOP END FIXED  
BASEPLATE AT TOP  
APPLICABLE FOR THREE TRAYS ON SINGLE SIDE



INSTALLATION DETAIL TYPE DS2:  
DOUBLE CHANNEL SUPPORT INSTALLATION  
ONLY TOP END FIXED  
BASEPLATE AT TOP  
APPLICABLE FOR UPTO THREE TRAYS ON BOTH SIDES



INSTALLATION DETAIL TYPE DS3:  
DOUBLE CHANNEL SUPPORT INSTALLATION  
ONLY TOP END FIXED  
WITH ANGLE FITTING HL1 AT TOP  
APPLICABLE FOR MORE THAN TWO TRAYS  
ON SINGLE SIDE



INSTALLATION DETAIL TYPE DS4:  
DOUBLE CHANNEL SUPPORT INSTALLATION  
ONLY TOP END FIXED  
WITH ANGLE FITTING HL1 AT TOP  
APPLICABLE FOR UPTO THREE TRAYS ON BOTH SIDES

SEE GENERAL NOTES IN SHEET 17.

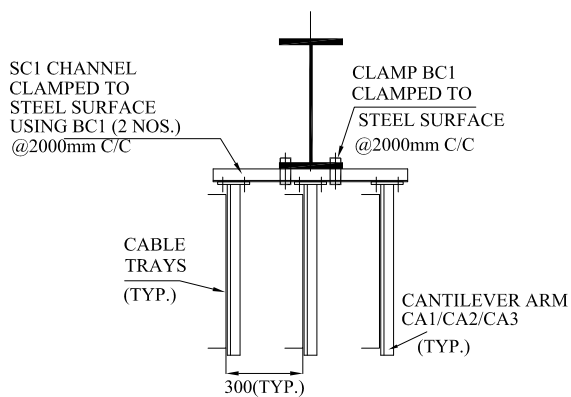
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INSTALLATION DETAILS FOR  
 CABLE TRAYS SUPPORT SYSTEM

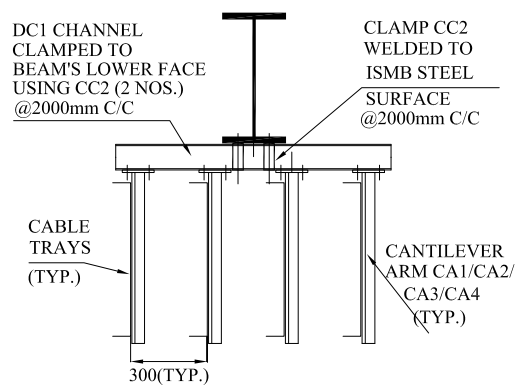
BHEL DRAWING NO.

PE-DG-435-507-E006

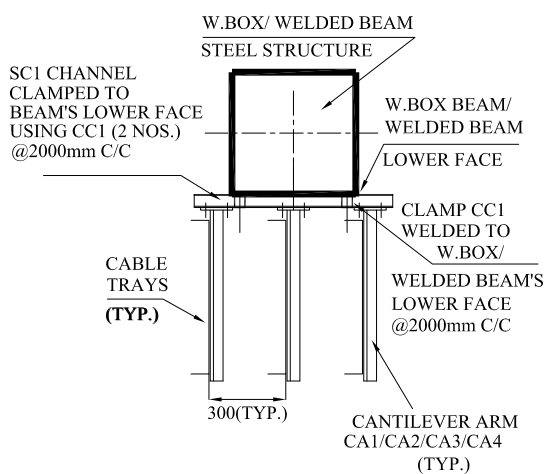




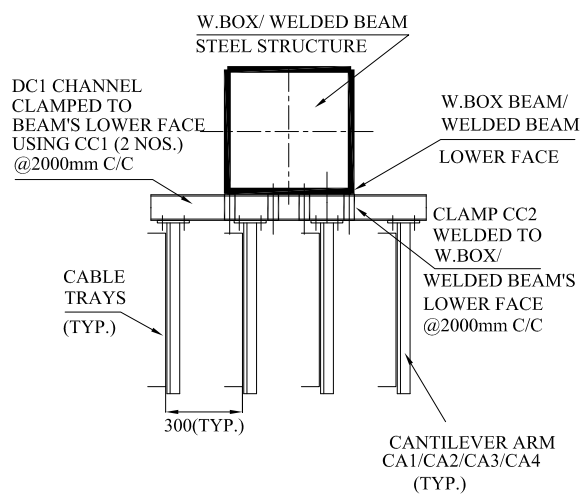
**INSTALLATION DETAIL TYPE BB1:**  
**CABLE TRAYS BELOW I-BEAMS**  
**(UPTO & INCLUDING THREE TRAYS)**



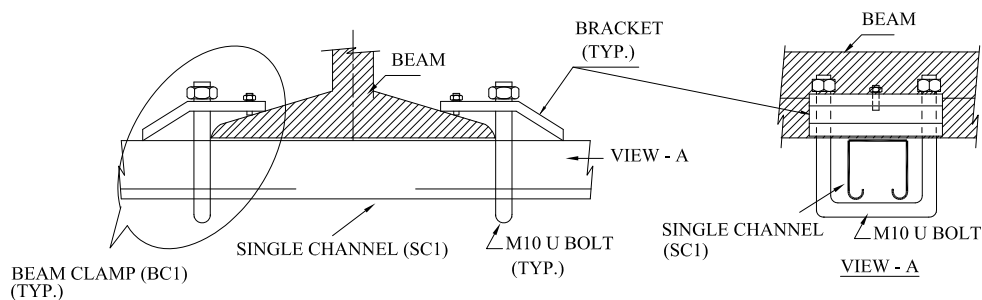
**INSTALLATION DETAIL TYPE BB2:**  
**CABLE TRAYS BELOW I-BEAMS**  
**(MORE THAN THREE TRAYS)**



**INSTALLATION DETAIL TYPE BB3:**  
**CABLE TRAYS BELOW W. BOX/**  
**WELDED BEAM'S (APPLICABLE FOR**  
**UPTO & INCLUDING THREE TRAYS)**



**INSTALLATION DETAIL TYPE BB4:**  
**CABLE TRAYS BELOW W. BOX/**  
**WELDED BEAM'S (APPLICABLE FOR**  
**MORE THAN THREE TRAYS)**



**SINGLE CHANNEL FIXING ARRANGEMENT WITH BEAM**

**CABLE TRAYS SUPPORTING ARRANGEMENT AROUND BOILER PLATFORMS**

SEE GENERAL NOTES IN SHEET 17.



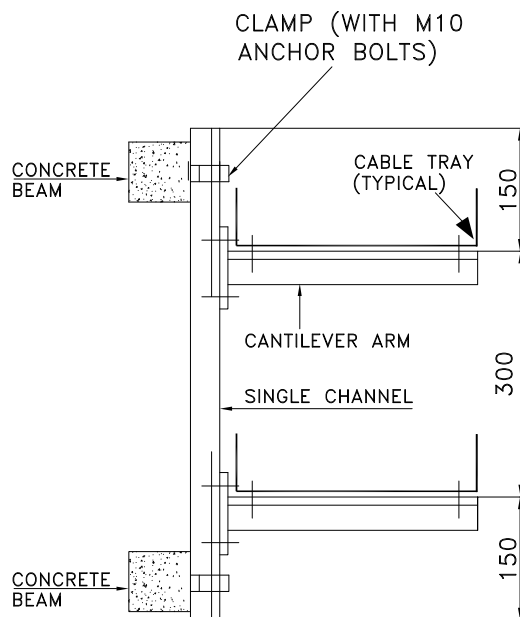
TITLE:

**INSTALLATION DETAILS FOR**  
**CABLE TRAYS SUPPORT SYSTEM**

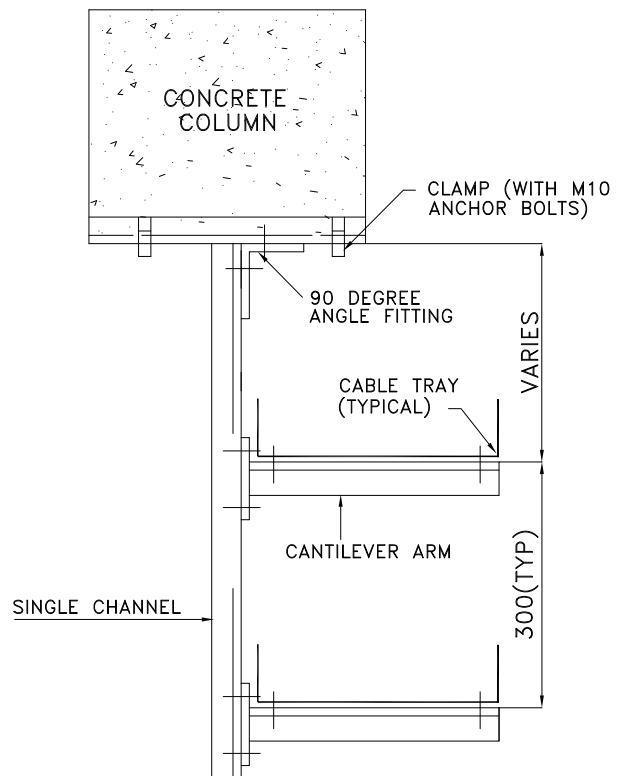
BHEL DRAWING NO.

PE-DG-435-507-E006

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SUPPORT ARRANGEMENT  
FROM CONCRETE BEAMS



SUPPORT ARRANGEMENT  
FROM CONCRETE COLUMNS  
WITH ANGLE FITTING

## GENERAL NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS INDICATED OTHERWISE.
2. ALL SUPPORTS ARE OF 2.5 MM THICK MS CHANNEL SECTIONS AND GALVANISED.
3. ALL FASTENERS SHALL BE ZINC PASSIVATED/ CADMIUM PLATED.
4. ALL SUPPORT SHALL BE FIXED ON WALL / COLUMN / TRENCH BY MEANS OF 136 X 40 X 6 MM THICK CLAMP.
5. ARRANGEMENT SHOWN ARE TYPICAL ONLY.
6. ALL WELDS FOR CABLE TRAY SUPPORTS SHALL HAVE A MINIMUM THROAT THICKNESS OF 6 MM.



TITLE:

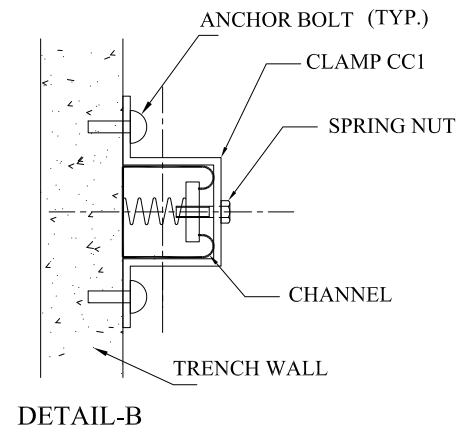
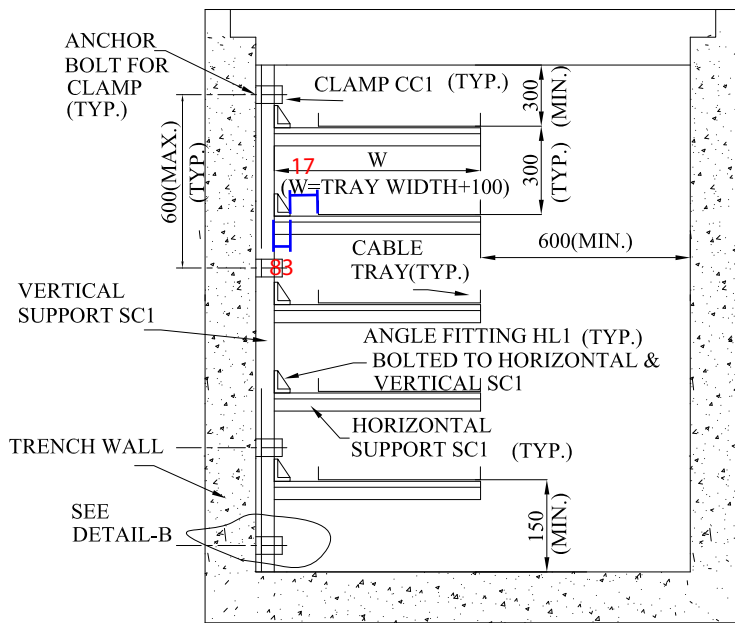
INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

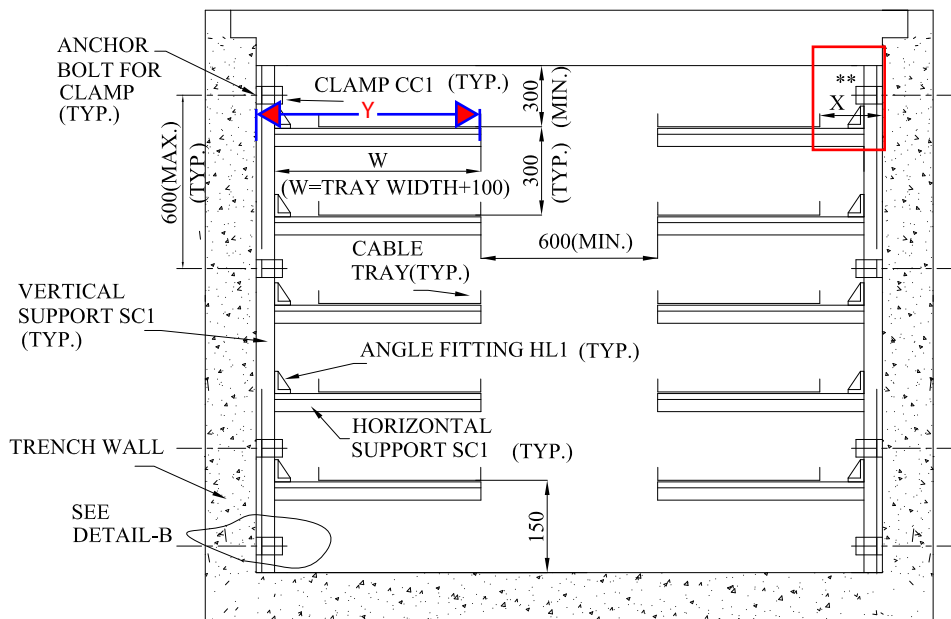
PE-DG-435-507-E006

SH 17 OF 26





SUPPORTING ARRANGEMENT IN CABLE TRENCH, TRAYS ON SINGLE SIDE



SUPPORTING ARRANGEMENT IN CABLE TRENCH TRAYS ON BOTH SIDE

01

SEE GENERAL NOTES IN SHEET 17.

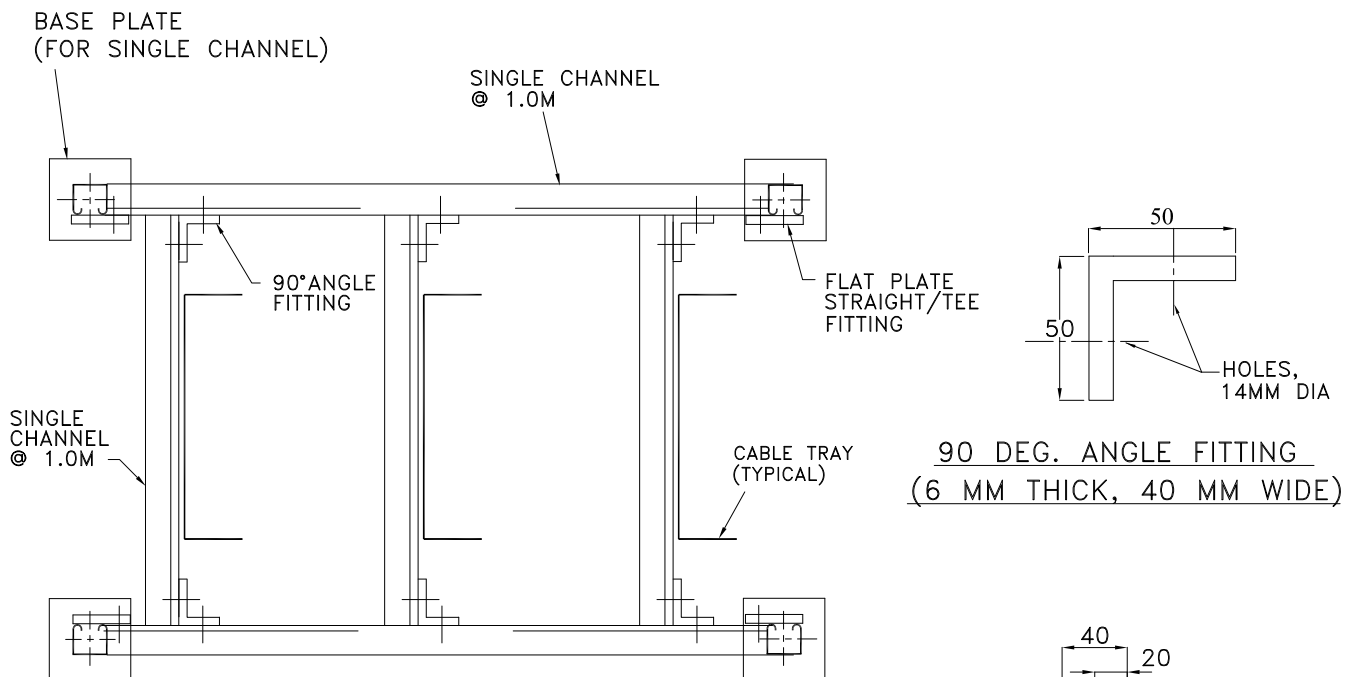


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CABLE TRAYS SUPPORT SYSTEM

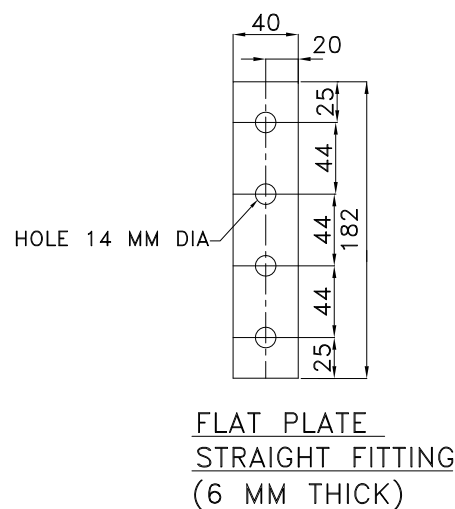
BHEL DRAWING NO.

PE-DG-435-507-E006

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TYPICAL FLOOR SUPPORTED  
CHANNEL FRAME WORK  
(FOR BOLTABLE TYPE  
CABLE TRAY RISER)



TYPICAL CHANNEL SUPPORT  
(ON WALL)

SEE GENERAL NOTES IN SHEET 17.



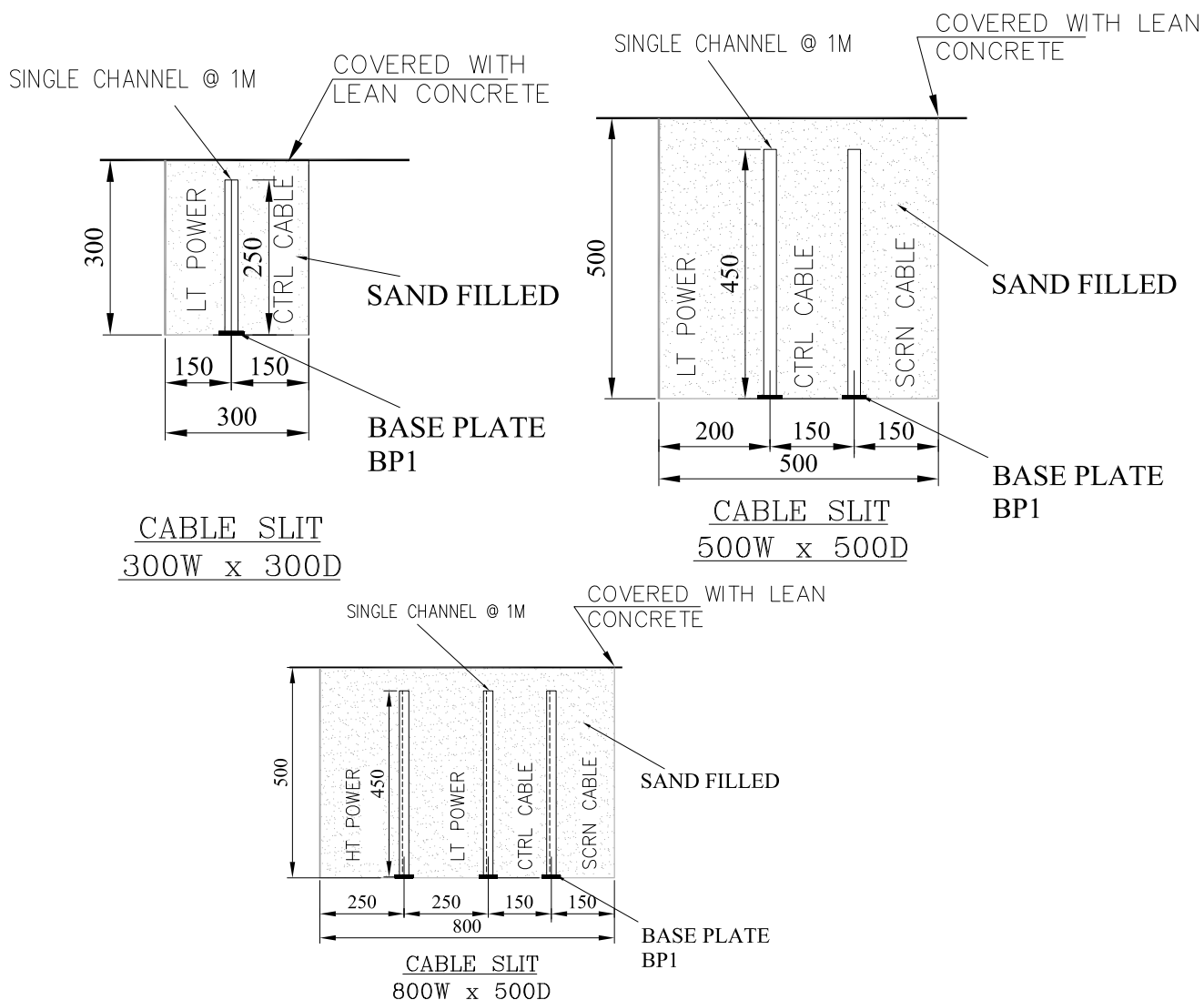
TITLE:

INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 19 OF 26



#### TYPICAL CABLE SLIT ARRANGEMENT

1. CABLE SLITS SHALL BE PLANNED NEAR THE EQUIPMENT TERMINATIONS.
2. CABLE SLITS SHALL BE DESIGNED ONLY WITH CABLES WITHOUT CABLE TRAYS.
3. CABLE SLITS SHALL BE FILLED WITH SAND AND FINISHED WITH 50MM PCC AFTER CABLES ARE LAID AND TERMINATED.
4. DEPTH OF SLIT SHALL BE DESIGNED CONSIDERING BENDING RADIUS OF CABLES.

01

SEE GENERAL NOTES IN SHEET 17.



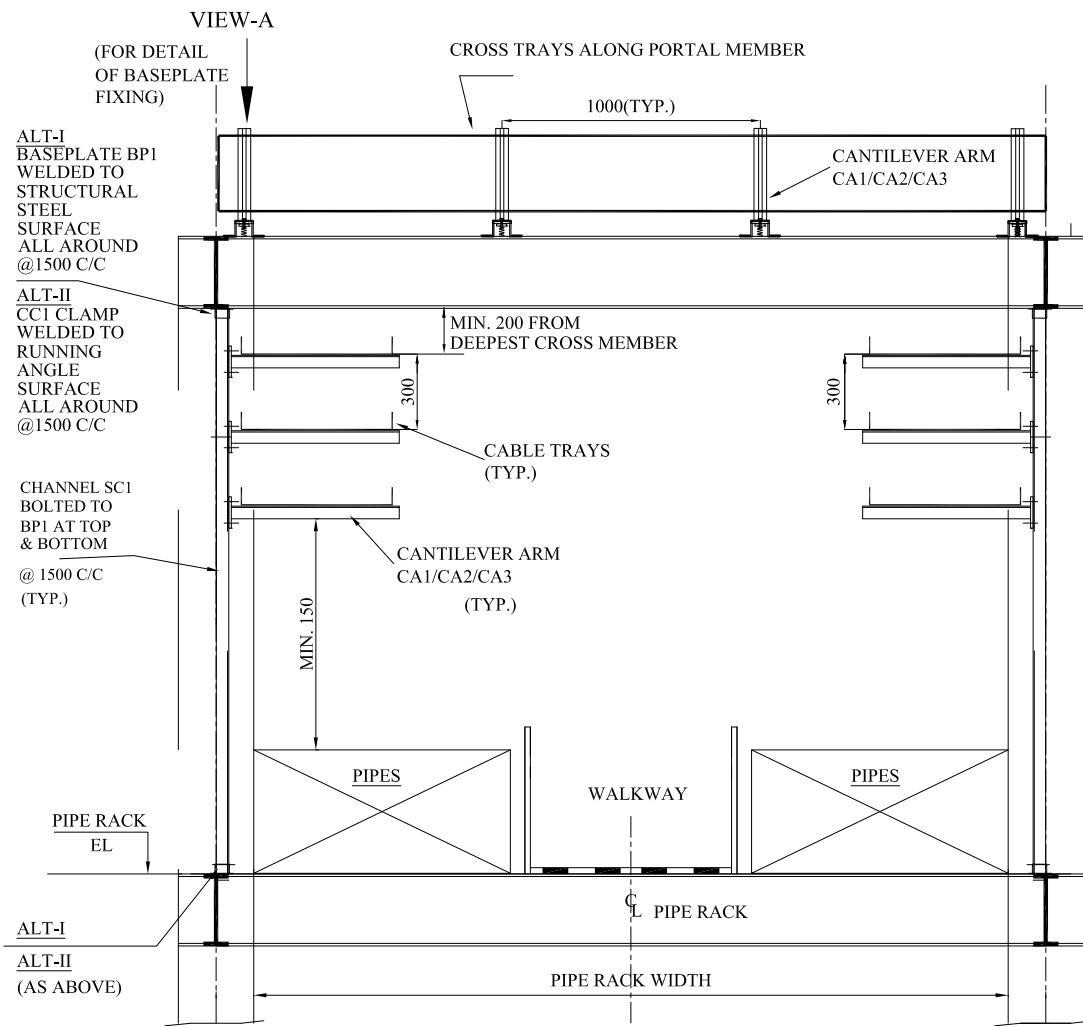
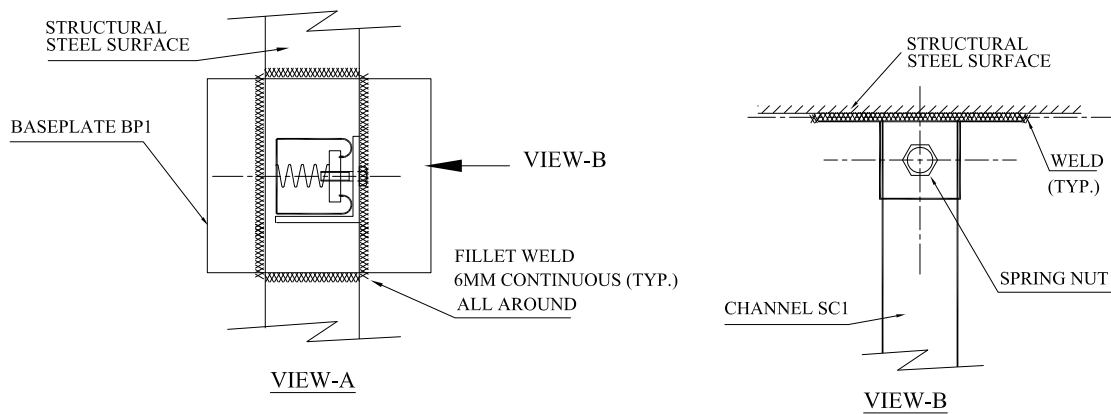
TITLE:

INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 20 OF 26



**TYPICAL TRAY SUPPORT ARRANGEMENT ALONG PIPERACK (UPTO AND INCLUDING THREE TRAYS)**

SEE GENERAL NOTES IN SHEET 17.

TITLE:

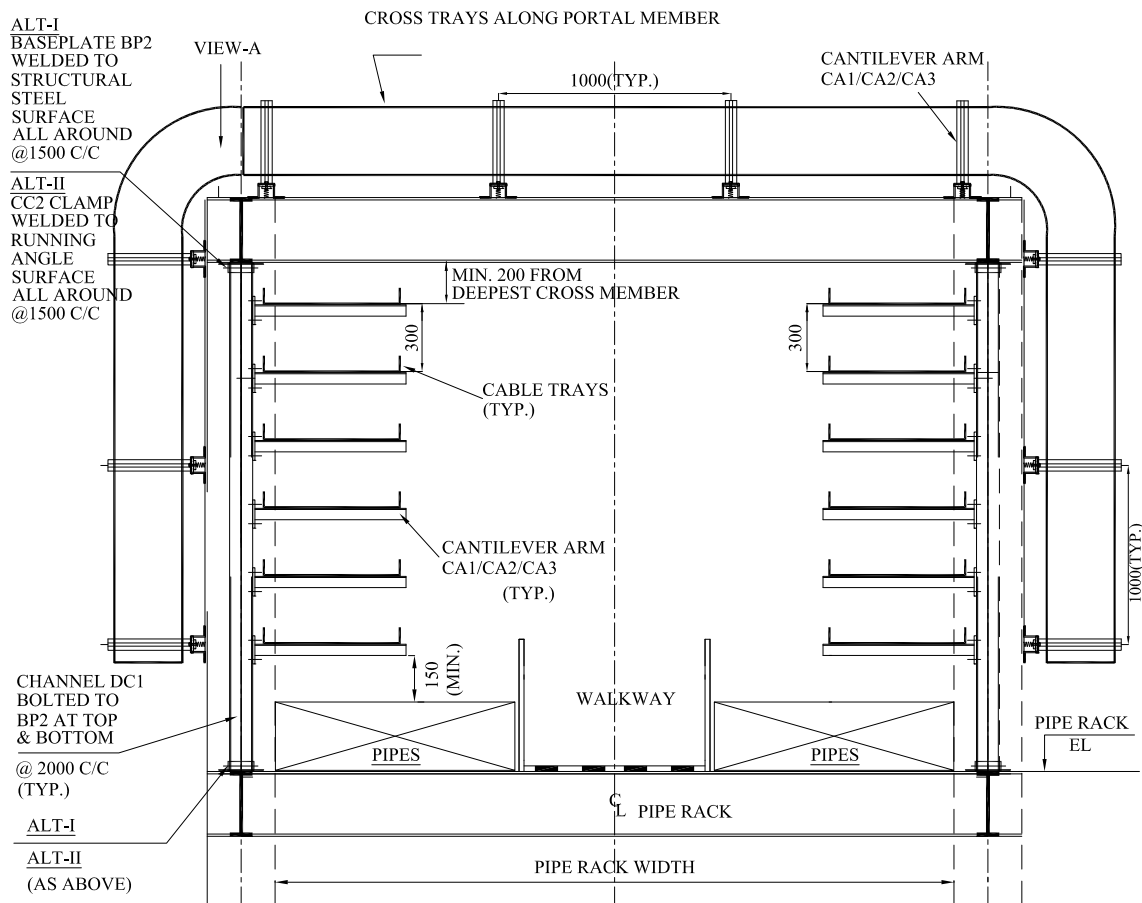
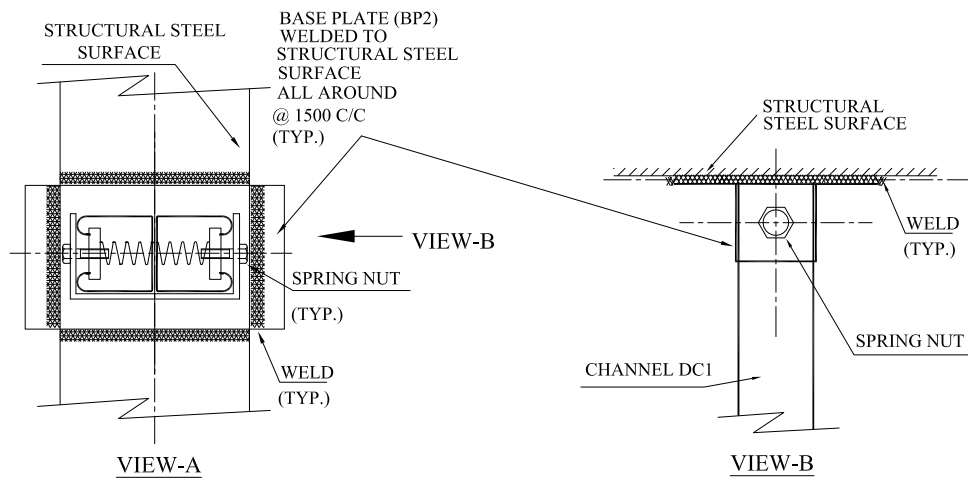
INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 21 OF 26





TYPICAL TRAY SUPPORT ARRANGEMENT ALONG PIPERACK  
(MORE THAN THREE TRAYS)

01

SEE GENERAL NOTES IN SHEET 17.

TITLE:

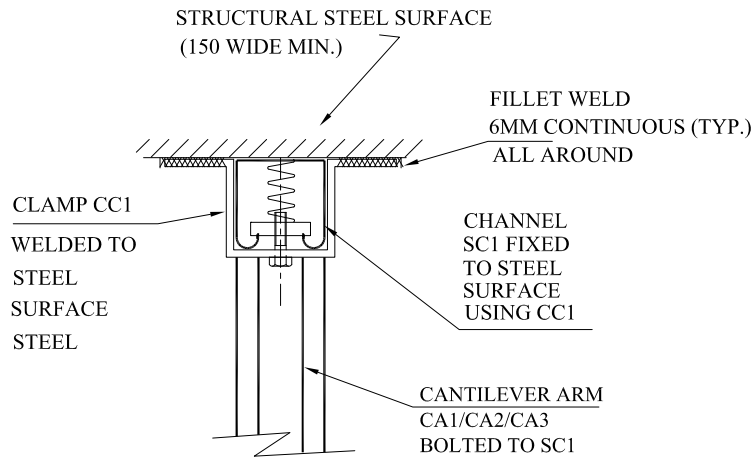
INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

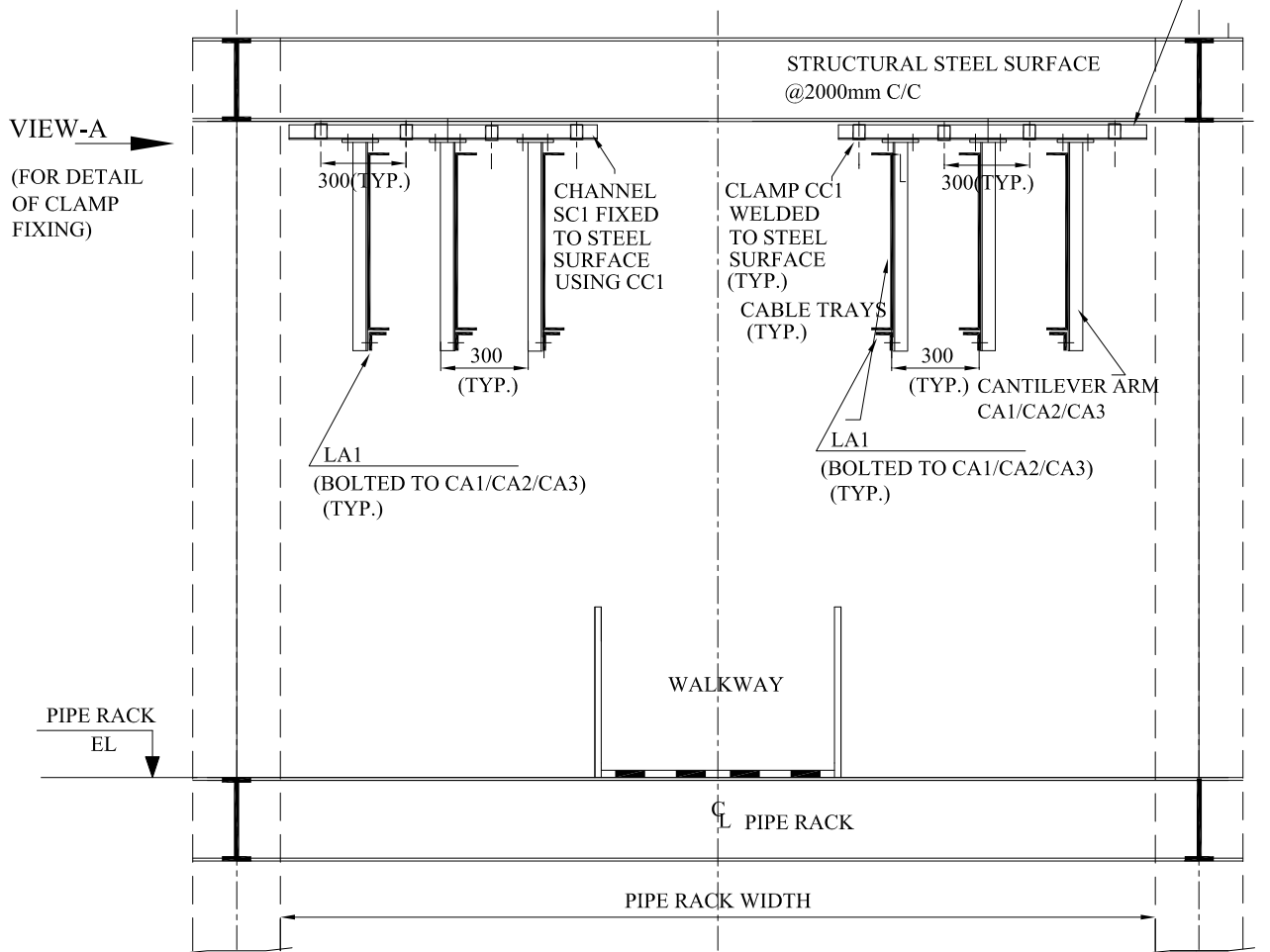
PE-DG-435-507-E006

SH 22 OF 26





VIEW-A



TYPICAL VERTICALLY ORIENTED TRAY SUPPORT ARRANGEMENT ALONG PIPERACK

01

SEE GENERAL NOTES IN SHEET 17.

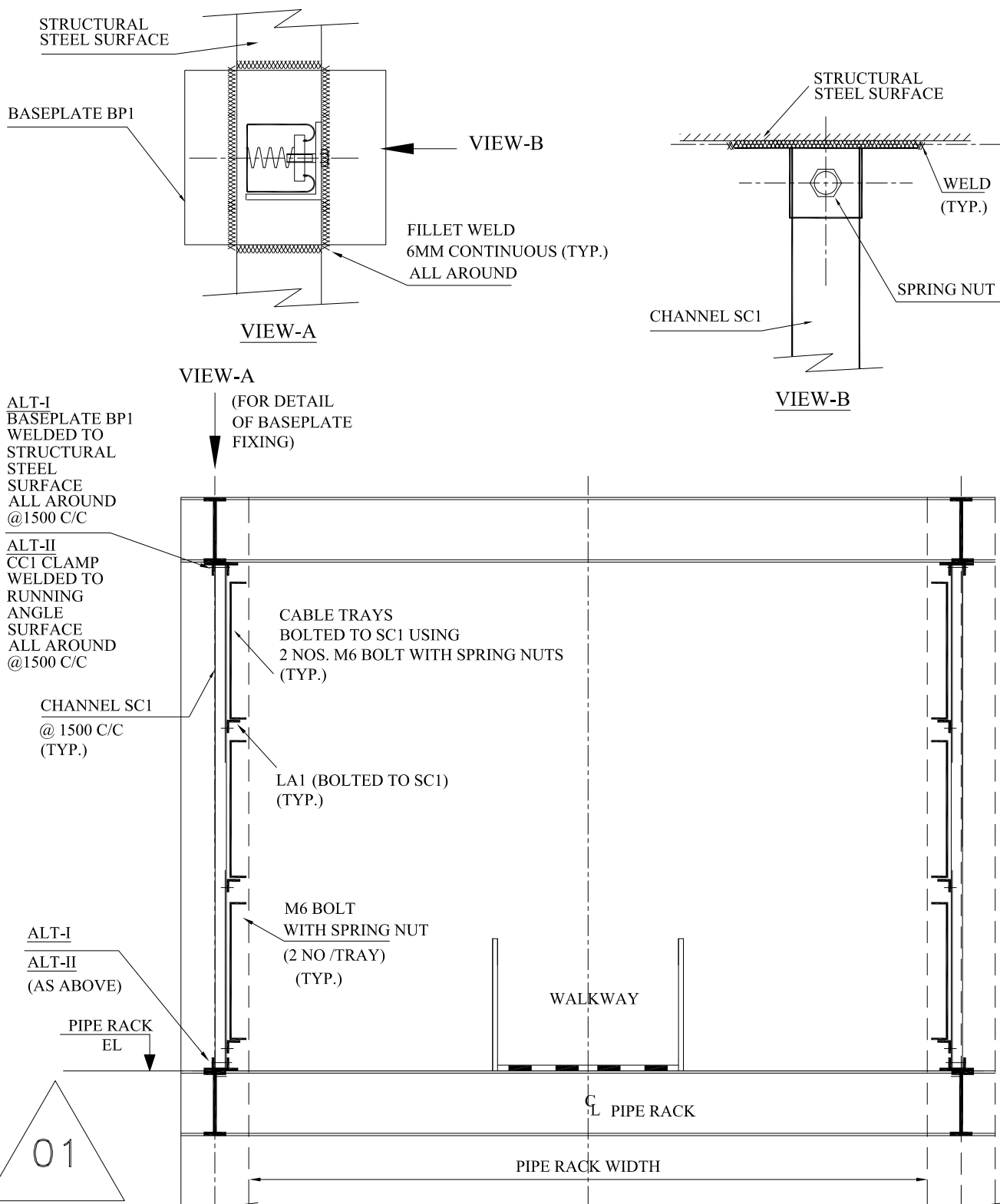


TITLE: INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 23 OF 26



INSTALLATION DETAIL TYPE OV2:

VERTICALLY ORIENTED TRAY SUPPORT ARRANGEMENT ALONG PIPERACK (USING BP1)

SEE GENERAL NOTES IN SHEET 17.



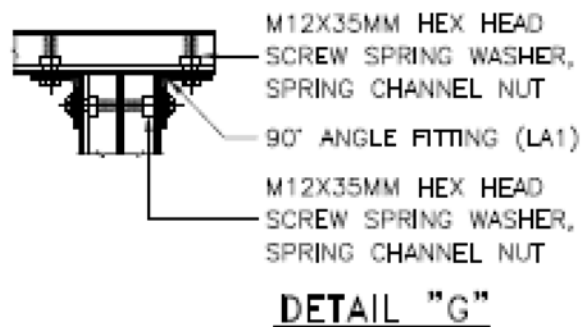
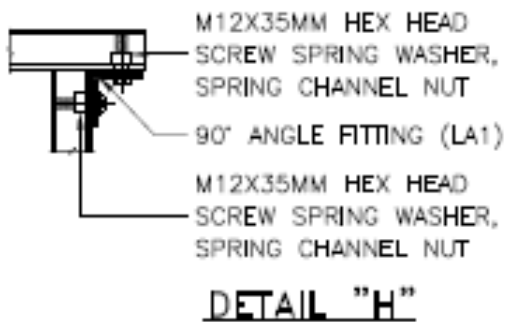
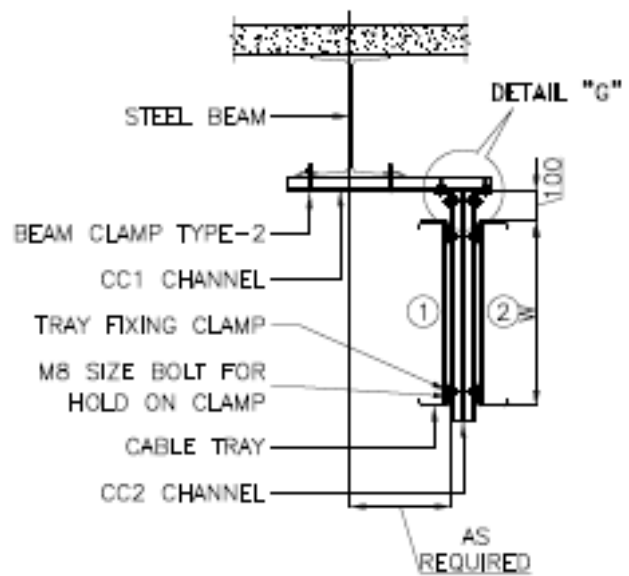
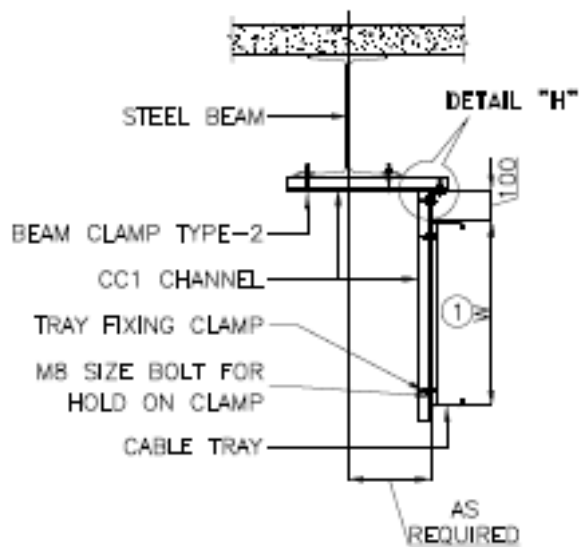
TITLE:

INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 24 OF 26



# VERTICAL TRAY SUPPORT FROM STEEL BEAM (TYPE-1)

01

SEE GENERAL NOTES IN SHEET 17.

TITLE:

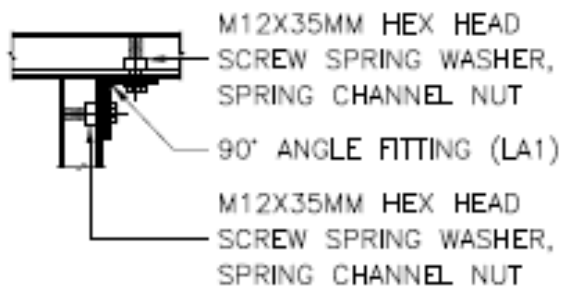
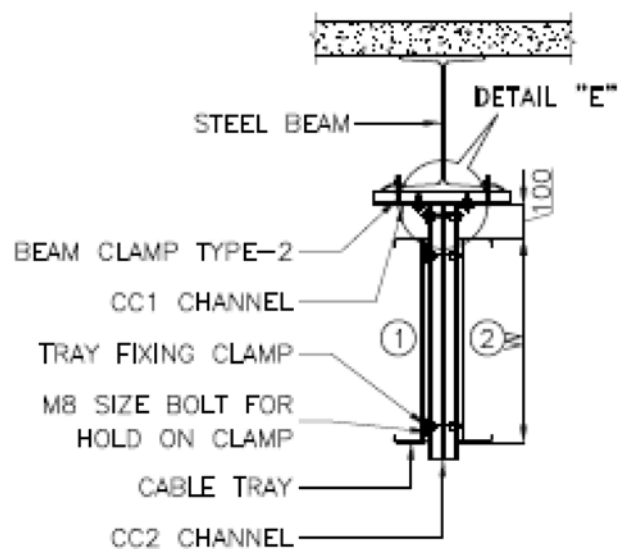
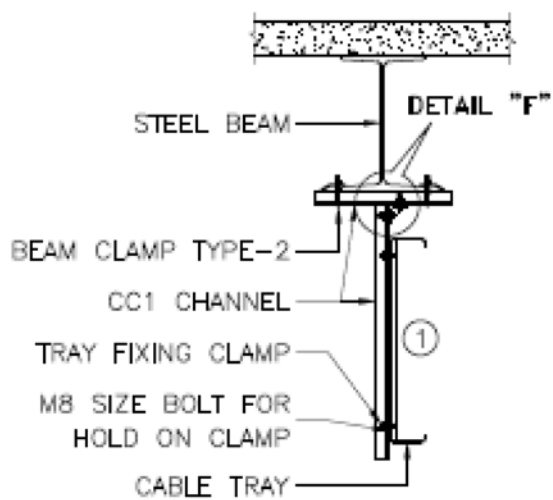
INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

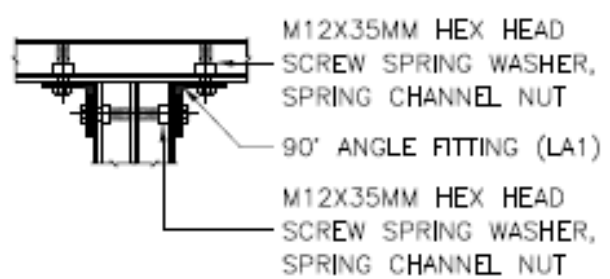
PE-DG-435-507-E006







DETAIL "F"



DETAIL "E"

VERTICAL TRAY SUPPORT FROM STEEL BEAM (TYPE-2)

01

SEE GENERAL NOTES IN SHEET 17.



TITLE:

INSTALLATION DETAILS FOR  
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-435-507-E006

SH 26 OF 26

# TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES GS AND FRP TYPE

**TATA CONSULTING ENGINEERS LIMITED**  
VENDOR DRAWING STATUS

	CATEGORY	DESCRIPTION
<input type="checkbox"/>	CAT-1	Drawing/documents approved for final distribution. BHEL will proceed with manufacturing/fabrication/construction.
<input checked="" type="checkbox"/>	CAT-2	Drawing/documents cleared for manufacturing/fabrication/construction subject to incorporating the comments given. BHEL to resubmit the drawing for Approval in Category – 1. Comments will be marked on the drawing documents.
<input type="checkbox"/>	CAT-3	Drawing document will be corrected as per comment and resubmitted by BHEL for further review/checking.
<input type="checkbox"/>	CAT-4	Drawing document of this category are for information only and not for approval. Information furnished on the document is noted.




Note :

1. It is mandatory to close documents with Code 2 & 3 to Code 1 in agreed contract period or 2 weeks, whichever is lower.
2. Any design changes / modification required to be carried out in Code 4 Drawings / Documents shall be the responsibility of BHEL. BHEL to resubmit reflecting the Design Changes for information.

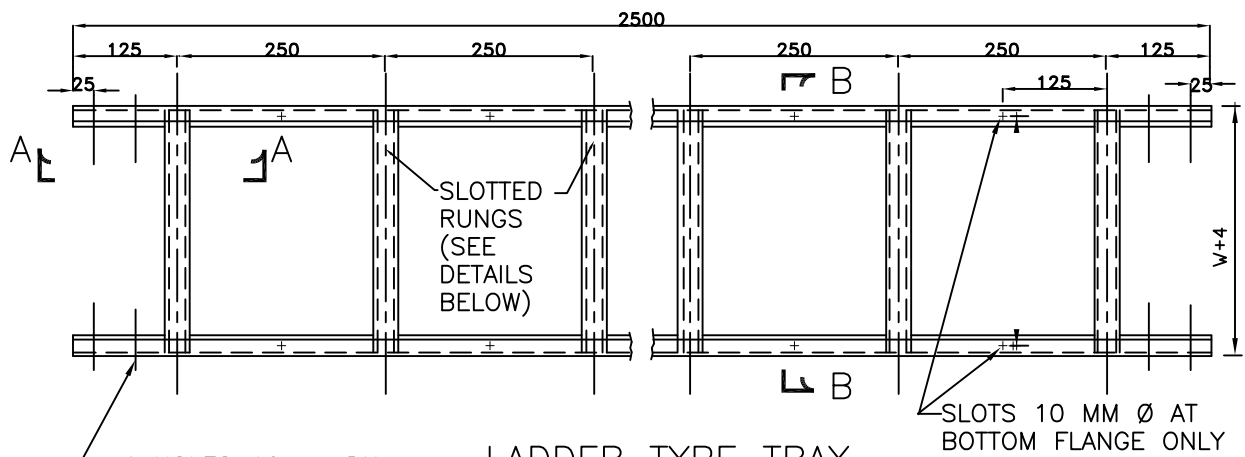
Approval conveyed herein neither relieves the Vendor/Contractor of his contractual obligations and his responsibilities for correctness of dimensions, materials of construction, weights, quantities, design details, assembly fits, performance requirements and conformity of supplies with the Indian Statutory Laws as may be applicable, nor does it limit the purchaser's rights under the contract.

Reviewed by S.S.Satish Date                     

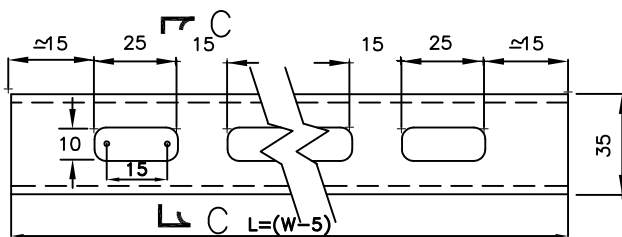
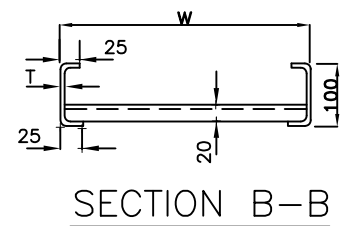
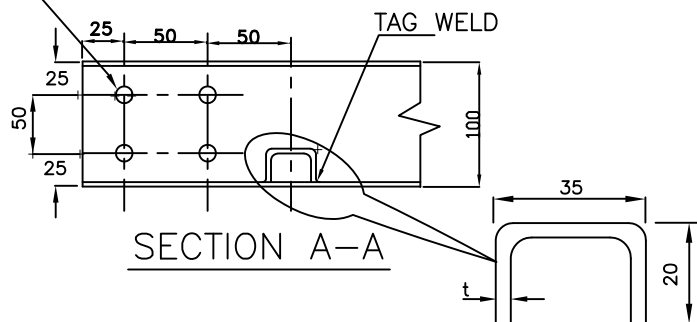
THIS DOCUMENT WILL BE APPROVED UNDER CAT-2. CAT-1 WILL BE DONE AFTER ERECTION OF ALL CABLE TRAYS AT SITE. ADDITIONAL DETAILS MAY BE ADDED DURING THE CABLE TRAY ERECTION.

<div>CUSTOMER NAME</div> <div>TAMIL NADU GENERATION &amp; DISTRIBUTION CORPORATION LIMITED 5TH FLOOR, WESTERN WING, NPKRR, MAALIGAI. 144, ANNA SALAI, CHENNAI-600002.</div>									
<div>CUSTOMER'S CONSULTANT</div> <div>  <b>TATA Consulting Engineers Limited</b> MUMBAI </div>									
<div>JOB No. 435</div> <div>STATUS CONTRACT</div> <div>DISTRIBUTION</div> <div>2 X 660 MW UDANGUDI TPP-STAGE I</div>									
<div>TO</div> <div>  <b>BHARAT HEAVY ELECTRICALS LTD</b> POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA </div> <div> DEPT CODE E DRN DESIGN CHD APPD NAME SKS SKS VY SL SIGN -Sd- -Sd- -Sd- DATE </div>									
REV 02	DATE 18.07.19	ALTD SKS	CHD VY	APPD SL	REV 01	DATE 03.05.19	ALTD SKS	CHD VY	APPD SL
1. DOCUMENT REVISED AS PER TCE COMMENTS, REF. NO: TCE: 11403A-EL-VDT-100, dated 12.06.2019					1. DOCUMENT REVISED AS PER TCE COMMENTS, REF. NO: TCE: 11403A-EL-VDT-0003, dated 01.04.2019				
<div>TITLE</div> <div>TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES GS AND FRP TYPE</div>									
<div>MPL</div> <div>C#</div> <div>MSE</div> <div>MAUX</div> <div>ELEC.</div> <div>CIVIL</div> <div>DEPT.</div> <div>SCALE ---</div> <div>DRAWING No.</div> <div>PE-DG-435-507-E005</div>									
<div>SIGN</div> <div>DATE</div> <div>  </div> <div>SHEET 1 OF 34</div> <div>REV 02</div>									

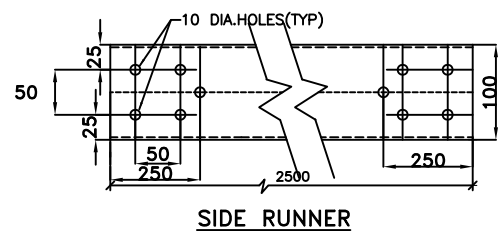
SIZE-A4



4 HOLES 10mm DIA. LADDER TYPE TRAY



(TO SUIT TRAY WIDTH)



W	150	300	450	600
L	145	295	445	595
T	2	2	2	2
t	2	2	2	2

FOR GENERAL NOTES REFER SHEET 14 OF 34

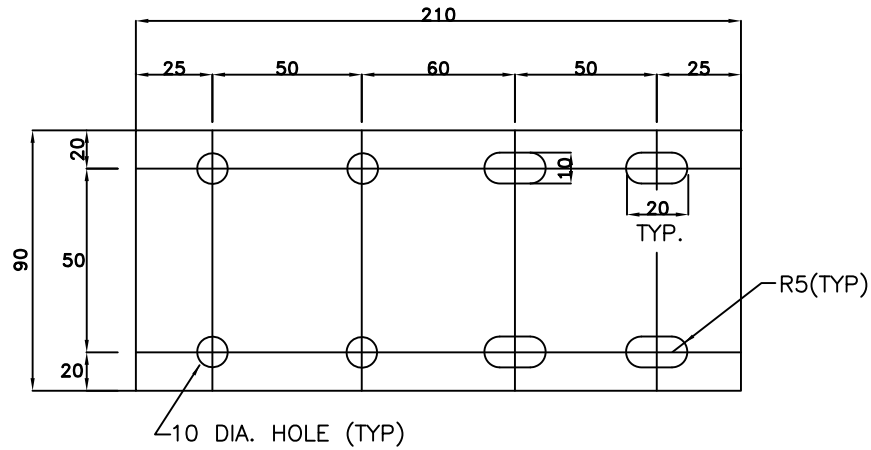


TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

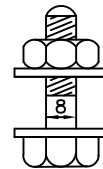
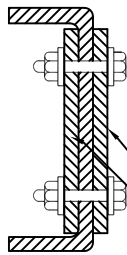
SHT. 02 OF 34

REV. 1



**SIDE COUPLER PLATE FOR  
LADDER/PERFORATED TYPE TRAYS**  
(600/450/300/150W TRAYS)

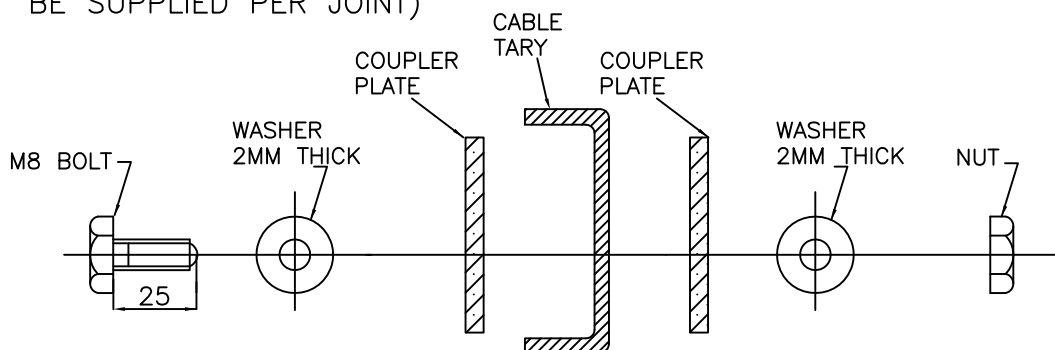
QTY. REQUIRED/TRAY SECTION : 4 NOS.



QTY. REQD/TRAY SECTION

- A) 16 NOS. M8 BOLTS
- B) 16 NOS. NUTS
- C) 32 NOS. WASHERS

(2 NOS. COUPLER PLATES  
OF 3 MM THICKNESS TO  
BE SUPPLIED PER JOINT)



SEQUENCE OF M8 BOLT, WASHER, NUT, COUPLER PLATE & CABLE TRAY  
FOR TYPICAL CABLE TRAY JOINT

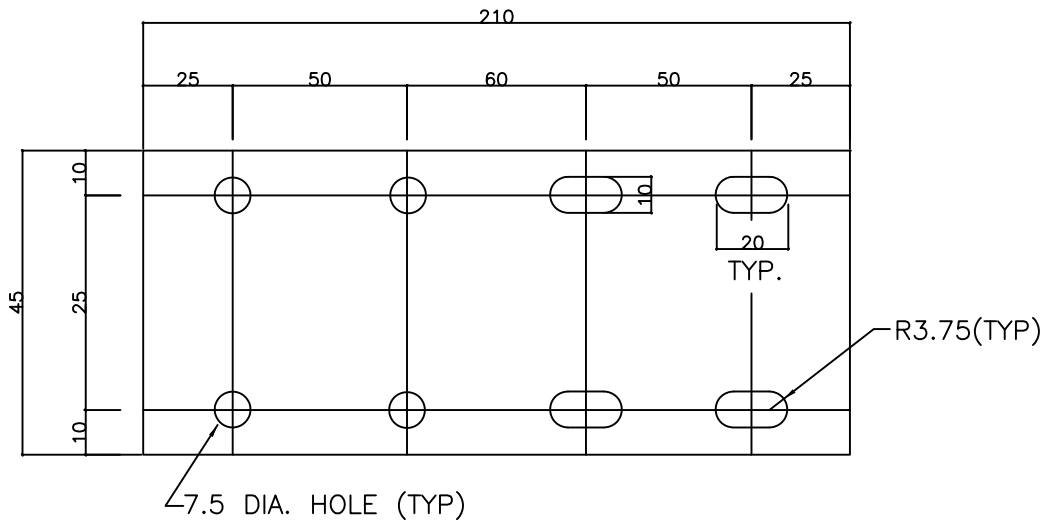
FOR GENERAL NOTES REFER SHEET 14 OF 34



**TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)**

DWG. NO.  
PE-DG-435-507-E005

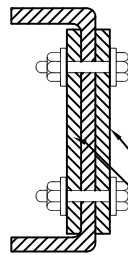
SHT. 03 OF 34      REV. 1



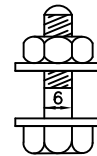
### SIDE COUPLER PLATE FOR PERFORATED TYPE TRAYS

(100/50W TRAYS)

QTY. REQUIRED/TRAY SECTION : 4 NOS.

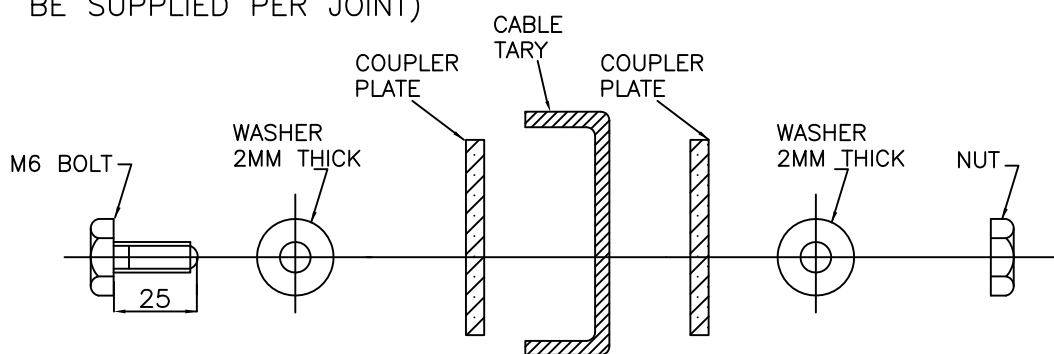


(2 NOS. COUPLER PLATES  
OF 3 MM THICKNESS TO  
BE SUPPLIED PER JOINT)



QTY. REQD/TRAY SECTION

- A) 16 NOS. M6 BOLTS
- B) 16 NOS. NUTS
- C) 32 NOS. WASHERS



SEQUENCE OF M6 BOLT, WASHER, NUT, COUPLER PLATE & CABLE TRAY  
FOR TYPICAL CABLE TRAY JOINT

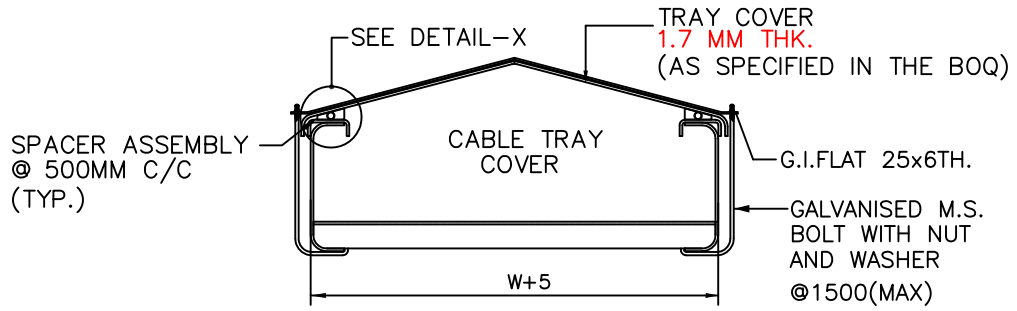
FOR GENERAL NOTES REFER SHEET 14 OF 34



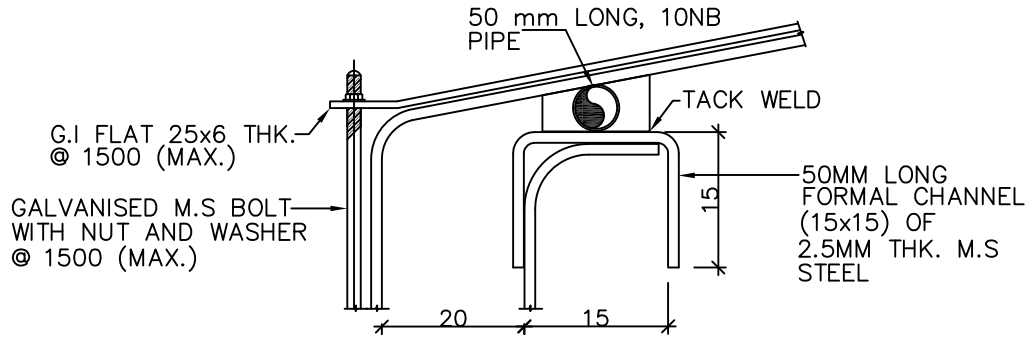
TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

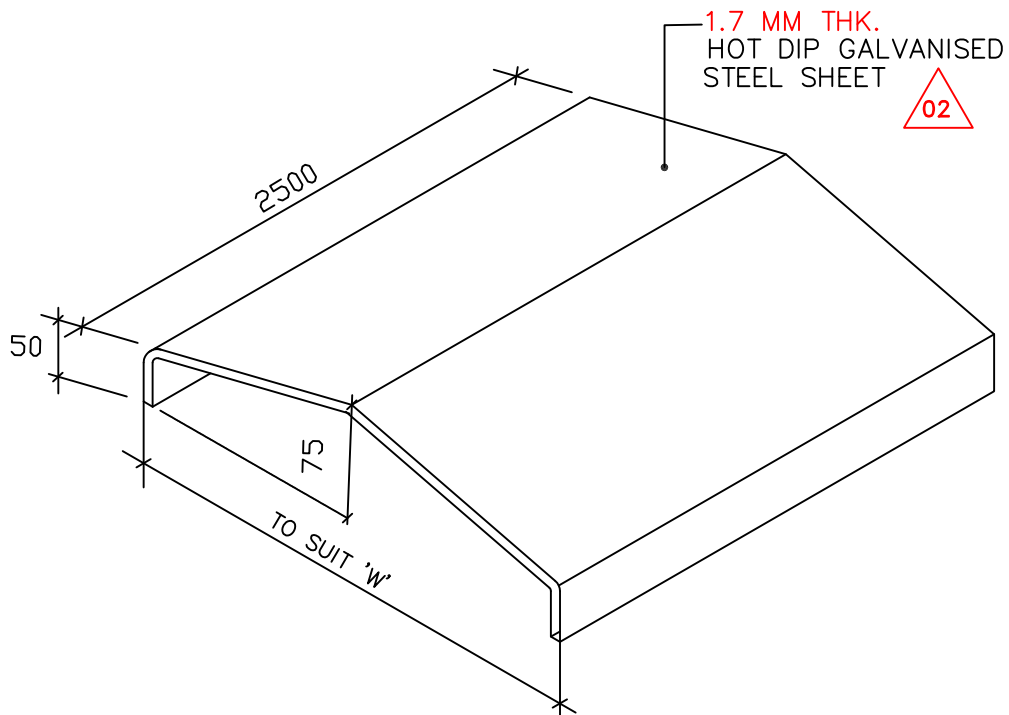
SHT. 04 OF 34 REV. 1



COVER FIXING (TYP.)



DETAIL-X



## CABLE TRAY COVER

FOR GENERAL NOTES REFER SHEET 14 OF 34

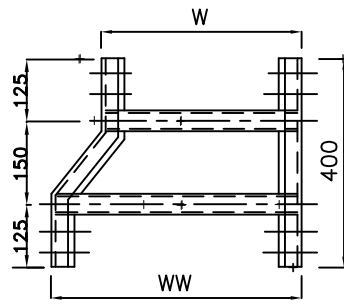
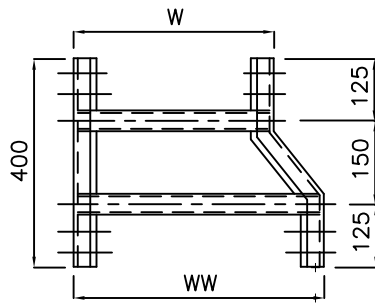


TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

SHT. 05 OF 34

REV. 2

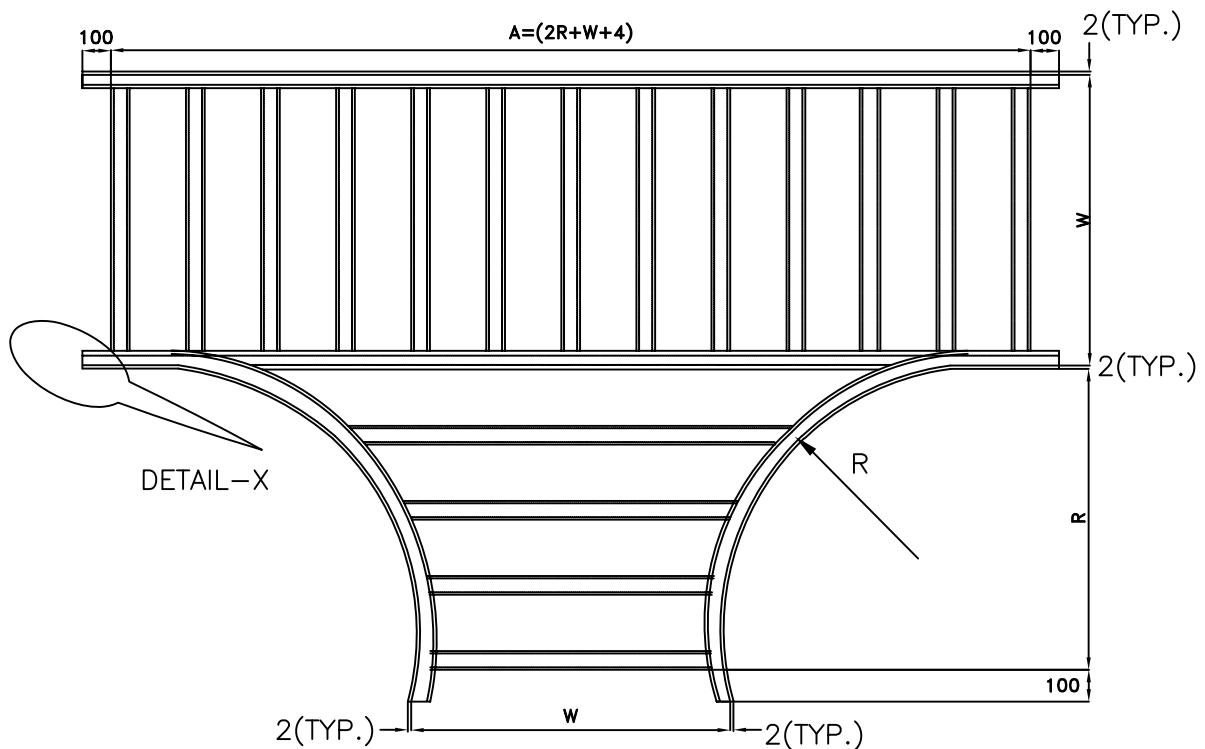


WW	W	DEPTH
600	450	100
600	300	100
600	150	100
450	300	100
300	150	100

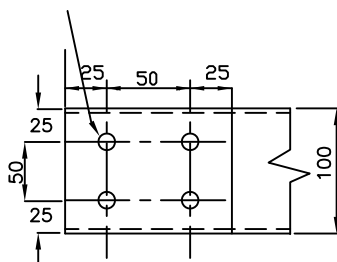
LEFT HAND REDUCER

RIGHT HAND REDUCER

### LADDER TYPE



10mm DIA. HOLES



WIDTH W	BENDING RADIUS R	DEPTH	A			
			W			
			150	300	450	600
150, 300, 450 & 600	600	100	1354	1504	1654	1804

### LADDER TYPE

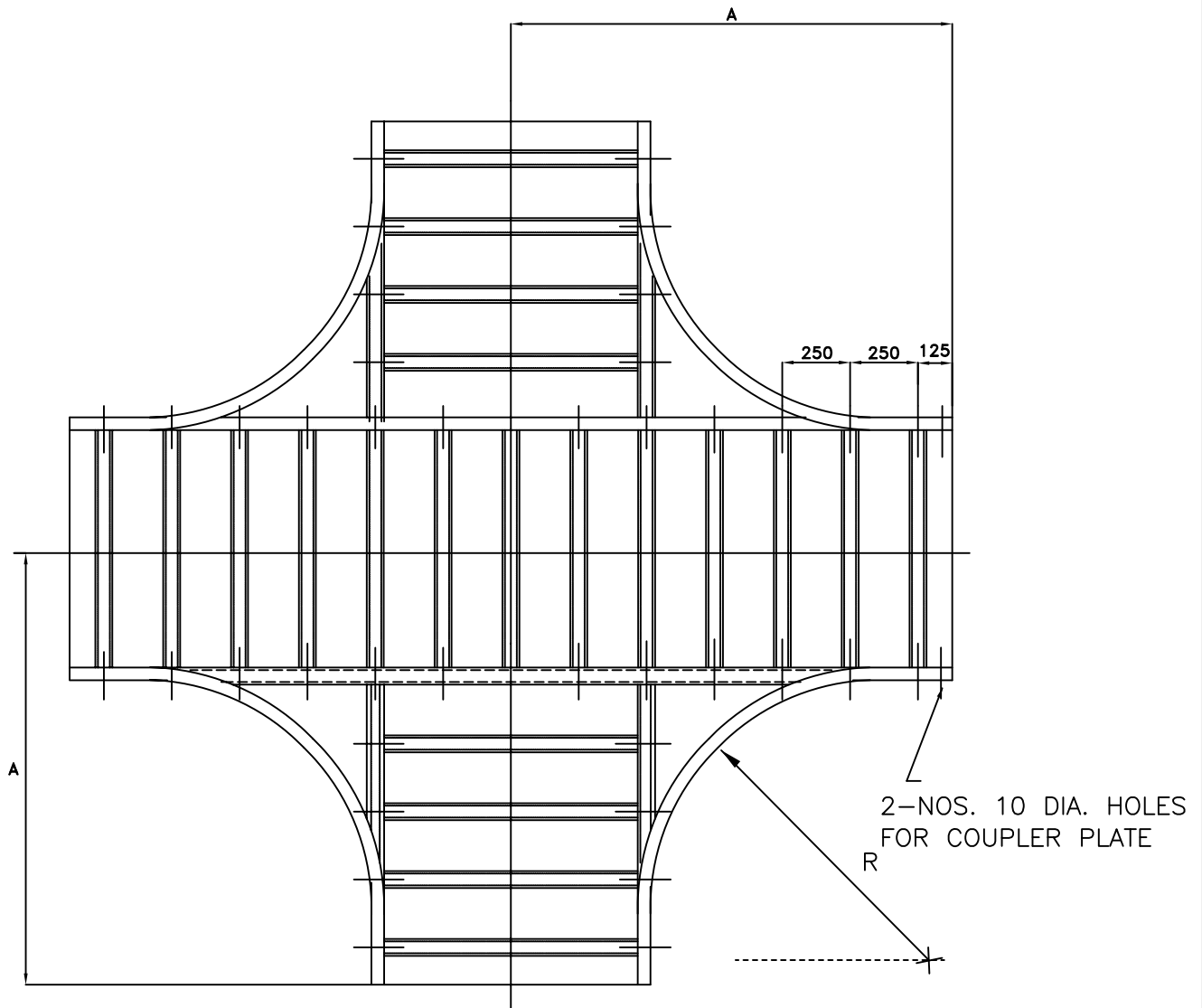
FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

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HORIZONTAL CROSS-PLAN

WIDTH W	BENDING RADIUS R	$A=R+W/2+100$
600	600	1000
450	600	925
300	600	850

FOR GENERAL NOTES REFER SHEET 14 OF 34



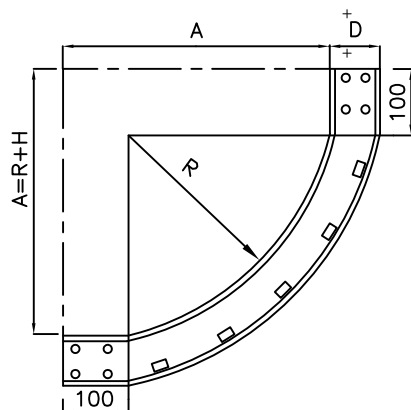
TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

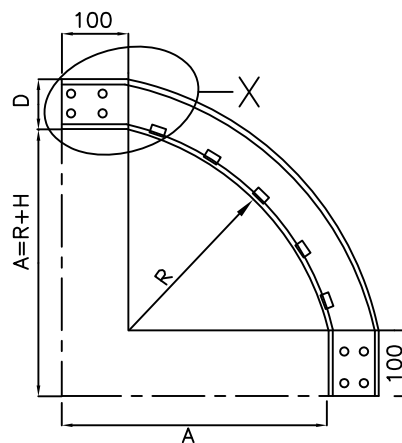
SHT. 07 OF 34

REV. 1

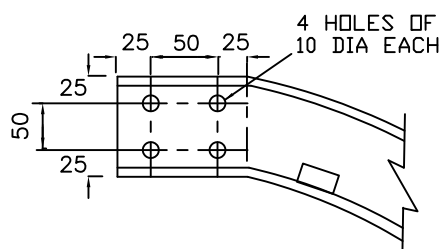




INSIDE TYPE



OUTSIDE TYPE

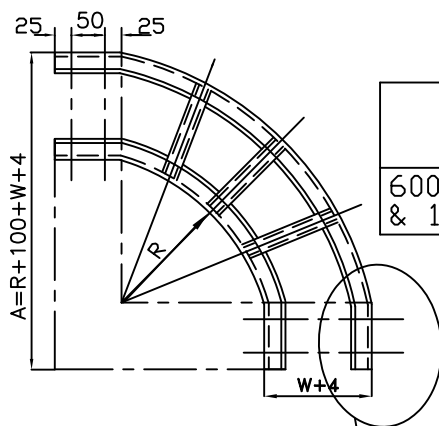


ENLARGED VIEW OF "X"

VERTICAL ELBOW 90 DEG UP/DOWN

INSIDE WIDTH W	BENDING RADIUS R	DEPTH	A
600, 450, 300 & 150	600	100	700

90° VERTICAL BEND - LADDER TYPE



LADDER TYPE

X (AS ABOVE)

HORIZONTAL ELBOW 90 DEG

INSIDE WIDTH W	BENDING RADIUS R	DEPTH	A			
			W			
			150	300	450	600
600, 450, 300 & 150	600	100	854	1004	1154	1304

90° HORIZONTAL BEND - LADDER TYPE

LADDER TYPE ACCESSORIES

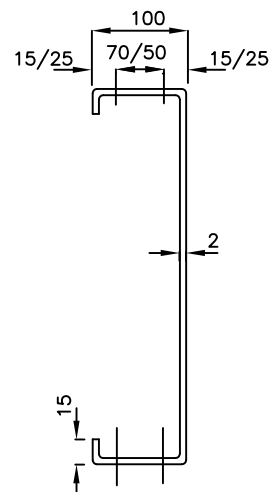
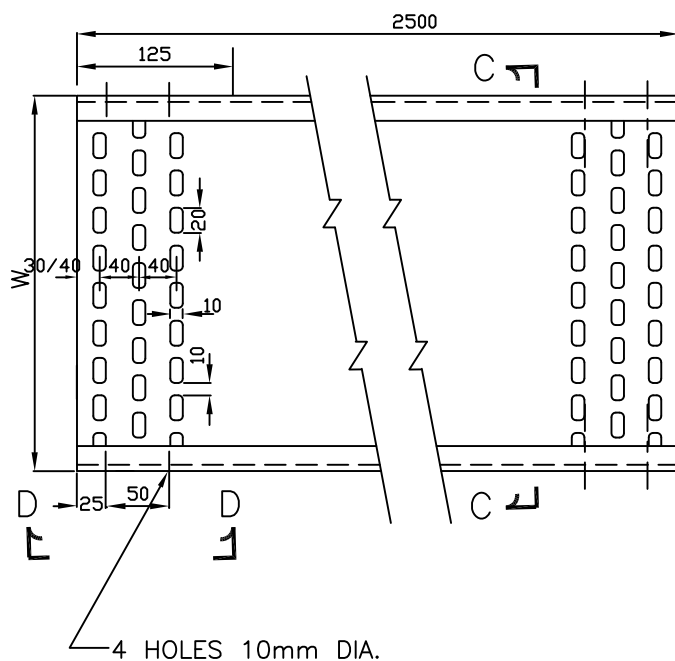
FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

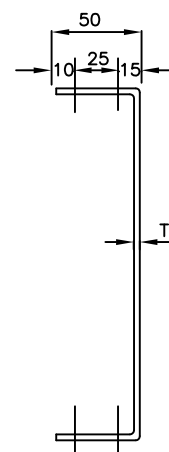
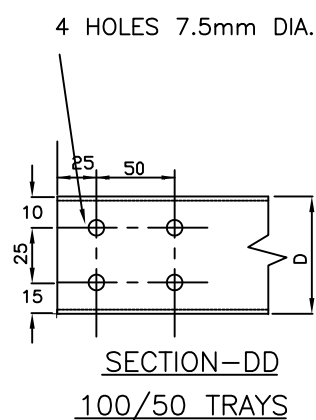
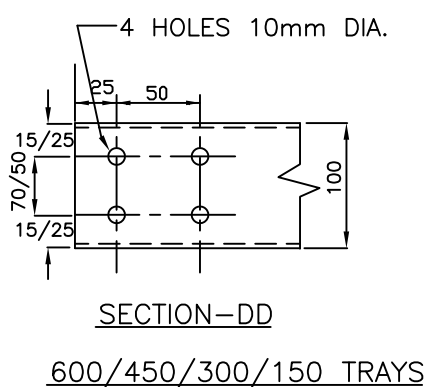
DWG. NO.  
PE-DG-435-507-E005

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SECTION-CC

600/450/300/150 TRAYS



SECTION-CC

(100/50 TRAYS)

TRAY WIDTH W (mm)	600	450	300	150	100	50
TRAY DEPTH D (mm)	100	100	100	100	50	50
T (mm)	2	2	2	2	2	2

### PERFORATED TYPE TRAY

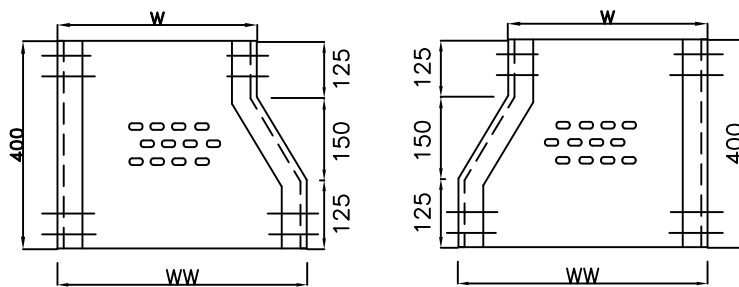
FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

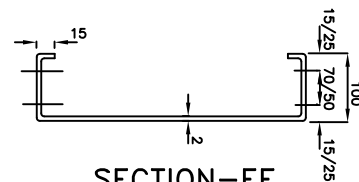
SHT. 09 OF 34 REV. 1



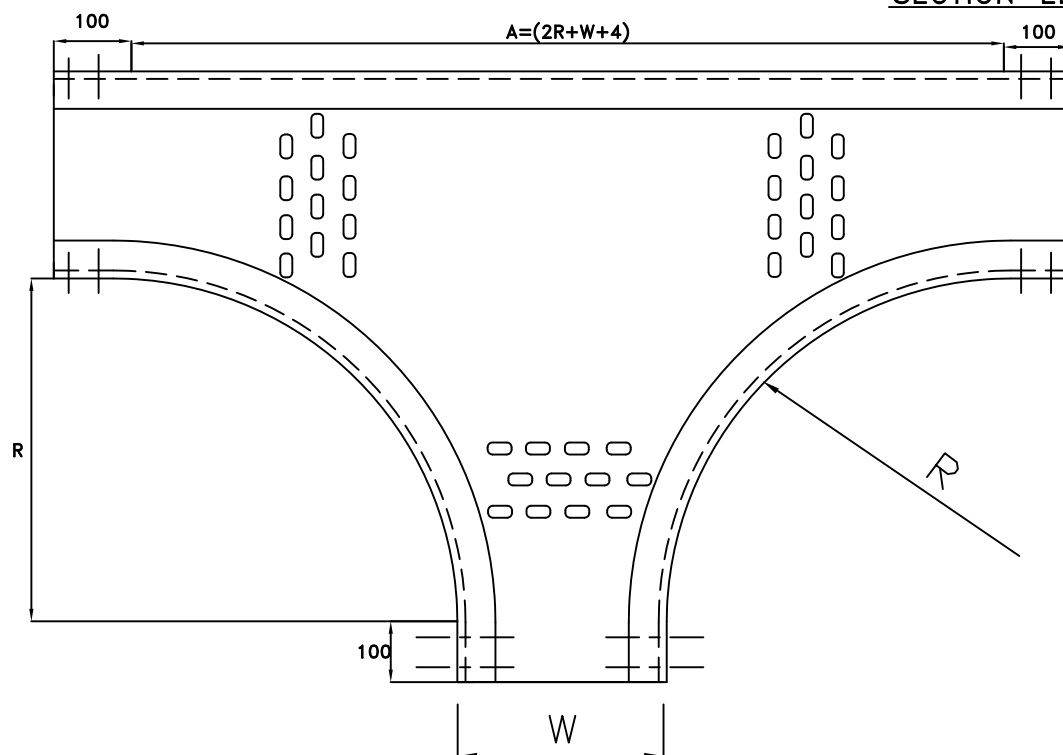
WW	W	DEPTH
600	450	100
600	300	100
600	150	100
450	300	100
300	150	100

LEFT HAND REDUCER RIGHT HAND REDUCER

PERFORATED TYPE



SECTION-EE



TEE

WIDTH W	BENDING RADIUS R	DEPTH	A			
			W			
			150	300	450	600
150, 300, 450 & 600	600	100	1354	1504	1654	1804

PERFORATED TYPE

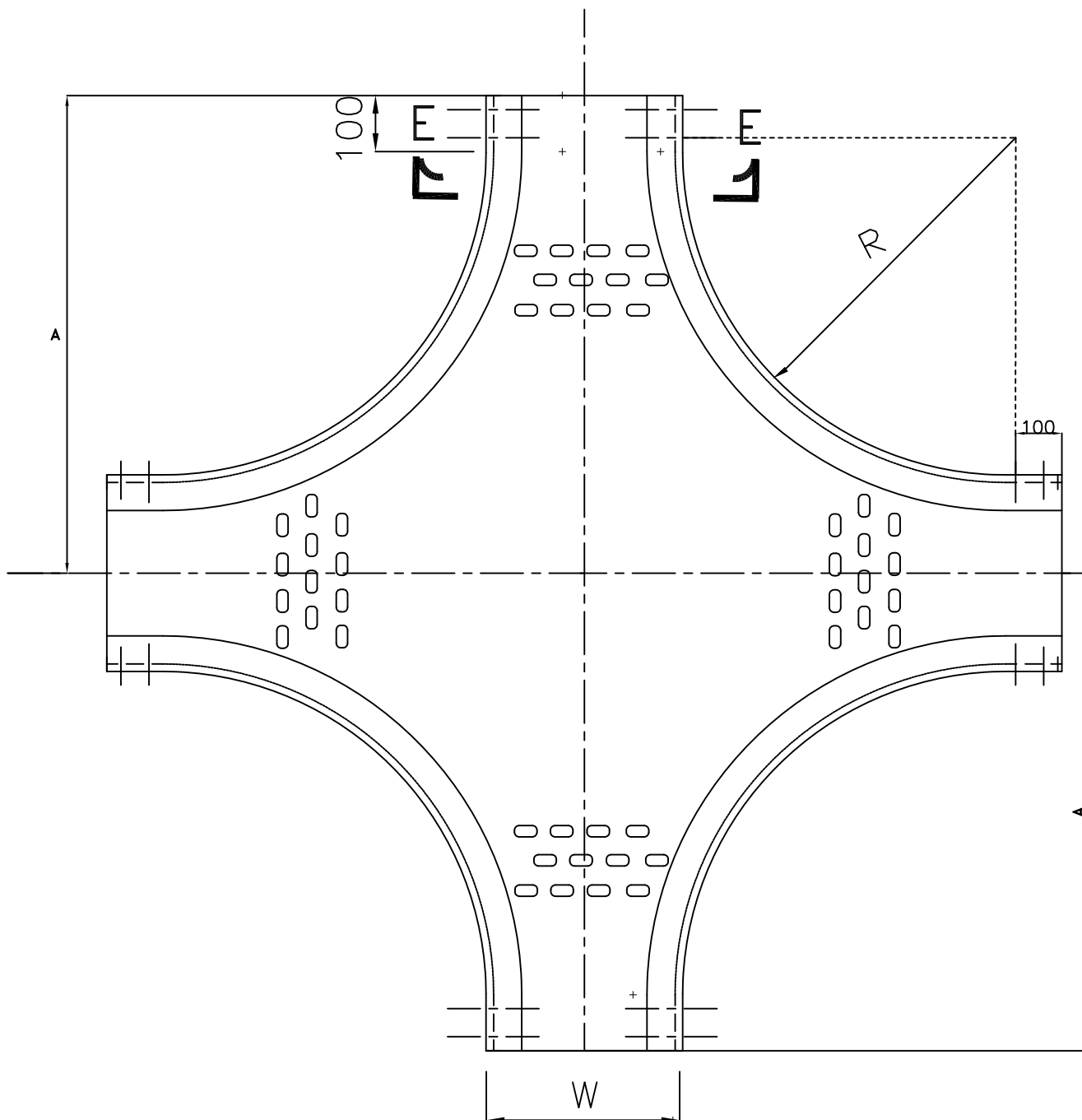
FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

SHT. 10 OF 34 REV. 1



CROSS

WIDTH W	BENDING RADIUS R	$A=R+W/2+100$
600	600	1000
450	600	925
300	600	850

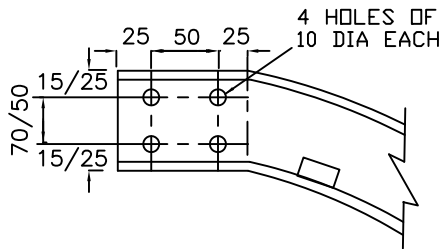
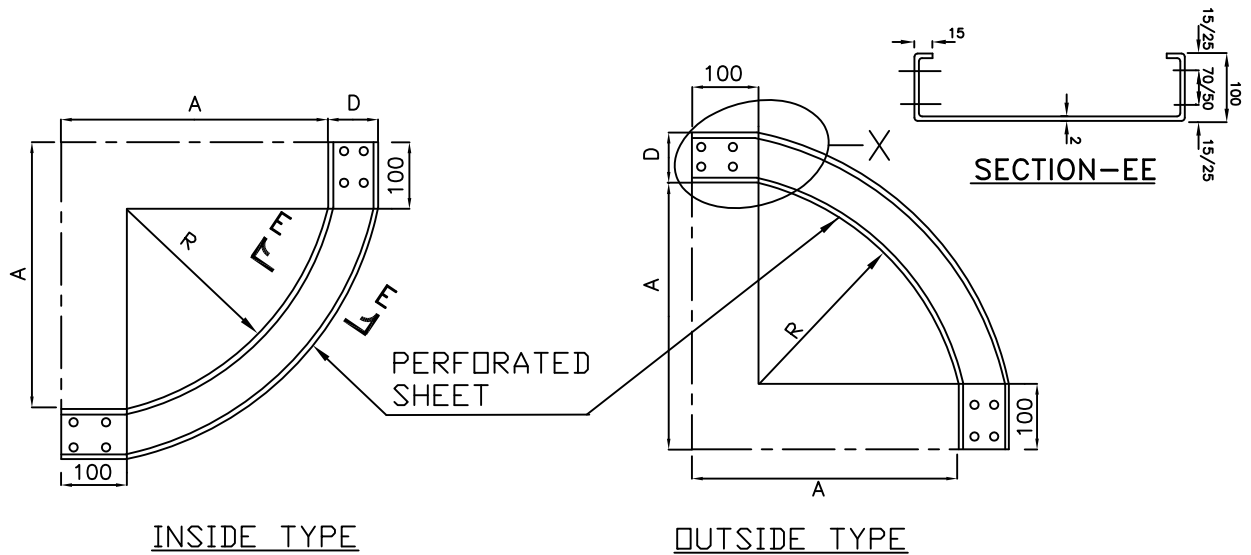
FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

SHT. 11 OF 34 REV. 1



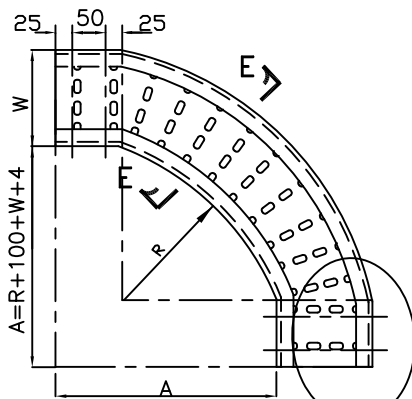
ENLARGED VIEW OF "X"

VERTICAL ELBOW 90 DEG UP/DOWN

INSIDE WIDTH W	BENDING RADIUS R	DEPTH	A
600, 450, 300 & 150	600	100	700

90° VERTICAL BEND - PERFORATED TYPE

HORIZONTAL ELBOW 90 DEG



INSIDE WIDTH W	BENDING RADIUS R	DEPTH	A			
			W			
			150	300	450	600
150, 300, 450 & 600	600	100	854	1004	1154	1304

90° HORIZONTAL BEND - PERFORATED TYPE

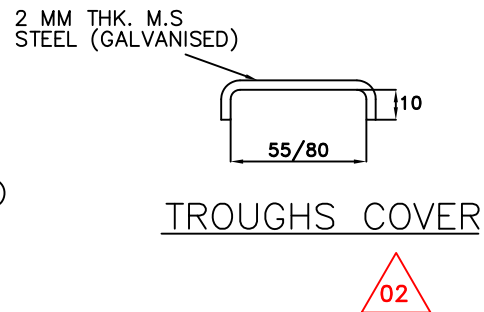
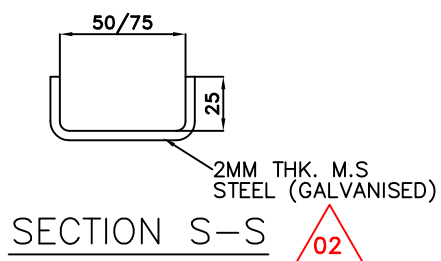
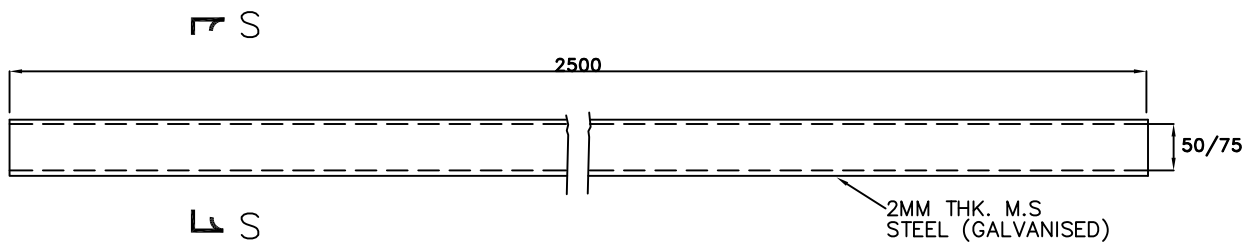
FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

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CABLE TROUGHS

FOR GENERAL NOTES REFER SHEET 14 OF 34



TYPICAL DETAILS OF CABLE TRAYS AND  
ACCESSORIES (GS TYPE)

DWG. NO.  
PE-DG-435-507-E005

SHT. 13 OF 34 REV. 2

## NOTES:—

1. THE CABLE TRAYS AND ACCESSORIES SHALL BE MADE OF 2mm HOT ROLLED M.S.SHEET CONFIRMING TO IS:1079. ALL THE COUPLER PLATE SHALL BE OF 3 MM THICK.
2. THE CABLE TRAYS AND ACCESSORIES SHALL BE HOT DIP GALVANISED AS PER IS 2629. THE MASS OF ZINC COATING SHALL BE 610 gm/m AND THICKNESS SHALL BE 75 MICRONS (MINIMUM).
3. FOR LADDER TYPE CABLE TRAYS AND ACCESSORIES, ALL RUNGS SHALL BE SLOTTED.
4. PERFORATED TRAYS SHALL BE FABRICATED OUT OF A SINGLE M.S. SHEET.
5. THE DIMENSIONS OF ALL BENDS, TEES, CROSSES, ETC. FOR PERFORATED CABLE TRAYS SHALL BE THE SAME AS FOR LADDER TYPE TRAY FITTINGS.
6. SIDE CHANNELS OF PERFORATED TRAY ACCESSORIES SHALL BE WELDED WITH THE PERFORATED SHEET AT INTERVALS OF 100mm.
7. LENGTH OF WELDING SHALL NOT BE LESS THAN 25mm. WELDING SHALL BE AS PER IS 9595.
8. PREFERABLY SINGLE MS PERFORATED SHEET SHALL BE USED AS BASE OF ALL PERFORATED TYPE TRAY ACCESSORIES. HOWEVER, IF USE OF PIECES OF PERFORATED SHEET IS UNAVOIDABLE FOR BASE, PIECES SHALL BE WELDED WITH EACH OTHER IN LINE WITH THE ABOVE.
9. ALL TRAY CORNERS SHALL BE FREE OF SHARP EDGES & SMOOTH.
10. THE DEPTH, WIDTH AND LENGTH OF TRAYS AND ACCESSORIES SHALL BE WITHIN A TOLERANCE AS PER RELEVANT IS
11. TO FACILITATE ASSEMBLY, ALL ACCESSORIES AT ENDS SHALL HAVE 100mm STRAIGHT PORTION.
12. ALL NUTS, BOLTS, WASHERS ETC., SHALL BE HOT DIP GALVANISED AS PER IS 1367 FOR SIZES ABOVE 12MM AND ELECTROPLATED/ELECTROGALVANISED FROM SIZE BELOW 12MM.
13. ALL DIMENSIONS ARE IN mm UNLESS NOTED OTHERWISE.
14. TRAY ACCESSORIES SHOWN IN THIS DRAWING SHALL BE FACTORY FABRICATED FOR USE AT SITE AS PER APPROVED LAYOUT DRAWINGS. FOR SPECIFIC SITE REQUIREMENTS (E.G. IRREGULAR ANGLE BENDS SUCH AS 30°/60° BENDS, ETC) AS PER SITE LAYOUT CONDITIONS, TRAY ACCESSORIES SHALL BE FABRICATED AT SITE FROM THE STRAIGHT LENGTH OF RESPECTIVE SIZES AS REQUIRED. GALVANISATION DAMAGED DURING CUTTING/WELDING OPERATIONS SHALL BE BRUSHED AND RED LEAD PRIMER, OIL PRIMER AND ALUMINIUM PAINT SHALL BE APPLIED BEFORE INSTALLATION OF THE ACCESSORIES.
15. WIDTH OF CABLE TRAYS PROPOSED TO BE USED FOR PROJECT ARE AS UNDER :  
LADDER TYPE CABLE TRAY (MM) : 600,450,300 & 150.  
PERFORATED TYPE CABLE TRAY (MM) : 600,450,300,150,100 & 50.
16. 600MM WIDE CABLE TRAY SHALL BE SUITABLE FOR WEIGHT OF 100KG/M INCLUDING LIVE LOAD OF RUNNING LENGTH OF CABLE TRAY.
17. CABLE TROUGHS SHALL BE USED FOR BRANCHING OUT FEW CABLES FROM MAIN CABLE ROUTE.
18. MAKE OF ALL ITEMS SHALL BE AS PER BHEL/CUSTOMER APPROVAL.
19. CABLE TROUGHS OR 50/75MM WIDE PERFORATED TYPE SHALL BE USED FOR LOCAL CABLING/BRANCHING OUT FEW CABLES FROM MAIN ROUTE.
20. THIS DOCUMENT SHALL BE READ ALONG WITH THE CONTRACT DOCUMENT. FOR ANY CLAUSES NOT COVERED IN THIS DOCUMENT, CONTRACT DOCUMENT SHALL BE REFERRED.

02



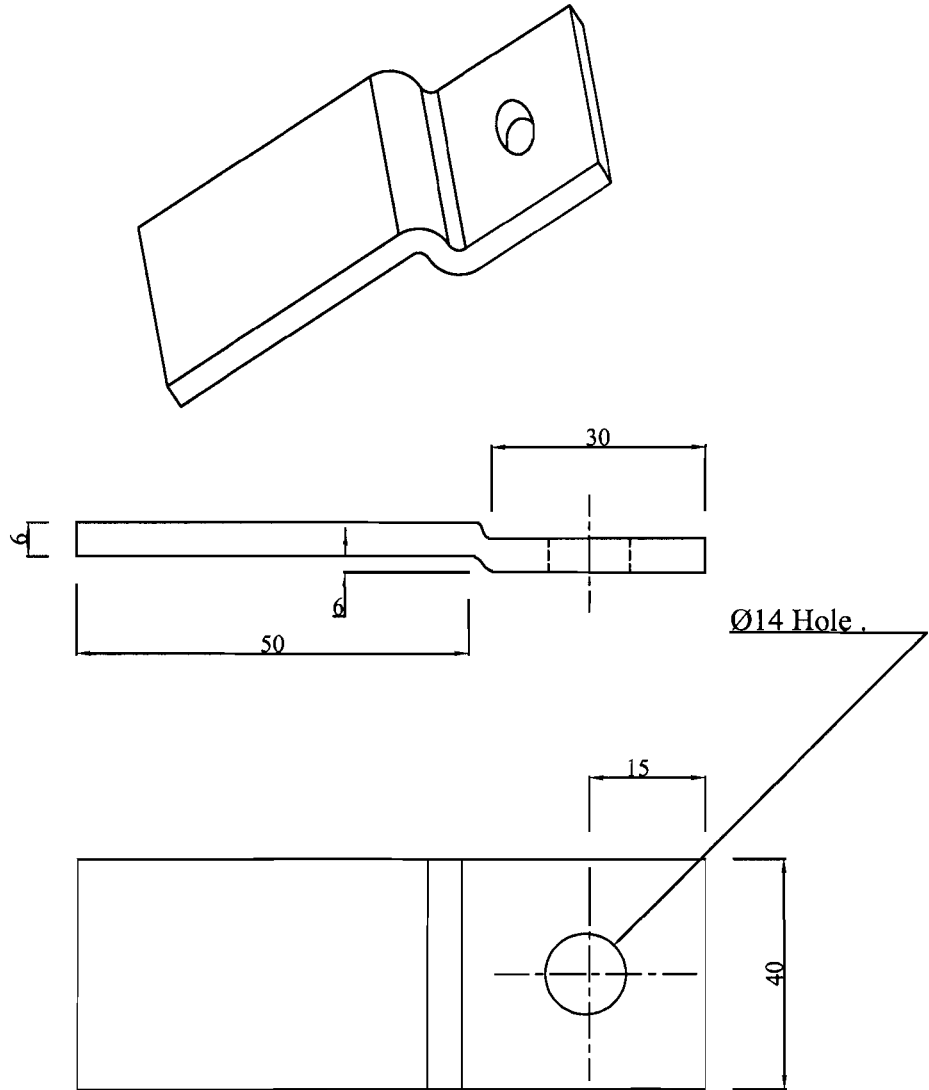
### TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES (GS TYPE)

DWG. NO.

PE-DG-435-507-E005

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REV. 2



### Z CLAMP FOR FIXING OF EARTH FLAT

#### NOTES:

- 1.ALL DIMENSIONS ARE IN MM.
- 2.PROFILE TOLERANCE  $\pm 0.5\text{mm}$
- 3.MATERIAL - 6mm THK. MILD STEEL AS PER IS-2062
- 4.FINISH - HOT DIP GALVANISED AS PER IS:2629/2633
- 5.TOLERANCES AS PER IS:1852
- 6.ZINC COATING-86 MICRONS(610 gm/sq.m ) AS PER IS:4759

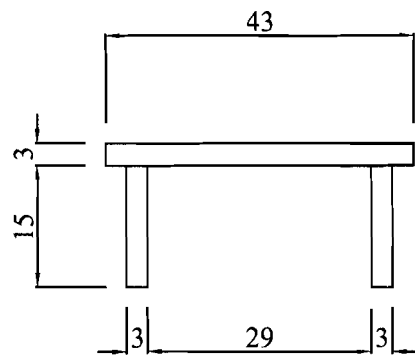
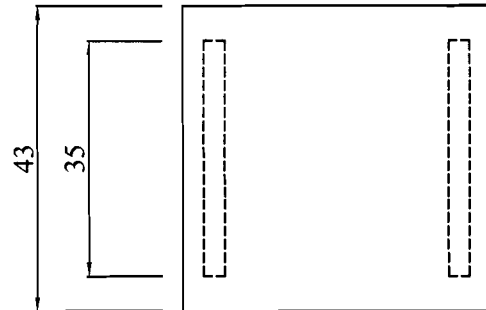
TITLE : Z-CLAMP FOR FIXING OF EARTH FLAT

NTPC DRG NO: 0350-215-PVE-B-001

SHEET NO. 18 OF 21

REV. 00





### PVC END CAP

#### NOTES:

- 1.ALL DIMENSIONS ARE IN MM.
- 2.PROFILE TOLERANCE  $\pm 0.5\text{mm}$
- 3.MATERIAL - PVC

TITLE : PVC END CAP

NTPC DRG NO: 0350-215-PVE-B-001

SHEET NO. 20 OF 21

REV. 00