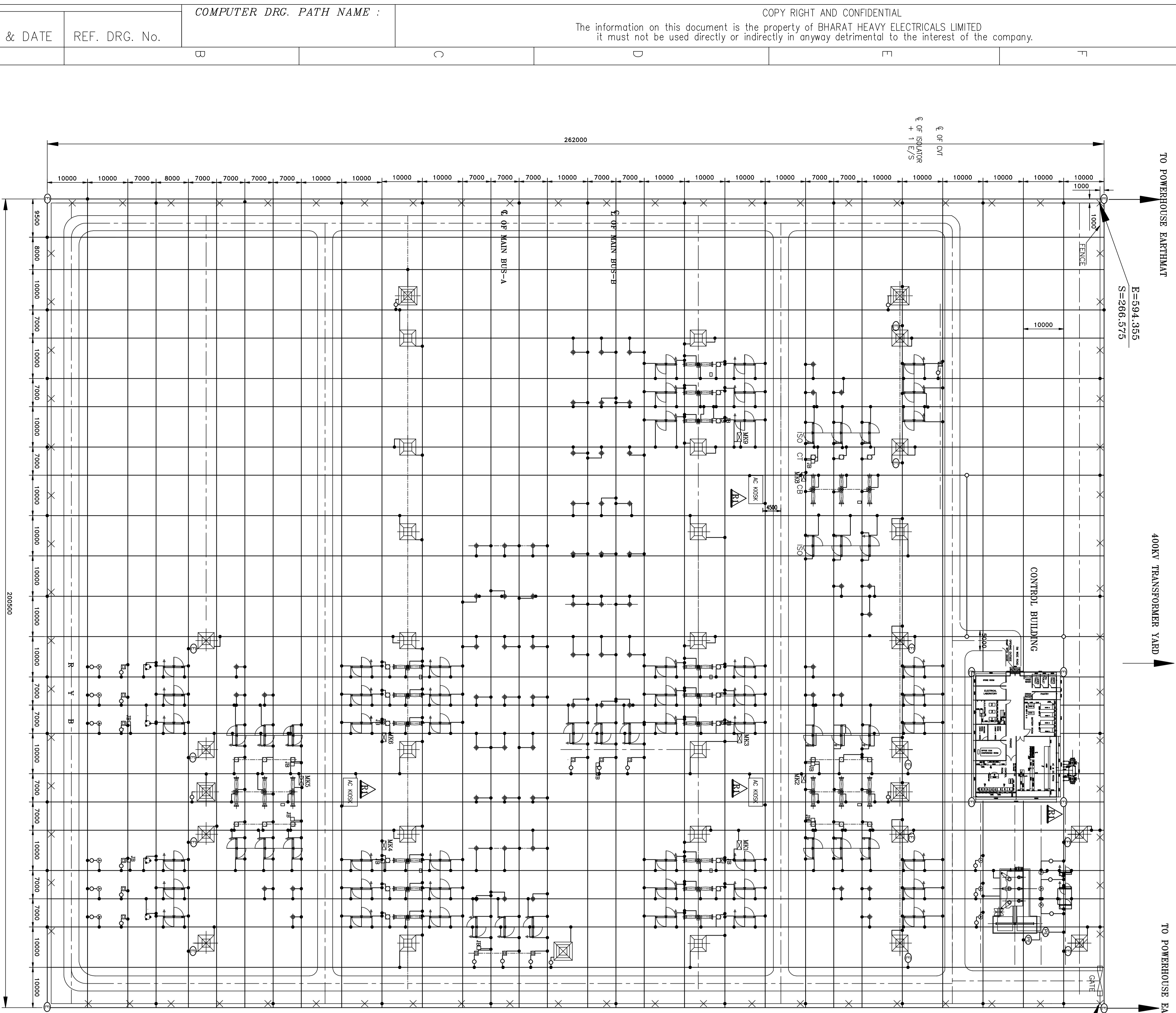


**ANNEXURE-4:**

LIST OF DRAWINGS/DOCUMENTS ENCLOSED WITH ETC BOQ

- 1) SINGLE LINE DIAGRAM
- 2) LAYOUT PLAN FOR 400KV SWITCHYARD
- 3) SECTIONAL ELEVATIONS-400KV SWITCHYARD
- 4) LAYOUT & SECTIONAL ELEVATIONS- 220KV SWITCHYARD
- 5) EQUIPMENT & STRUCTURE EARTHING DRAWING
- 6) EARTHMAT LAYOUT DRAWING
- 7) TRENCH LAYOUT DRAWING
- 8) CONTROL ROOM BUILDING DRAWING
- 9) CONTROL ROOM TRENCH LAYOUT.



**EARTHING NOTES:-**

- 1) ALL EQUIPMENTS AND STRUCTURES SHALL IN GENERAL, BE GROUNDED AT TWO POINTS AT OPPOSITE CORNERS WHETHER SHOWN IN DRAWING OR NOT.
- 2) ALL EARTHING DETAILS AS PER TYPICAL DETAIL & STRUCTURE EARTHING DRAWING NO. TB-4-344-509-013.
- 3) GROUNDING CONDUCTORS IN OUTDOOR AREAS SHALL BE BURIED 600MM BELOW FINISHED GROUND LEVEL.
- 4) WHEREVER A GROUNDING CONDUCTOR CROSSES ROADS, CABLE TRENCHES, UNDERGROUND SERVICE DUCTS, PIPE TUNNELS, RAILWAY TRACKS, OR RECOVERY TANK, TRANSFORMER SINK PIT ETC. SHALL BE LAID AT LEAST 300MM BELOW THEM, BUT NOT LESS THAN 600MM BELOW FOR OR SHALL BE REBUTTED ROUND THE EQUIPMENT/STRUCTURE FOUNDATIONS.
- 5) GROUNDING CONDUCTOR AROUND THE BUILDING SHALL BE BURIED IN GROUND AT A MINIMUM DISTANCE OF 2000MM FROM THE OUTER BOUNDARY OF THE BUILDING.
- 6) CONNECTION WITH EQUIPMENT EARTHING PAD SHALL BE BOLTED TYPE CONNECTION BETWEEN EQUIPMENT GROUNDING LEADS AND MAIN GROUND CONDUCTORS SHALL BE WELDED TYPE. FOR RUST PROTECTION, THE WELDS SHALL BE CLEANED WITH WIRE BRUSH, TREATED WITH RED PRIMER AND AFTERWARDS THICKLY COATED WITH BITUMEN COMPOUND TO PREVENT CORROSION.
- 7) ALL GROUND CONNECTIONS SHALL BE MADE BY ELECTRIC ARC WELDING. ALL WELDED JOINTS SHALL BE ALLOWED TO COOL DOWN GRADUALLY TO ATMOSPHERIC TEMPERATURE BEFORE COOL DOWN BEFORE APPLYING ANY LOAD ON THEM. ARTIFICIAL COOLING SHALL NOT BE ALLOWED.
- 8) BITUMEN COMPOUND TO BE APPLIED ON ALL WELDED JOINTS.
- 9) BENDING OF LARGE DIAMETER ROD/THICK CONDUCTOR SHALL BE DONE PREFERABLY BY GAS HEATING OR ANY OTHER APPROVED METHOD.
- 10) 500MM STEEL GI FLAT SHALL BE USED FOR EARTHING OF CABLE TRENCHES. ALL TRENCHES SHALL BE EARTHED AT AN INTERVAL OF 30M ALONG THE LENGTH OF THE TRENCH. RISERS SHALL BE PROVIDED FOR TRENCH EARTHING AT EVERY 30 M.
- 11) MAXIMUM SPACING OF HORIZONTAL GRID CONDUCTOR SHALL BE 10MTR. IN BOTH DIRECTION.
- 12) SWITCHYARD EARTHMAT GROUNDING CONDUCTOR SHALL BE CONNECTED TO TRANSFORMER YARD EARTHMAT GRID AT TWO POINTS.
- 13) SUITABLE CLAMP SHALL BE USED FOR CONNECTION OF SHEILD WIRE AND GS FLAT FOR PEAK TOWER AND SAME CLAMP SHALL WORK AS A TEST LINK FOR MEASUREMENT OF SHIELD WIRE RESISTANCE AND CONTINUITY.
- 14) EARTHING LAYOUT SHOWN IN THE DRAWING IS DIAGRAMMATIC ONLY. THE CONDUCTOR SPACING CAN BE CHANGED SLIGHTLY TO SUIT THE SITE CONDITIONS.
- 15) EARTHING STRIP SHALL BE LAID FLAT AND NOT ON EDGE.
- 16) ALL STEEL COLUMNS, METALLIC STAIRS ETC. SHALL BE CONNECTED TO THE NEAREST GROUNDING CONDUCTOR BY GROUNDING LEADS. ELECTRICAL CONTINUITY SHALL BE ENSURED BY BONING THE DIFFERENT SECTIONS OF HAND RAILS AND METALLIC STAIRS.
- 17) A SEPARATE GROUNDING CONDUCTOR SHALL BE PROVIDED FOR GROUNDING LIGHTING FITTURES, RECEPTACLES, SWITCHES, JUNCTION BOXES, LIGHTING CONDUITS, ETC.
- 18) WHEREVER GROUNDING CONDUCTOR GROSSES OR RUNS ALONG METALLIC STRUCTURES SUCH AS GAS/WATER/STEAM CONDUIT/PIPES ETC. AND STEEL REINFORCEMENT OF CONCRETE, IT SHALL BE BONDED TO THE SAME.
- 19) EVERY ALTERNATE POST OF FENCE SHALL BE CONNECTED TO EARTH MAT THROUGH RISERS.
- 20) SURGE ARRESTERS REJECTED IN 400KV TRANSFORMER YARD SHALL BE CONNECTED TO TRANSFORMER YARD EARTHMAT GRID.
- 21) EARTHING CONDUCTOR SHALL BE COVERED ON ALL SIDES BY A LAYER OF GOOD SOIL, FREE FROM ROCKS, STONES, LOGS AND THEN FILLED UP.
- 22) LOCATION OF ROD ELECTRODES WITH TEST LINK, PIPE ELECTRODES WITH TREATED EARTH PIT & ROD ELECTRODES SIMPLY BURIED ARE SHOWN TENTATIVELY. ELECTRODES FOR TRANSFORMER NEUTRALS SHALL BE LOCATED NEAREST TO RESPECTIVE EQUIPMENT
- 23) EACH RISER SHALL PROJECT UP TO GRAVEL LEVEL OF SUB STATION.
- 24) WHEREVER THE EARTH CONDUCTOR PASSES THROUGH WALL, IT SHALL TAKEN DIRECTLY THROUGH WALL, WITHOUT INSERTS.
- 25) EARTHMAT SHALL BE LAID PREFERABLY AFTER COMPLETION OF FOUNDATIONS AND BEFORE CASTING OF TRENCHES.
- 26) THE EARTHMAT SHALL BE CONSTRUCTED AFTER THE BRIBAL OF ELECTRODE.
- 27) FOR BORING THE ELECTRODES A PIT SHALL BE DUG UP, ELECTRODE LOCATED AND FILLED WITH ALTERNATE LAYER OF SALT AND CHARCOAL.

TABLE 1 : EARTHING DETAILS

S/N	DESCRIPTION	CONDUCTOR
1	EARTHING FOR EQUIPMENT	75X12 MM GI FLAT
2	EARTHING FOR EQUIPMENT STRUCTURE	75X12 MM GI FLAT
3	TOWERS & LM STRUCTURE	75X12 MM GI FLAT
4	CABLE TRENCH MATERIAL	50X6 MM GI FLAT
5	INDOOR PANELS AND BOARDS	25X3 MM GI FLAT
6	OUTDOOR MK, JB, CONTROL CABINET	50X6 MM GI FLAT
7	OUTDOOR MK, JB, LIGHTING PANEL, CONTROL CABINET, OPERATING MECHANISM BOX	50X6 MM GI FLAT
8	RISERS AND EARTHMAT (BELOW GROUND)	40 MM DIA MS ROD

TABLE 2 : BILL OF QUANTITY FOR EARTH ELECTRODES

S/N	DESCRIPTION	EQUIPMENTS	QUANTITY
1	ROD ELECTRODE WITHOUT TEST LINK	LIGHTNING ARRESTERS	15 NOS.
2	ROD ELECTRODE WITHOUT TEST LINK	CAPACITIVE VOLTAGE TRANSFORMER	13 NOS.
3	ROD ELECTRODE WITH TEST LINK	CORNERS OF EARTHMAT	4 NOS.
4	ROD ELECTRODE WITH TEST LINK	PERIPHERY OF CONTROL ROOM	4 NOS.
5	ROD ELECTRODE WITH TEST LINK	TOWER WITH PEAK	12 NOS.
6	PIPE ELECTRODE WITH TEST LINK AND TREATED PIT	TRANSFORMERS	6 NOS.
7	ROD ELECTRODE WITHOUT TEST LINK	LIGHTNING MAST	5 NOS.

**LEGEND:-**

- EARTHMAT CONDUCTOR SIZE 40MM DIA MS ROD.
- ROD ELECTRODES WITH TEST LINK
- ROD ELECTRODES WITHOUT TEST LINK
- PIPE ELECTRODES WITH TREATED EARTH PIT
- RISER LOCATION (INDICATIVE)
- FENCE

REF DRAWINGS : -  
 LAYOUT PLAN OF 400KV SWITCHYARD- TB-0-344-316-403 REV.00  
 DESIGN CALCULATION FOR EARTHMAT- TB-344-509-406 REV.00  
 EQUIPMENT EARTHING DRAWING- TB-4-344-509-013 REV.00

REV.	DATE	ALTERED	ZONE
CHECKED			
APPROVED			

**APGENCO**  
 400/220 KV SWITCHYARD-  
 RAYASEEMA T.P. PLANT STAGE-IV, UNIT#6 (1X600MW)

**CONSULTANT:**  
 Desein Consulting Engineers

**STATUS OF DRAWING**  
 CONTRACT

**DISTRIBUTION OF PRINTS**  
 APGENCO - 7  
 PEM - 1  
 DESBIN - 5

**ADDITIONAL INFORMATION**  
 W.O.NO. 80012

**NAME OF CUSTOMER/PROJECT**  
 RAYASEEMA T.P. PLANT STAGE-IV, UNIT#6 (1X600MW)

**DEPT.**  
 422

**SCALE**  
 1:450

**DATE**  
 26.06.12

**DESIGNER**  
 DKM

**CHECKED**  
 RS

**DATE**  
 26.06.12

REV.	DATE	ALTERED	ZONE
CHECKED			
APPROVED			

**APGENCO**  
 400/220 KV SWITCHYARD-  
 RAYASEEMA T.P. PLANT STAGE-IV, UNIT#6 (1X600MW)

**CONSULTANT:**  
 Desein Consulting Engineers

**STATUS OF DRAWING**  
 CONTRACT

**DISTRIBUTION OF PRINTS**  
 APGENCO - 7  
 PEM - 1  
 DESBIN - 5

**ADDITIONAL INFORMATION**  
 W.O.NO. 80012

**NAME OF CUSTOMER/PROJECT**  
 RAYASEEMA T.P. PLANT STAGE-IV, UNIT#6 (1X600MW)

**DEPT.**  
 422

**SCALE**  
 1:450

**DATE**  
 26.06.12

**DESIGNER**  
 DKM

**CHECKED**  
 RS

**DATE**  
 26.06.12

REV.	DATE	ALTERED	ZONE
CHECKED			
APPROVED			

**APGENCO**  
 400/220 KV SWITCHYARD-  
 RAYASEEMA T.P. PLANT STAGE-IV, UNIT#6 (1X600MW)

**CONSULTANT:**  
 Desein Consulting Engineers

**STATUS OF DRAWING**  
 CONTRACT

**DISTRIBUTION OF PRINTS**  
 APGENCO - 7  
 PEM - 1  
 DESBIN - 5

**ADDITIONAL INFORMATION**  
 W.O.NO. 80012

**NAME OF CUSTOMER/PROJECT**  
 RAYASEEMA T.P. PLANT STAGE-IV, UNIT#6 (1X600MW)

**DEPT.**  
 422

**SCALE**  
 1:450

**DATE**  
 26.06.12

**DESIGNER**  
 DKM

**CHECKED**  
 RS

**DATE**  
 26.06.12

INVENTORY No. SIGN. & DATE REF. DRG. No. COMPUTER DRG. PATH NAME :

COPY RIGHT AND CONFIDENTIAL  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED  
 it must not be used directly or indirectly in anyway detrimental to the interest of the company.







FIRST ANGLE PROJECTION ( ALL DIMENSIONS ARE IN MM. )

DRAWING No. TB-2-344-316-410

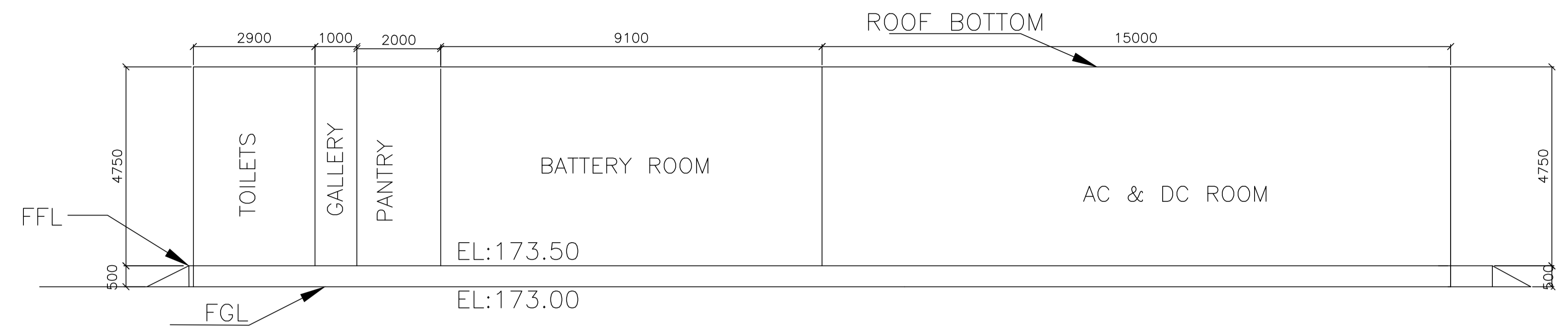
COPY RIGHT AND CONFIDENTIAL  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED  
it must not be used directly or indirectly in anyway detrimental to the interest of the company.

COMPUTER DRG. PATH NAME :

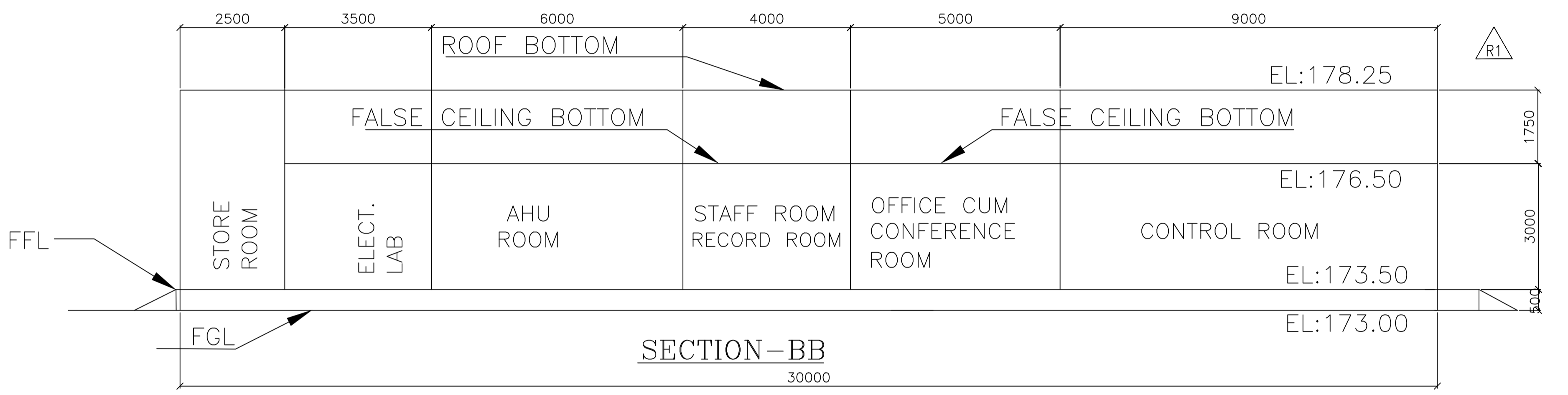
REF. DRG. No.

SIGN. & DATE

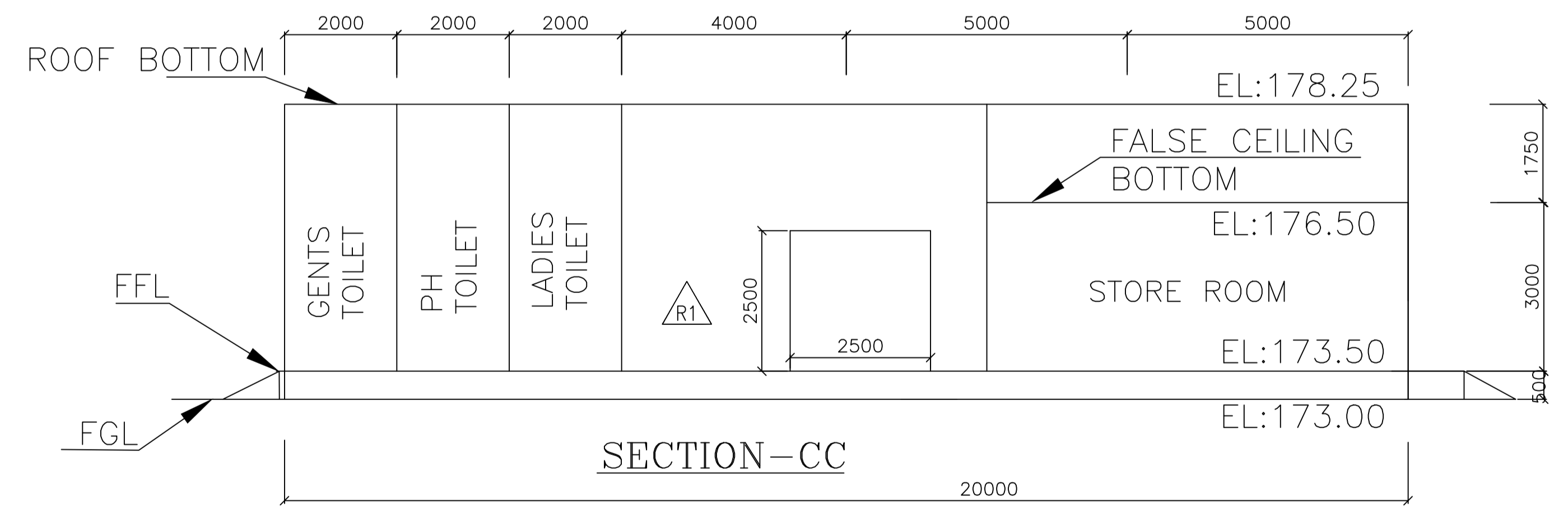
INVENTORY No.



SECTION-AA




SECTION-BB



SECTION-CC

NOTES:-

1. ALL DIMENSION ARE IN mm.
2. CONTROL ROOM, STAFF ROOM, RECORD ROOM, ELECTRICAL LABORATORY, OFFICE CUM CONFERENCE ROOM SHALL BE AIRCONDITIONED. OTHER PARTS OF BUILDING SHALL BE NON AIRCONDITIONED.
3. THE DIMENSION AND ARRANGEMENT OF PANELS INSIDE CONTROL ROOM BUILDING ARE INDICATIVE AND SHALL BE FINALISED DURING DETAILED ENGINEERING.
4. ACDB ROOM, BATTERY ROOM, PANTRY AND TOILETS SHALL BE PROVIDED WITH EXHAUST AIR FANS. OFFICE CUM CONFERENCE ROOM, STAFF ROOM & RECORD ROOM SHALL BE PROVIDED WITH WALL MOUNTED FAN.
5. ALL ROOM EXCEPT AHU ROOM SHALL BE PROVIDED WITH WINDOW.
6. ALL THE DIMENSIONS OF THE ROOMS ARE INNER DIMENSIONS.
7. SEPARATE DRAWING SHALL BE SUBMITTED FOR DETAILED ARCHITECTURE AND TRENCH LAYOUT OF CONTROL ROOM BUILDING.
8. PROTECTION/BAY CONTROL PANELS AND PLCC PANELS WILL BE LOCATED IN OUTDOOR SWITCHYARD AC KIOSK.
9. ALUMINIUM GLAZED WINDOW SHALL BE PROVIDED IN CONTROL ROOM TO HAVE A CLEAR VIEW OF SWITCHYARD EQUIPMENTS.

ADDITIONAL INFORMATION W.O.No. 80012		ग्राहक/परियोजना का नाम NAME OF CUSTOMER/PROJECT		APGENCO 400/220 KV SWITCHYARD- RAYALSEEMA T.P.STN. STAGE-IV, UNIT#6 (1X600MW)		
STATUS OF DRAWING CONTRACT		CONSULTANT: Desein Consulting Engineers				
DISTRIBUTION OF PRINTS APGENCO - 3 CE(O&M), RTPP - 3 DESEIN - 5		 भारत हेवी इलेक्ट्रिकल्स लिमिटेड दूरसंचालन परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION		नाम./NAME RK/NK	हस्ता./SIGN. -SD-	दि./DATE 14.06.12
REV. 01	DATE 22.08.12	ALTERED CHECKED APPROVED	RK/NK DKM RS	विभाग DEPT. TBEW	अनुपात / SCALE 1:500	कार्ड कोड CARD CODE 422
ZONE DRAWING REVISED AS PER M/s DESEIN COMMENTS VIDE THEIR LETTER REF. No. 523 DATED 14.06.12		ZONE शीर्षक/TITLE 400KV SWITCHYARD CONTROL ROOM BUILDING SECTIONS		डाईंग.क./DRAWING NO. TB-1-344-316-410		पुनः/REV. 01
				पृष्ठ क्र./SHEET No. 2		अगला पृष्ठ/NEXT SHEET -



# GENERAL INSTRUCTION FOR EARTHING:

1. EARTH STRIP & EARTH WIRE SHALL BE CLEATED TO LATTICE TYPE STRUCTURE AT AN INTERVAL OF 1 M & 2 RESPECTIVELY.
2. ALL EARTH STRIPS SHALL BE TAKEN FLAT ALONG EDGE OF STRUCTURE.
3. MAXIMUM OF TWO EARTHING STRIP SHALL BE CONNECTED TO ONE RISER.
4. ALL EARTHING SHALL BE DONE IN ACCORDANCE WITH IS:3034 UNLESS OTHERWISE STATED IN TECHNICAL SPECIFICATION
6. EACH RISER OF A PARTICULAR EQUIPMENT SHALL BE CONNECTED TO A DIFFERENT EARTH ROD (EITHER HORIZONTAL OR VERTICAL EARTH ROD)
7. ALL EQUIPMENT & STRUCTURES SHALL BE EARTHED AT TWO POINTS WITH 75X12 MM GS FLAT.
8. ALL JUNCTION BOXES, OPERATING MOM BOXES, MKs, PANELS, CABINETS SHALL BE EARTHED AT TWO POINTS WITH 50X6 MM GS FLAT.
9. ALL WELDING JOINTS BETWEEN MS ROD & GS FLAT SHALL BE BELOW GRAVEL LEVEL.
9. GRAVEL LEVEL IS 100 MM ABOVE GROUND LEVEL.

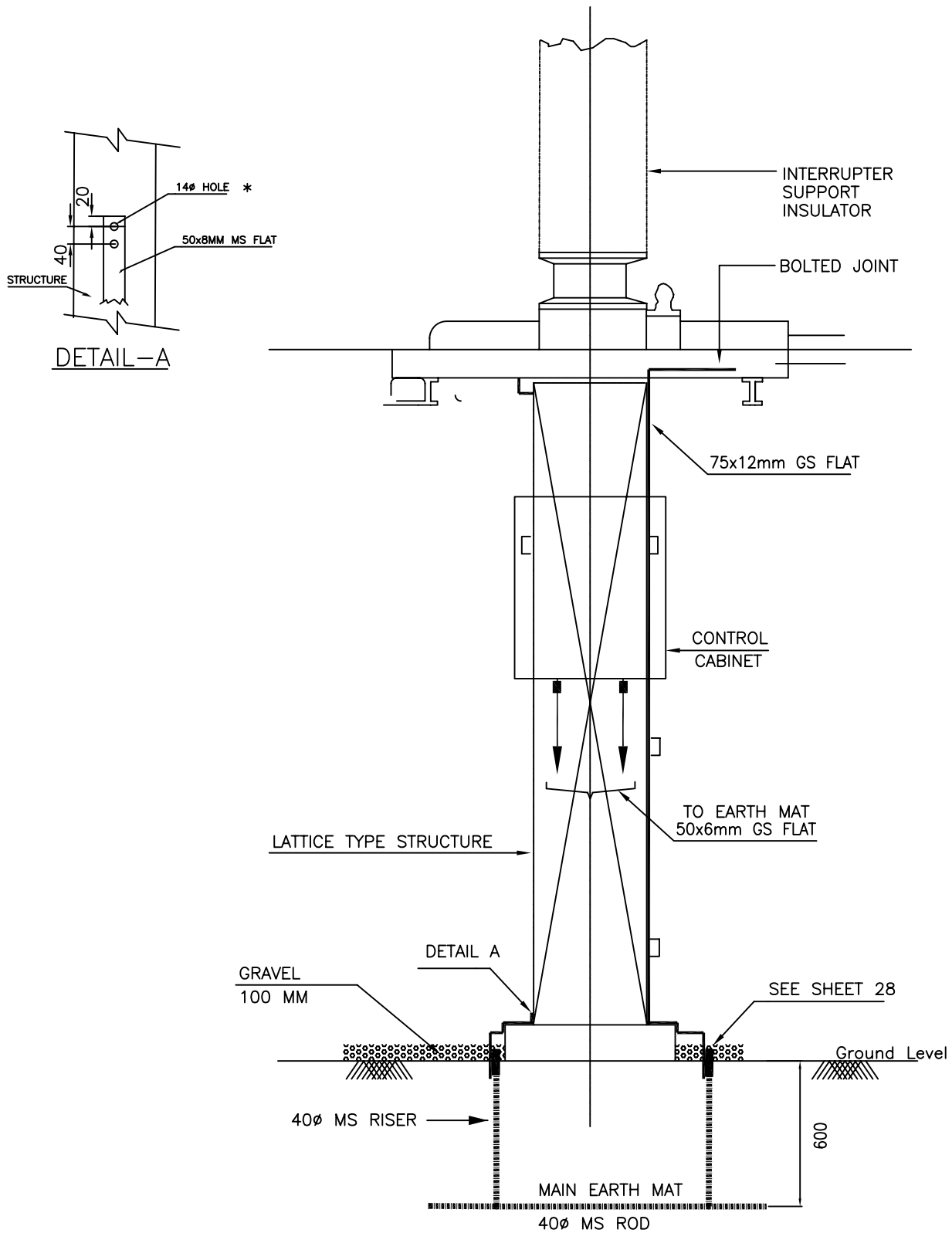
### LEGEND:

- 40 $\phi$  MS ROD FOR RISER/EARTH MAT  
 GS FLAT ( 75X12 MM/ 50X 6 MM)

SHEET.	DESCRIPTION	SHEET.	DESCRIPTION
2.	SF6 CIRCUIT BREAKER	17.	ROD ELECTRODE WITH TEST PIT
3.	CVT	18.	RAIL BONDING
4.	POST INSULATOR (SOLID CORE TYPE)	19.	LIGHTNING MAST
5.	LIGHTNING ARRESTER	20.	AUXILIARY EARTH MAT FOR ISOLATOR MAIN MECH., E/S MECH. BOX
6.	MARSHALLING KIOSK	21.	SWITCHGEAR / MCC / C & R PANEL /ACDCDB/LDB INSIDE CONTROL ROOM
7.	DOUBLE BREAK ISOLATOR WITHOUT EARTH SWITCH	22.	AUX TRANSFORMER
8.	DOUBLE BREAK ISOLATOR WITH ONE EARTH SWITCH	23.	FENCE POST
9.	DOUBLE BREAK ISOLATOR WITH TWO EARTH SWITCH	24.	CABLE TRENCH
10.	ISOLATOR TYPICAL PLAN	25.	TYPICAL ARRANGEMENT OF BOLTED JOINTS
11.	CURRENT TRANSFORMER	26.	WELDING DETAILS-1
12.	WAVE TRAP	27.	WELDING DETAILS-2
13.	SHIELD WIRE TOWER	28.	RISERS & GS FLAT WELDING ARRANEGMENT
14.	TOWER WITHOUT PEAK		
15.	PIPE EARTH ELECTRODE IN TREATED EARTH PIT		
16.	ROD ELECTRODE WITHOUT TEST PIT		

JOB NO.					PROJECT	400/220KV SWITCHYARD- RTPP STAGE-IV (600MW UNIT#6)				
STATUS	CONTRACT				CUSTOMER	APGENCO, HYDERABAD				
DRG./REF. NO. (INTERNAL)					CONSULTANT	DESEIN PVT LTD, HYDERABAD				
SIGN & DATE					 भारत हेवी इलेक्ट्रिकल्स लिमिटेड ट्रांसमिशन परियोजना विभाग BHARAT HEAVY ELECTRICALS LTD. TRANSMISSION PROJECTS DIVISION	DEPT CODE		NAME	SIGN.	DATE
						DRN				
						DESN		NK		04.05.11
						CHD		DKM		04.05.11
APPD		RS		04.05.11						
REV.	DATE	ALTD	CHD	APPD						
					TITLE					
					EQUIPMENT EARTHING DETAILS					
					DEPT.	SCALE	DRAWING NO.			
					SIGN		TB-4-344-509-013			
					DATE		SHEET	1	OF	28

COPY RIGHT AND CONFIDENTIAL  
 The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED it must not be used directly or indirectly in anyway detrimental to the interest of the company.



NOTE:

- 1) COMMON CONTROL CABINET SHALL BE EARTHED SEPARATELY.
- 2) NO. OF RISERS FOR CIRCUIT BREAKER - 2 / PHASE
- 3) NO. OF RISERS FOR LADDER - 2 / PHASE
- 4) NO. OF RISERS FOR CONTROL CABINET - 2 / PHASE



EQUIPMENT EARTHING DETAILS  
CIRCUIT BREAKER

COMPU. DRG. REF.

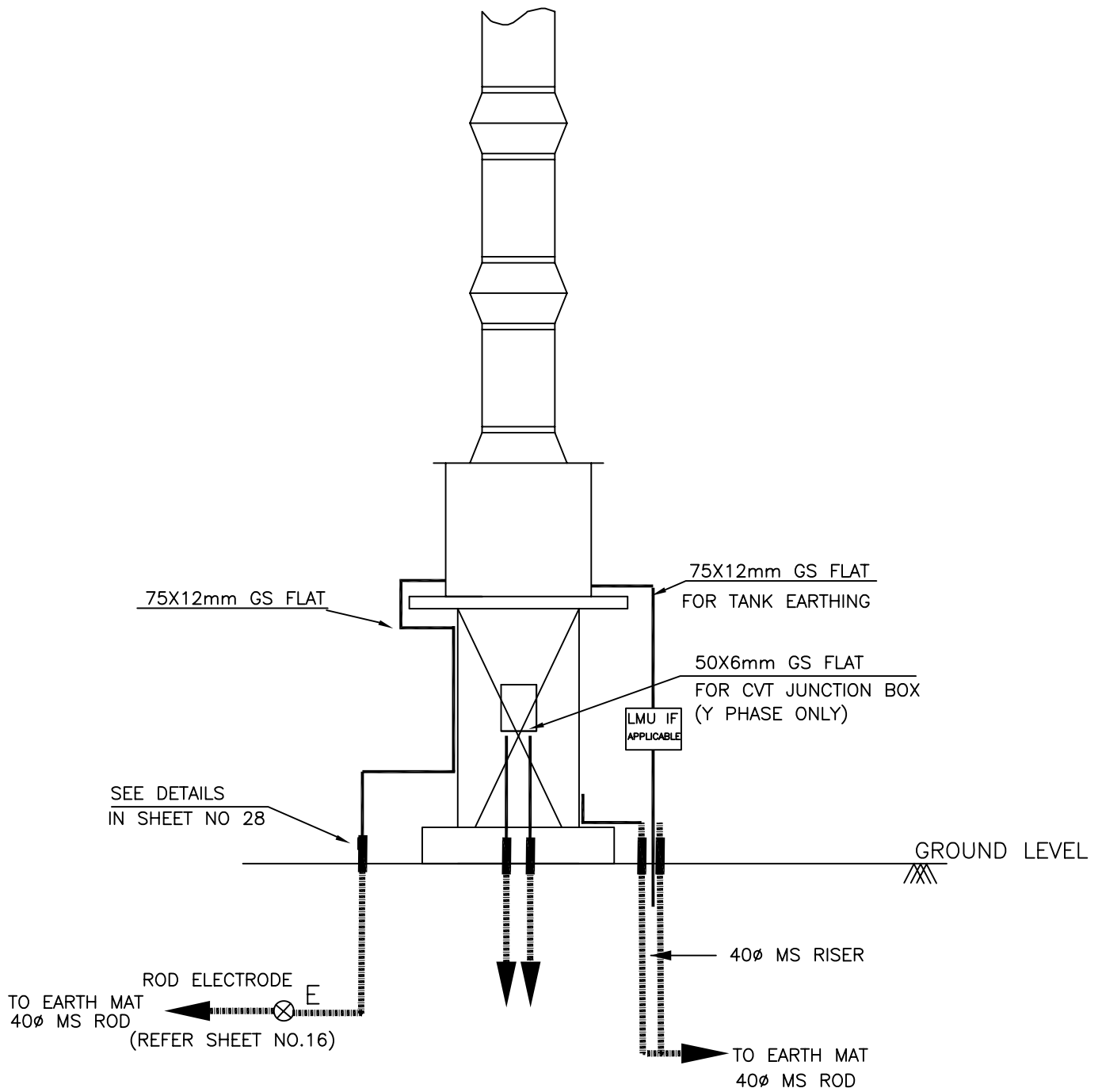
DRG. No.

TB-4-344-509-013

REV. 00

SHEET No.

2

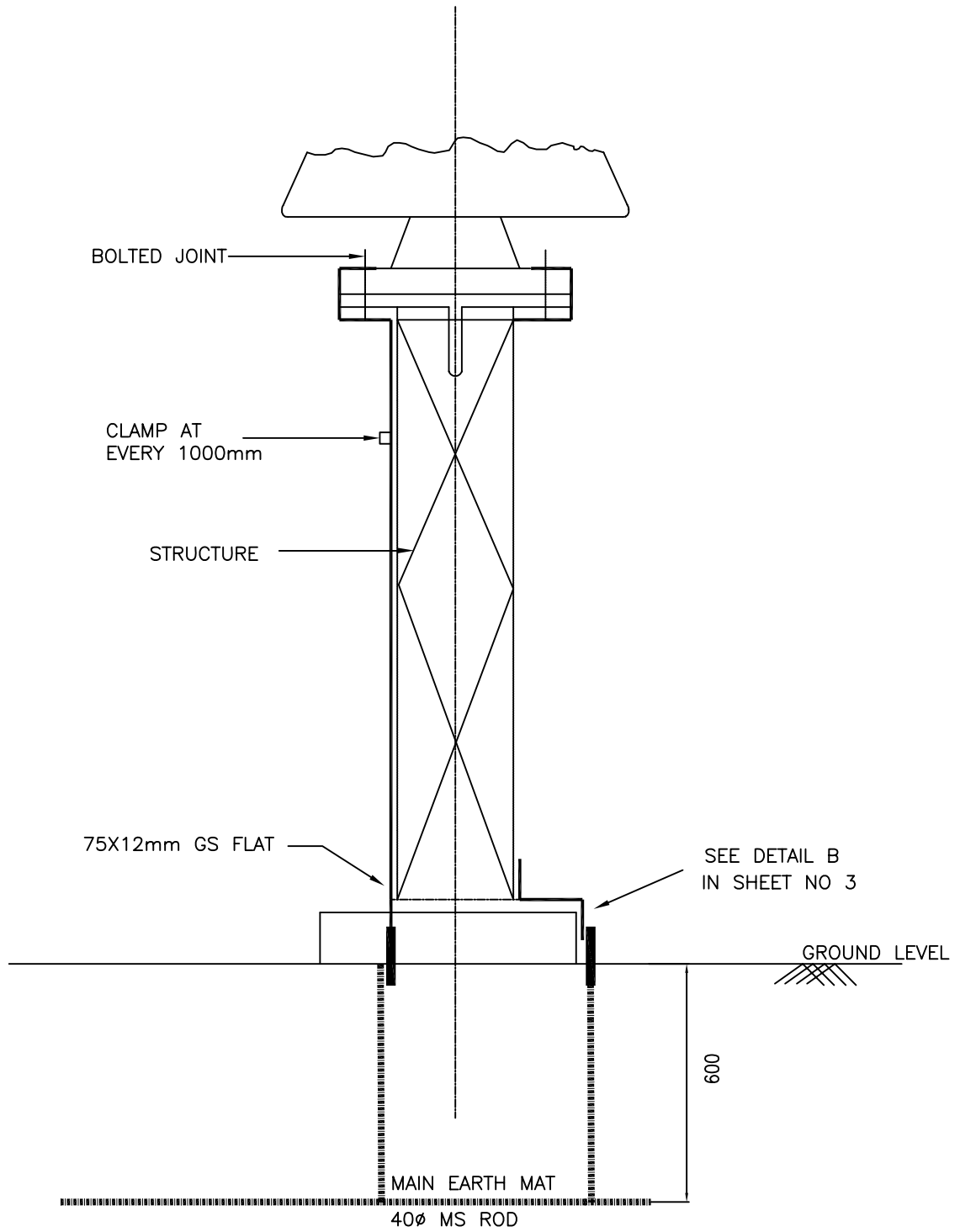


NOTE:

- 1) NO. OF RISERS FOR EQUIPMENT & STRUCTURE- 3 / PHASE
- 2) NO. OF RISERS FOR JUNCTION BOX - 2 / PHASE
- 3) NO. OF ROD ELECTRODE - 1 / PHASE



EQUIPMENT EARTHING DETAILS  
CVT



NOTE:

- 1) NO. OF RISERS FOR EQUIPMENT & STRUCTURE- 2 / PHASE



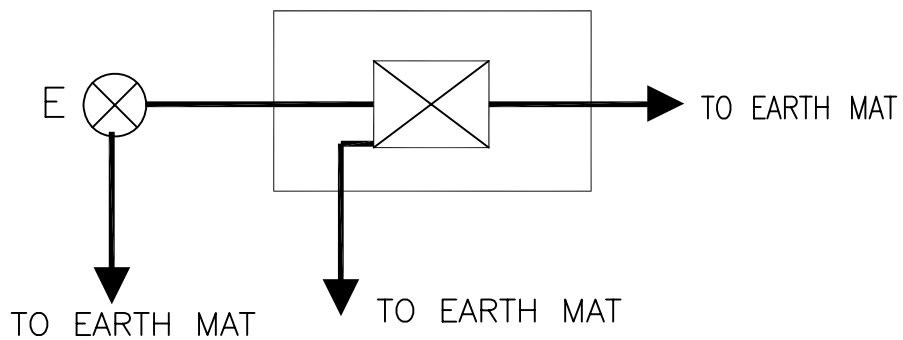
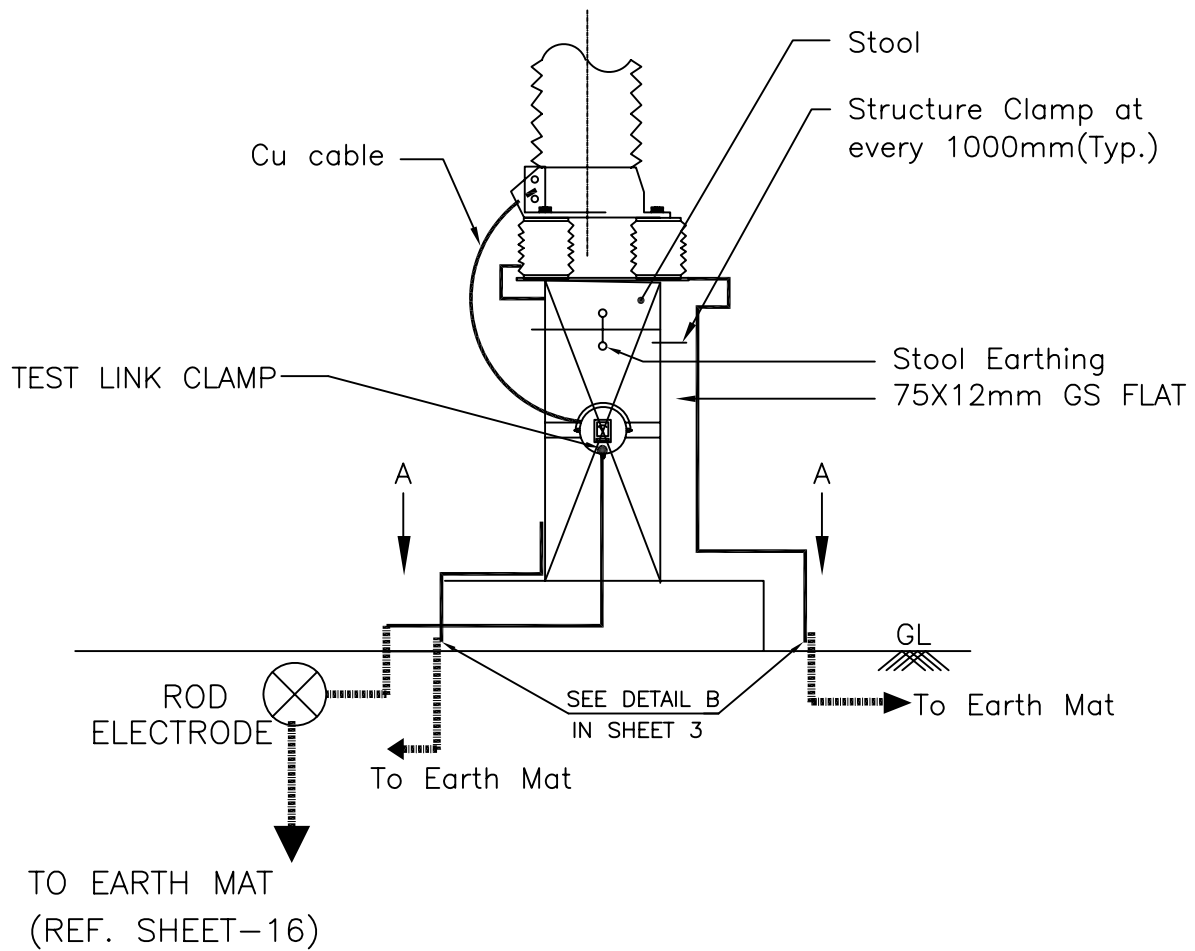
## EQUIPMENT EARTHING DETAILS

### POST INSULATOR (SOLID CORE TYPE)

DRG. No. TB-4-344-509-013

REV. 00

SHEET No.  
4



VIEW A-A

NOTES;

1. LA SHALL BE EARTHED THROUGH EARTH TERMINAL OF SURGE COUNTER
2. NO. OF ROD ELECTRODE : 1 NO. PER PHASE.
3. NO. OF RISERS FOR EQUIPMENT & STRUCTURE- : 3 / PHASE.



EQUIPMENT EARTHING DETAILS  
LIGHTNING ARRESTER

COMPU. DRG. REF.

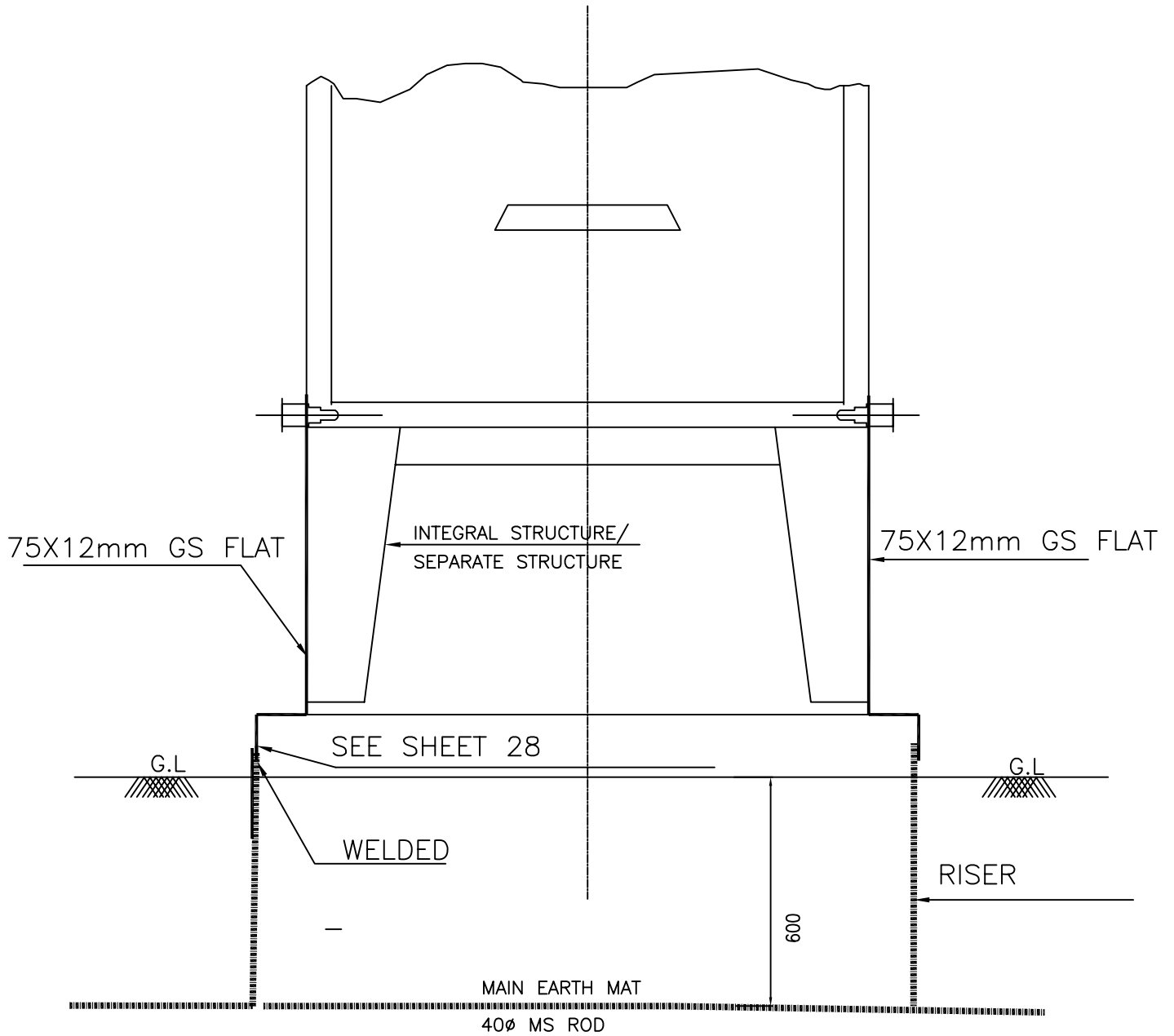
DRG.NO.

TB-4-344-509-013

REV. 00

SHEET No.

5



NOTES;

1. NO. OF RISERS FOR MK- : 2 / PHASE.



EQUIPMENT EARTHING DETAILS  
MARSHALLING KIOSK

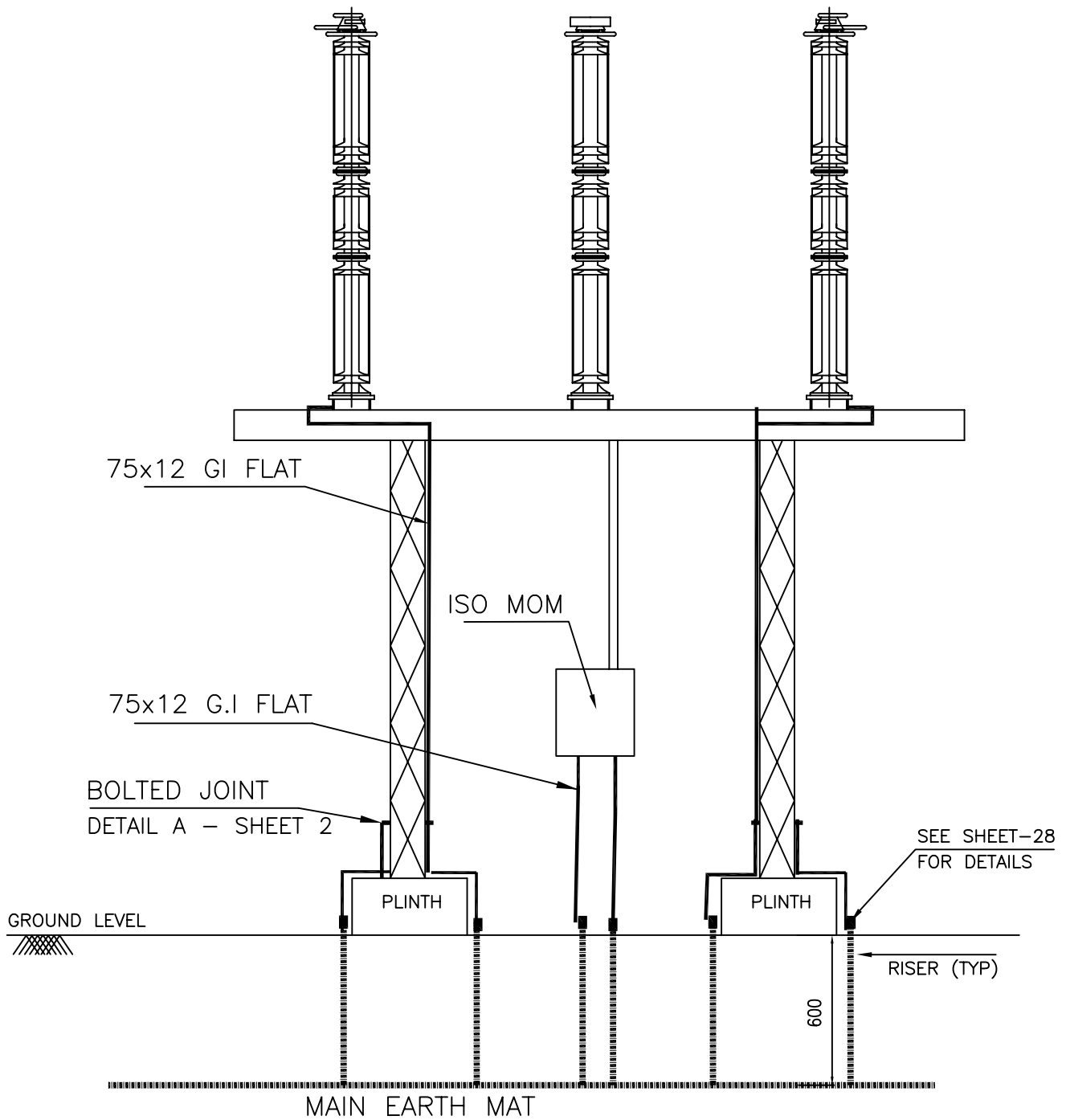
COMPUTERREF.NO.

DRG. No.

TB-4-344-509-013

REV. 00

SHEET No.  
6

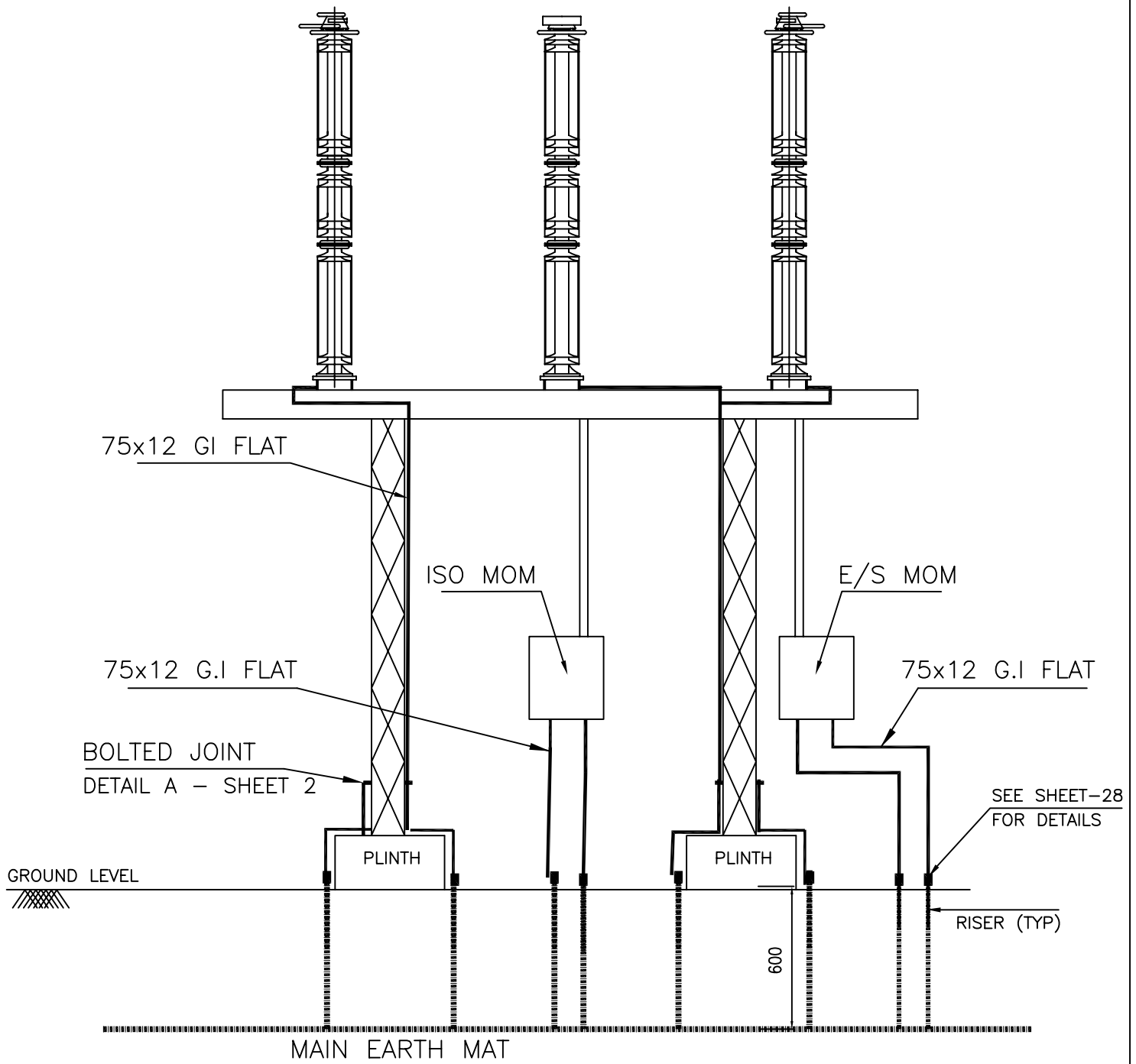


No. OF RISERS FOR ISOLATOR = 4 Nos./PHASE  
 No. OF RISERS FOR ISOLATOR MECH. BOX = 2 Nos.



## EQUIPMENT EARTHING DETAILS

### ISOLATOR HORIZONTAL DOUBLE BREAK WITHOUT E/S

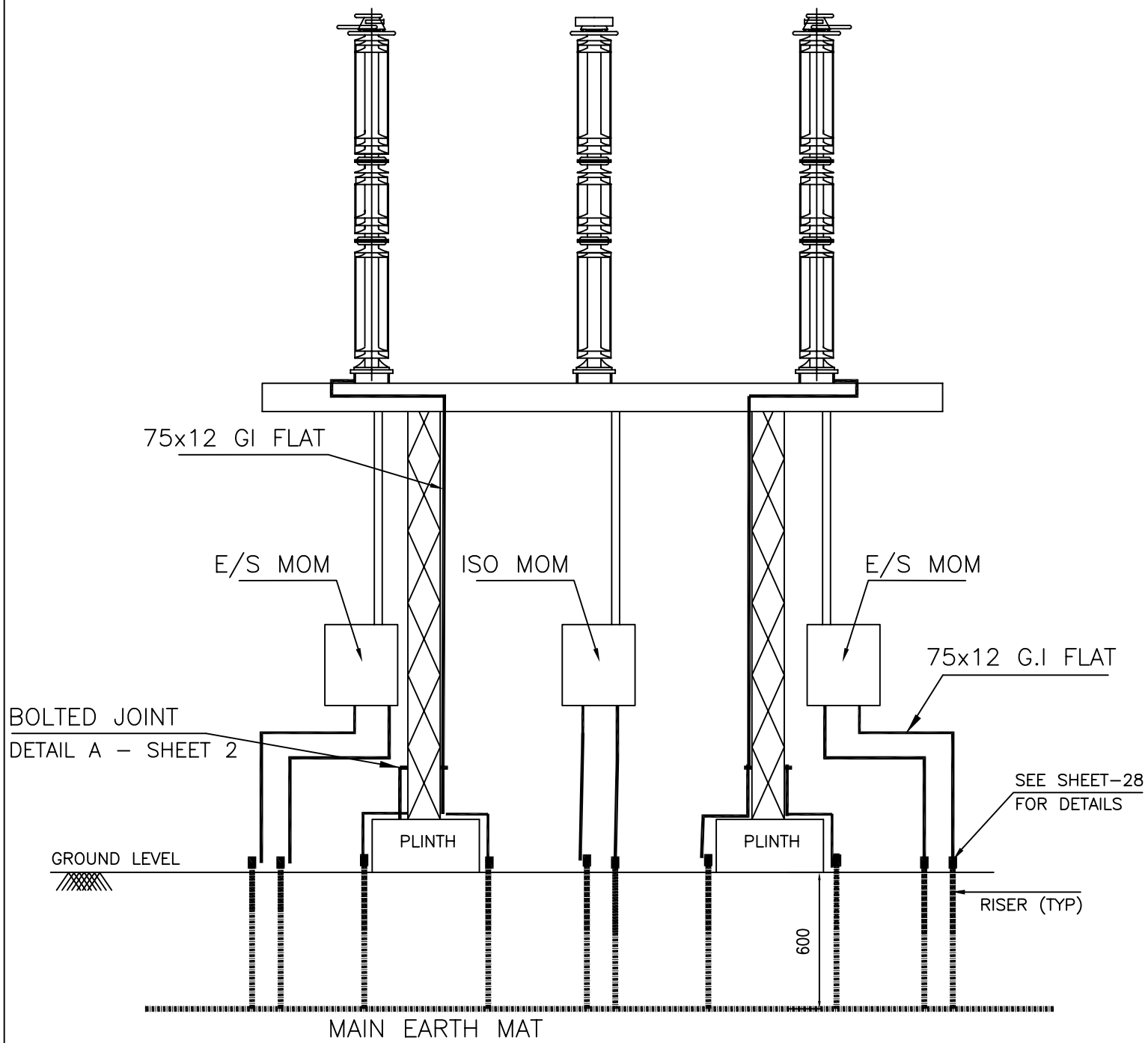


No. OF RISERS FOR ISOLATOR = 4 Nos./PHASE  
 No. OF RISERS FOR ISOLATOR MECH. BOX = 2 Nos.  
 No. OF RISERS FOR EARTH SWITCH MECH. BOX = 2 Nos.



## EQUIPMENT EARTHING DETAILS

### ISOLATOR HORIZONTAL DOUBLE BREAK WITH ONE E/S

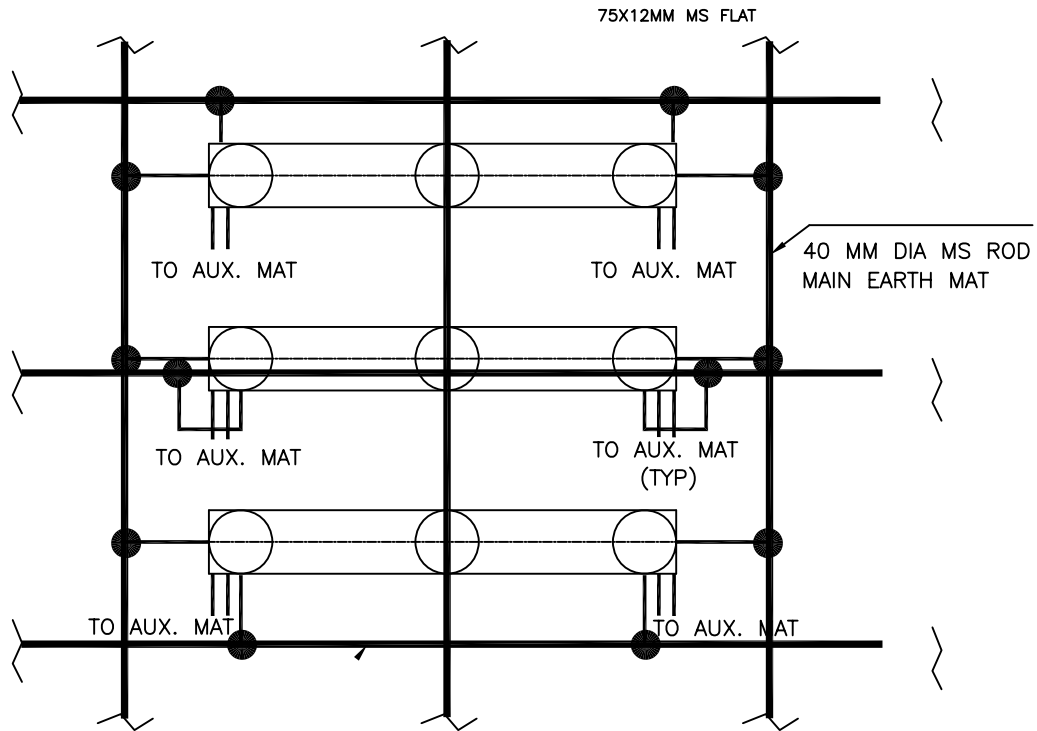


No. OF RISERS FOR ISOLATOR = 4 Nos./Phase  
 No. OF RISERS FOR ISOLATOR MECH. BOX = 2 Nos.  
 No. OF RISERS FOR EARTH SWITCH MECH. BOX = 4 Nos.



## EQUIPMENT EARTHING DETAILS

### ISOLATOR HORIZONTAL DOUBLE BREAK WITH TWO E/S



NOTES

1. AUXILIARY EARTH MAT SHALL BE PROVIDED BELOW EVERY MOM BOX (REFER SHEET 20)

● RISER



EQUIPMENT EARTHING DETAILS  
ISOLATOR TYPICAL PLAN

COMPU. DRG. REF.

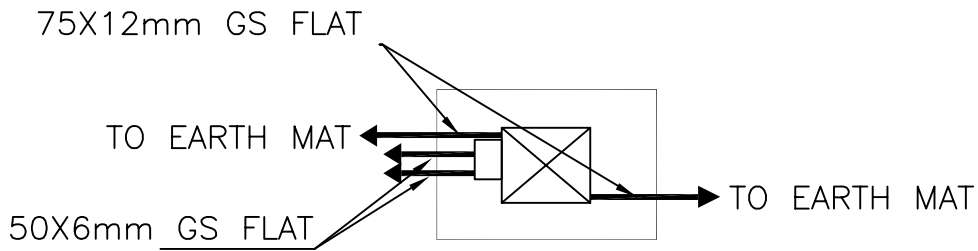
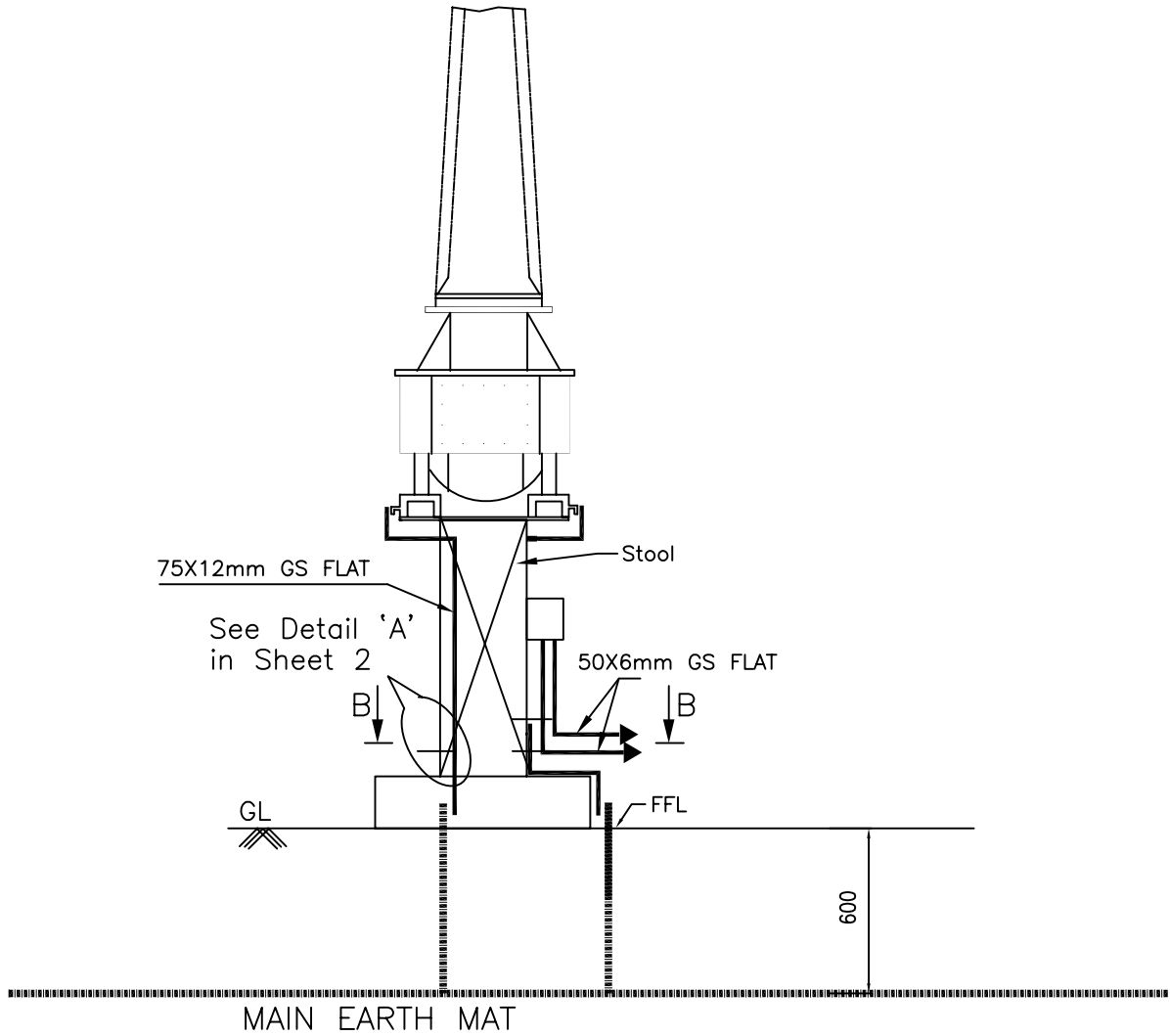
DRG.NO.

TB-4-344-509-013

REV. 00

SHEET No.

10



View B-B

No. OF RISERS FOR CT = 2 Nos./Phase  
 No. OF RISERS FOR JUNCTION BOX = 2 Nos.



# EQUIPMENT EARTHING DETAILS

## Current Transformer

COMPU. DRG. REF.

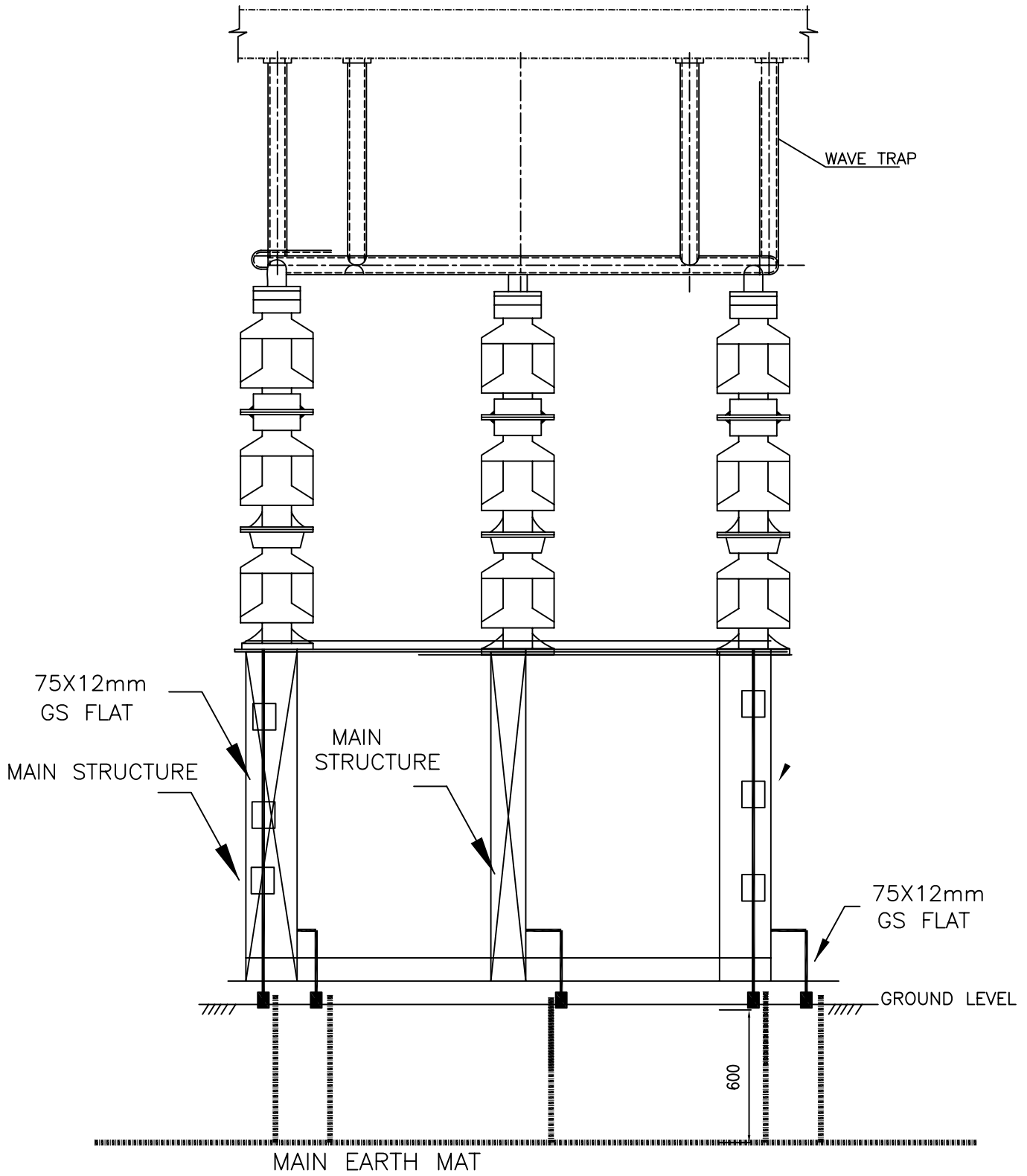
DRG.NO.

TB-4-344-509-013

REV. 00

SHEET No.

11



No. OF RISERS FOR WAVE TRAP = 5 Nos./Phase



EQUIPMENT EARTHING DETAILS  
WAVE TRAP

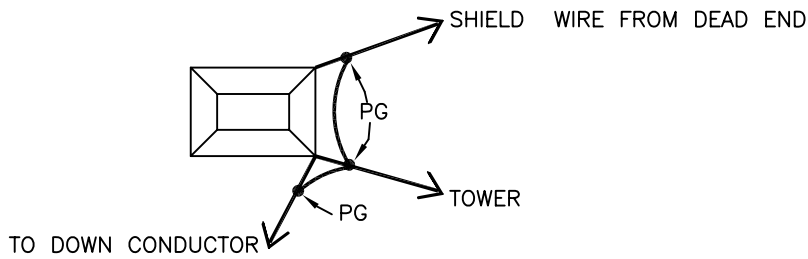
COMPUTERREF.NO.

DRG. No.

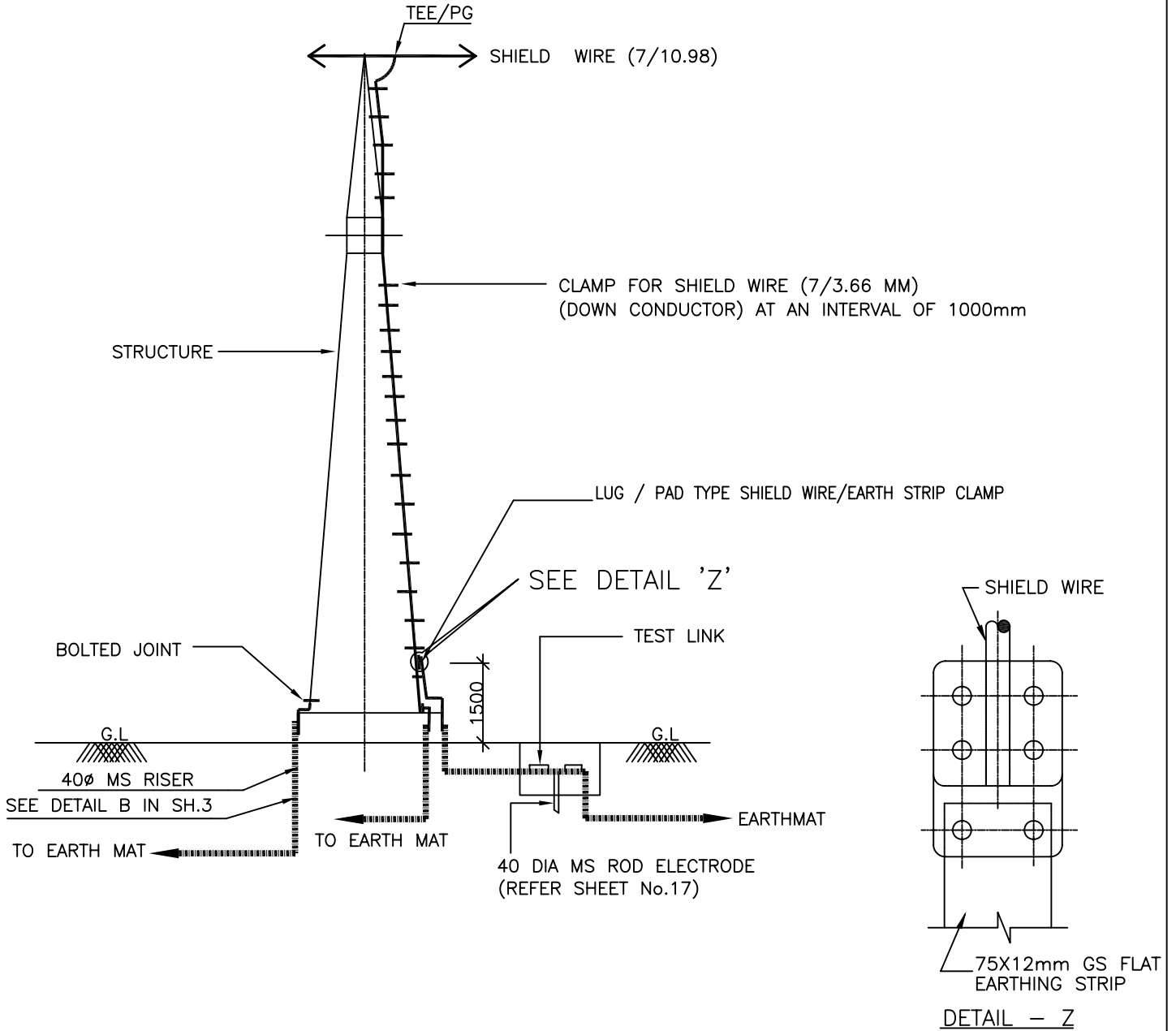
TB-4-344-509-013

REV. 00

SHEET No.  
12



DETAIL WHEN 2 & E/WIRE TERMINATES A TOWER

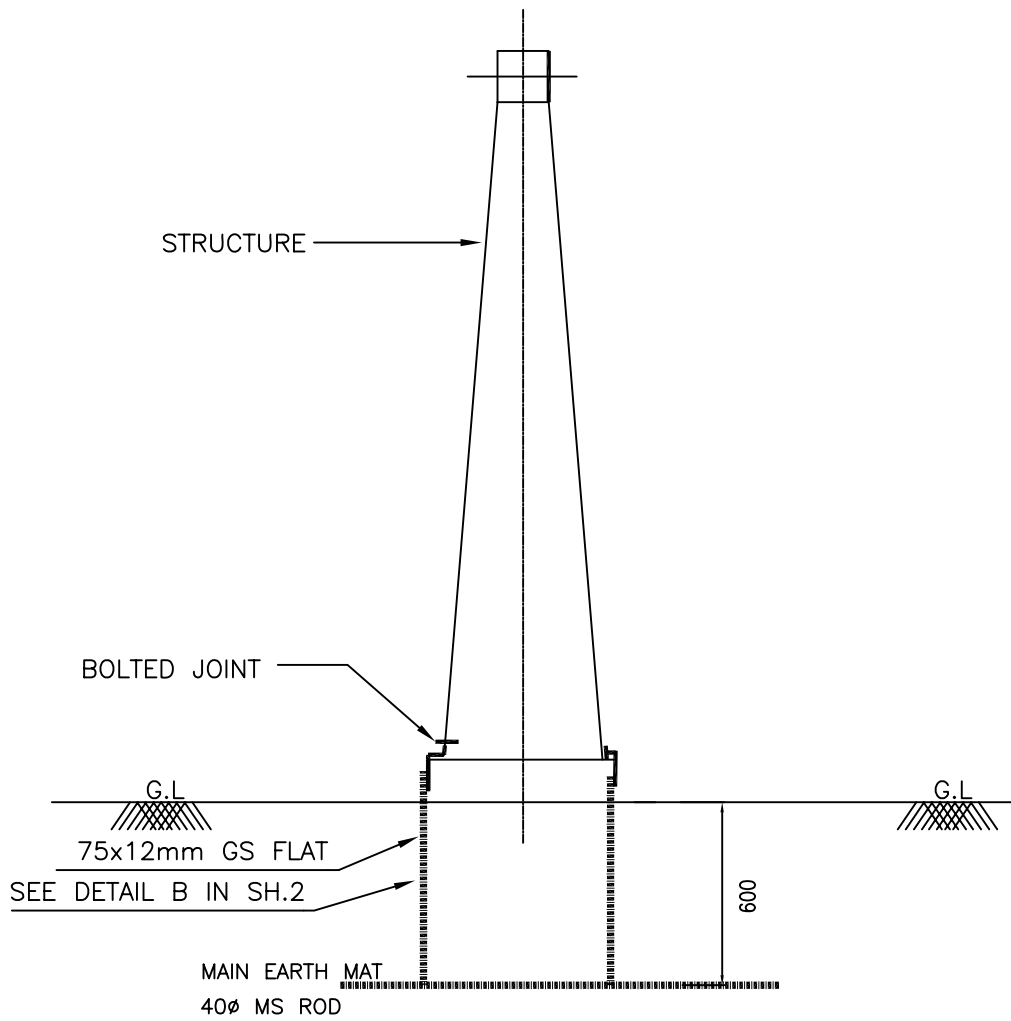


NOTE:

1. NO. OF ROD ELECTRODE WITH TEST LINK : 1 NO. / TOWER
2. NO. OF RISERS : 3 NO. / TOWER



EQUIPMENT EARTHING DETAILS  
SHIELD WIRE TOWER



EQUIPMENT EARTHING DETAILS  
TOWER WITHOUT PEAK

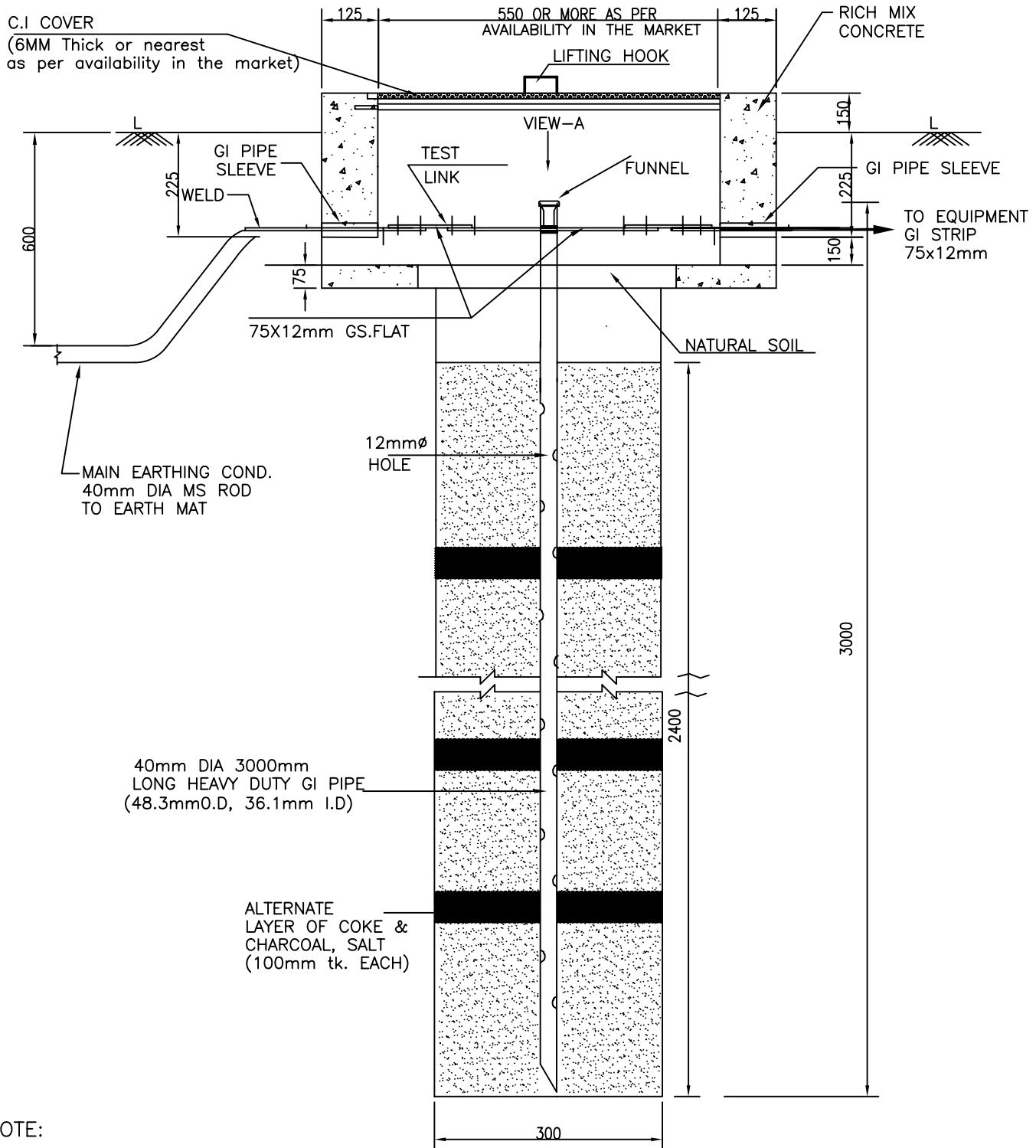
COMPUTERREF.NO.

DRG. No.

TB-4-344-509-013

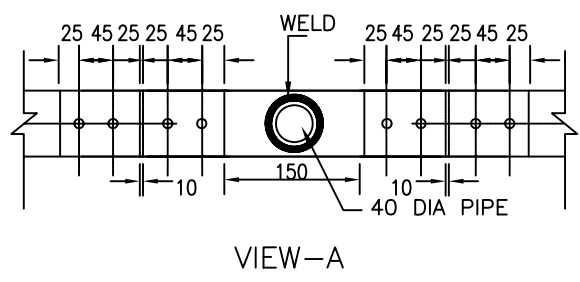
REV. 00

SHEET No.  
14



NOTE:

1. ALL NUTS, BOLTS AND WASHERS, GI PIPE AND WIRE MESH SHALL BE GALVANISED AS PER SPECIFICATION.
2. PIPE SLEEVE ENDS SHALL BE SEALED AFTER COMPLETION OF WORKS.

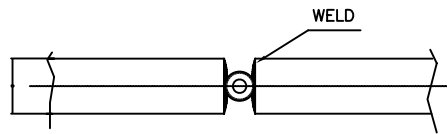
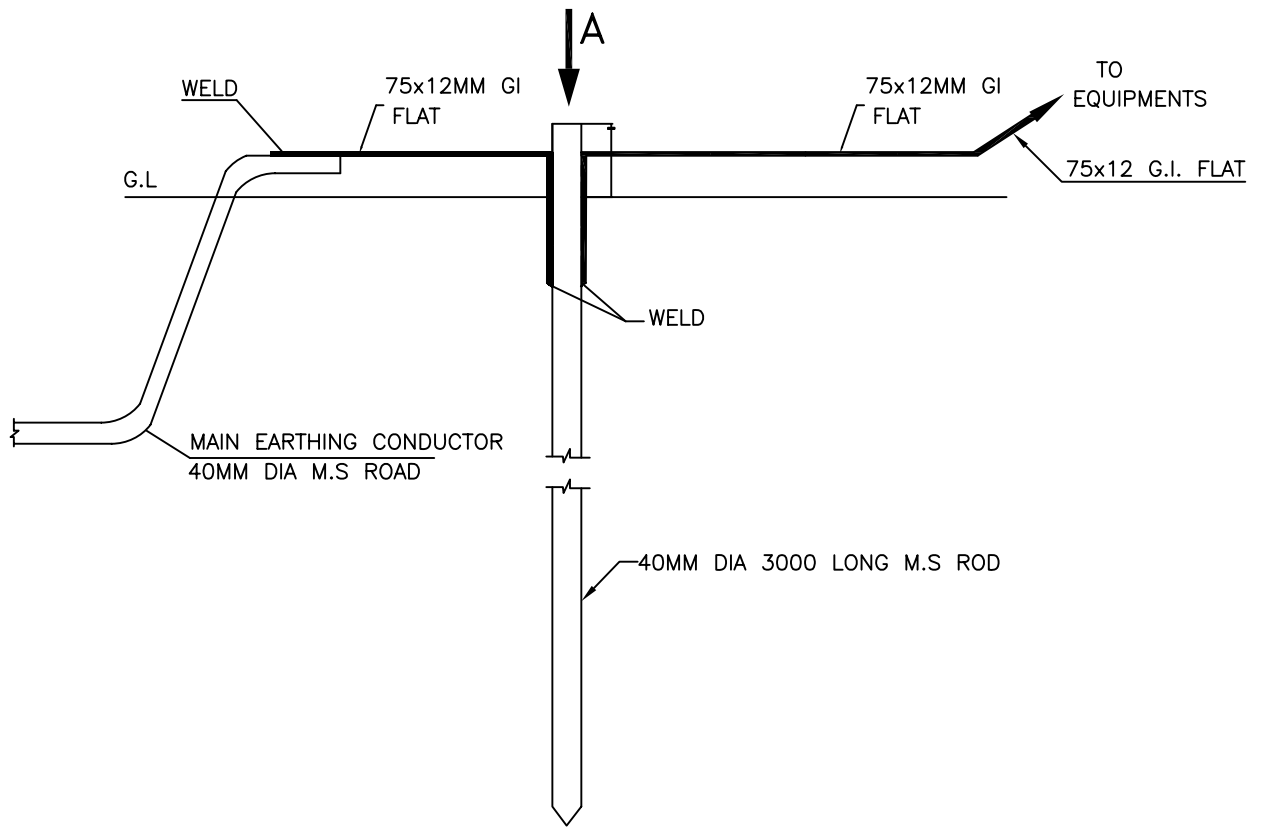


COMPUTERREF.NO.

EQUIPMENT EARTHING DETAILS  
DETAILS OF PIPE ELECTRODE  
IN TREATED EARTH PIT

DRG. No. TB-4-344-509-013

REV. 00 SHEET No. 15



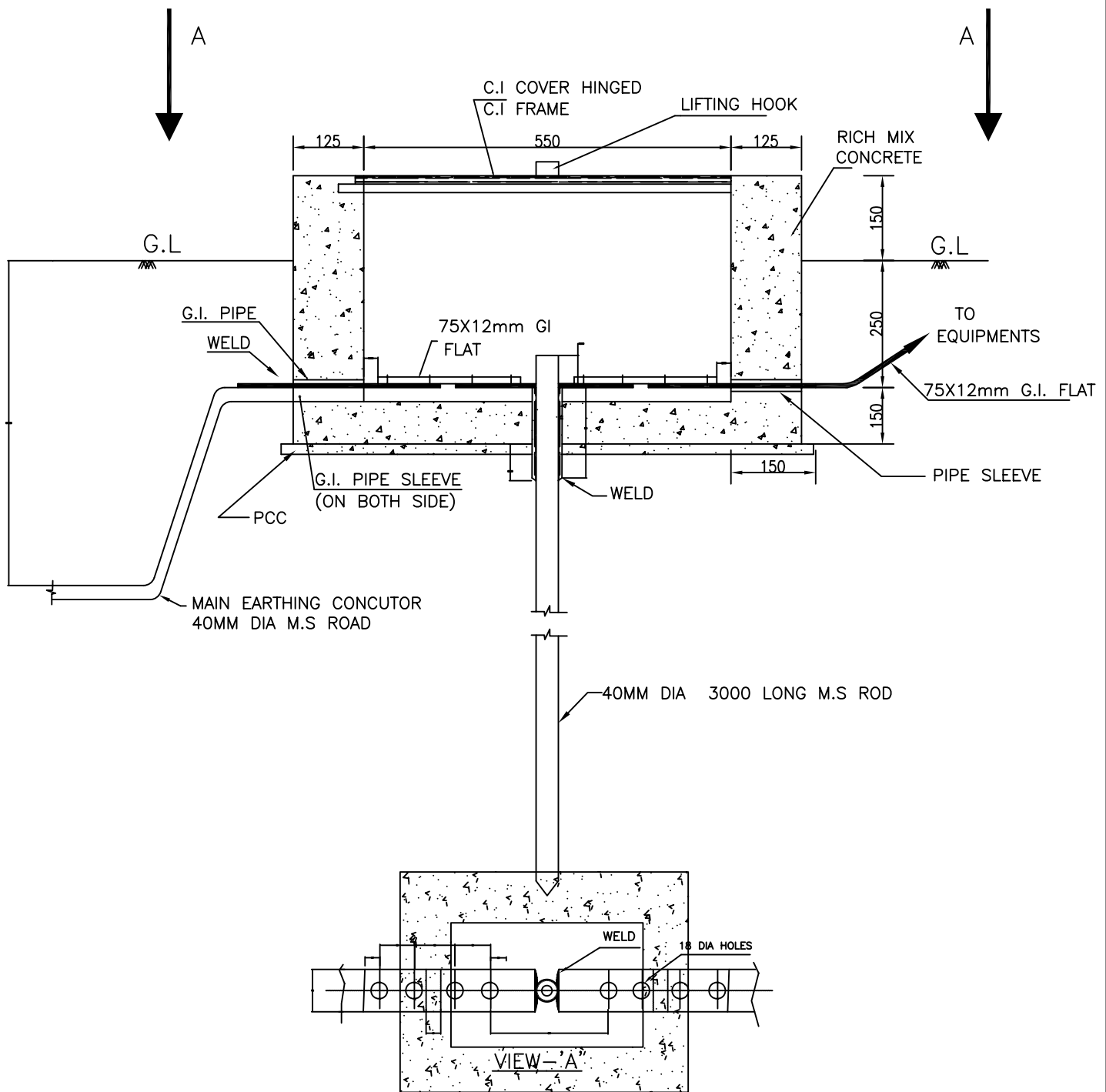
VIEW-'A'

NOTES:-

1. SUPPLY OF FIXING BOLTS NUTS & WASHERS FOR GI FLAT EARTHING CONDUCTOR IS ALSO FORMS PART OF THE SCOPE.
2. TO BE USED FOR CONNECTING DOWN CONDUCTOR OF CVT, LA.
3. ALL NUTS, BOLTS & WASHERS SHALL BE GALVANISED.



EQUIPMENT EARTHING DETAILS  
ROD EARTH ELECTRODE WITHOUT TEST PIT



NOTES:-

1. SUPPLY OF FIXING BOLTS NUTS & WASHERS FOR GI FLAT EARTHING CONDUCTOR IS ALSO FORMS PART OF THE SCOPE.
2. TO BE USED FOR CONNECTING DOWN CONDUCTOR OF LIGHTNING PROTECTION SYSTEM.
3. PIPE SLEEVE ENDS SHALL BE SEALED AFTER COMPRETION OF WORK.



EQUIPMENT EARTHING DETAILS  
ROD ELECTRODE WITH TEST PIT & LINK

COMPU. DRG. REF.

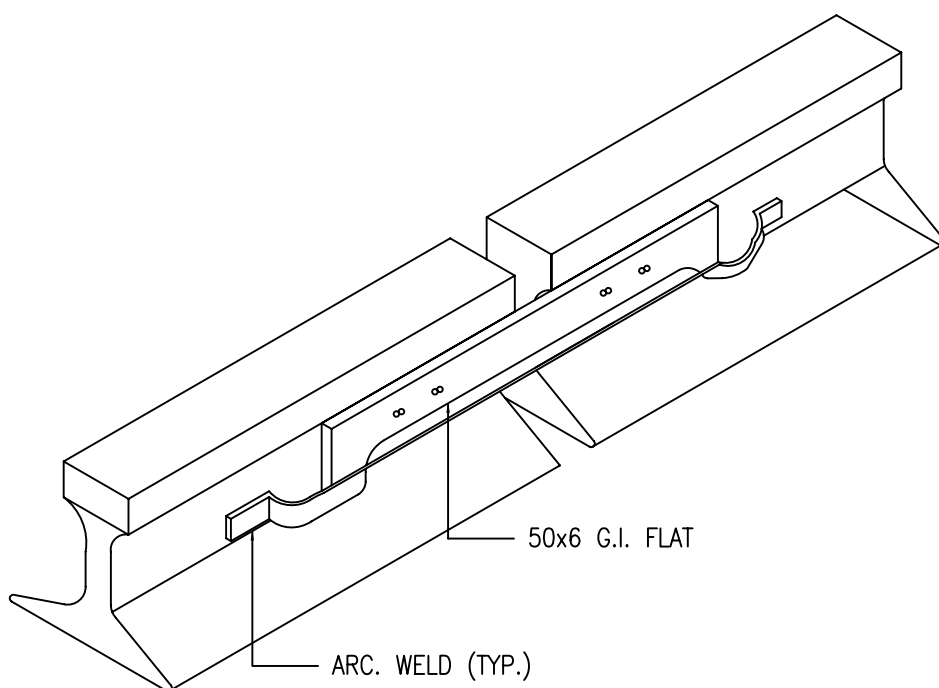
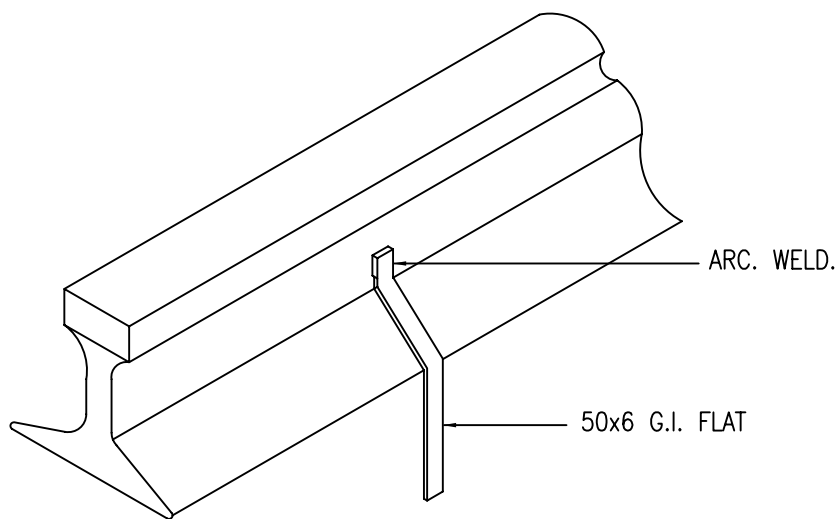
DRG. No.

TB-4-344-509-013

REV. 00

SHEET No.

17



NOTE:—

EACH SECTION OF RAIL WITHIN SWITCHYARD &  
TRANSFORMER YARD SHALL BE EARTHED AT BOTH ENDS.



## EQUIPMENT EARTHING DETAILS

### RAIL BONDING

COMPU. DRG. REF.

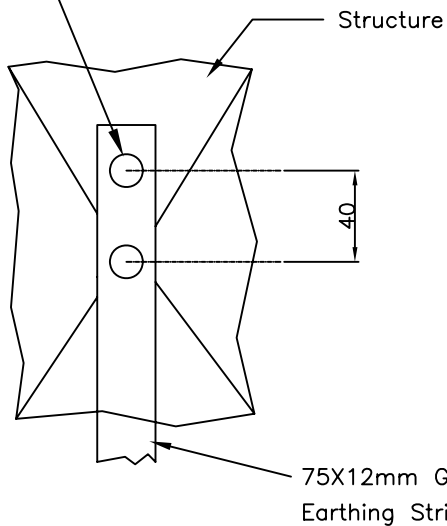
DRG. NO.

TB-4-344-509-013

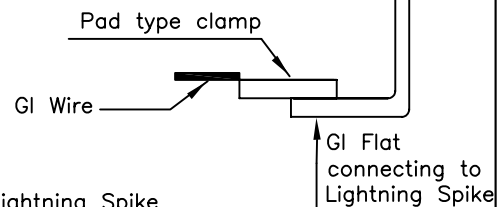
REV. 00

SHEET No.  
18

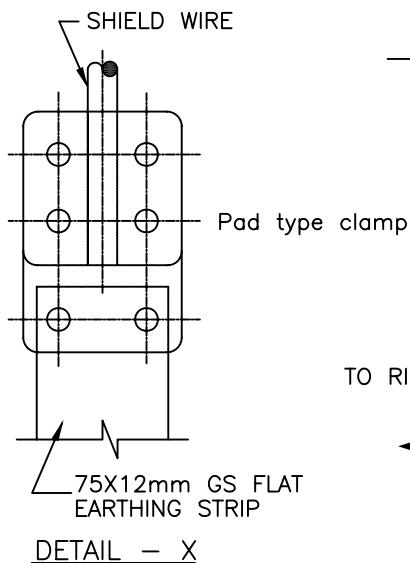
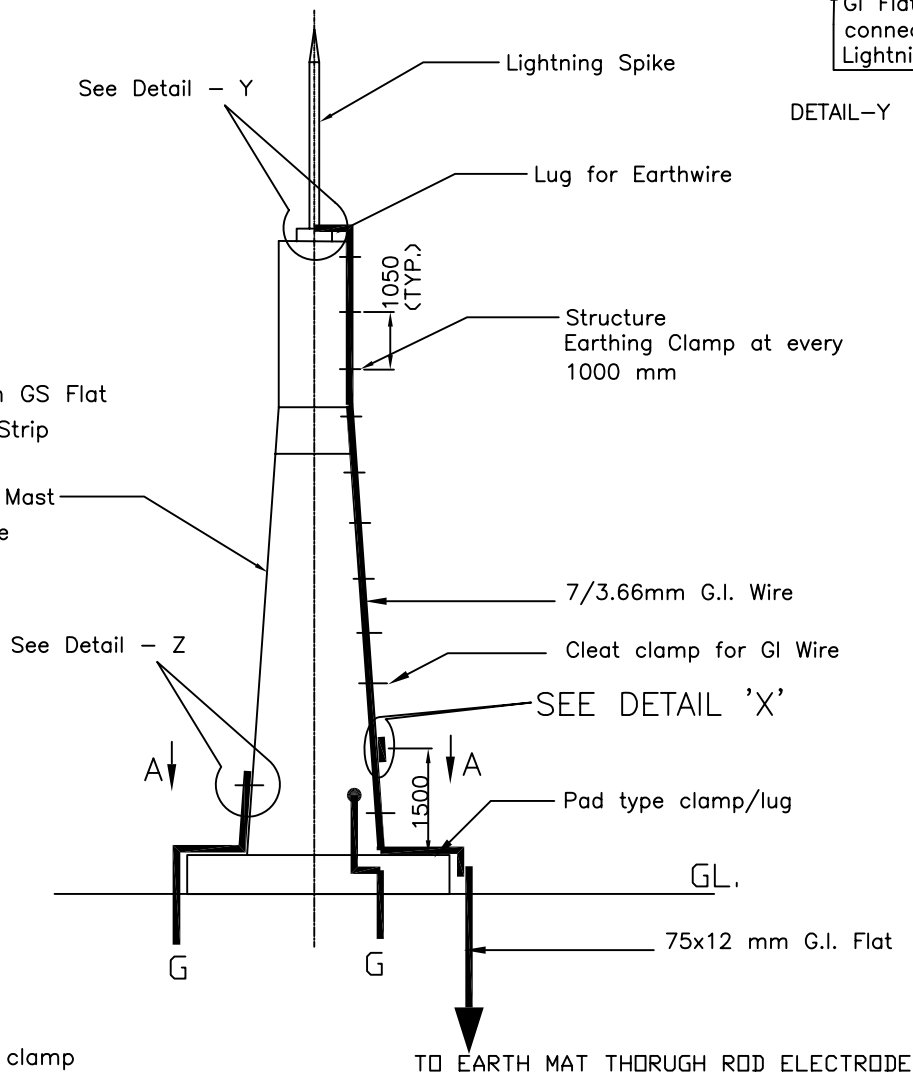
2 X M12/M16 Bolts (Bolt size to suit hole in the structure)



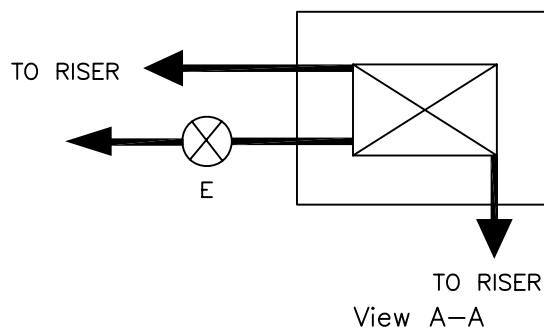
Detail - Z



DETAIL-Y



DETAIL - X



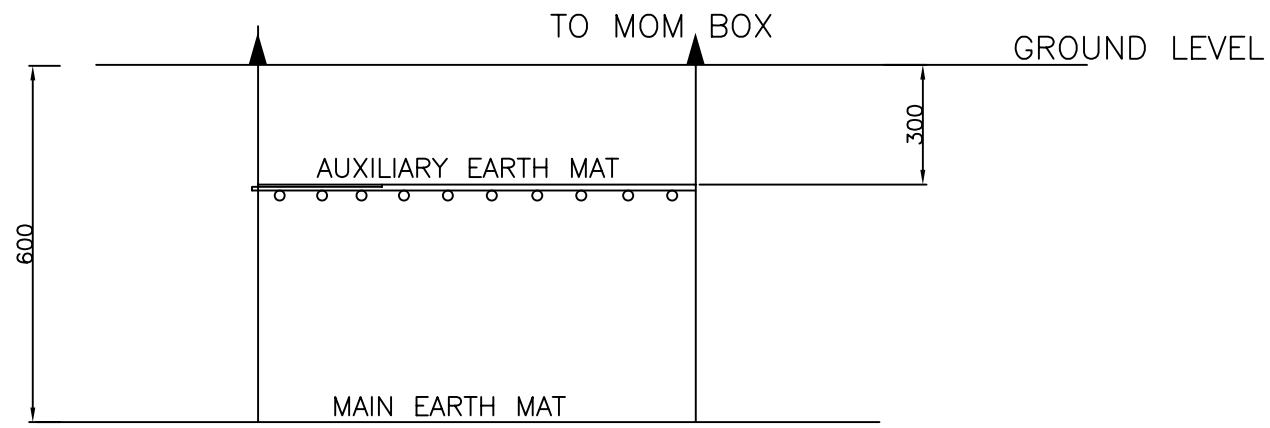
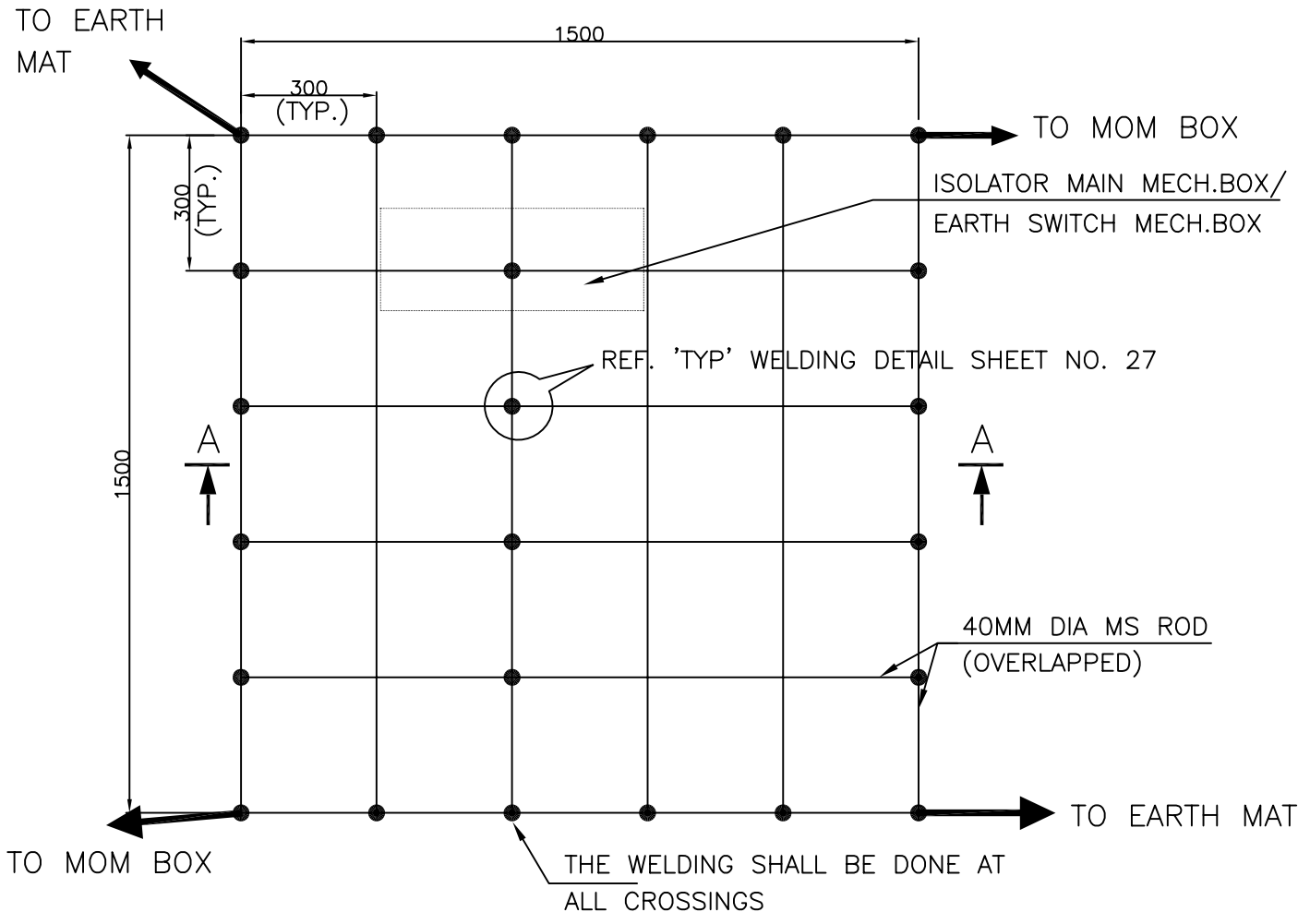
NOTE:

1. NO. OF ROD ELECTRODE : 1 NO.
2. NO. OF RISERS : 3 NO.



## EQUIPMENT EARTHING DETAILS

### Lightning Mast



SECTION AA

NOTE:

AUX. EARTH MAT SHALL BE SO POSITIONED THAT THE FOOT OF THE OPERATOR ALWAYS LIE OVER THE AUX. EARTH MAT AREA WHILE ATTENDING / OPERATING THE MECH. BOX.



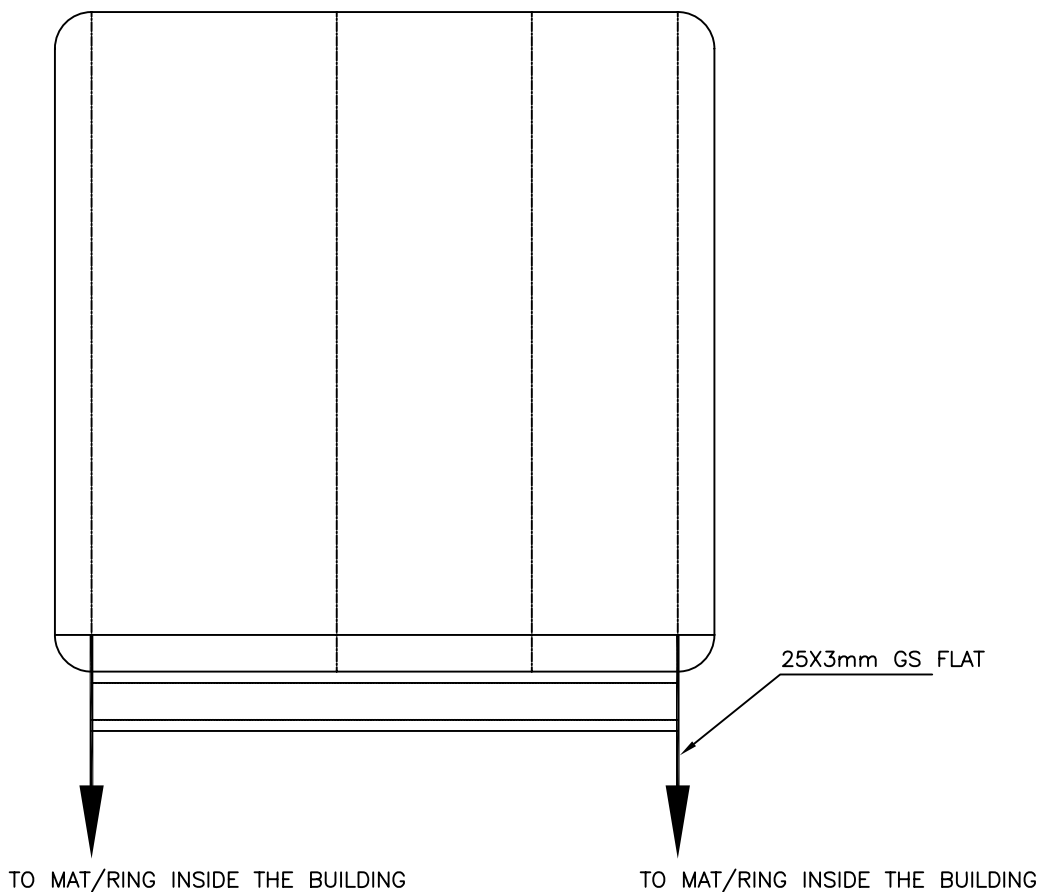
EQUIPMENT EARTHING DETAILS  
AUXILIARY EARTH MAT FOR ISOLATOR MAIN MECH.,E/S  
MECH. BOX (TYP.)

COMPU. DRG. REF.

Report No. TB-4-344-509-013

REV. 00

SHEET No.  
20



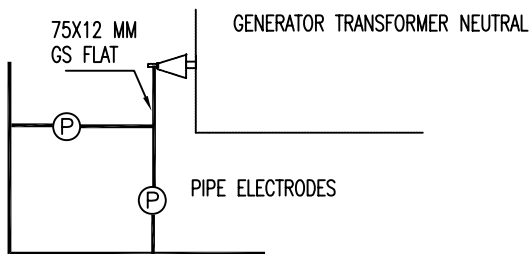
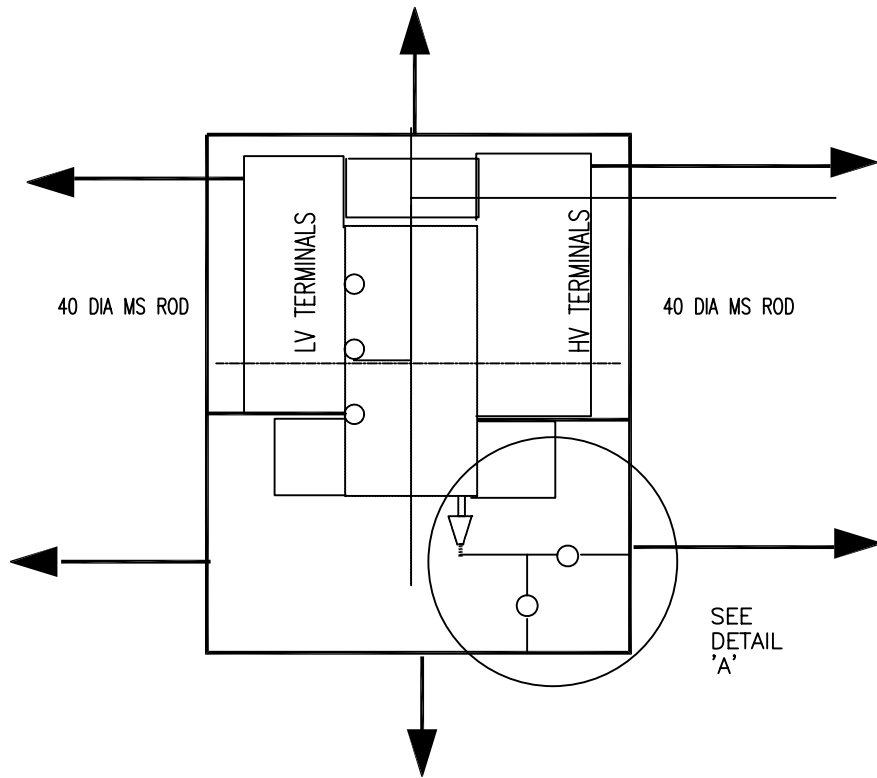
EQUIPMENT EARTHING DETAILS  
 SWITCHGEAR / MCC / CONTROL AND RELAY BOARD /ACDCDB/LDB  
 PANELS MOUNTED INSIDE CONTROL ROOM

DRG. No.

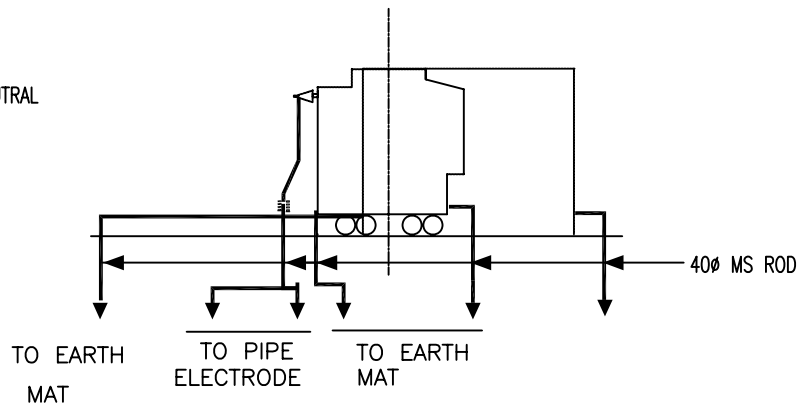
TB-4-344-509-013

REV. 00

SHEET No.  
21



DETAIL A



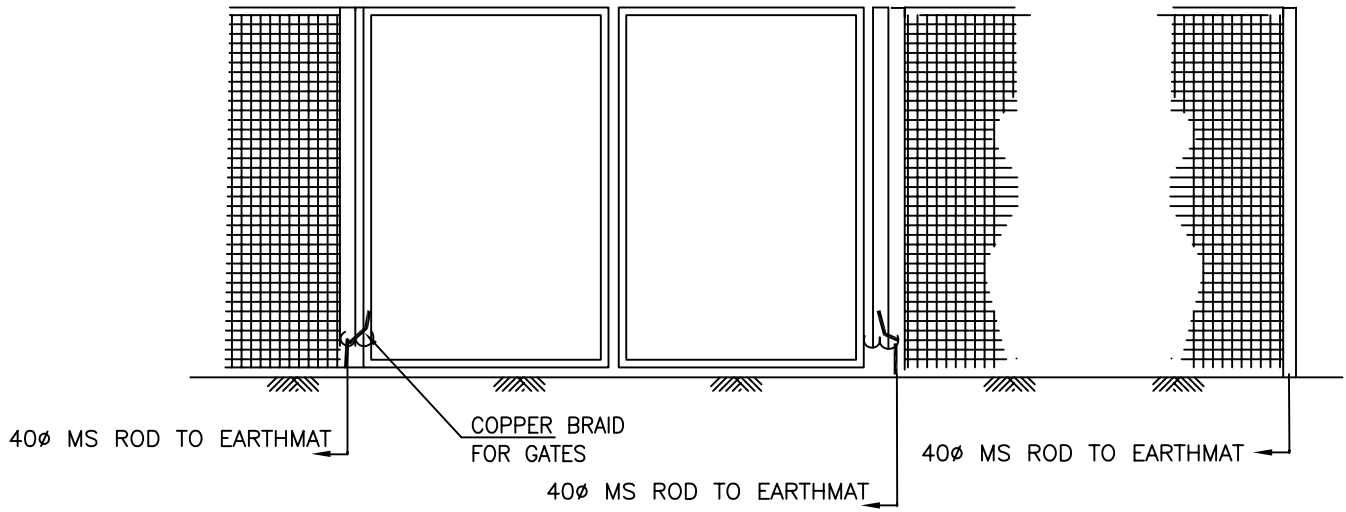
No. OF RISERS FOR OUTDOOR AUX TRANSFORMER = 6 Nos.  
 No. OF PIPE ELECTRODES WITH TEST PIT = 2 Nos.



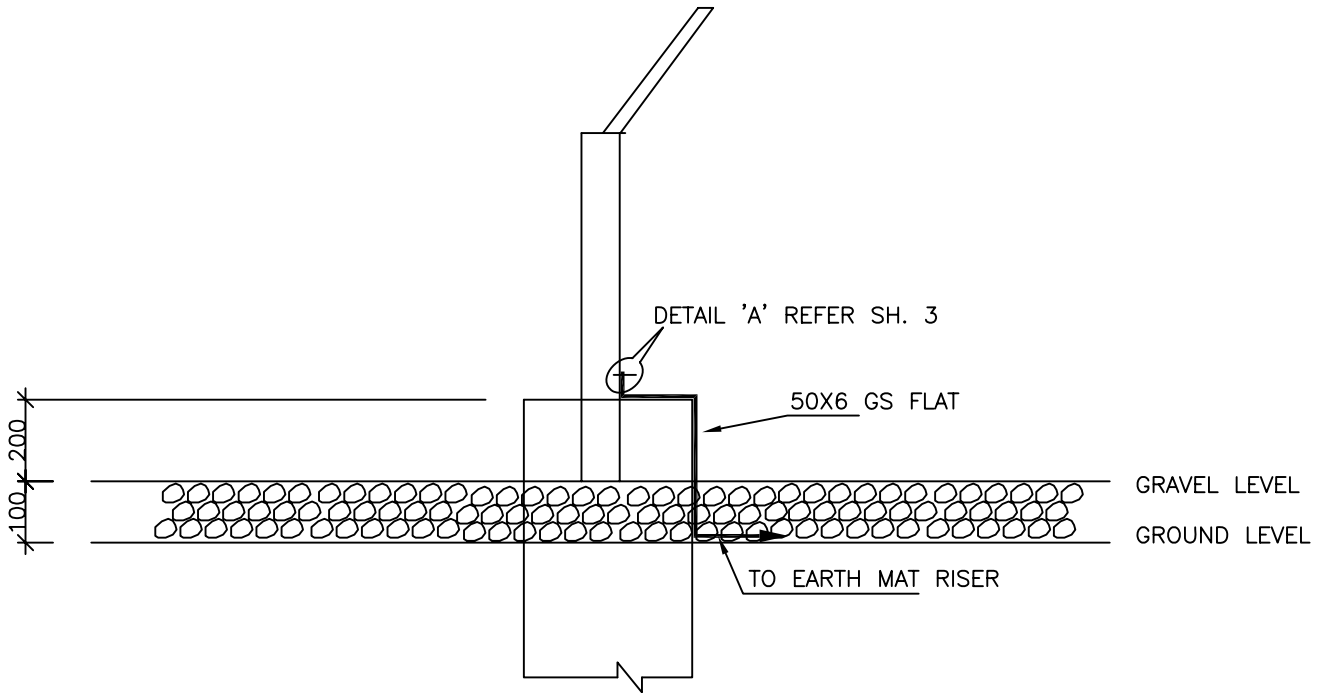
EQUIPMENT EARTHING DETAILS  
 Aux TRANSFORMER

### FENCE GATE

### FENCE GROUNDING



### FENCE EARTHING



EVERY ALTERNATE FENCE POSTS SHALL BE EARTHED BY 50X6 MM GS FLAT.



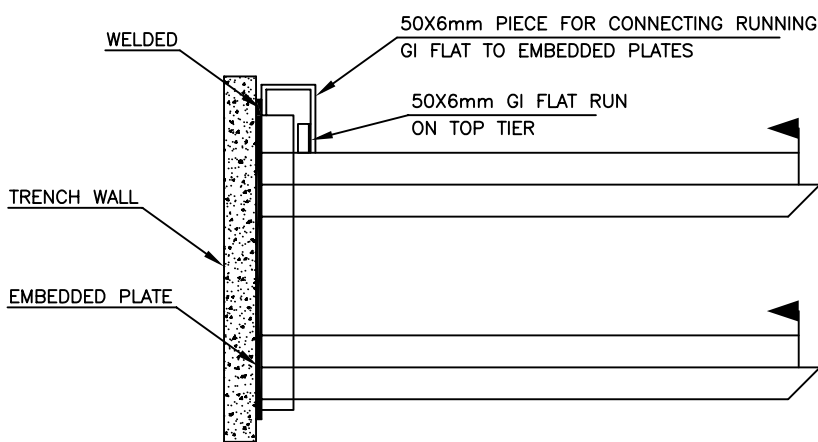
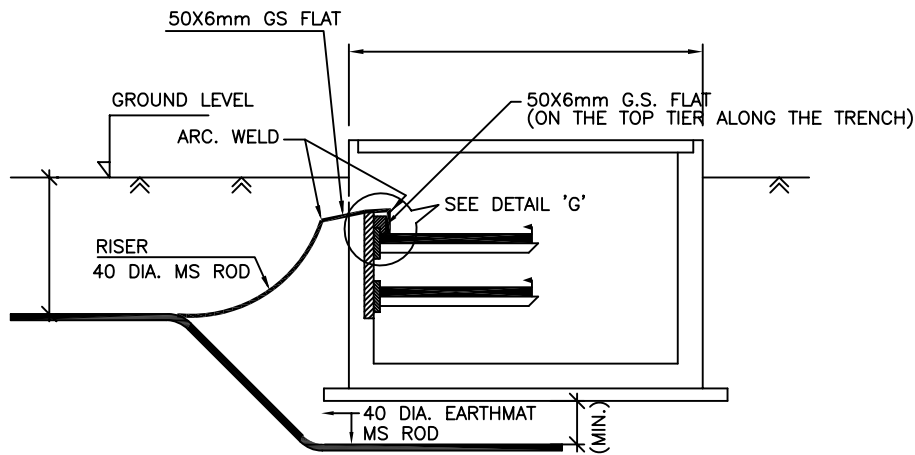
## EQUIPMENT EARTHING DETAILS FENCE POST

DRG. No.

TB-4-344-509-013

REV. 00

SHEET No.  
23



DETAIL 'G'

DETAIL FOR CONNECTING GI FLAT RUNNING ON TOP TIER TRENCH TO EMBEDDED PLATE.

NOTE:

1. ALL TRENCHES SHALL BE EARTHED AT AN INTERVAL OF 30M ALONG THE LENGTH OF TRENCH & FREE ENDS.
2. THE EARTH STRIP (50X6mm G.S. FLAT) SHALL BE WELDED TO EMBEDDED PLATE AT EVERY 3M INTERVAL.
3. WHERE THE CABLE RACKS ARE PROVIDED ON BOTH SIDES OF THE TRENCH, BOTH SIDES SHALL BE EARTHED AS PER ABOVE.
4. CABLE AND CABLE TRAYS EARTHING WILL BE DONE AS PER SPECIFICATION.



EQUIPMENT EARTHING DETAILS  
CABLE TRENCH

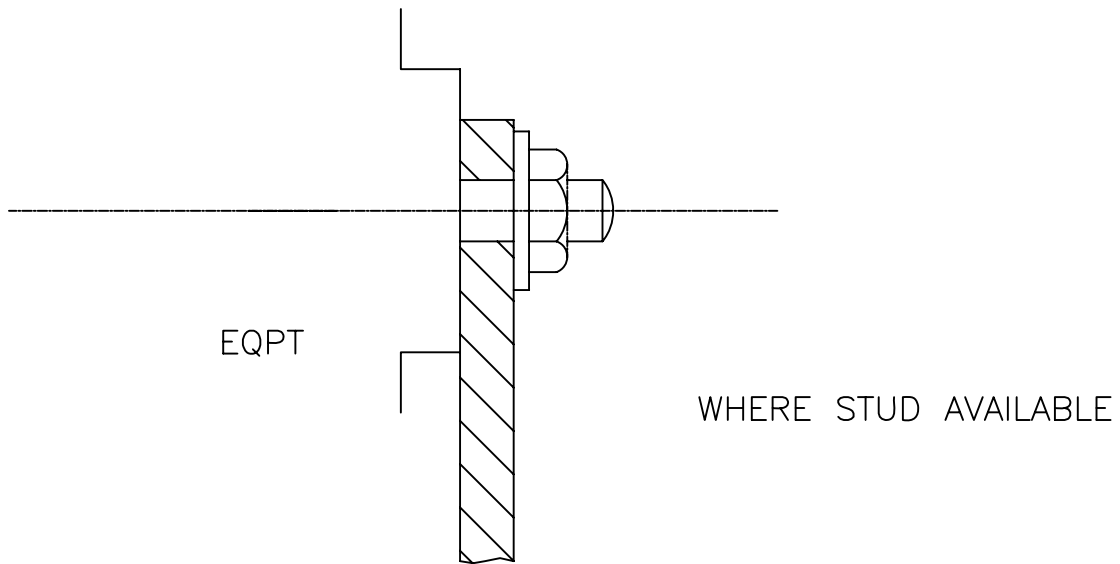
COMPU. DRG. REF.

DRG. NO.

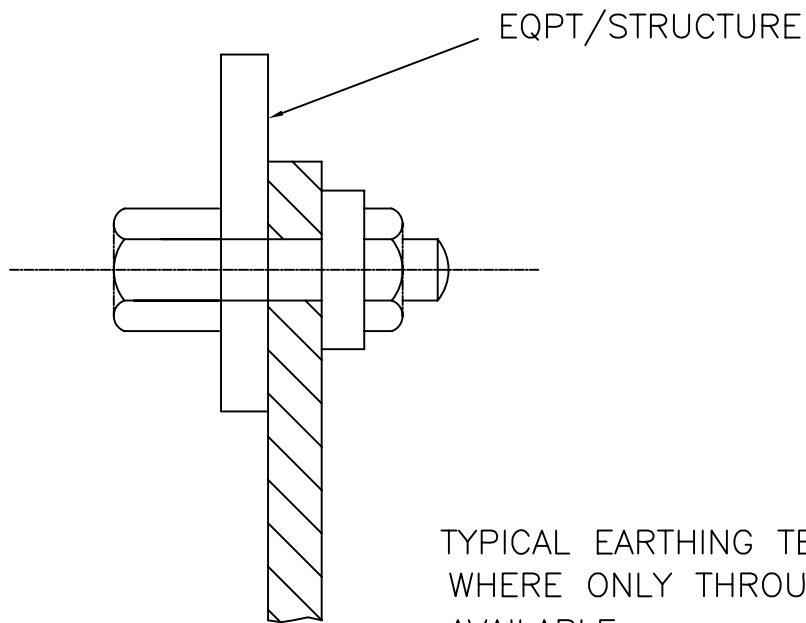
TB-4-344-509-013

REV. 00

SHEET  
24



TYPICAL EARTHING TERMINAL JOINT



NOTE

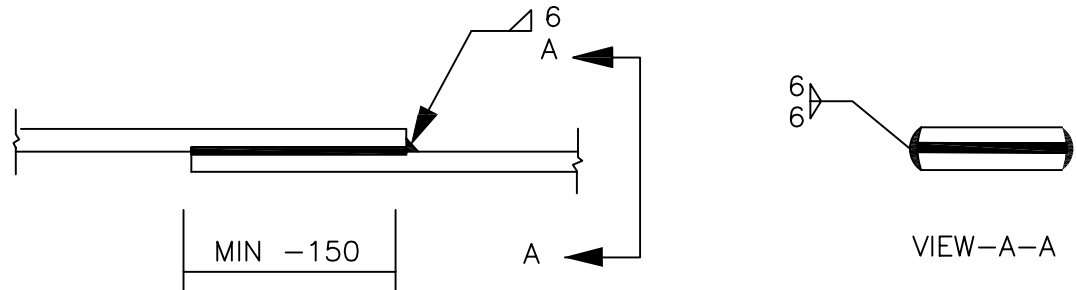
1. THIS IS GENERAL TYPICAL BOLTING ARRANGEMENT APPLICABLE TO ALL PANELS, EQUIPMENT,ETC,WHERE BOLTING ARRANGEMENT IS PROVIDED.
2. IN CASE EARTHING TERMINAL COMPRISES ONLY A TAPPED HOLE SUITABLE BOLT/ SCREW WITH WASHER MAY BE USED FOR EARTHING CONDUCTOR TERMINATION



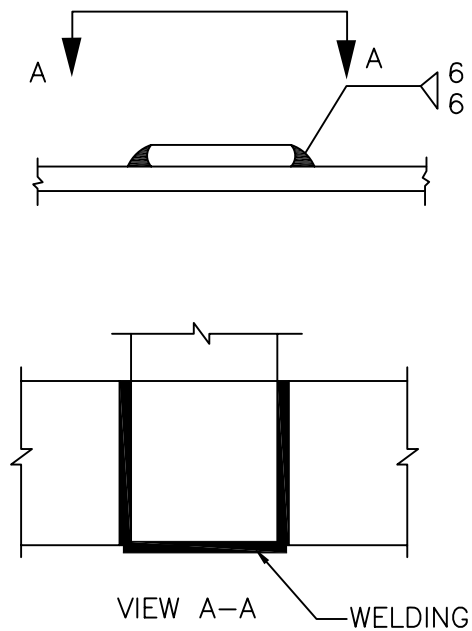
EQUIPMENT EARTHING DETAILS  
TYPICAL ARRANGEMENT OF BOLTED JOINTS

# STRIP TO STRIP (50X6mm or 75x12 mm FLAT ONLY)

## 1. STRAIGHT LAP JOINT/RISER



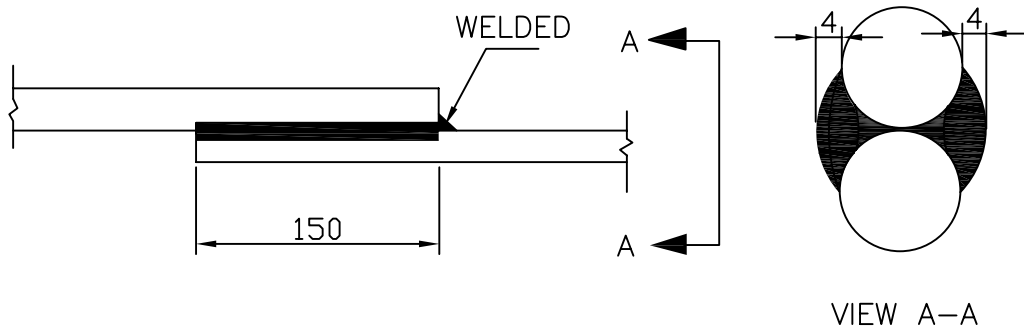
## 2. CROSS LAP JOINT



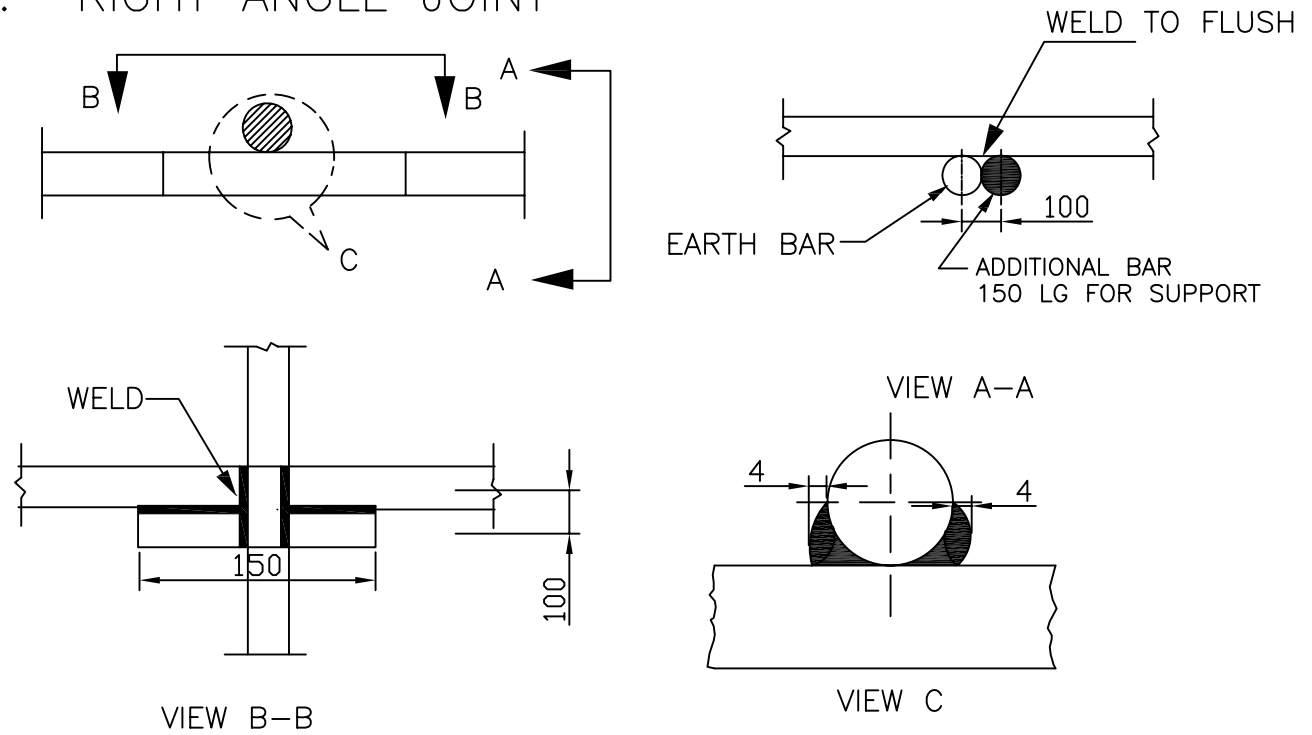
### EQUIPMENT EARTHING DETAILS WELDING DETAIL-1

# ROD TO ROD

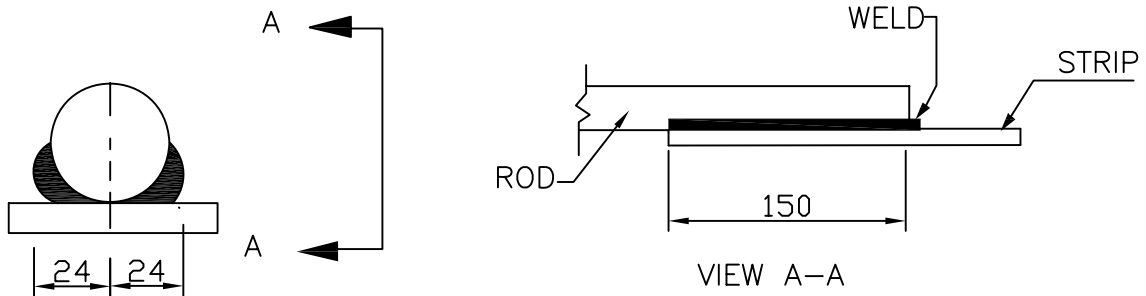
## 1. STRAIGHT LAP JOINT/RISER



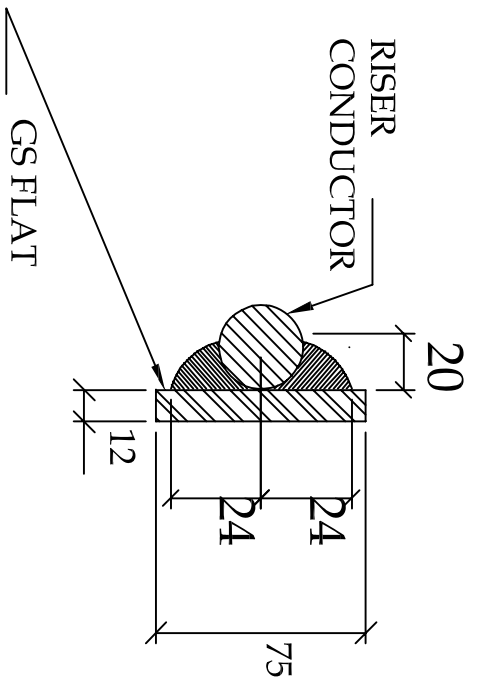
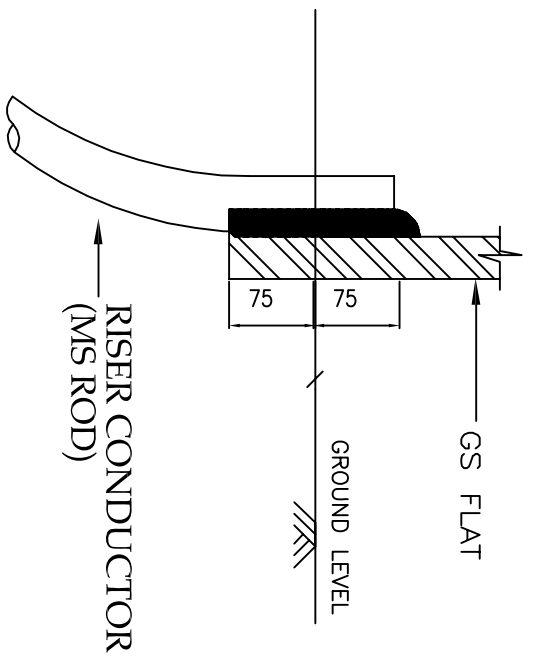
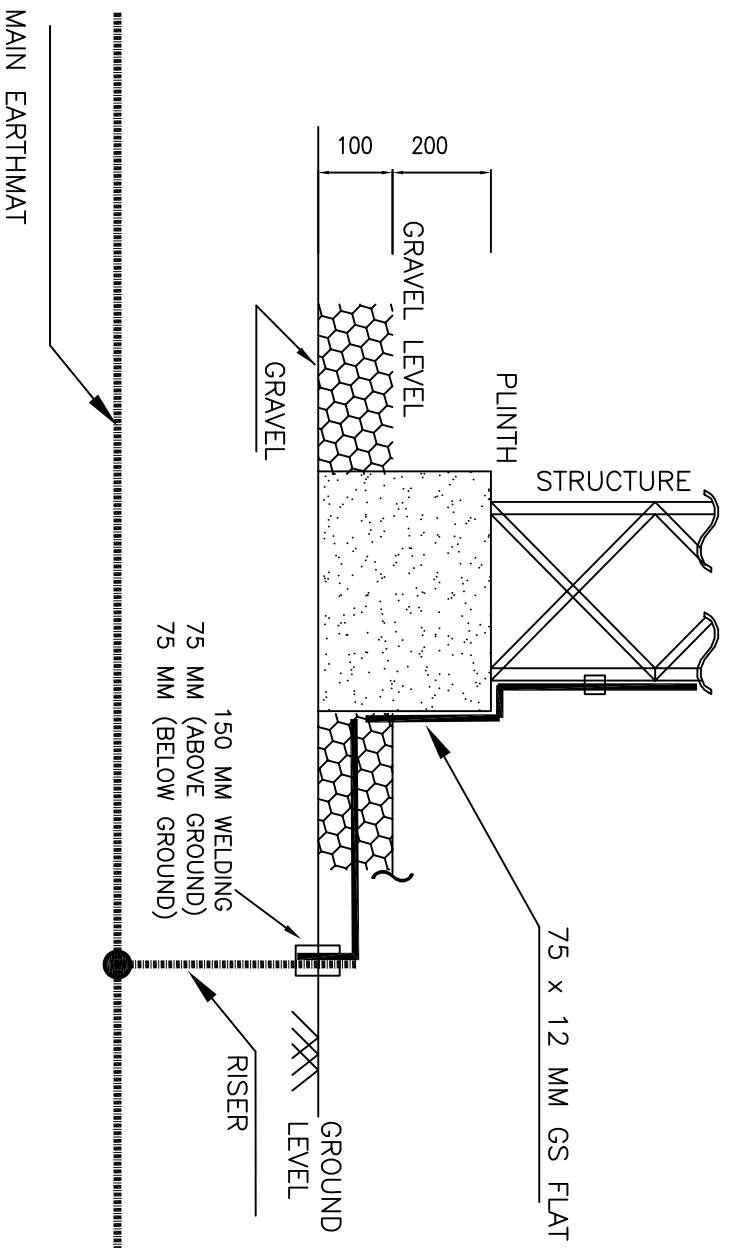
## 2. RIGHT ANGLE JOINT



## 3. ROD TO STRIP



# EQUIPMENT EARTHING DETAILS WELDING DETAIL-2



EQUIPMENT EARTHING DETAILS  
RISER & FLAT WELDING ARRANGMENT

COMPUTERREF. NO.

DRG. No.

TB-4-344-509-013

REV. 00

SHEET No.  
28

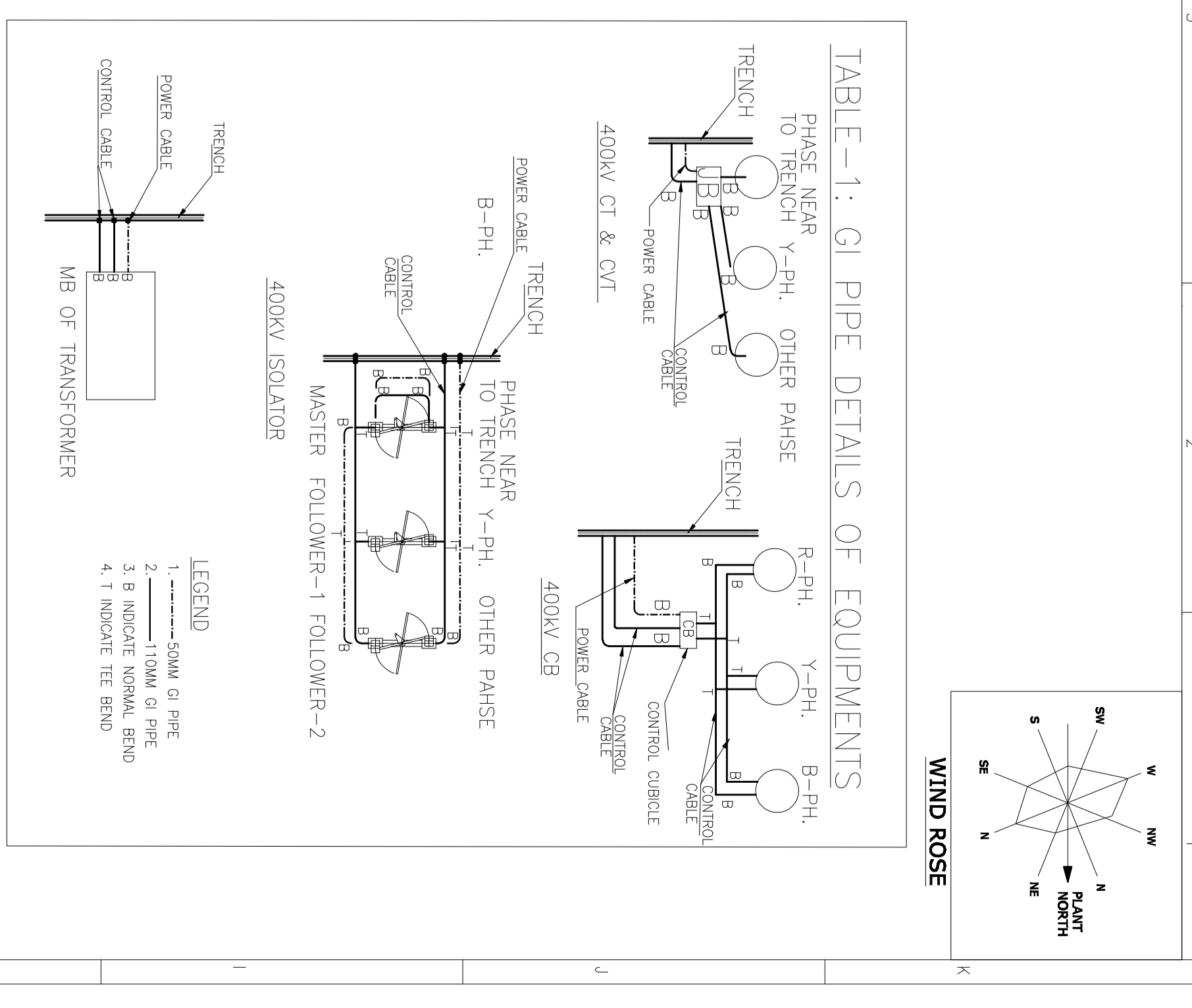
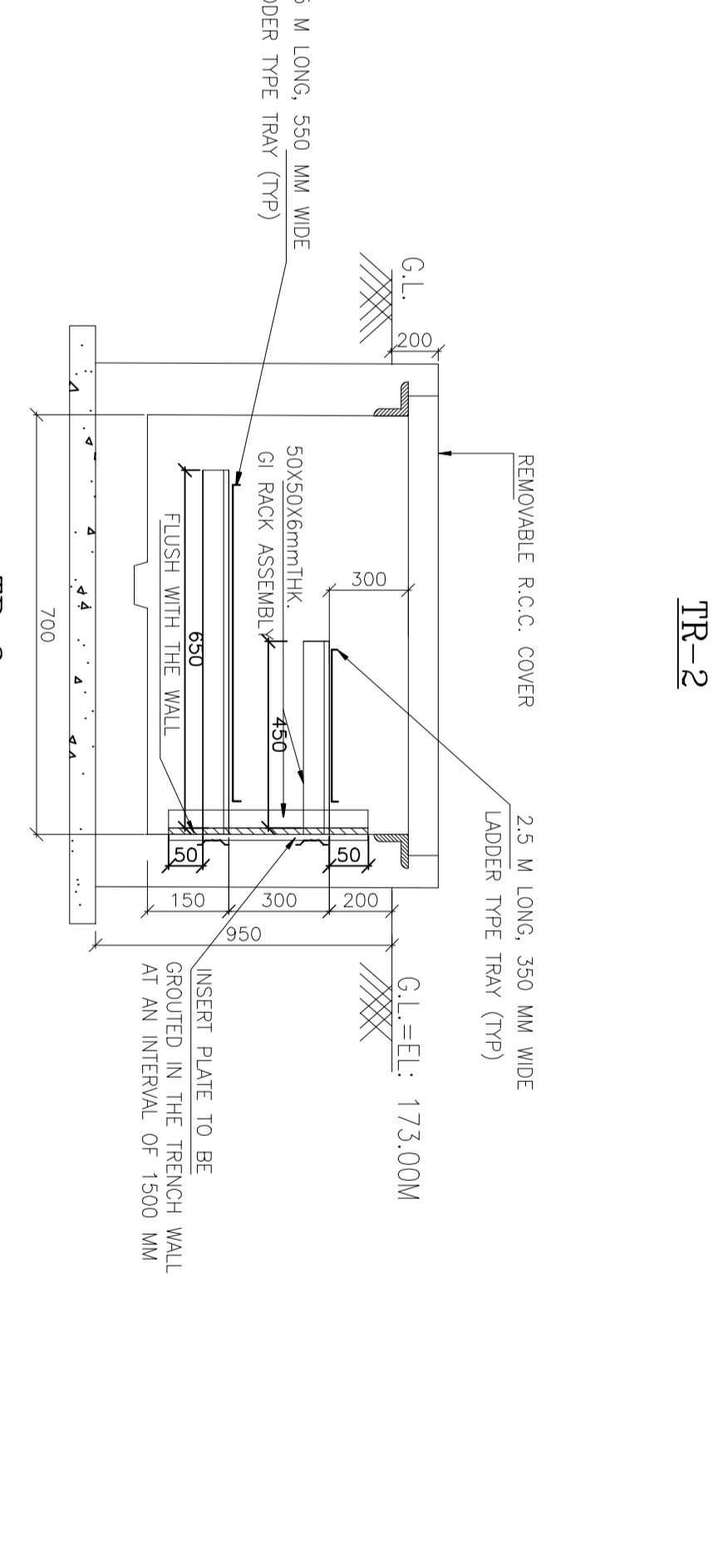
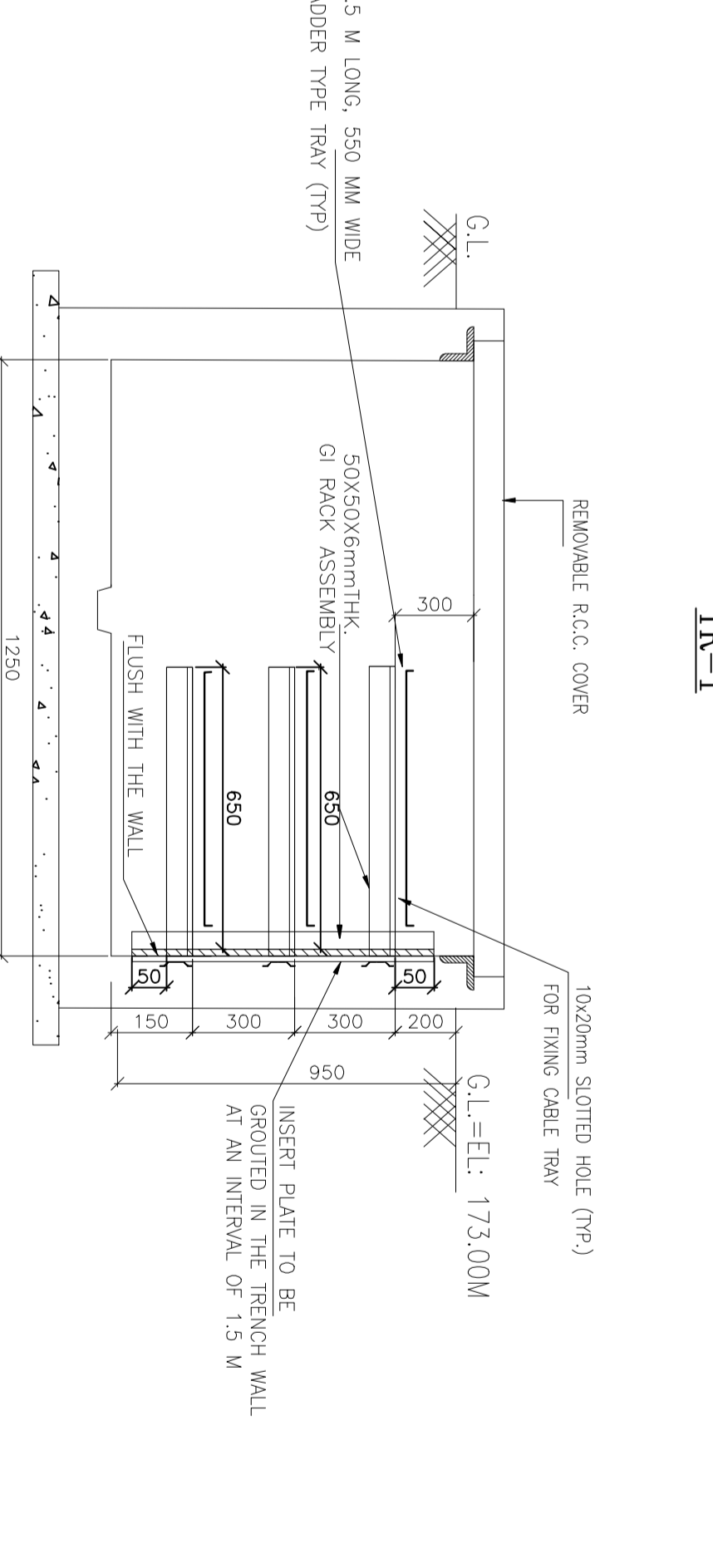
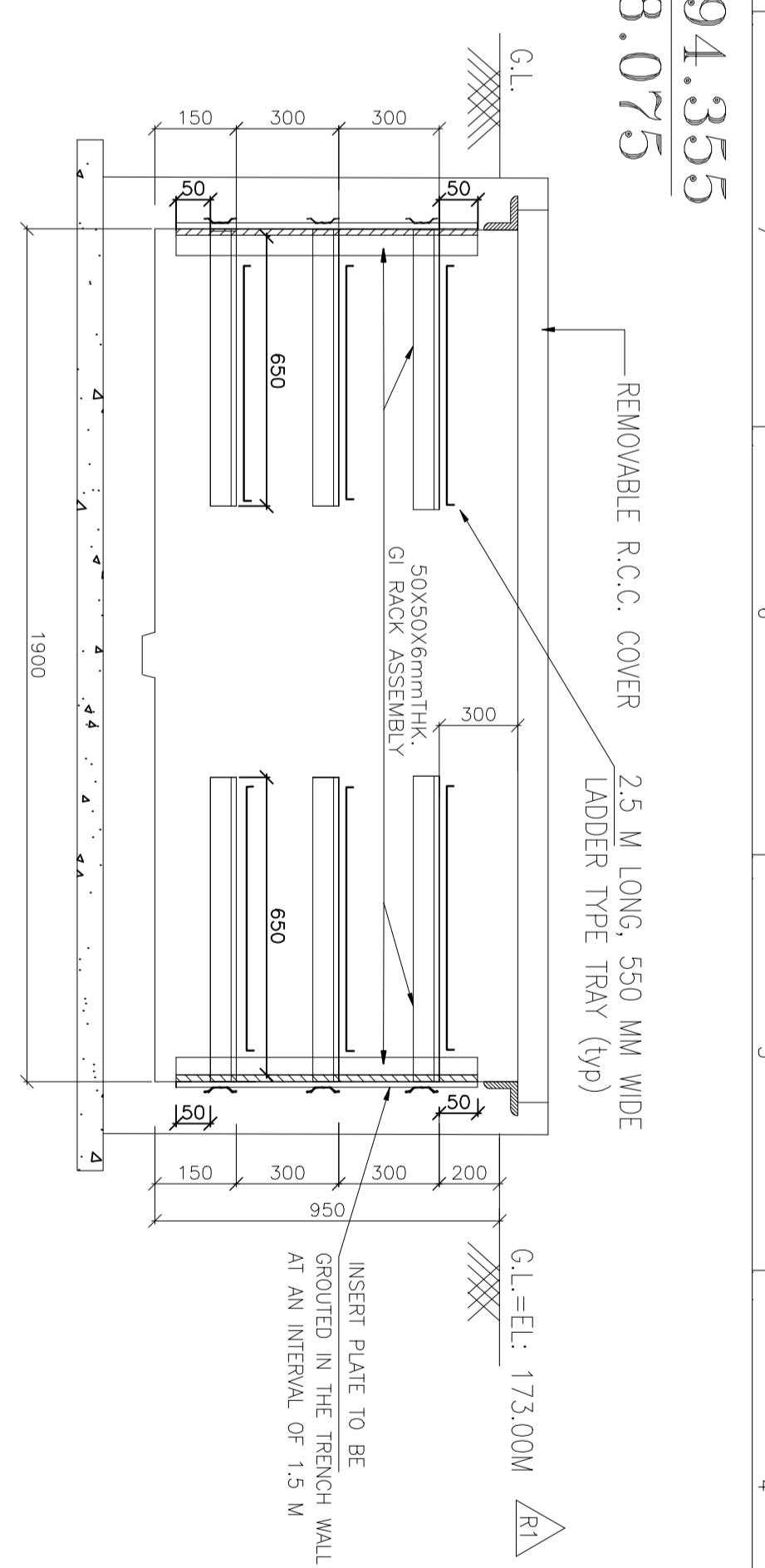


COPY RIGHT AND CONFIDENTIAL  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

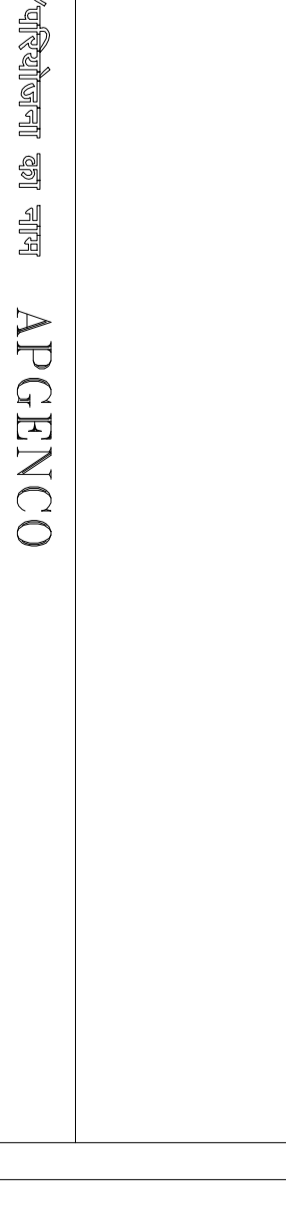
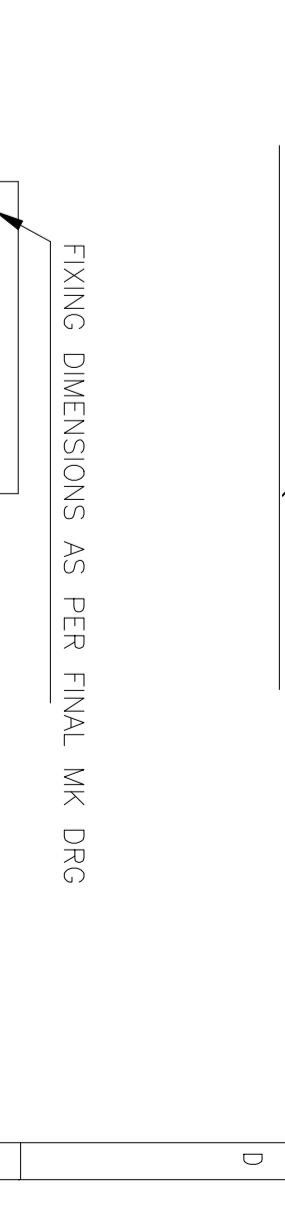
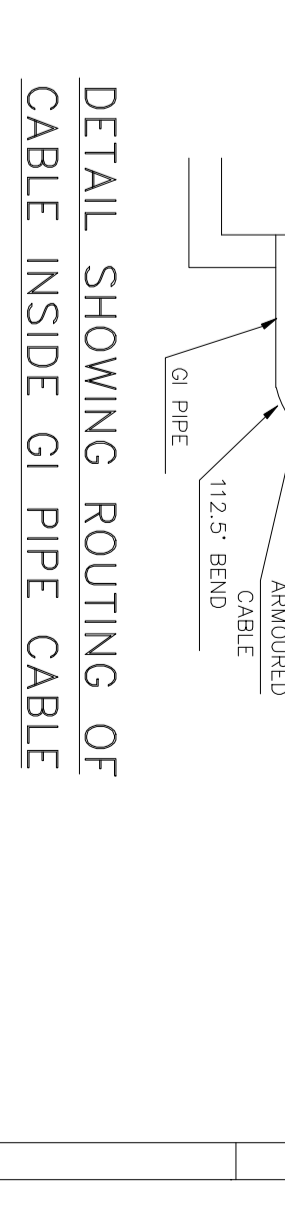
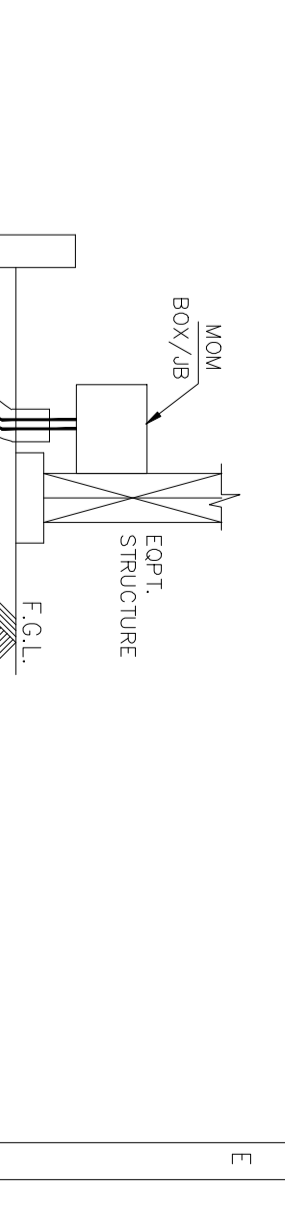
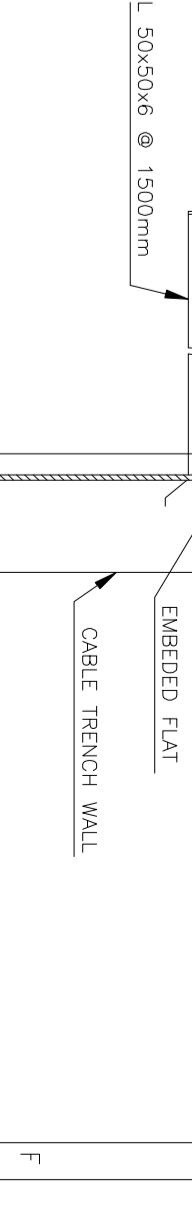


INVENTORY No.	SIGN. & DATE	REF. DRG. No.	COMPUTER DISC. PATH NAME
REQ. DATE	DATE	DATE	DATE
DESIGNED	DESIGNED	DESIGNED	DESIGNED
APPROVED	APPROVED	APPROVED	APPROVED
ZONE	ZONE	ZONE	ZONE

E=594.355  
S=68.075



- NOTES :-**
1. ALL DIMENSIONS ARE IN MM.
  2. THE LOCATION OF CABLE TRENCHES MARKED IN THIS DWG MAY BE SLIGHTLY MODIFIED TO
  3. MARKED INDICATES OPENINGS FOR TAKING OUT OF PIPES TO EQUIPMENTS. THE SUITABLE SIZED HOLES FOR DIA. 50/700 SHALL BE PROVIDED BELOW TOP CABLE SUPPORT.
  4. MK & JB INDICATE MARSHALLING KIOSK & JUNCTION BOX RESPECTIVELY.
  5. EXACT COORDINATES OF MK SHALL BE SUITABLY DECIDED AT SITE.
  6. 11KV CABLE SHALL BE PLACED IN MULTILAYER ON LADDER TYPE TRAYS FIXED ON GI CABLE RACK ASSEMBLY.
  7. AUXILIARY POWER CABLES SHALL BE LAID IN TOP TRAYS AND CONTROL CABLES IN BOTTOM TRAYS.
  8. PIPES ON SLOPE BETWEEN TWO POINTS OF SUPPORTS AND CONTROL ROOM SHALL BE LAID IN 50mm DIA GI
  9. BARRID CABLES FOR LIGHTING PURPOSE SHALL BE AS PER LIGHTING LAYOUT.
  10. LOCATION OF CABLE TRENCHES INSIDE CONTROL ROOM SHALL BE SHOWN IN SEPARATE DRAWING NO. TB-1-344-316-418
  11. EARTH CONDUCTOR 50mm GI PLAT TO BE WELDED IN VERTICAL ON THE CABLE SUPPORT BEFORE INSTALLATION OF CABLES.
  12. CABLES CROSSING ROAD SHALL BE LAID IN BOX CULVERT.
  13. FOR POWER & CONTROL CABLES, SEPARATE PIPES SHALL BE USED COMPLYING 60% VOID FOR EACH PIPE I.E. 40% FILLING CRITERIA.
  14. ALL OTHER DETAILS PERTAINING TO CIVIL WORKS SHALL BE RELECTED IN THE
  15. RESPECTIVE CIVIL DRAWINGS.
  16. THE ENDS OF GI PIPES SHALL BE FULLY SEALED TO PREVENT
  17. INGRESS OF WATER INSIDE THE PIPE.
  18. THE PURPOSE OF TRENCH LAYOUT DRAWING IS FOR USE AS FOLLOWS:
    - TO BE USED AS CIVIL INPUT FOR CABLE TRENCHES.
    - FOR ERECTION OF CABLE RACKS AT SITE.
    - FOR CABLE LAYING AND ROUTING AT SITE.
  19. 630 SQ. MM XLPE/AL. POWER CABLE BETWEEN LT TRANSFORMER (ERECTED OUTSIDE THE CONTROL BUILDING) AND 415V ACDB (LOCATED IN SWITCHYARD CONTROL ROOM) SHALL BE LAID IN FLAT FORMATION.
  20. THE CABLE OF CT /CVT BETWEEN SECONDARY TERMINAL BOX AND JUNCTION BOX SHALL BE LAID IN 100MM GI PIPE.
  21. INDICATE BOX CULVERT.
  22. THE CABLE RACK ASSEMBLY SHALL BE WELDED TO EMBEDDED INSERT PLATE AS MENTIONED BELOW
  23. EMBEDED INSERT PLATE SHALL BE WELDED TO BOTH SIDES OF VERTICAL ANGLE AT TOP AND BOTTOM AND NEAR
  24. EMBEDED INSERT PLATE SHALL BE WELDED TO BOTH SIDES OF VERTICAL ANGLE. MEAN THAT CABLE RACK ASSEMBLY
  25. CABLES SHALL BE ROUTED THROUGH SUPPORT ROUTE AS POSSIBLE.
  26. FOR ISOLATOR OPERATING MECHANISM IS IN CENTER THE 100 DIA GI PIPE FOR CABLE OF ISOLATORS
  27. SHOULD BE ROUTED TO THE OPERATING BOX.
  28. DRAWING NO. TB-1-344-316-418 (TRENCH LAYOUT PLAN FOR CONTROL BUILDING) MAY BE REFERRED FOR THE DETAILS OF TRENCH SECTIONS 3A & 4.



**REFERENCE DRAWINGS :-**

- LAYOUT PLAN FOR 400KV SWITCHYARD - TB-0-344-316-403
- TRENCH LAYOUT FOR SWITCHYARD CONTROL ROOM BUILDING - TB-1-344-509-418

**ADDITIONAL INFORMATION**

STATUS OF DRAWING - CONTRACT

DISTRIBUTION OF PRINTS

AGENCY - 3

PROJECT NAME - 2

CONTRACT NO. - 1

CONTRACT VALUE - 1000000000

CONTRACT DATE - 15/08/2011

CONTRACT NO. - 1

CONTRACT VALUE - 1000000000

CONTRACT DATE - 15/08/2011

CONTRACT NO. - 1

CONTRACT VALUE - 1000000000

CONTRACT DATE - 15/08/2011





