

**TAMIL NADU GENERATION & DISTRIBUTION
CORPORATION LIMITED**

2 X 660 MW ENNORE SEZ SUPERCRITICAL TPP.

VOLUME – II

**TECHNICAL SPECIFICATION
FOR
*CABLE TRAY SUPPORT SYSTEM (BOLTABLE)***

**SPECIFICATION NO: *PE-TS-412-507-E013*
REVISION: 0**



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, UP (INDIA) – 201301**



**2X660 MW ENNORE STPP
TECHNICAL SPECIFICATION FOR CABLE
TRAYS SUPPORT SYSTEM**

SPECIFICATION NO. PE-TS- 412-507-E013

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Total nos. of sheets including cover, content & separator sheets = 39 sheets



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SECTION – I
SPECIFIC TECHNICAL REQUIREMENTS



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COMPLIANCE CERTIFICATE

The bidder shall confirm compliance to the following by signing/ stamping this compliance certificate and furnishing same with the offer.

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusion/ deviation with regard to same
2. There are no deviation with respect to specification other than those furnished in the 'schedule of deviations'
3. Only those technical submittals which are specifically asked for in NIT to be submitted at tender stage shall be considered as part of offer. Any other submission, even if made, shall not be considered as part of offer.
4. Any comments/ clarifications on technical/ inspection requirements furnished as part of bidder's covering letter shall not be considered by BHEL, and bidder's offer shall be construed to be in conformance with the specification.
5. Any changes made by the bidder in the price schedule with respect to the description/ quantities from those given in 'BOQ-Cum-Price schedule' of the specification shall not be considered (i.e., technical description & quantities as per the specification shall prevail).

BIDDER'S STAMP & SIGNATURE



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1.0 SCOPE

- 1.1 Manufacture, Inspection and Testing at Manufacturer's works, proper packing and delivery to site of Cable Tray Support System (Bolttable Type) conforming to this specification.
- 1.2 Technical requirements of Cable Tray Support System (Bolttable Type) are indicated in Data Sheet-A & Section-II.
- 1.3 The stipulation of Data Sheet-A shall prevail in case of any conflict between the stipulations of Data Sheet-A, Section-I & Section-II.

2.0 BILL OF QUANTITIES

Quantity requirements shall be as per 'BOQ-cum-price schedule' as part of NIT.

3.0 SPECIFIC TECHNICAL REQUIREMENTS

S. No.	Reference clause No. of Section II (if any)	Specific Requirement/ Change
1	NIL	NIL

4.0 DRAWINGS & DOCUMENTS TO BE SUBMITTED

4.1 Documents required along with Technical offer

Signed and Stamped copies of following documents:-

- Schedule of BOQ cum Price Schedule (Unpriced)
- Compliance certificate
- Schedule of deviations.

4.2 Documents required after award of LOI

Following documents/drawings shall be submitted after placement of order for BHEL & customer's approval:-

Sl. No.	Drawings/Document Description	Drawings / Document Number	Submission date by vendor
1	Technical Data Sheet	PE-V0-412-507-E051	Within one week of award of contract
2	GA Drg of cable tray supports (Bolttable type)	PE-V0-412-507-E052	Within one week of award of contract
3	Type test procedure including Typical details of type test arrangement	PE-V0-412-507-E053	Within one week of award of contract
4	Type test certificates	PE-V0-412-507-E054	Within one week of award of contract
5	Quality Plan	PE-V0-412-507-E908	Within one week of award of contract



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Note:-

1. It may please be noted that successful bidder is not to make any fresh submittals at contract stage w.r.t. above mentioned drawings/documents except document against sl.no 04. Data Sheet-A, GA Drg of cable tray supports & Standard Quality Plan as enclosed in the technical specification are to be appended with cover sheet bearing drawing/document number & description as stated above. The signed & stamped for the same shall be submitted by successful bidder to BHEL within one week of award of contract without making any changes in the contents of the drawing/document.
2. Document indicated at clause no. 4.2 above, shall be submitted through document management system (DMS).



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DATASHEET A
(SPECIFIC TECHNICAL REQUIREMENTS)

1.0 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.
- f) IS: 6005 For surface pre-treatment.
- g) IS: 2629 For hot dip galvanising of steel.
- h) IS: 2633 For testing of zinc coating.
- i) IS: 6745 For determining of mass of zinc coating.
- j) IS: 1852 For Rolling and Cutting Tolerances of hot rolled steel products.
- k) IS:513 For cold rolled low carbon steel sheet & strip
- l) IS:1367 For requirement for Bolt, screw and Studs

2.0 CABLE TRAY SUPPORT

- a) Tray support type: Boltable type
- b) Material: Hot/ Cold Rolled MS sheet steel for channel SC1/ DC1 and channel portion of cantilever arms
- c) Make: SAIL/ TISCO/ RINL / JINDAL STEEL/ JINDAL ISPAT/ BHUSHAN STEEL/ ESSAR/ LLOYD/ IISCO or authorised re-rollers of SAIL
- d) Thickness: 2.5 mm
- e) Length: Standard length of 6 meters
- f) Fabrication: At works
- g) Construction: Conforming to enclosed drawings [PE-DG- 412-507-E006]

3.0 SURFACE TREATMENT:

Galvanizing:

- a) Pre-treatment: As per IS 2629 prior to galvanisation
- b) Type: Hot dip galvanization
- c) Applicable Standard: IS 2629
- d) Minimum thickness: 86 microns (minimum)
- e) Min. weight of Zinc deposit: 610 gms. per square meter
- 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
 - iv) Adhesion as per IS: 2629



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SECTION – II

STANDARD TECHNICAL SPECIFICATION



**2X660 MW ENNORE STPP
TECHNICAL SPECIFICATION FOR
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1.0 CODES AND STANDARDS

- 2.1 The material shall comply with all currently applicable safety codes and statutory regulations of India as well as of the locality where the material is to be installed.
- 2.2 The design, material, construction, manufacture, inspection, testing and performance of cable tray support system (BOLTABLE) shall conform to the latest revision of relevant standards and codes of practices as per Datasheet-A.
- 2.3 In case of conflict between the applicable reference standard and this specification, this specification shall govern.

2.0 TECHNICAL REQUIREMENTS

- 3.1 Cable Trays Support (boltable type) shall be supplied as per technical particulars of cable tray support system specified in Data Sheet – A.
- 3.3 All finished galvanised MS structural members for cable tray supports shall be free from sharp edges, corners, burs & unevenness.
- 3.4 Necessary fasteners shall be provided with each cable tray support accessory as specified in enclosed drawings.
- 3.5 All welded joints of cable tray support accessories shall be smooth enough to provide a good appearance & shall not cause any injury to working personnel. All welding work shall be done by skilled personnel.

4.0 QUALITY/ INSPECTION:

- 4.1 BHEL's Standard QP (QP NO. PE-QP-999-507-E007 REV 0) is enclosed as per Annexure-II for reference. However, at contract stage, the successful bidder shall submit the QP for BHEL/ ultimate customer's approval. In case bidder has reference QP agreed with ultimate customer, same can be submitted for specific project after award of contract for BHEL/ ultimate customer's approval. There shall be no commercial implication to BHEL on account of QP approval.
- 4.2 All materials shall be procured, manufactured, inspected and tested by vendor/ subvendor as per approved quality plan.
- 4.3 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 equipments & components shall be deemed to be included in the bid price.

5.0 TESTING:



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The tests shall be in accordance with appropriate Indian Standards. The extent of the tests to be performed by the supplier shall include but not be limited to the following: -

a) Type tests :

Cable tray support system (Boltable Type) shall be of proven type & type tested design conforming to type tests as under:

- a) Load test for Main support channel with cantilever arm fixed on one side
- b) Load test for Main support channel with cantilever arm fixed on both sides
- c) Load test for Channel fixed on Beam/Floor
- d) Load test for channel supported on wall with Cantilever arm
- e) Channel nut slip characteristics (wherever applicable)
- f) Weld integrity test
- g) Test for galvanizing: Weight, thickness and uniformity of zinc coating shall be determined in accordance with IS: 6745 and IS: 2633 for the values indicated in Data Sheet- A.

Type testing shall be carried out for tests listed at “(a) through (f)” above in line with Type test procedure and drawings attached in Annexure-IV. The final type test procedure shall be subjected to BHEL/customer approval.

Type tests listed at (a) through (f) shall be conducted once. However, type test listed at (g) shall be conducted on each lot offered for inspection.

b) Routine Tests:

(i) Dimension checks

c) Acceptance Test:

(i) Dimension checks

(ii) Tests for galvanizing

6.0 **PACKING**

The material shall be packed to ensure protection against damage during transit, storage for prolonged periods and handling.



**TECHNICAL SPECIFICATION FOR
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Annexure-A

STANDARD QUALITY PLAN

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE : 2x660 MW ENNORE TPS		SPECIFICATION NO. PE-TS-412-507-E013				
				BIDDER/ VENDOR :		STANDARD QP NO. : PE-QP-999-507-E007, REV. 0		SPECIFICATION TITLE: TECHNICAL SPEC FOR CABLE TRAY SUPPORT SYSTEM (BOLTABLE)				
				SHEET 1 OF 2		SYSTEM CABLING		ITEM : CABLE TRAY SUPPORT MATERIAL & ACCESSORIES (BOLTABLE)		DOC. NO. :		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL											
1.1	ROLLED SHEET	1.CHEM.& PHY. PROPERTIES	MA	VERIFICATION OF TC'S	100%	IS1079 (for hot rolled) IS-513 (for cold rolled)	IS1079 (for hot rolled) IS-513 (for cold rolled)	MILL TC	3/2	-	1/2	Steel shall be procured from SAIL/TISCO/RINL/BHUSAN/JINDAL STEEL/JINDAL ISPAT/ESSAR/LLOYD/ IISCO/ authorised SAIL Re Rollers.
		2.DIMENSIONS	MA	MEASUREMENT	100%	IS-1730/ APP. DATA SHEET	IS-1730/ APP. DATA SHEET	QC RECORD	3/2	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	IS1079 (for hot rolled) IS-513 (for cold rolled)	IS1079 (for hot rolled) IS-513 (for cold rolled)	QC RECORD	3/2	-	-	
1.2	ZINC	CHEM.COMP.	MA	CHEM TEST	EACH HEAT	IS-209	IS-209	QC RECORD	3/2	-	1/2	
2.0	IN-PROCESS											
2.1	FABRICATION	1.DIMENSIONS	MA	MEASUREMENT	100%	APPD. DRGS.	APPD. DRGS.	QC RECORD	2	-	1	Welding is to be done by qualified welders in accordance with ASME SEC. IX article III. WPS , PQR & WPQ to be reviewed during inspection.
		2.WELDING QUALITY	MA	VISUAL	100%	GOOD WELDING PRACTICE	FREE FROM DEFECTS & SLAG	QC RECORD	2	-	1	
		3.SURFACE FINISH	MA	VISUAL	100%	FREE FROM DEFECTS & SLAG	FREE FROM DEFECTS & SLAG	QC RECORD	2	-	1	
2.2	SURFACE PREPARATION	1.CLEANING, PICKLING, RINSING & FLUXING	MA	VISUAL	PERIODIC IN EACH SHIFT	IS:2629	IS:2629	QC RECORD	2	-	-	
		2. SURFACE QUALITY	MA	VISUAL	100%	IS:2629	IS:2629	QC RECORD	2	-	-	
2.3	GALVANISING	1.TEMPERATURE OF BATH	MA	TEMPERATURE INDICATOR	CONTINUOUS	IS-2629	IS-2629	QC RECORD	3/2	-	-	If vendor doesn't have his own galvanizing plant duly approved by BHEL PEM; then galvanizing shall be carried out at BHEL-PEM approved other galvanizing plants as per Annexure-1.
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

		QUALITY PLAN		CUSTOMER :		PROJECT TITLE : 2x660 MW ENNORE TPS		SPECIFICATION NO. PE-TS-412-507-E013					
				BIDDER/ VENDOR :		STANDARD QP NO. : PE-QP-999-507-E007, REV. 0		SPECIFICATION TITLE: TECHNICAL SPEC FOR CABLE TRAY SUPPORT SYSTEM (BOLTABLE)					
		SHEET 2 OF 2		SYSTEM CABLING		ITEM : CABLE TRAY SUPPORT MATERIAL & ACCESSORIES (BOLTABLE)		DOC. NO. :					
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	P	W	V	11	
3.0	FINISHED ITEMS	2. DROSS 3. RATE OF IMMERSION 4. SURFACE QUALITY	MA MA MA	VISUAL VISUAL / MEASUREMENT VISUAL	PERIODIC 100% 100%	IS - 2629 IS - 2629 / MFR'S PRACTICE IS - 2629	IS - 2629 IS - 2629 / MFR'S PRACTICE FREE FROM BURRS, SLAG, ROUGHNESS, FLUX. STAIN. ETC.	QC RECORD QC RECORD QC RECORD	3/2 3/2 3/2	- - -	- 2 -	FASTENERS SHALL BE OF REPUTED MAKE	
3.1	SINGLE / DOUBLE CHANNELS, CANTILEVER ARMS, CLAMPS	1. DIMENSIONS DISTORTION 2. SURFACE FINISH	MA MA	MEASUREMENT VISUAL	IS-2500 (PART 1) LEVEL S-4 IS-2500 (PART 1) LEVEL S-4	APPD. DRG FREE FROM BURRS, SLAG, ROUGHNESS, FLUX. STAIN. ETC.	APPD. DRG FREE FROM BURRS, SLAG, ROUGHNESS, FLUX. STAIN. ETC.	INSP. REPORT INSP. REPORT	2 2	1 1	- -		
		3. MASS OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-6745 / APP. DATA SHEET	APP. DATA SHEET	INSP. REPORT	2	1	-		
		4. UNIFORMITY OF ZINC COATING	MA	CHEM. TEST	IS-4759	IS-2633	IS-2633	INSP. REPORT	2	1	-		
		5. THICKNESS OF ZINC COATING	MA	ELCOMETER	IS-4759	APP. DATA SHEET	APP. DATA SHEET	INSP. REPORT	2	1	-		
		6. ADHESION	MA	MECH. TEST	IS-4759	IS-2629	IS-2629	INSP. REPORT	2	1	-		
3.1.1	TYPE TESTING		CR	TEST	1 SAMPLE	APPD. TYPE TEST PROCEDURE	APPD. TYPE TEST PROCEDURE	INSP. REPORT	2	1	-		
3.1.2	WELD INTEGRITY TEST	SOUNDNESS	CR	MAGNETIC PARTICLE INSPECTION (MPI) DIE-PENETRATION (DP)	SAMPLE TESTED DURING TYPE TESTING	APPD. TYPE TEST PROCEDURE	NO DEFECT	INSP. REPORT	2	1	-		AFTER CARRYING OUT TYPE TEST, WELD INTEGRITY TEST TO CHECK THE WELD SOUNDNESS/ ACCEPTANCE SHALL BE DONE BY MANUFACTURER
BHEL			PARTICULARS			BIDDER/VENDOR							
			NAME										
			SIGNATURE										
			DATE						BIDDER'S/VENDORS COMPANY SEAL				

LEGEND : 1 - BHEL/ CUSTOMER 2 - VENDOR 3 - SUB- VENDOR P - PERFORM W - WITNESS V - VERIFICATION

ANNEXURE-1

INSTRUCTIONS FOR QUALITY PLAN

The Quality Plan shall include all the Quality Control Measures and Checks adopted by the Vendor to ensure that the material/component/assembly/services supplied by him meet/will meet the requirements as per specifications and good practices. They shall include all stages of operation such as materials, processes, manufacture, assembly, packing and despatch. The following guide lines may be noted:

Column 1-	Serial Number
Column 2-	Component/Operation- The component and/or operation being checked shall be given here.
Column 3-	Characteristics check- The characteristics being checked shall be given here, e.g., chemical composition, mechanical properties, leak tightness, surface defects etc..
Column 4-	Category -'CR' stands for critical characteristic - affecting safety of equipment and personnel 'MA' stands for major Characteristic - affecting safety of equipment and personnel 'MI' stands for minor characteristic - affecting appearance etc.
Column 5-	Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.
Column 6-	Extent of check, such as, 100, 10, 1 percent etc.
Column 7-	Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.
Column 8-	Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.
Column 9-	Format of Record - Formats, log sheets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here.
Column 10-	Agency - The agency which performs the test/instruction shall be written in sub-column 'W' The agency which verifies test certificates/inspection records and carries out audit check of the components/operation shall be written in sub-column 'V'
The agencies are codified as 1,2 & 3	
'1'	stands for (BHEL)
'1' *	means the operation shall be cleared by BHEL before the start of the next operation.
'2'	Stands for Vendor
'3'	stands for sub-Vendor of the Vendor and so on.
Example :	
Entry	'3' in column 'P' means test./inspection to be performed by sub-Vendor's QC
Entry	'2' in column 'W' means test./inspection to be witnessed by Vendor's QC
Entry	'1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL
Column11-	Remarks - Any special remarks shall be given here.

NOTES :

1. In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn by BHEL and all tests as per relevant specifications shall be carried out in their presence or in recognized Government Laboratory.
2. When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be preserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless otherwise agreed.
3. For castings and forgings integral test specimens shall be provided, When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise, if witnessing of test by BHEL is called for.
4. When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.
5. This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings specifications, the latter shall prevail.
6. Wherever inspection by BHELs Purchaser/Third Party/Statutory authorities are mandatory, this shall be complied with.
7. Inspection reports, log sheets, test reports/certificate. etc. shall be furnished to BHEL at the appropriate stages or at the time of final inspection, as required.
8. This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.
9. The quality plan shall be submitted in minimum 4 copies with a soft copy of the same or in line with contract requirements.

ANNEXURE-2 to Quality Plan

(LIST OF BHEL- PEM APPROVED GALVANIZERS)

SL. NO.	ITEM	VENDOR NAME	ADDRESS
1	Galvanising	Jenco Industrial Corporation	Chincholi Bunder Khkar Road Near Link Road Devruwadi Malad (W) Mumbai 400064
2	Galvanising	National Galvanizing Company	66, Barrackpore Kamarhatt Trunck Road Calcutta-700058
3	Galvanising	Sigma Galvanising Pvt. Ltd.	Plot No.C-169, TTC, MIDC Ind Area Navin Mumbai-400705
4	Galvanising	B.P. Projects PVT LTD	167A, Vivekananda Road Kolkata-700006
5	Galvanising	Standard Galvanisers	Makardah Road, Kabar Para, Bankra, Howarah -711403
6	Galvanising	Steel Products	National Highway No. 6, Chamrail, Kona, Howrah-711114
7	Galvanising	Unitech Fabricators & Engineers Pvt. Ltd.	Village- Ajab Nagar, P.O. -Molla Simlla, P.S. - Singur, Dist - Hoogly, Pin-712223
8	Galvanising	Shivam Engineers & Fabricators	A0-282-284, Industrial Area, South Side of G.T. Road, Ghaziabad, U.P.
9	Galvanising	B.G. Shirke Construction Technology Pvt. Ltd	72-76, Mundhawa, Pune - 401 036
10	Galvanising	Galbro Ispat Galvanizers Pvt. Ltd.	GUT 11 AND 12, OPP. Kudus Steel,Rolling Mill, Wada, Thane , Mumbai
11	Galvanising	Eros Metals	G-97, MIDC, Bhutibori , Nagpur
12	Galvanising	Industrial Perforation (India) Pvt. Ltd.	Ganganagr, Katakhal, Kolkata-700132
13	Galvanising	Indmark Formtech Pvt. Ltd.	Phase - 3, E - 11 / 1, M. I. D. C., Chakan, Pune - 410 501, Maharashtra, India.
14	Galvanising	Namdhari Industrial Traders Pvt. Ltd.	Village Latton Dana, Chandigarh Road, Ludhiana
15	Galvanising	Neha Galvaniser	Jalan Industrial Estate, Gate No-1, 1st Right Choise Lane, Near N.G-6, Jangalpur, PO Domjur Howrah - 700071, West Bengal, India
16	Galvanising	Patny Systems (P) Ltd.	Unit-IV, Sy No. -228/9, Plot No. 6, IP Kuchavaram, Toopran(M) Dist.- Medak, Telegana - 502336
17	Galvanising	Parmar Metal Company	Survey No.207,Veraval (Shapar) Dist. Rajkot, India.
18	Galvanising	Passive Infra Projects Pvt. Ltd	8th KM Stone, Sampla Kharkhoda Road, Hassangarh, Rohtak, Haryana
19	Galvanising	Rukmani Electrical & Fabricators Pvt. Ltd.	Urla Industrial Area, Urla Sarora Road, Raipur- 493 221 (Chhattisgarh)
			Shankharidaha Baniyarah, Jalan Industrial Complex, Gate no.3, Lane no. 4, Domjur, Howrah , W.B .- 71141
20	Galvanising	DMP Projects Pvt.Ltd.	Dulagarh Industrial Park , PS-Sankrail , Howrah -711302
21	Galvanising	Vinfab Engineers India Private Limited	Gut no. 224/1 &2 Bhiwandi Wada State Highway, Village khupri, Dist. Thane, Maharashtra -421303
22	Galvanising	Saral Projects & Processors	B-1, Industrial Area, Site-II, Amawan Road Rae Bareli
23	Galvanising	Jamna Metal Company	D - 1513, DSIDC, Narela Industrial Area Delhi - 110040, India
24	Galvanising	Brahampuri Steels Limited	172 (F) Industrial Area, Jhotwara, Jaipur-302013

NOTES:

1. ANY CHANGE IN THE ABOVE LIST SHALL BE INFORMED AT THE TIME OF SPECIFIC PROJECT REQUIREMENT AND NO COMMERCIAL IMPLICATION SHALL BE ALLOWED ON THIS ACCOUNT.

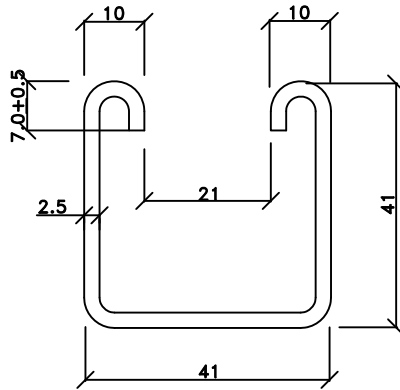
2. IT SHALL BE THE RESPONSIBILITY OF THE VENDOR TO GET THE MATERIAL GALVANIZED FROM THE ABOVE LIST WITHOUT ANY COMMERCIAL IMPLICATION TO BHEL.

INSTALLATION DETAILS FOR CABLE TRAY SUPPORT SYSTEM (BOLTABLE TYPE)

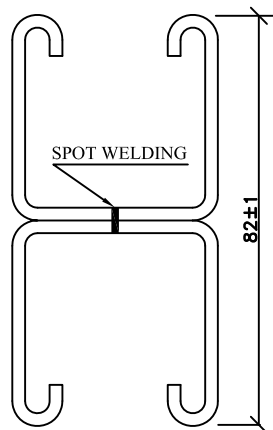
PROJECT	2X660MW ENNORE SEZ SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYKE OF NCTPS,CHENNAI		
	OWNER	TAMIL NADU GENERATION & DISTRIBUTION CORPORATION LIMITED	
	OWNER'S CONSULTANT	DESEIN PRIVATE LIMITED, DESEIN HOUSE,NEW DELHI	
	EPC CONTRACTOR	BHARAT HEAVY ELECTRICALS LIMITED POWER SECTOR PROJECT ENGINEERING MANAGEMENT NOIDA(U.P) INDIA	

REV	DATE	DRN	CHD	APPD	REV	DATE	DRN	CHD	APPD
02	01.04.15	AAT	SL	RG	01	13.02.15	AAT	SL	RG
DRAWING REVISED AS PER CUSTOMER COMMENT DT 27.03.15.					DRAWING REVISED AS PER CUSTOMER COMMENT DT 10.02.15.				

DOCUMENT TITLE: INSTALLATION DETAILS FOR CABLE TRAY SUPPORT SYSTEM(BOLTABLE TYPE)	DPT CODE-E		NAME	SIGN	DATE
		DRN	AAT	-SD-	11.12.14
		CHD	SL	-SD-	11.12.14
		APP	RG	-SD-	11.12.14
DOCUMENT NO: PE-DG-412-507-E006					
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SHT. 01 OF 19 REV. 02					



SINGLE CHANNEL C1



DOUBLE CHANNEL C2

TWO LENGTHS OF SINGLE CHANNEL

SPOT WELDED BACK TO BACK

AT 75MM C/C

NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. MATERIAL : HOT/ COLD ROLLED M.S. AS PER RELEVANT IS.
3. FINISH : HOT DIP GALVANISED AS PER IS 2629
4. TOLERANCE ON THICKNESS IS AS PER IS 1852
5. PROFILE TOLERANCE ± 0.5 mm

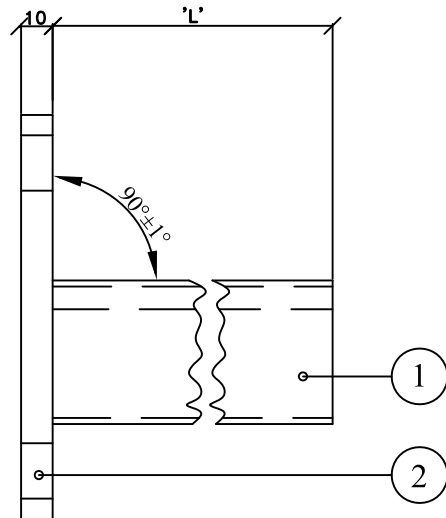
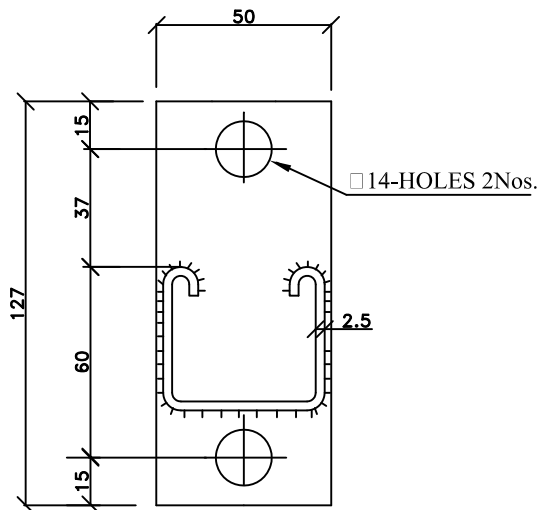


TITLE:

**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

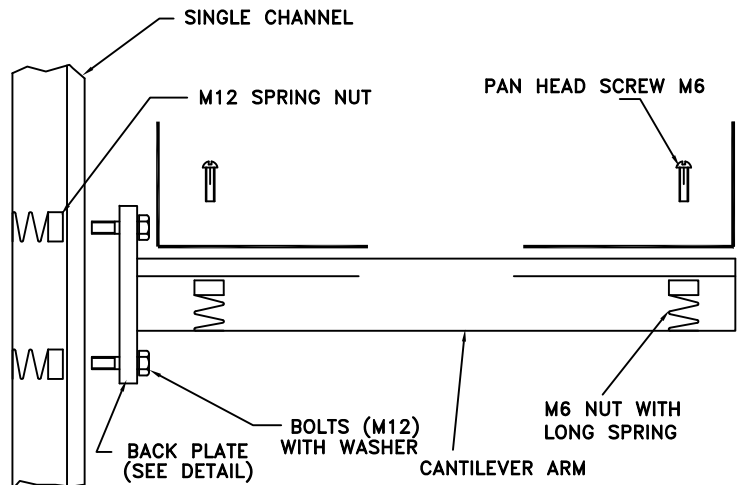
DRG. NO.

PE-DG-412-507-E006



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.

NOTES :

1. ALL DIMENSIONS ARE IN mm.
2. ITEM NO.1 MATERIAL : HOT/ COLD ROLLED M.S. AS PER RELEVANT IS.
3. ITEM NO.2 MATERIAL : M.S AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS IS AS PER IS:1852
5. ALL FABRICATION TOLERANCES ARE $\pm 1.0\text{mm}$



TITLE:

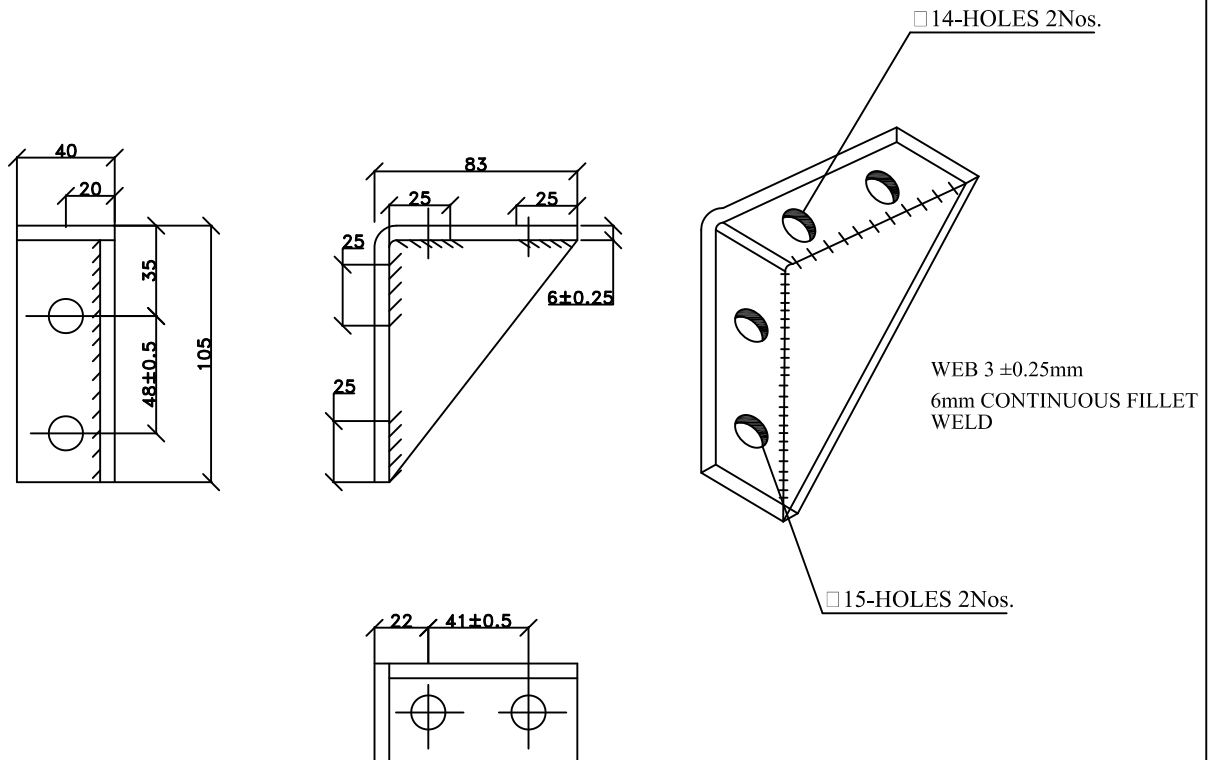
**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

DRG. NO.

PE-DG-412-507-E006

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90° ANGLE FITTING HL1

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

NOTES :

1. ALL DIMENSIONS ARE IN mm.
2. ALL FABRICATION TOLERANCES ± 1.0 mm
3. MATERIAL :MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS AS PER IS:1852



TITLE:

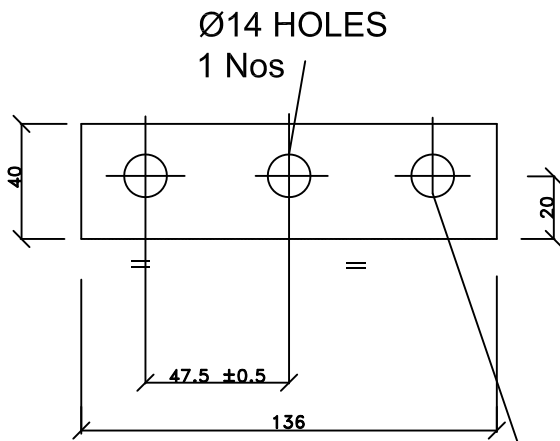
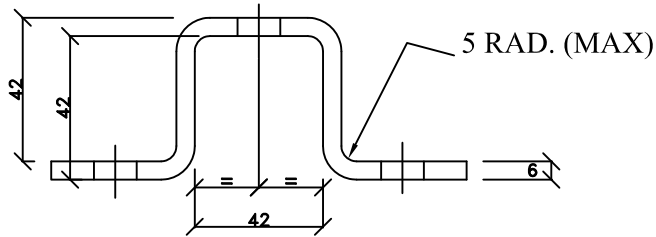
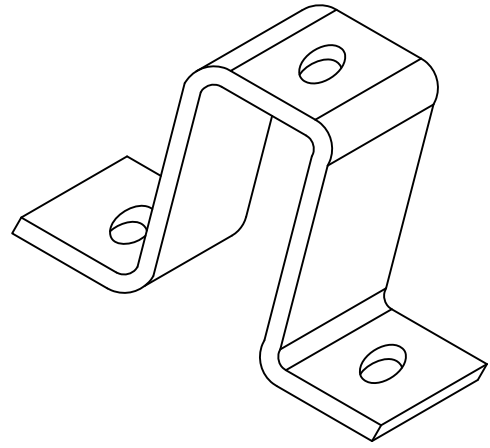
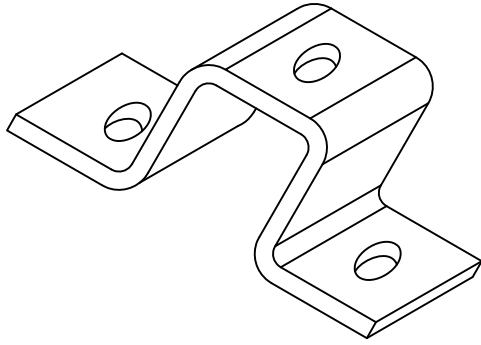
**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

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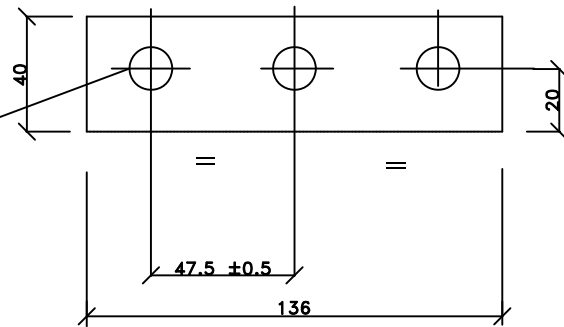
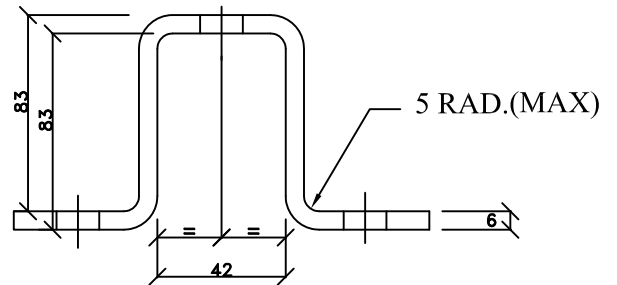
PE-DG-412-507-E006

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CLAMP FOR SINGLE CHANNEL CC1



CLAMP FOR DOUBLE CHANNEL CC2

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. ALL FABRICATION TOLERANCES ± 1.0 mm
3. MATERIAL :MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS AS PER IS:1852

**ANCHOR FASTENER-2Nos.
SPRING NUT & WASHER-1No.**



TITLE:

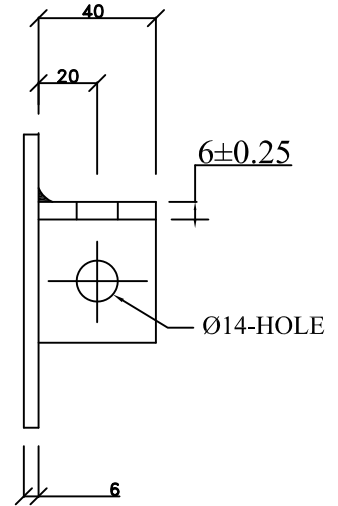
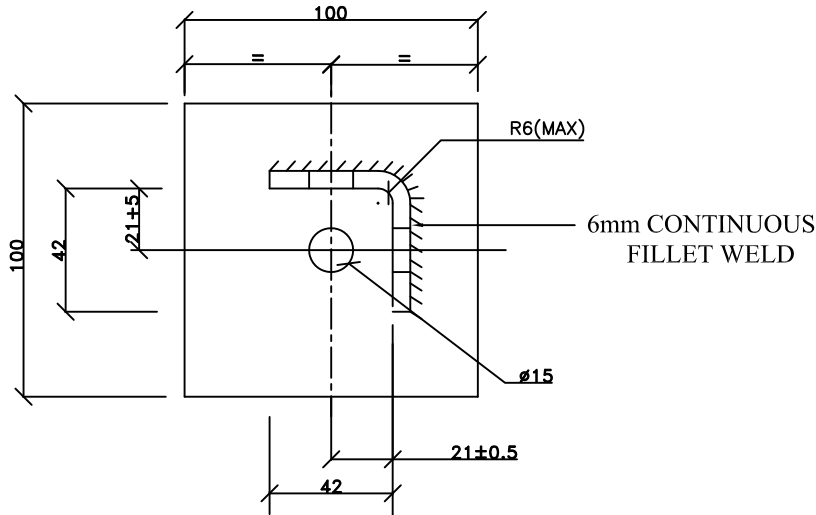
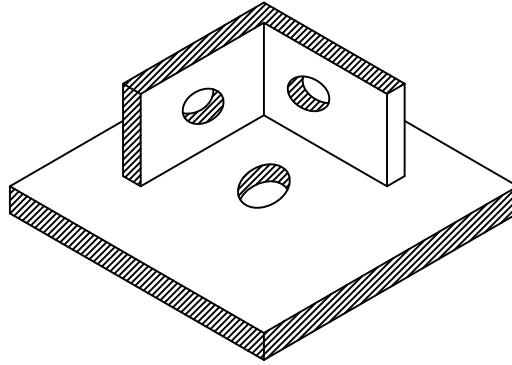
**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

DRG. NO.

PE-DG-412-507-E006

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BASE PLATE FOR SINGLE CHANNEL BP1

NOTE

1. ALL DIMENSIONS ARE IN MM.
2. ALL FABRICATION TOLERANCES $\pm 1.0\text{mm}$.
3. MATERIAL :MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS AS PER IS:1852

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



TITLE:

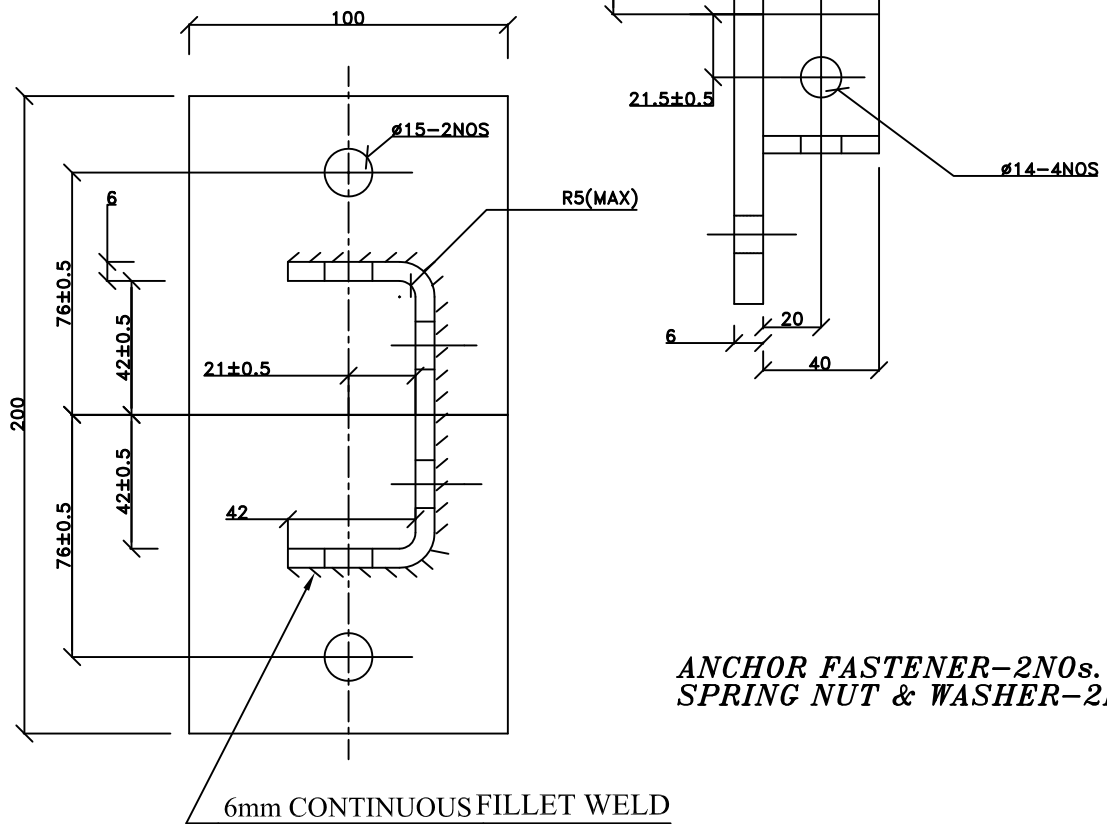
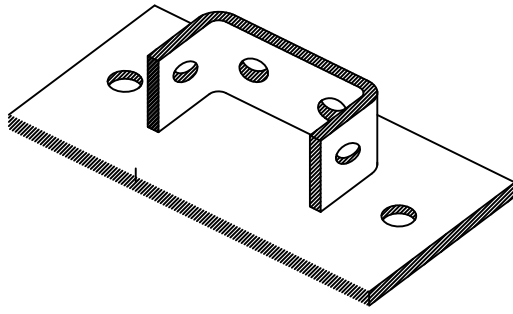
**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

DRG. NO.

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BASE PLATE FOR DOUBLE CHANNEL BP2

NOTES

1. ALL DIMENSIONS ARE IN MM
2. ALL FABRICATION TOLERANCES $\pm 1.0\text{mm}$
3. MATERIAL :MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS AS PER IS:1852



TITLE:

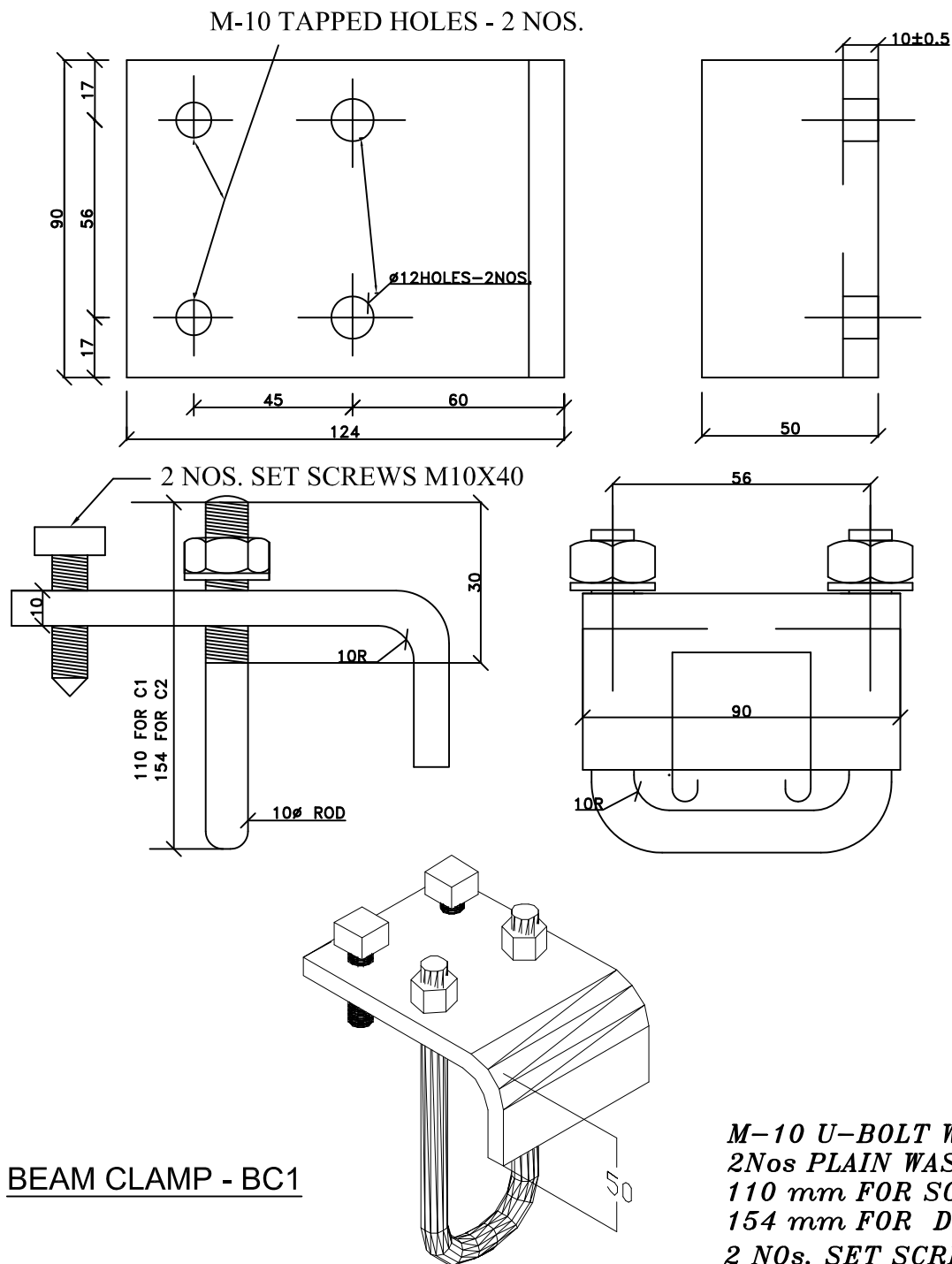
INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM

DRG. NO.

PE-DG-412-507-E006

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NOTES

1. ALL DIMENSIONS ARE IN mm.
2. ALL FABRICATION TOLERANCES $\pm 1.0\text{mm}$
3. MATERIAL :MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS AS PER IS:1852



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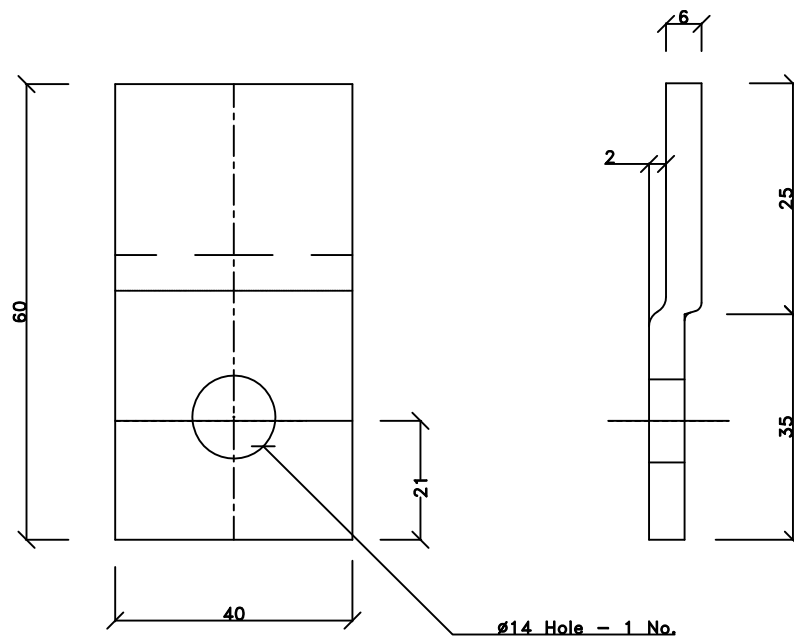
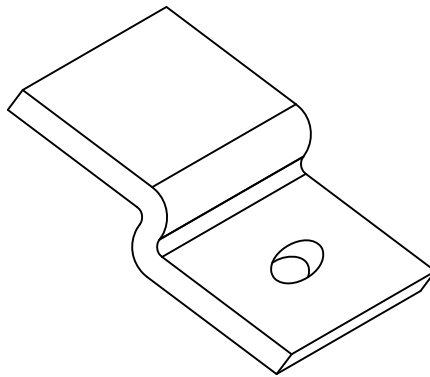
**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

BHEL DRAWING NO.

PE-DG-412-507-E006

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TRAY FIXING CLAMP - TC1

SPRING NUT & WASHER-1NO.

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. ALL FABRICATION TOLERANCES : $\pm 1.0\text{mm}$
3. MATERIAL : MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629
5. TOLERANCE ON THICKNESS AS PER IS:1852



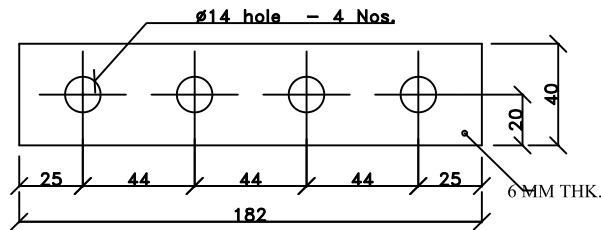
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**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

BHEL DRAWING NO.

PE-DG-412-507-E006

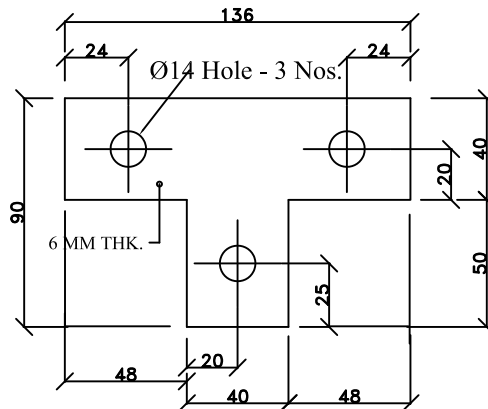
SH 9 OF 19

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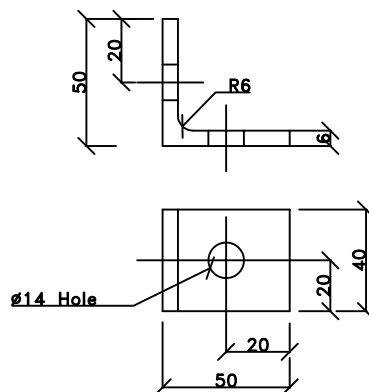
SPRING NUT & WASHER-4N0s.

FLAT PLATE STRAIGHT FITTING PF2



SPRING NUT & WASHER-3N0s.

FLAT PLATE TEE FITTING PF1



SPRING NUT & WASHER-2N0s.

90° ANGLE FITTING LA1

NOTES

1. ALL DIMENSIONS ARE IN mm.
2. ALL FABRICATION TOLERANCES ± 1.0 mm
3. MATERIAL :MILD STEEL AS PER IS-2062
4. FINISH : HOT DIP GALVANISED AS PER IS:2629



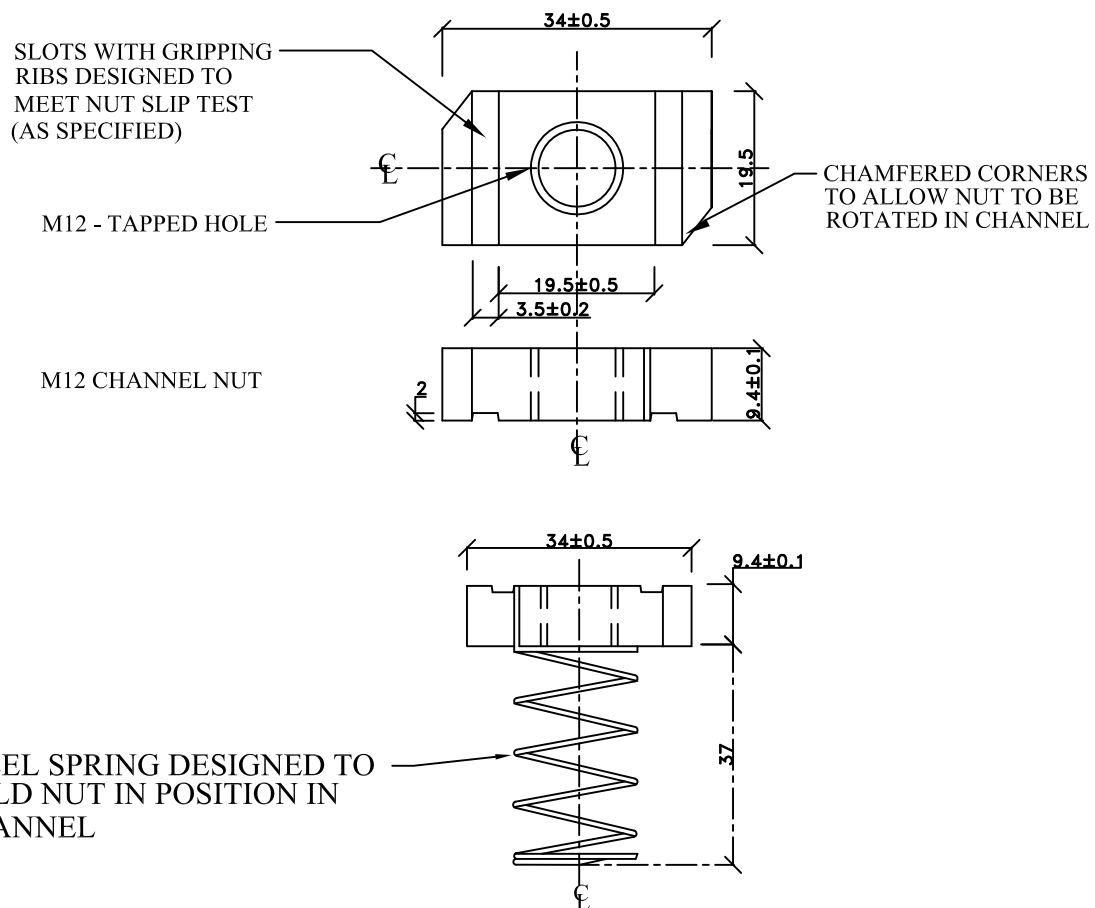
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**INSTALLATION DETAILS FOR
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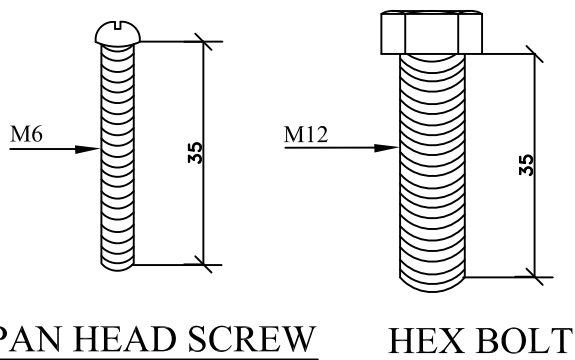
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PE-DG-412-507-E006

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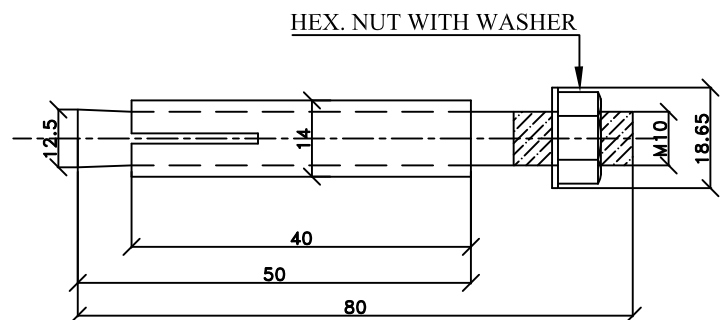


SPRING NUT ASSEMBLY



PAN HEAD SCREW

HEX BOLT



ANCHOR BOLT M10

NOTES:

1. MATERIAL - MS AS PER IS - 2062.
2. M6 CHANNEL NUT DIMENSIONAL SIMILAR TO M12.
EXCEPT HOLE DRILLED AND TAPPED TO M6 PAN HEAD SCREWS.
3. TAPPED HOLE THREADING TO MATCH WITH THREADING OF BOLTS.
4. SURFACE PROTECTION ELECTROGALVANISED / CADMIUM PLATED.
5. ALL DIMENSIONS ARE IN MM.



TITLE:

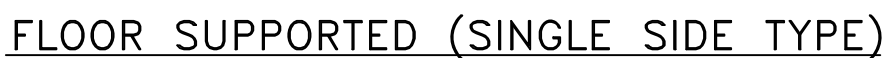
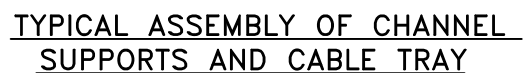
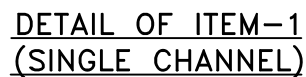
INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

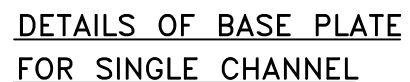
PE-DG-412-507-E006

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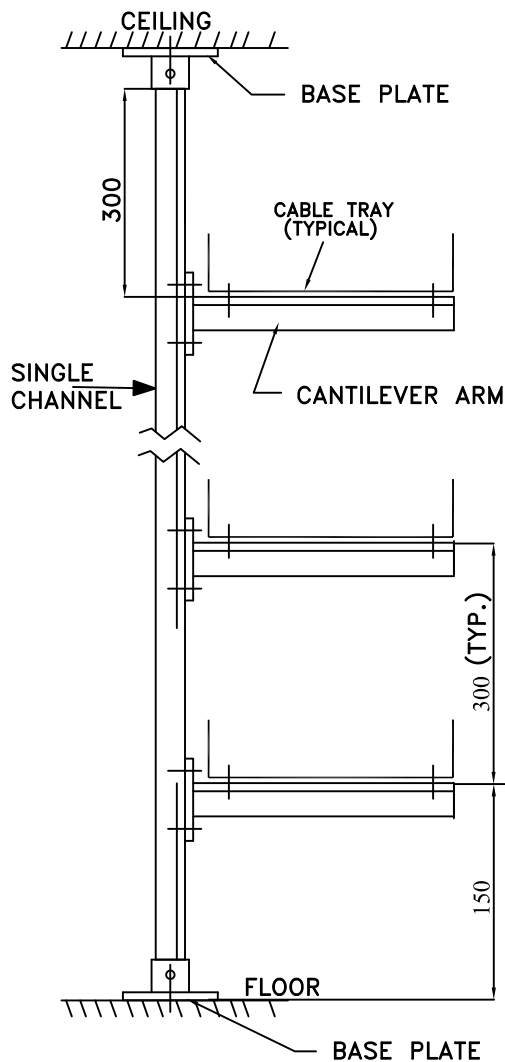


INSTALLATION DETAILS FOR CABLE TRAYS SUPPORT SYSTEM

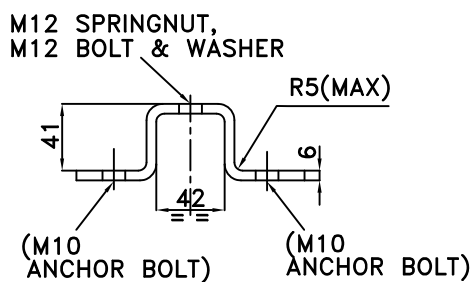


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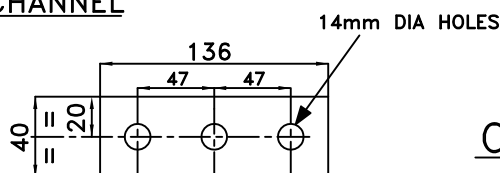
SH 12 OF 19



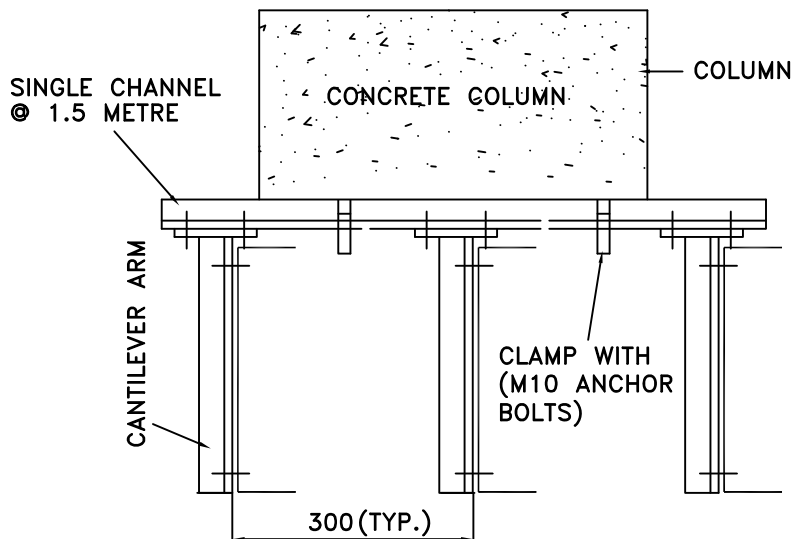
**SUPPORTING ARRANGEMENT
BETWEEN FLOOR AND CEILING
(SINGLE SIDE TYPE)**



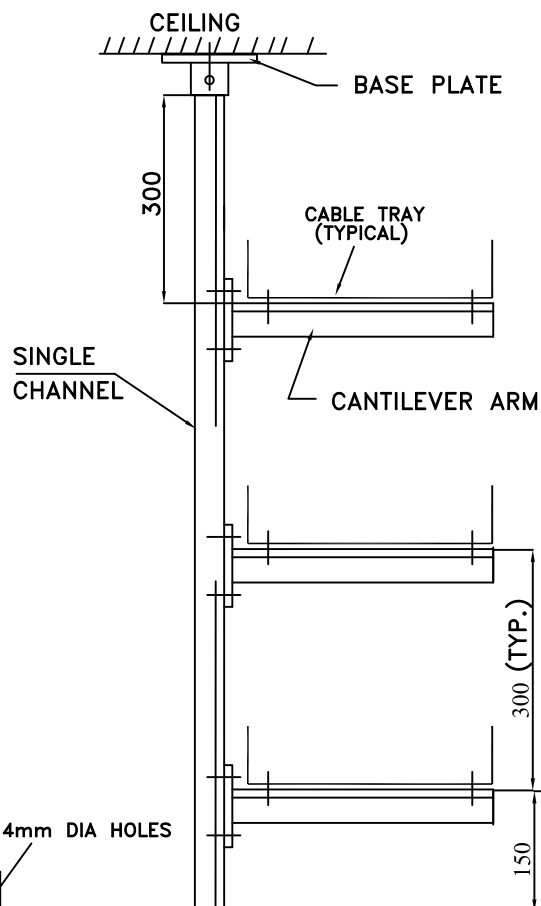
CLAMP FOR SINGLE CHANNEL



SEE GENERAL NOTES IN SHEET 15.



**SUPPORT ARRANGEMENT
FROM BUILDING COLUMN**



**CEILING SUPPORTED
(SINGLE SIDE TYPE)**



TITLE:

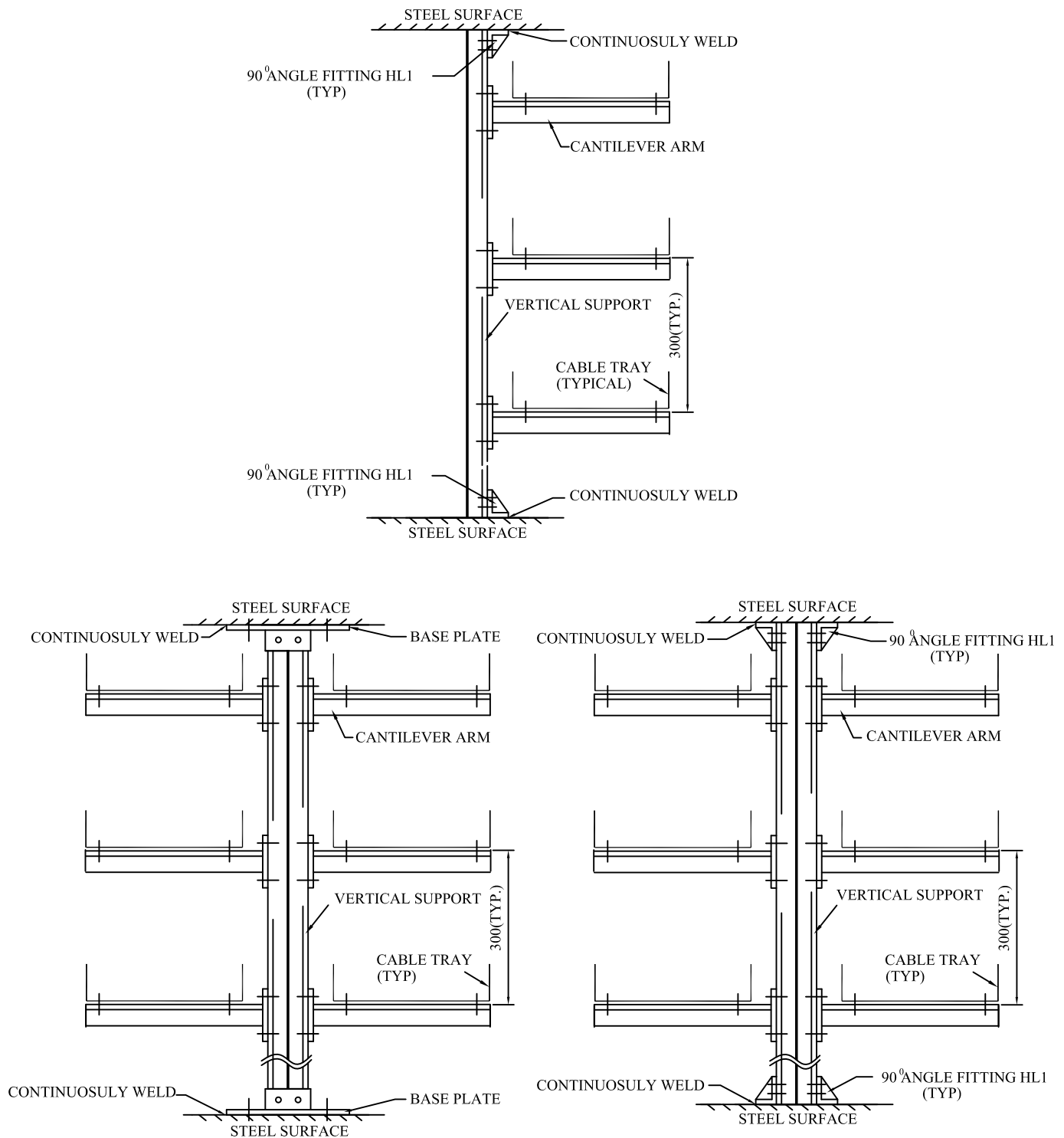
**INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM**

BHEL DRAWING NO.

PE-DG-412-507-E006

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

SEE GENERAL NOTES IN SHEET 15.



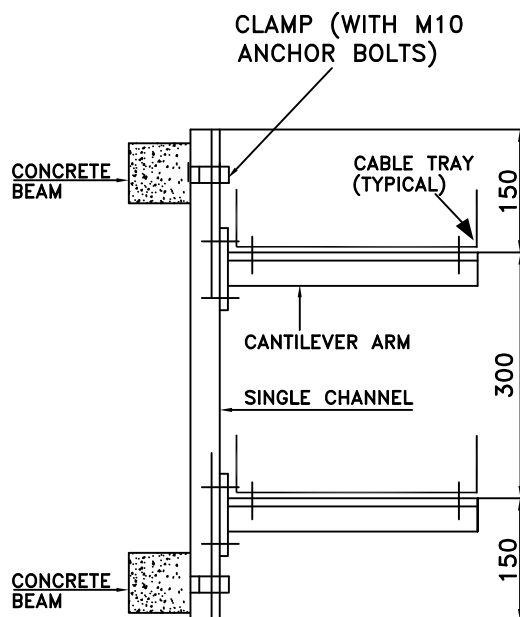
TITLE: INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

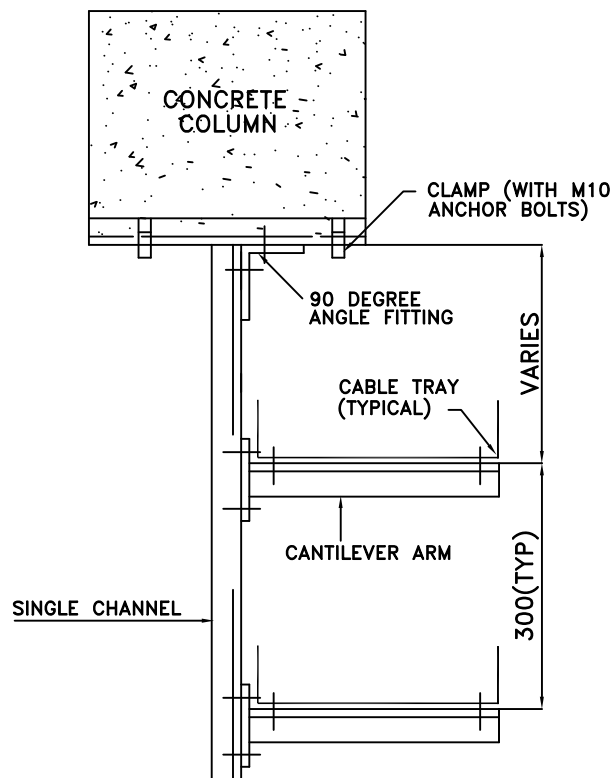
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SUPPORT ARRANGEMENT
FROM CONCRETE BEAMS



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

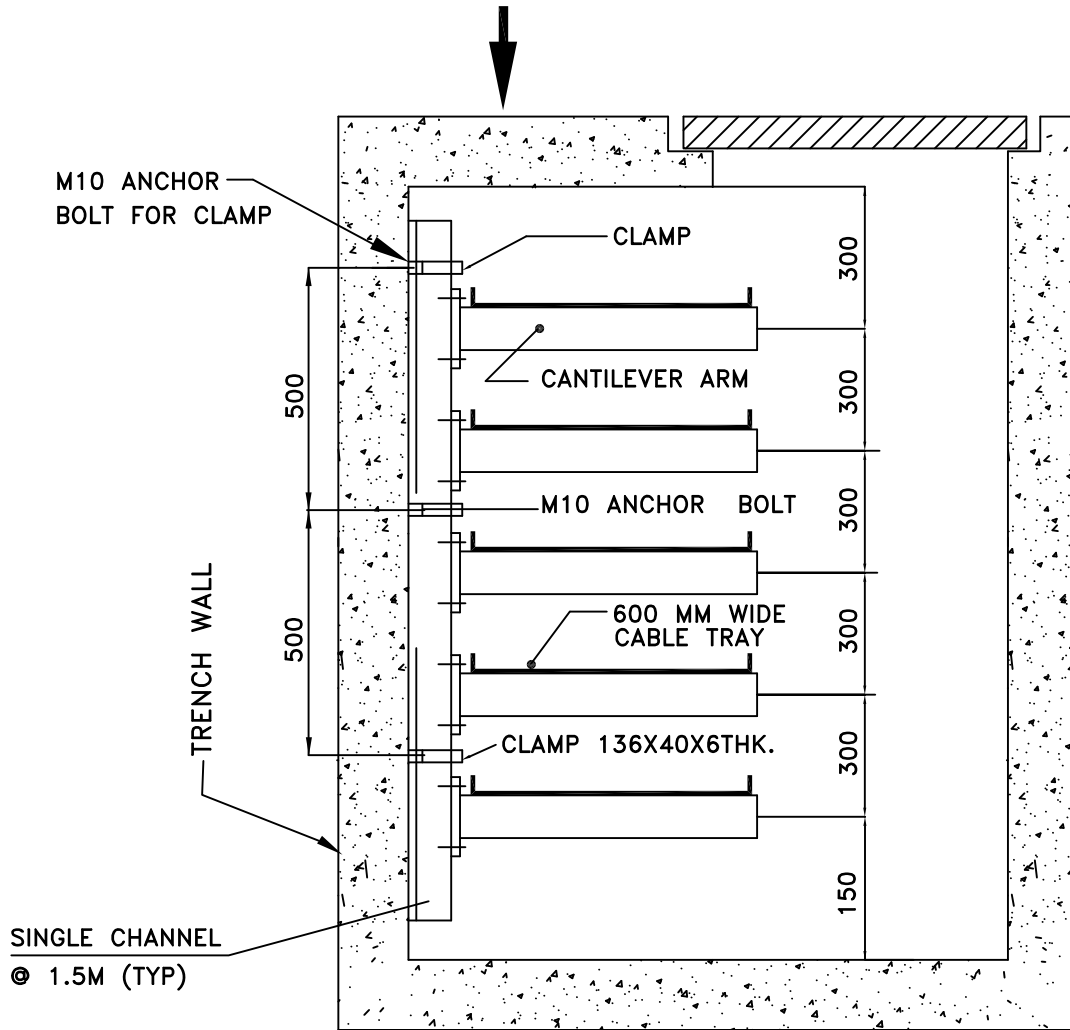
BHEL DRAWING NO.

PE-DG-412-507-E006

SH 15 OF 19

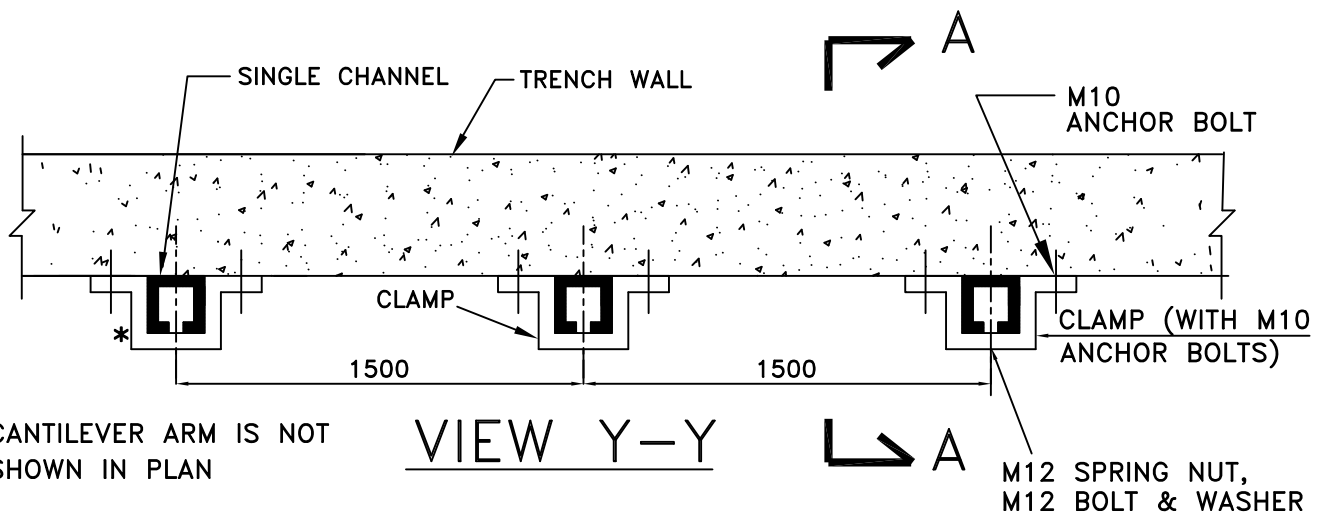
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VIEW Y-Y



SECTION-AA

TYP. CABLE TRAYS FIXING ARRANGEMENT IN TRENCH



*CANTILEVER ARM IS NOT SHOWN IN PLAN

SEE GENERAL NOTES IN SHEET 15.



TITLE:

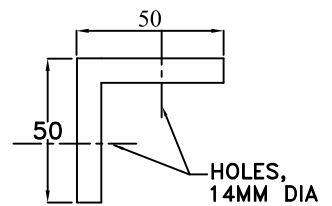
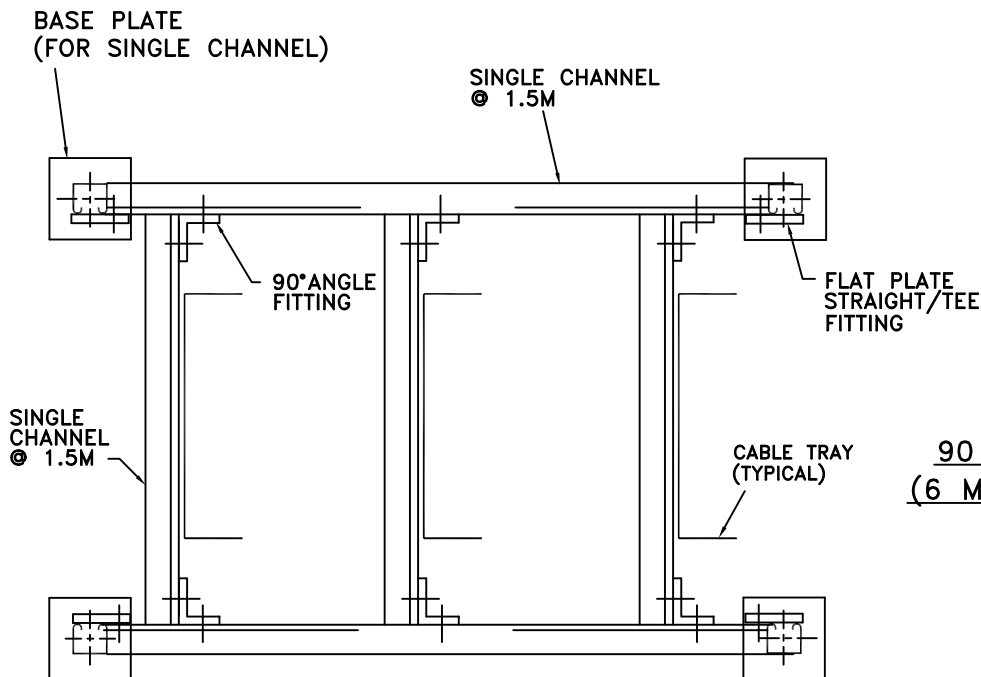
INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

PE-DG-412-507-E006

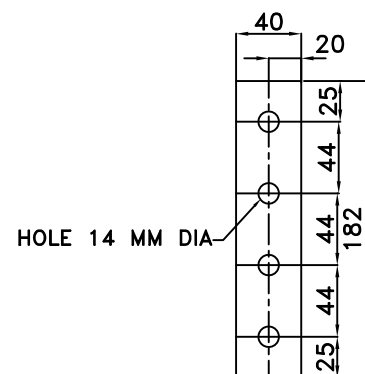
SH 16 OF 19

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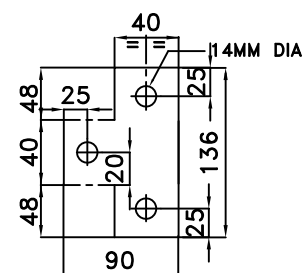
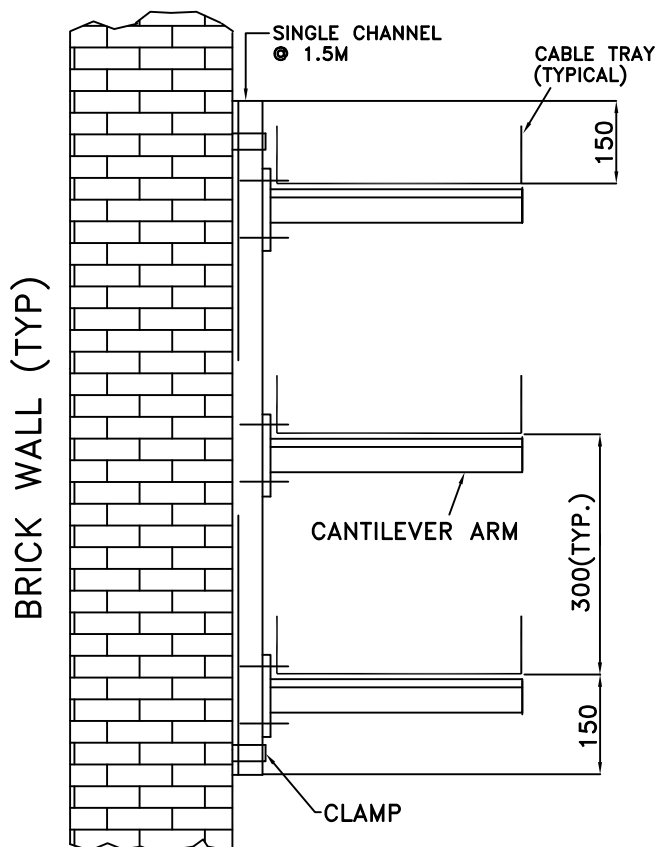


90 DEG. ANGLE FITTING
(6 MM THICK, 40 MM WIDE)

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



FLAT PLATE
STRAIGHT FITTING
(6 MM THICK)



FLAT PLATE TEE FITTING
(6 MM THICK)

TYPICAL CHANNEL SUPPORT
(ON WALL)

SEE GENERAL NOTES IN SHEET 15.



TITLE:

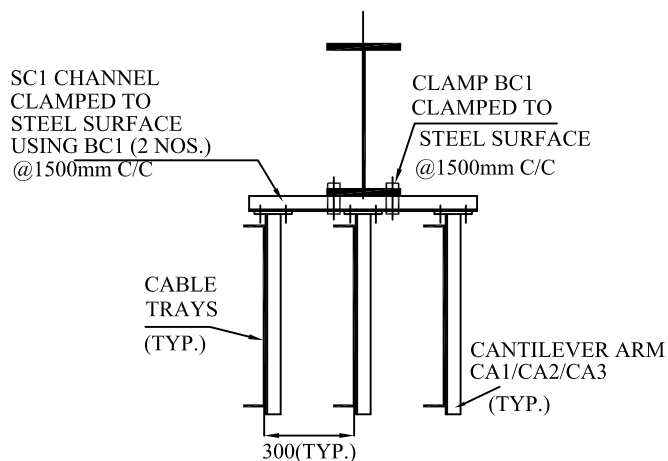
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CABLE TRAYS SUPPORT SYSTEM

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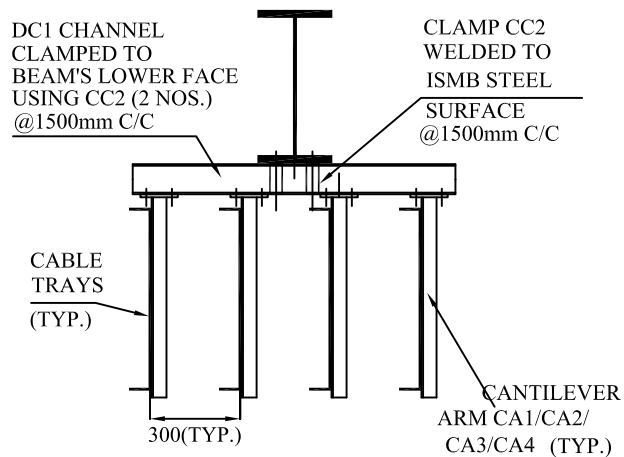
PE-DG-412-507-E006

SH 17 OF 19

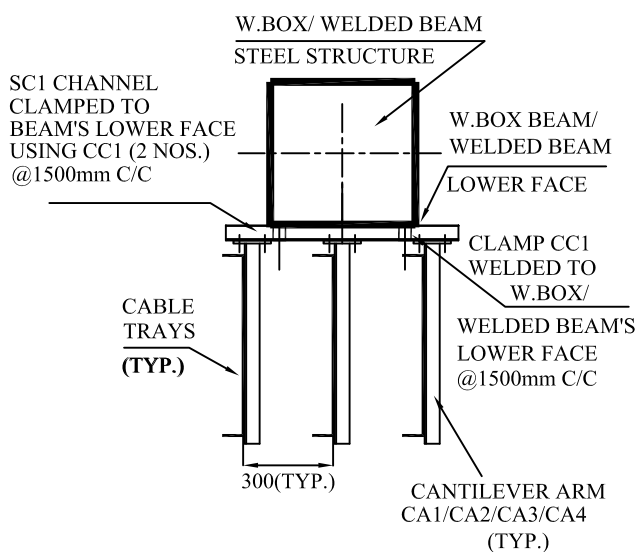
Page 32 of 39



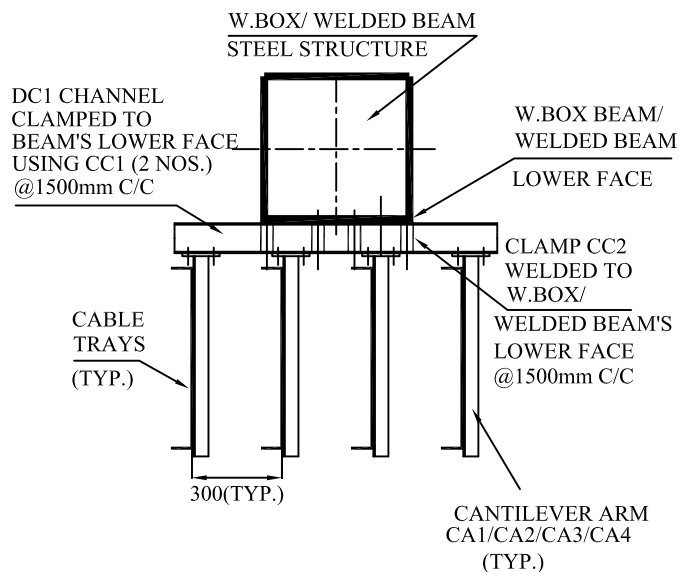
INSTALLATION DETAIL TYPE BB1:
(A)-CABLE TRAYS BELOW I-BEAMS
(UPTO & INCLUDING THREE TRAYS)



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



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



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

CABLE TRAYS SUPPORTING ARRANGEMENT AROUND BOILER PLATFORMS



TITLE:

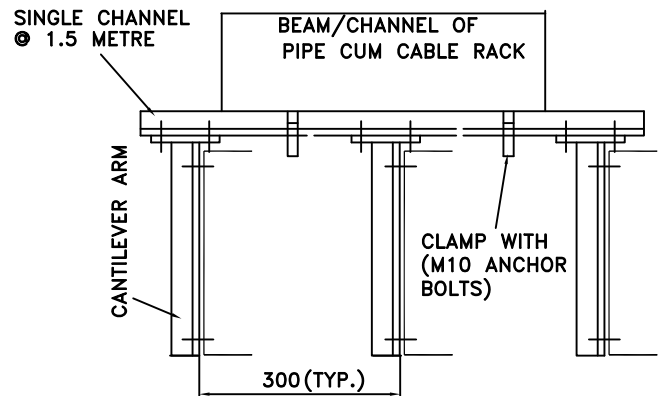
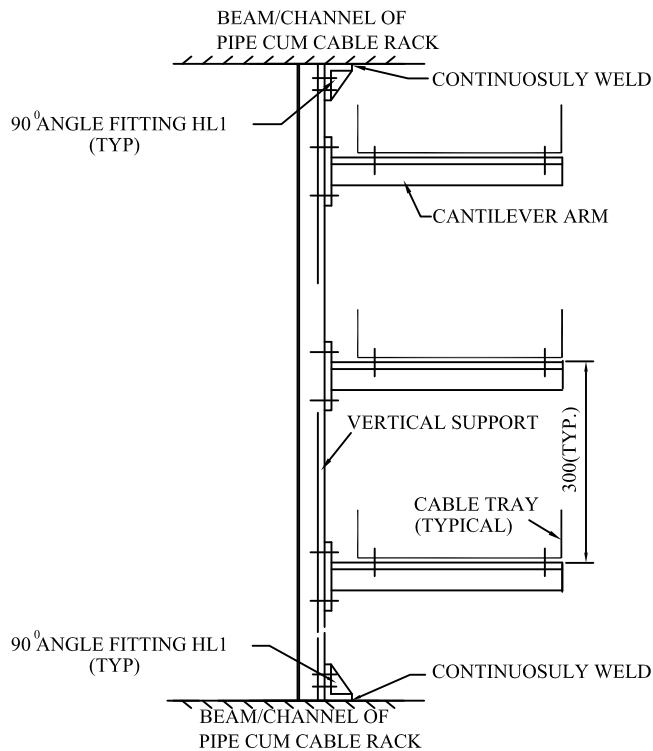
INSTALLATION DETAILS FOR
CABLE TRAYS SUPPORT SYSTEM

BHEL DRAWING NO.

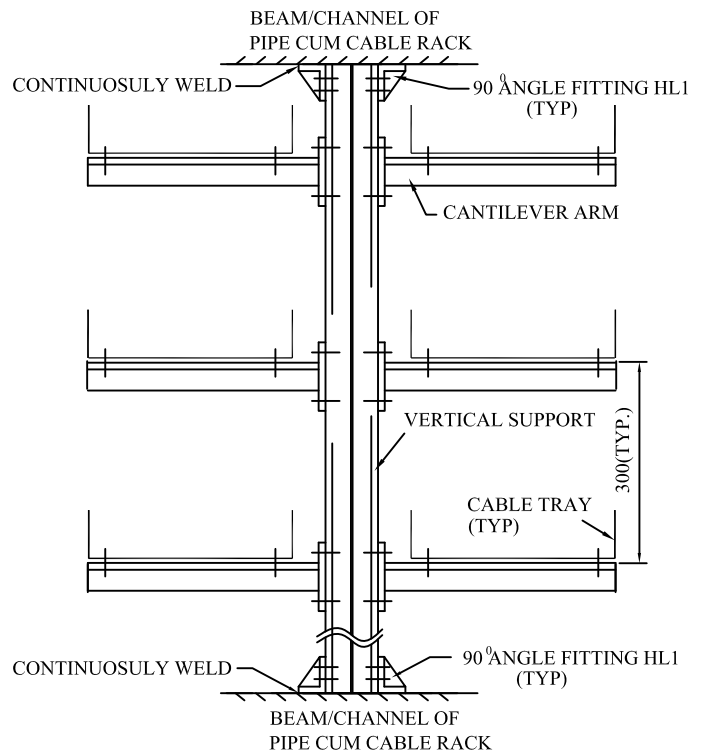
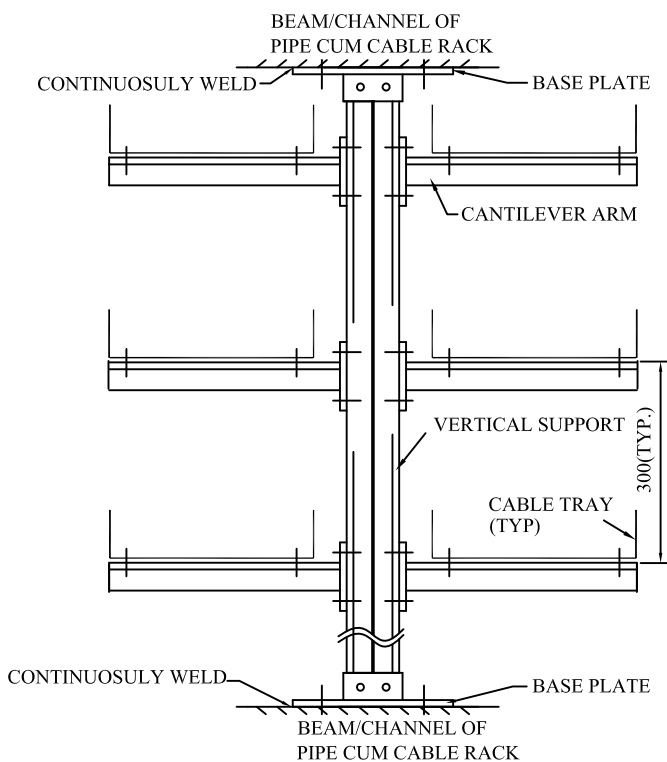
PE-DG-412-507-E006

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**SUPPORT ARRANGEMENT
FROM BUILDING COLUMN**



**TYPICAL CABLE TRAY ARRANGEMENT
OF PIPE/CABLE RACK IN THE
BOILER GRADE LEVEL AREA**

REV
02

SEE GENERAL NOTES IN SHEET 15.



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

BHEL DRAWING NO.

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	DOCUMENT TITLE TYPE TEST PROCEDURE FOR CABLE TRAY SUPPORT SYSTEM	SPECIFICATION NO. PE-TS-412-507-E013	
		VOLUME II B	
		SECTION - D	
		Rev. O	DATE: 26/10/2016
		SHEET 1	OF 5

ANNEXURE-IV

Type tests on Support System for Cable Trays

C1 shall be read as SC1 :- having provision of supporting cable trays on one side

C2 shall be read as DC1 :- having provision of supporting cable trays on both sides

LIST OF TESTS TO BE CONDUCTED

Type tests on Cable Trays support system

A) Test 1A:

On main support channel type-C2 for cantilever arms fixed on one side only. A 3.5 metre length of main support channel shall be fixed vertically at each end to a rigid structure as per appropriate fixing arrangement. Eight (8) nos. 750 mm cantilever arms shall be fixed to the main channel and each arm shall be loaded over the outboard 600 mm with a uniform working load of 100 kg. Subsequently a point load of 100 kg shall be applied on arm 2. A uniform proof load on all the arms equal to twice the working load shall be then be applied. Deflections shall be measured at the following load intervals and other necessary points:

- i) Working load
- ii) Working load + point load
- iii) Off load



DOCUMENT TITLE

TYPE TEST PROCEDURE FOR
CABLE TRAY SUPPORT SYSTEM

SPECIFICATION NO. PE-TS-412-507-E013

VOLUME II B

SECTION - D

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iv) Proof load + point load

v) Off load

The deflection measured at working loads shall not exceed 16 mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of proof load and point load applied.

B) Test 1B: Test 1A shall be repeated with Eight Cantilever arms uniformly loaded and with the same point load on arm 2

Test 2: On Main support channel type -C2 for cantilever arms fixed on both sides

a)Test 2A: A 3.5 m length of main support channel C2 for cantilever arms fixing on both sides shall be fixed at each end to rigid structure as per appropriate fixing arrangement. Six (6), 750 mm cantilever arms shall be attached to each sides and each arm uniformly loaded to a working load of 100 kg over the out board 600 mm. A point load of 100 kg shall than be applied to arm 2, followed by a uniform proof load of twice the working load on all the arms; deflection shall be measured at the following load intervals and other necessary points.

i) Working load

ii) Working load + Point load

iii) Off load

iv) Proof load + Point load

v) Off load

The deflection measured at working loads shall not exceed 16mm. The permanent deflection after removing the combination of working load and point load shall not exceed 10 mm at the arm tips and 6 mm on the channel. No collapse of the structure shall occur with a combination of



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proof load and point load applied

- b) Test 2B:** The test 2 A shall be repeated with the assembly but with an asymmetrical load on the C2 column and point load applied to arm 8. The 100 kg and 200 kg uniformly distributed loads shall be applied to the upper three arms on one side and the lower three arms on the opposite side.

Test 3: Tests on Channel Fixed on Beam/Floor

A length of main support channel section shall be fixed to steel structure/floor and have loads applied as detailed below and other important points not mentioned herein.

- a) Test 3A :** A length of steel structure shall be rigidly supported. It should be fitted on a metre length of channel section using beam clamps welded/bolted. A point load of 1200 kg shall be applied to the centre point via two brackets. No distortion or pulling of the components shall take place.
- b) Test 3B:** With the components assembled as in Test 3A, two perpendicular point loads of 600 kg shall be simultaneously applied at positions 150 mm either side of the centre line, no distortion or pulling of the components shall take place.
- c) Test 3C:** With the components assembled as in Test 3A, a perpendicular point load shall be applied at a point 150 mm on one side of the centre line.

The load shall be gradually increased to the maximum value that can be applied without causing distortion or pulling of the components. This value shall be recorded.

Test 4 Channel nut slip characteristics (what ever applicable)**Tests 4A1, 4A2, 4A3:**

A length of channel C1 section 200 mm long shall have fitted bracket with the two bolts fixing.



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With loads applied at the appropriate position nut slip shall be determined with bolt torque of 30 NM, 50 NM and 65 NM No fewer than three measurements shall be made or each torque setting.

A minimum loading of 720 kg shall be obtained before nut slip with bolt torque of 65 NM.

Tests 4B1, 4B2, 4B3:

The length of channel C1 section 200 mm long shall have fitted bracket with the one bolt fixing. With loads applied at the appropriate position, nut slip shall be determined with bolt torques of 30 NM, 50 NM and 65 NM. No fewer than three measurements shall be made for each torque setting.

A minimum loading of 350 kg shall be obtained before nut slip with a bolt torque of 65 NM

Test 5 Weld Integrity Test

After deflection test as per test 1A, 1B, 2, 3 & 4 weld integrity shall be checked by magnetic particle inspection to detect sub-surface cracks developed, if any.

Cable termination kit and straight through joints should have been tested as per IS: 13573 for 3.3kV and 11kV class.

Fire proof Cable Penetration system should have been tested for the following tests:

- a) Accelerated Ageing test
- b) Water absorption test
- c) Fire rating test
- d) Hose Stream test
- e) Vibration test followed by fire rating test

Routine/ Acceptance Tests

Following routine/acceptance tests shall be carried out on all the equipments, devices & materials supplied:

Galvanizing Tests



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The quality of galvanizing shall be inspected visually and shall be smooth, continuous, and free from flux stains.

- i) 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.
- ii) The quality of cadmium/zinc plating on items with screw threads shall be inspected visually and shall be free from visible defects such as unplated areas, blisters and modules.
- iii) In addition, the plating thickness shall be determined microscopically/chemically or electronically.

Welding

The quality of welding shall be visually inspected, particular attention being paid to the following points.

- 1) The welded joints shall be continuous along its length on both sides and of uniform width and thickness. It should be free from blow holes.
 - 2). The weld metal shall be properly fused with the parent metal without undercutting.
 - 3) The outside surface of the weld shall be clean. All slag shall have been removed. All welding shall be regularly checked for cracking using magnetic particle inspection or their equivalent technique.
1. Physical and dimensional checks for all items.
 2. All conduits/pipes, etc. shall be routine/acceptance tested as per relevant standards.
 3. All acceptance and routine tests on cable glands as for BS: 6121. Additionally Proof torque test shall be carried out as acceptance on each body group of cable glands.
 4. Deflection test cable trays.