







LEGEND

	CONNECTION TO GROUND MAT THROUGH RISER
 RE	CONNECTION TO ROD ELECTRODE WITH NON- TREATED TEST PIT.
 PE	CONNECTION TO PIPE ELECTRODE WITH TREATED EARTH PIT
	75x12mm GS FLAT
	50x6mm GS FLAT
	40mm DIA MS ROD

GENERAL NOTES:

- 1 EARTH STRIP CLEATED TO LATTICE /PIPE TYPE STRUCTURE AT AN INTERVAL OF 1.0M SUITABLE PROVISION SHALL BE MADE WITH SUPPORT STRUCTURE.
- 2 ALL EARTH STRIPS SHALL BE TAKEN ALONG EDGE OF STRUCTURE. ALL DRAWING SHOWS TYPICAL ARRANGEMENT ONLY.
- 3 ALL STRUCTURES/EQUIPMENTS SHALL BE EARTHED AS SHOWN IN THE FOLLOWING SHEETS.
- 4 BOLT SIZE FOR CONNECTING EARTHING FLAT TO THE EQPT/STRUCTURE SHALL BE TO SUIT RESPECTIVE HOLE SIZE.
5. ALL EARTHING SHALL BE DONE IN ACCORDANCE WITH IS:3043 UNLESS OTHERWISE STATED IN TECHNICAL SPECIFICATION
- 6 TWO EARTHING STRIPS CAN BE CONNECTED TO ONE RISER.
- 7 EACH RISER OF A PARTICULAR EQUIPMENT SHALL BE CONNECTED TO A DIFFERENT EARTHROD (EITHER HORIZONTAL OR VERTICAL CONDUCTORS OF MAIN EARTHMAT).
- 8 FOR WELDING DETAILS REFER SHEET #20 & 21
- 9 E/WIRE DOWN CONDUCTOR SHALL BE CLEATED AT AN INTERVAL OF 2.0 M ALONG WITH STRUCTURE NO HOLES IN STRUCTURE IS ALLOWED FOR THIS PURPOSE




SHEET NO. DESCRIPTION

01. TITLE
- 1A. NOTES
02. 400kV & 220kV SF6 CIRCUIT BREAKER
03. 400kV CVT
04. 400kV & 220kV POST INSULATOR (SOLID CORE TYPE)
05. 390kV & 216kV LIGHTNING ARRESTER
06. MARSHALLING KIOSK
- 7A. 400kV HORIZONTAL DOUBLE BREAK ISOLATOR WITH ONE EARTH SWITCH (TYPICAL)
- 7B. 400kV HORIZONTAL DOUBLE BREAK ISOLATOR WITH TWO EARTH SWITCH (TYPICAL)
- 7C. 220kV HORIZONTAL CENTER BREAK ISOLATOR WITH TWO EARTH SWITCH (TYPICAL)
- 7D. 220kV HORIZONTAL CENTER BREAK ISOLATOR WITH ONE EARTH SWITCH (TYPICAL)
- 7E. 220kV HORIZONTAL CENTER BREAK ISOLATOR WITHOUT EARTH SWITCH (TYPICAL)
- 08A. TOWER WITHOUT PEAK
- 08B. TOWER WITH PEAK
- 08C. LIGHTENING MAST (LM)
09. 400kV & 220kV CURRENT TRANSFORMER
10. CABLE TRENCH
11. PIPE EARTH ELECTRODE WITH TREATED PIT
12. ROD ELECTRODE WITHOUT PIT

SHEET NO. DESCRIPTION

13. RAIL BONDING
- 14A. ICT TRANSFORMER
- 14B. BUS REACTOR.
- 14C. LT TRANSFORMER
15. AUXILIARY EARTH MAT FOR ISOLATOR MAIN MECH./E/S MECH. BOX
16. CONTROL AND RELAY PANELS/BATTERY CHARGER/ AC DC BOARDS/MLDB
17. WAVE TRAP
18. GATE/FENCE POST
19. TYPICAL ARRANGEMENT OF BOLTED JOINTS
20. WELDING DETAILS
21. WELDING DETAILS

DESIGN NO.	401
STATUS	CONTRACT
DISTRIBUTION	
REV.	
REV. NO.	
DATE	
BY	
CHECKED	
APPROVED	

NTPC DRG. No. 1450-001R-SWYD-PVE-E-002	
NBPPL DRG. No.	
PROJECT FEROZE GANDHI UNCHAHAR THERMAL POWER PROJECT STAGE-IV 1X500MW	
OWNER  NTPC	NTPC Limited (A MEMBER OF THE GROUP)
EPC VENDOR  NBPPL	NTPC BHEL Power Projects Private Limited (A Joint Venture Company of NTPC & BHEL) Y.S.R. Puram, Village Mannavaram, Sri Kalahasti Mandal, Distt. Chittoor - 517620 (A.P.)
CLIENT  BHEL	POWER SECTOR PROJECT ENGINEERING MANAGEMENT NEW DELHI
FILE	400/220 kV - Equipment Earthing Philosophy & Details
DATE	SCALE
DRAWING NO.	TB-4-359-PVE-E-002
SHEET	0

1. RISER FROM THE EARTH GRID SHALL BE 40MM DIAMETER MILD STEEL ROD. RISER SHALL RISE FROM THE GROUND ALONG THE NEAREST EQUIPMENT FOUNDATION/BUILDING COLUMN/WALL TO AVOID ANY OBSTRUCTION TO MOVEMENT OF PERSONNEL.
2. CONNECTION TO ALL EQUIPMENT AND TOWERS SHALL BE BY BOLTED JOINTS. CONTACT SURFACES SHALL BE THOROUGHLY CLEANED BEFORE CONNECTIONS. EQUIPMENT BOLTED CONNECTIONS AFTER BEING TESTED AND CHECKED SHALL BE PAINTED WITH ANTI CORROSIVE PAINT/COMPOUND.
3. CONNECTIONS BETWEEN EQUIPMENT EARTHING LEADS AND BETWEEN MAIN EARTHING CONDUCTORS SHALL BE OF WELDED TYPE. FOR RUST PROTECTION THE WELDS SHOULD BE TREATED WITH RED LEAD COMPOUND AND AFTERWARDS THICKLY COATED WITH BITUMEN COMPOUND.
THE SURFACES TO BE WELDED SHALL BE CLEANED OF DIRT, OIL, GREASE AND OXIDES BEFORE WELDING. ANY OXIDE FILMS THAT MAY HAVE FORMED DURING WELDING MUST BE REMOVED FROM THE WELDED JOINT.
4. EARTHING CONDUCTOR FOR EQUIPMENT SHALL BE OF GALVANISED M.S. OF SIZE 75x12 mm.
THE CONDUCTOR BELOW THE GROUND LEVEL SHALL BE 40 mm DIA BLACK MS ROD.
5. IN THE ATTACHED DRAWINGS GL REPRESENTS GROUND LEVEL.
6. ALL THE EQUIPMENTS SHALL BE EARTHED AT TWO POINTS WITH 75x12 mm. G.S. FLAT EVEN THOUGH THEY ARE SHOWN OR NOT IN THE DRAWING DUE TO CLARITY.
7. ALL JUNCTION BOXES, OPERATING MECHANISAM BOXES, GROUND MOUNTED CONTROL CABINETS SHALL BE EARTHED AT TWO POINTS WITH 50x6mm G.S. FLAT BY TWO SEPARATE AND DISTINCT EARTH CONNECTERS.
8. EARTHING CONDUCTORS FROM EQUIPMENT STRUCTURES SHALL BE CONNECTED TO THE NEAREST POSSIBLE EARTH MAT RISER. EQUIPMENT EARTHING SHALL BE AS PER IS 3043.
9. ALL JOINTS BETWEEN 40 DIA M.S. ROD AND 75x12 mm. G.S. FLAT SHALL BE BELOW GROUND LEVEL.
10. FOR WELDED JOINTS LOW HYDROGEN CONTENT ELECTRODES SHALL BE USED.
11. METTALIC SHEATHS/SCREENS, AND ARMOUR OF MULTI CORE CABLES SHALL BE EARTHED AT BOTH ENDS.
METTALIC SHEATHS AND ARMOUR OF SINGLE CORE CABLES SHALL BE EARTHED AT SWITCHGEAR END ONLY UNLESS OTHERWISE INSTRUCTED BY THE EMPLOYER.
12. EQUIPMENT BOLTED CONNECTIONS AFTER BEING TESTED AND CHECKED SHALL BE PAINTED WITH ANTI CORROSIVE PAINT/COMPOUND.
13. LOCATION OF EARTHING CONDUCTORS/RISERS SHOWN IN THE EARTHING DRAWING MAY CHANGE TO SUIT THE SITE CONDITION.
14. FOR SURGE ARRESTER, EARTHING LEAD FROM SURGE COUNTER TO MAIN EARTHMAT SHALL BE SHORTEST IN LENGTH AS PRACTICALLY AS POSSIBLE.
15. AN ADDITIONAL AUXILIARY GRID OF 1500MMX1500MM COMPRISING OF CLOSELY SPACED(300MMX300MM) 40 DIA CONDUCTORS AT A DEPTH OF 300MM FROM FINISHED GROUND LEVEL SHALL BE PROVIDED BELOW THE OPERATING HANDLE OF ISOLATORS AND EARTH SWITCHES. THIS GRID SHALL BE CONNECTED TO THE MAIN GROUND GRID. THE EARTH CONNECTION TO OPERATING HANDLE SHALL BE MADE OF FLEXIBLE CONNECTION. THE MOM BOX OF THE ISOLATOR TO BE CONNECTED TO THIS AUX. GRID.
16. ALL NON CURRENT CARRYING METALIC PARTS SHALL BE EARTHED AT TWO DIFFERENT PLACES.
17. ALL EQUIPMENT DRAWINGS SHOWN ARE INDICATIVE ONLY.
18. WELDING OF EARTHING CONDUCTOR SHALL BE CONNECTED IN VERTICAL PLANE WHEREVER POSSIBLE.
19. MS ROD SHALL BE AS PER GRADE-A DESIGNATION Fe410WA OF IS 2062-2011 OR GREADE SAE 1018 AS PER ASTM A 576-90B.

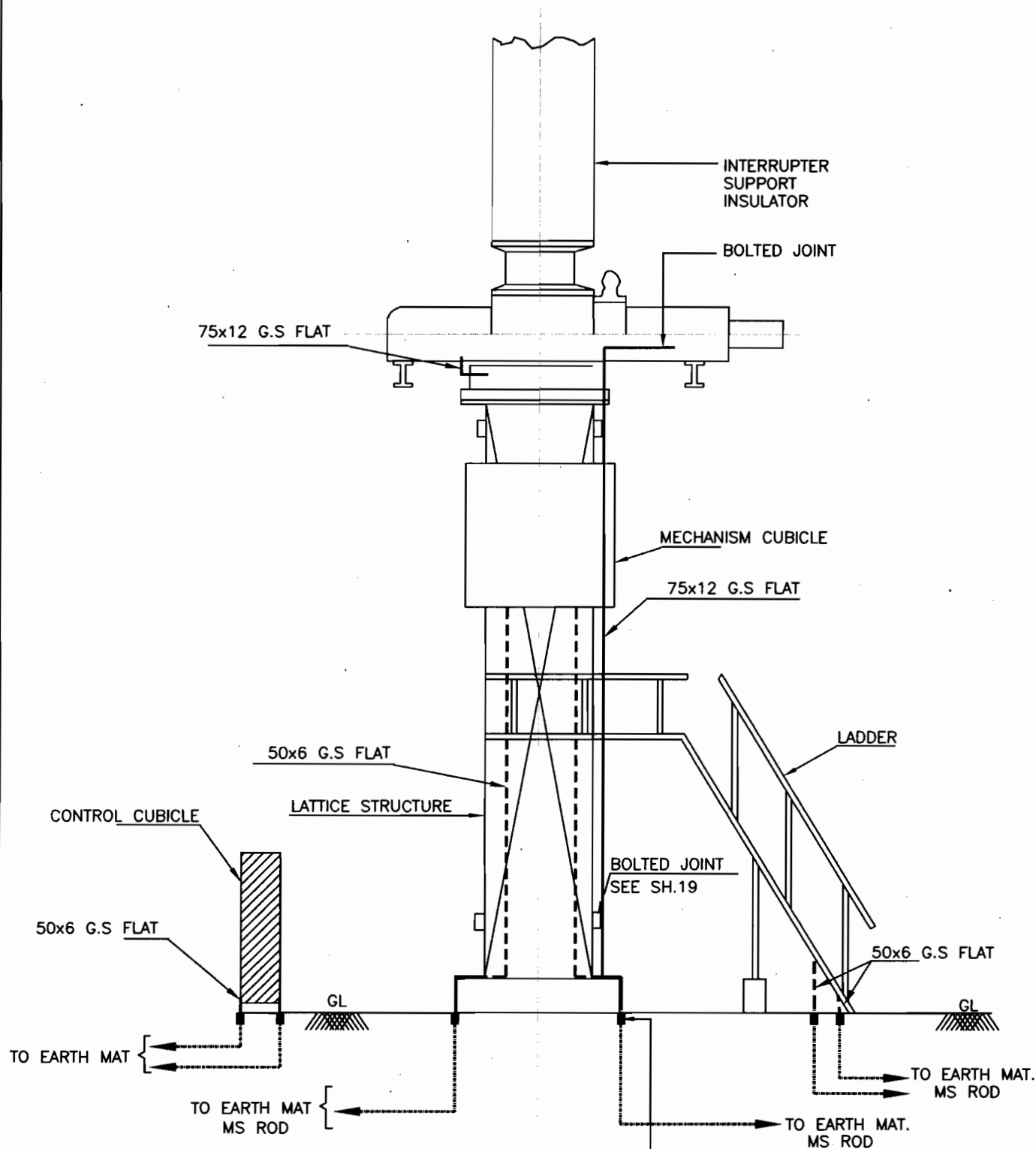


EQUIPMENT EARTHING DETAILS NOTES

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
1A



NOTES:

1. NO. OF RISERS FOR CIRCUIT BREAKER = 2 Nos./PHASE
2. NO. OF RISERS FOR MECHANISM CUBICLE = 2 Nos.
3. NO. OF RISERS FOR LADDER = 2 Nos.
4. NO. OF RISERS FOR CONTROL CUBICLE = 2 Nos.

SEE DETAIL B
IN SHEET NO 21



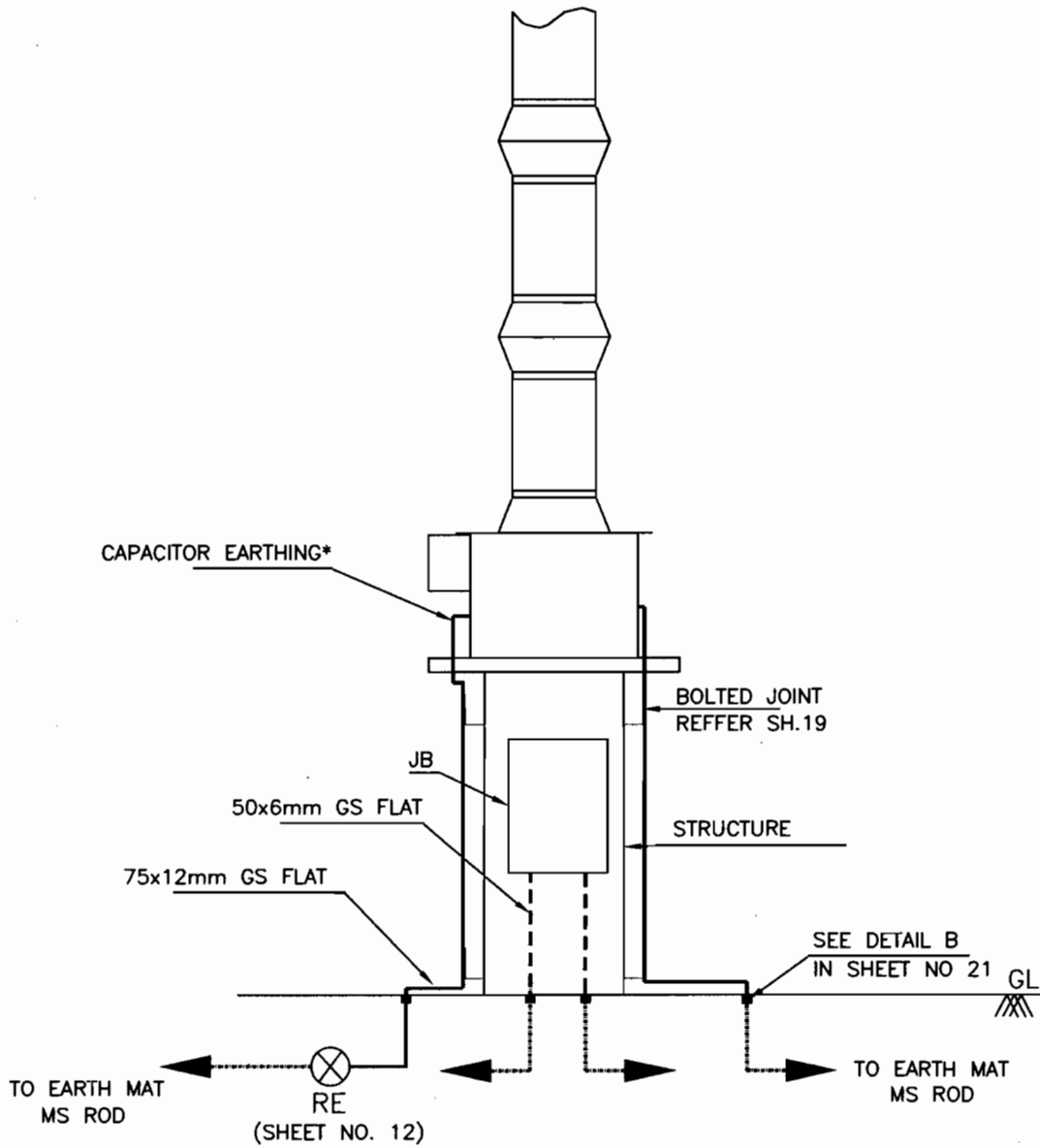
EQUIPMENT EARTHING DETAILS 400kV & 220kV SF6 CIRCUIT BREAKER

COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
2



NOTE:

1. "*"— FOR LINE SIDE PROTECTION CVT CAPACITOR TO BE EARTHED THROUGH LMU.
2. FOR LINE METERING CVT, SYNCHRONISING CVT & BUS CVT CAPACITOR SHALL BE EARTHED INSIDE THE BOX
3. NO. OF RISER FOR CVT = 1 Nos.
4. NO. OF RISER FOR CVT JB = 2 Nos. (ONLY IN 'Y' PHASE)
5. NO. OF RISER FOR ROD ELECTRODE = 1 Nos. (WHEREVER APPLICABLE)



EQUIPMENT EARTHING DETAILS

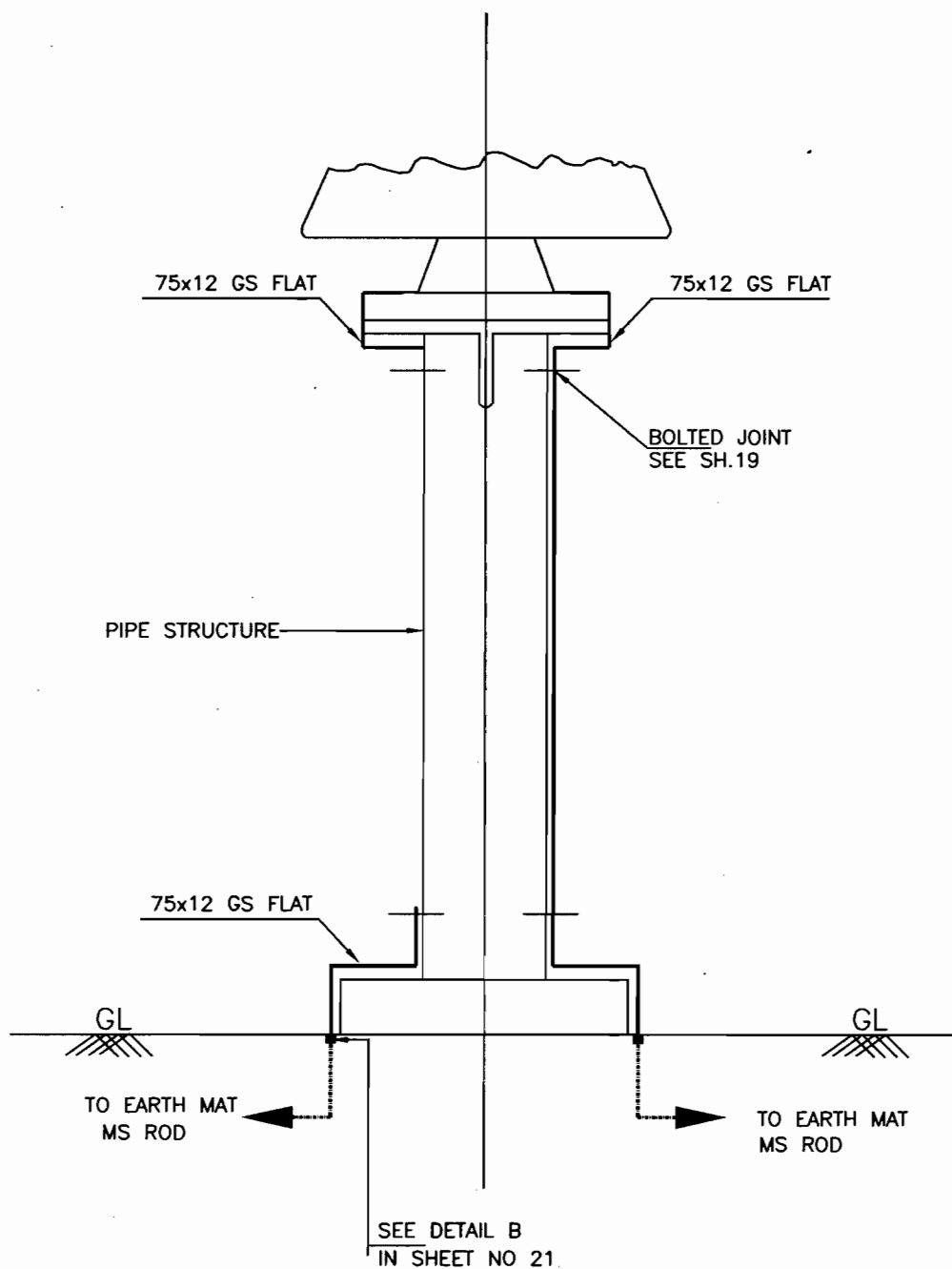
400kV CVT

COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
3



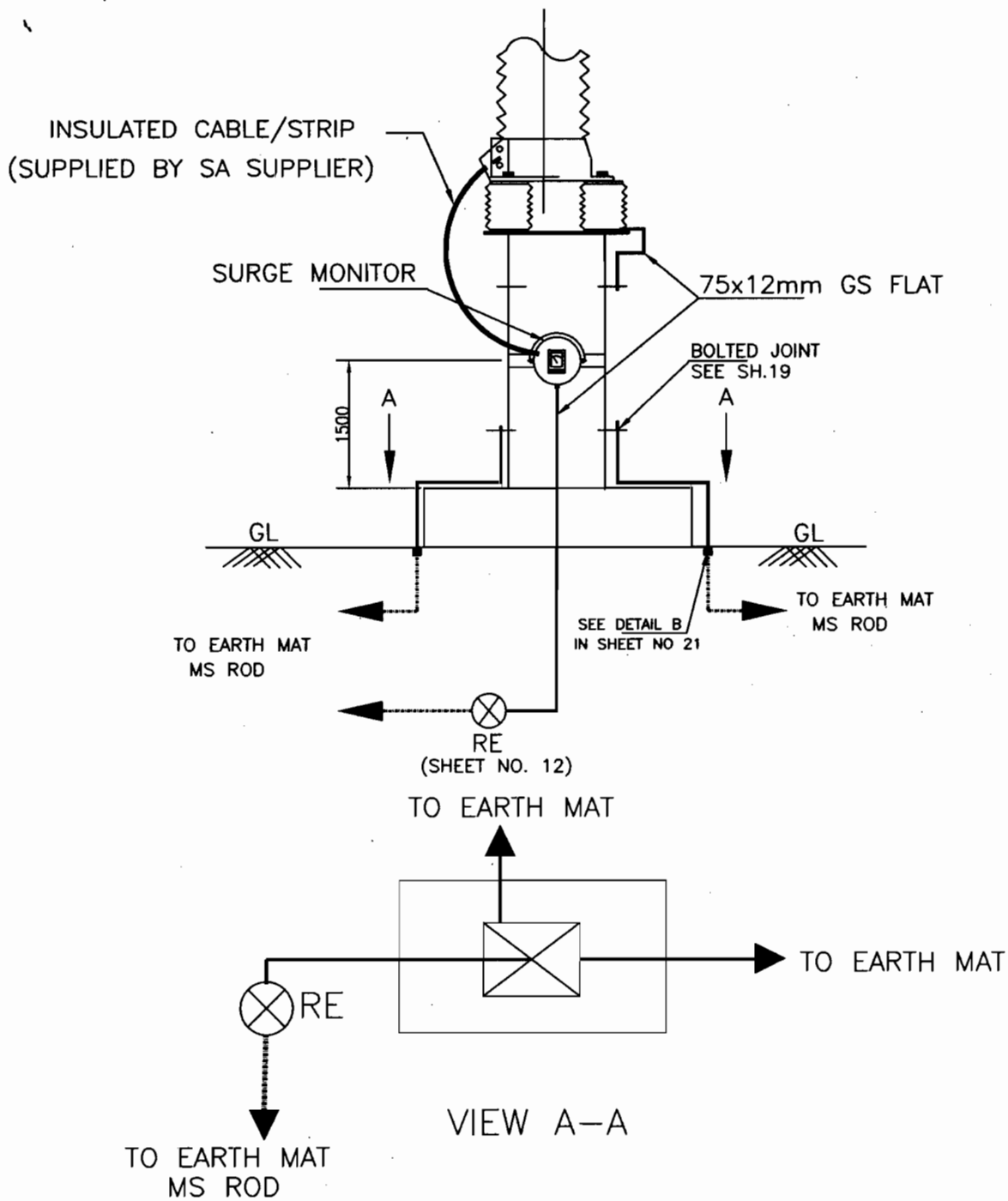
1. NO. OF RISER FOR BPI = 2 Nos.



EQUIPMENT EARTHING DETAILS 400kV & 220kV POST INSULATOR (SOLID CORE TYPE)

DRG. No. TB-4-359-PVE-E-002

SHEET No.
4



NOTES:

1. NO. OF RISER FOR EQUIPMENT = 2 Nos.
2. NO. OF RISER FOR ROD ELECTRODE = 1 Nos.
3. LA SHALL BE EARTHED THROUGH EARTH TERMINAL OF SURGE COUNTER



EQUIPMENT EARTHING DETAILS

390kV & 216kV LIGHTNING ARRESTER

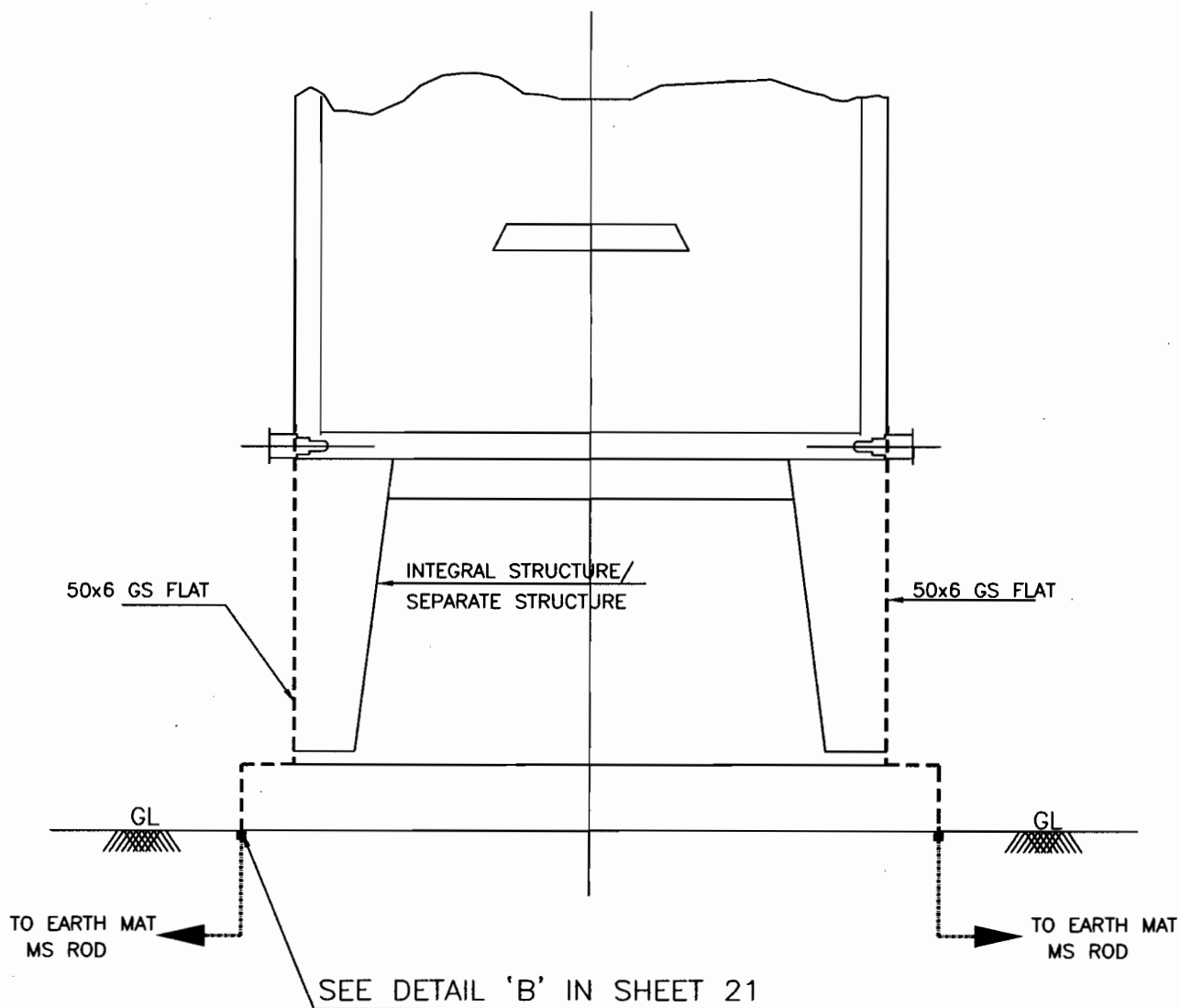
COMPU. DRG. REF.

DRG.NO.

TB-4-359-PVE-E-002

SHEET No.

5



NOTES:

1. NO. OF RISER FOR MK = 2 Nos.



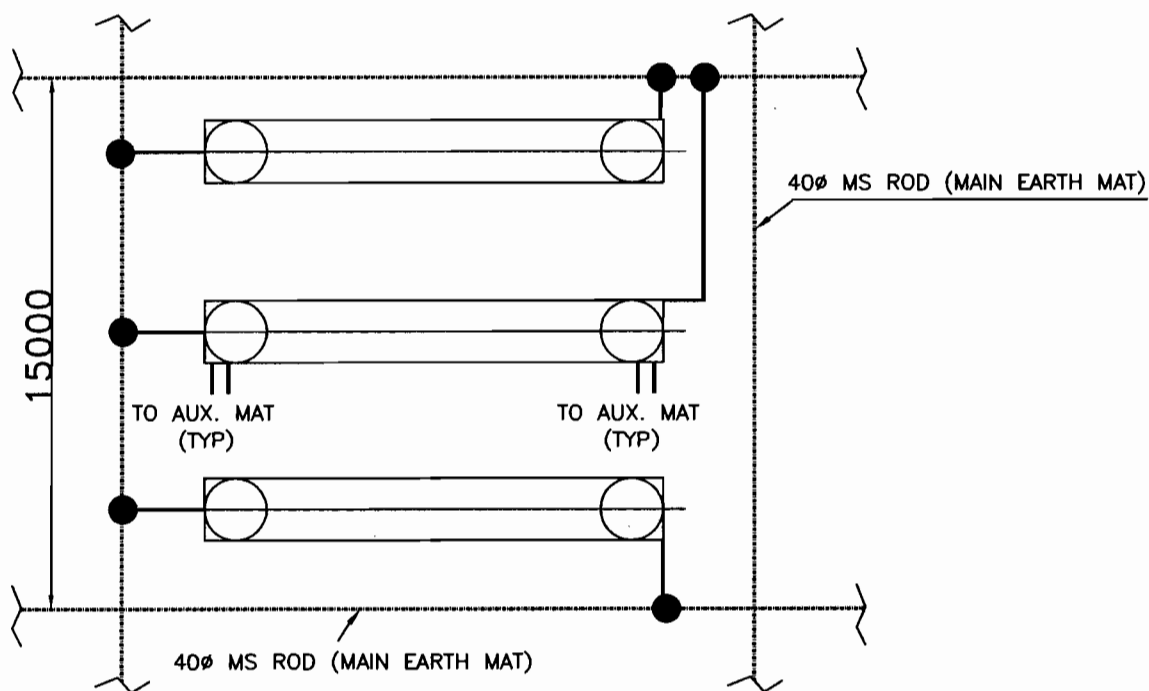
EQUIPMENT EARTHING DETAILS
MARSHALLING KIOSK

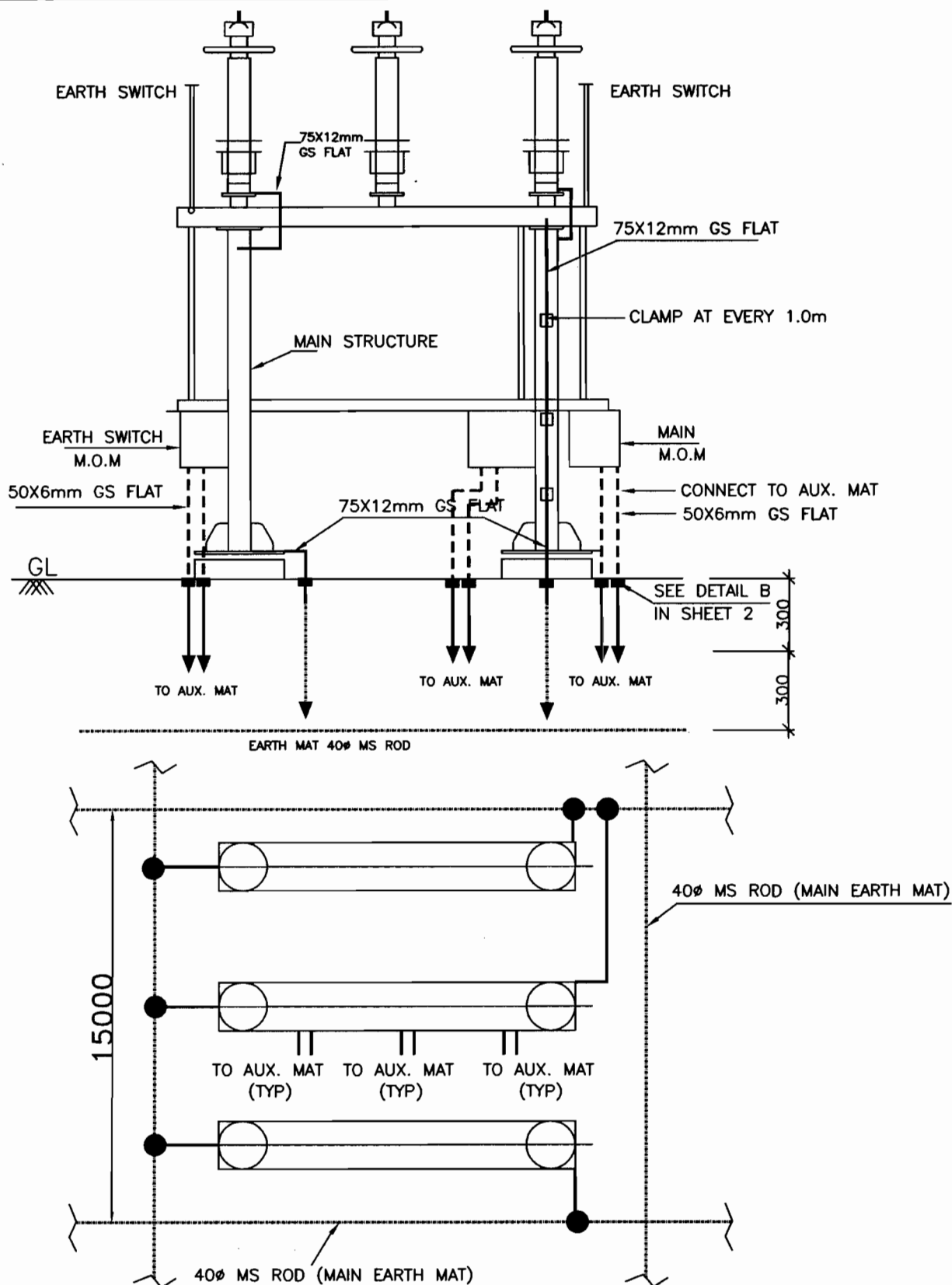
COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
6





NOTES:

1. NO. OF RISER FOR EQUIPMENT = 2 Nos./PHASE
2. NO. OF RISER FOR MECHANISM BOX = 2 Nos./BOX
3. NO. OF AUXILIARY MAT = 1 No./BOX



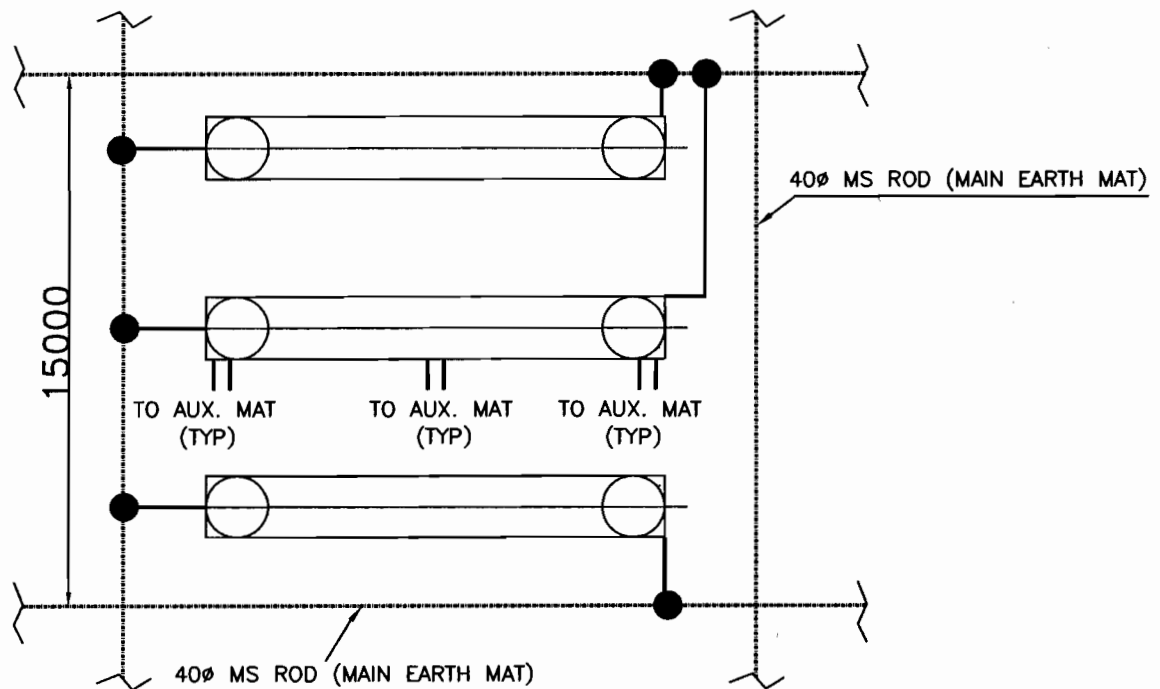
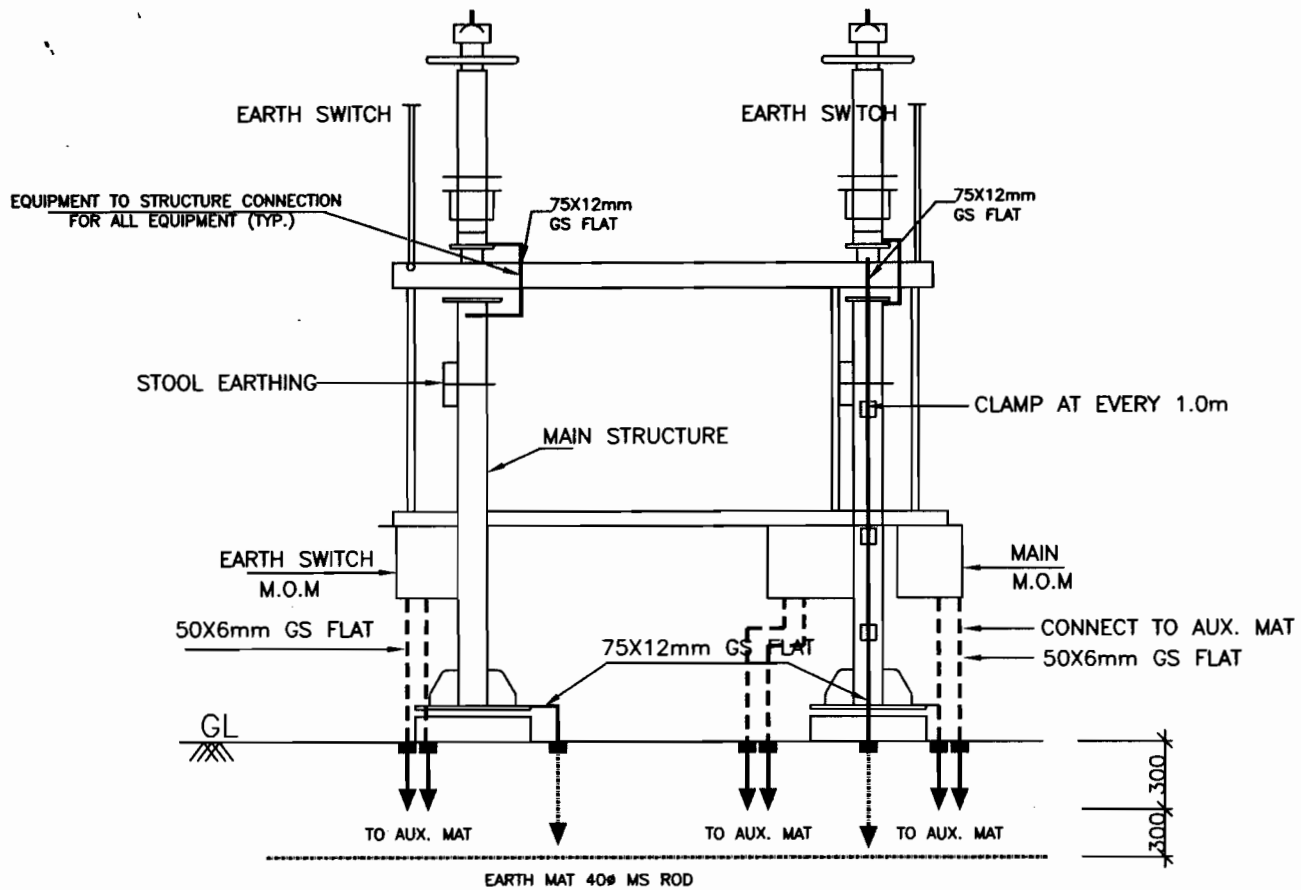
EQUIPMENT EARTHING DETAILS
 400kV HORIZONTAL DOUBLE BREAK
 ISOLATOR (TYPICAL) WITH TWO EARTH SWITCH

COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
7B



NOTES:

1. NO. OF RISER FOR EQUIPMENT = 2 Nos./PHASE
2. NO. OF RISER FOR MECHANISM BOX = 2 Nos./BOX
3. NO. OF AUXILIARY MAT = 1 No./BOX



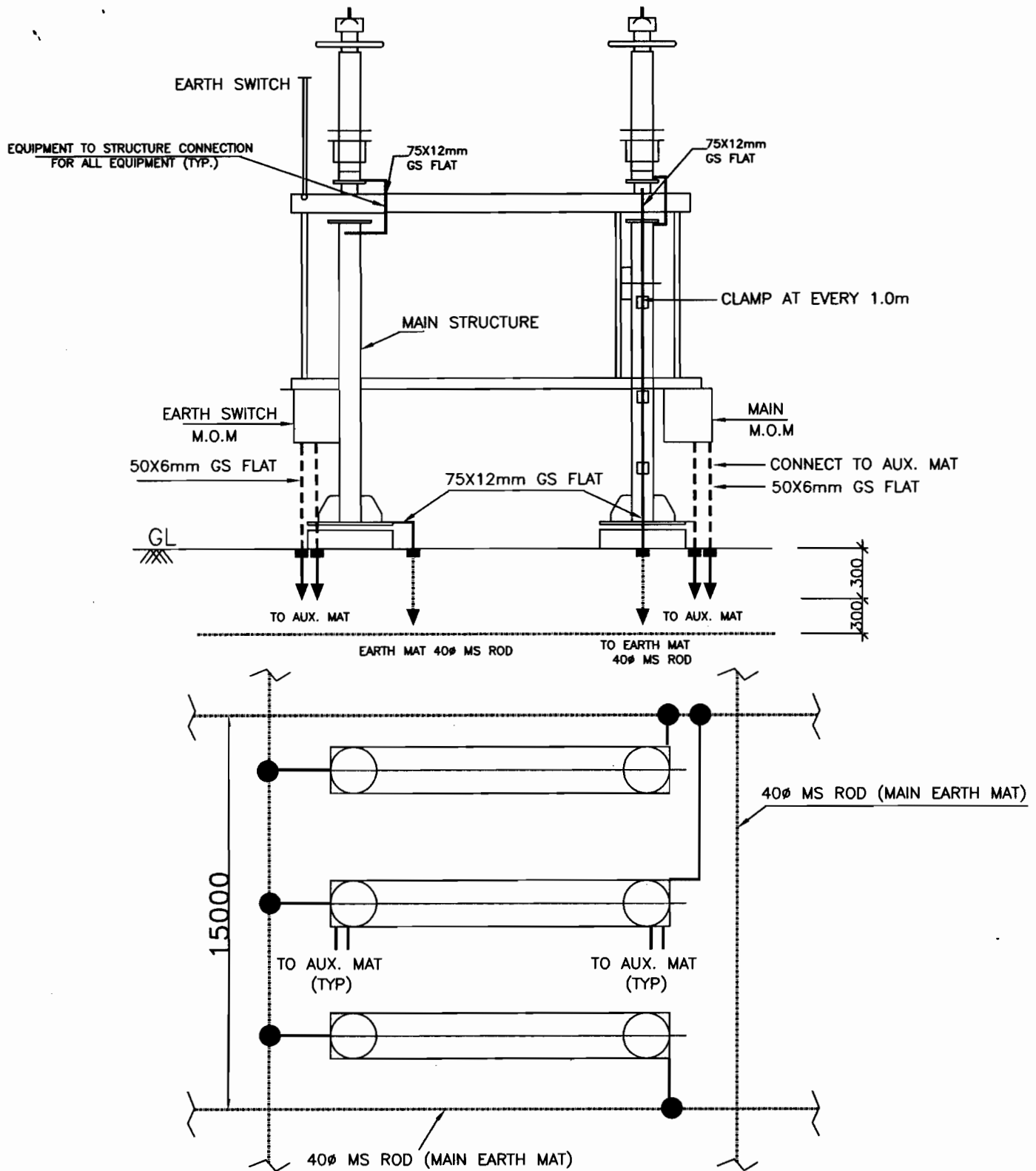
EQUIPMENT EARTHING DETAILS
220KV HORIZONTAL CENTER BREAK
ISOLATOR (TYPICAL) WITH TWO EARTHSWITCH

COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
7C



NOTES:

1. NO. OF RISER FOR EQUIPMENT = 2 Nos./PHASE
2. NO. OF RISER FOR MECHANISM BOX = 2 Nos./BOX
3. NO. OF AUXILIARY MAT = 1 No./BOX



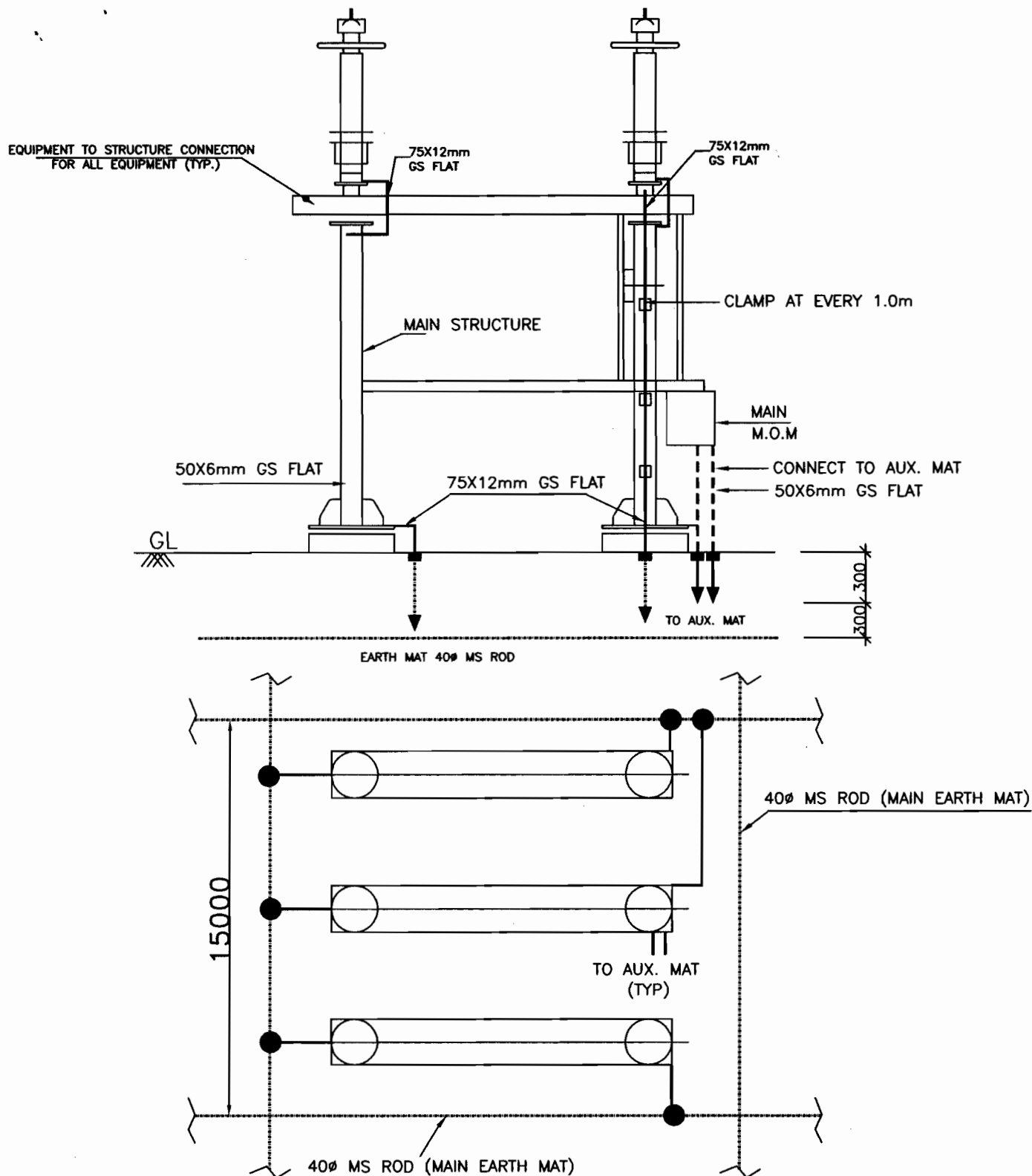
EQUIPMENT EARTHING DETAILS
 220KV HORIZONTAL CENTER BREAK
 ISOLATOR (TYPICAL) WITH ONE EARTHSWITCH

COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
7D



NOTES:

1. NO. OF RISER FOR EQUIPMENT = 2 Nos./PHASE
2. NO. OF RISER FOR MECHANISM BOX = 2 Nos./BOX
3. NO. OF AUXILIARY MAT = 1 No./BOX



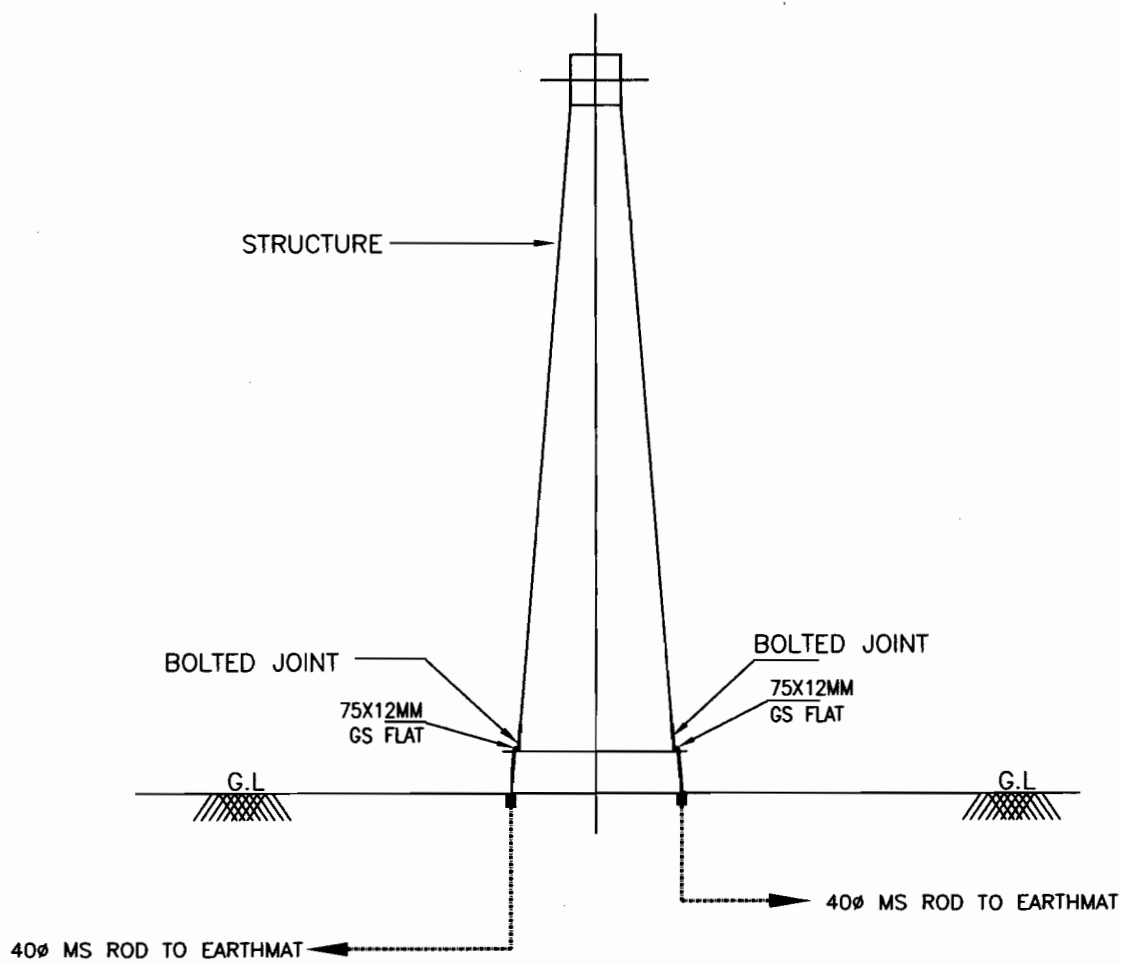
EQUIPMENT EARTHING DETAILS
 220KV HORIZONTAL CENTER BREAK
 ISOLATOR (TYPICAL) WITHOUT EARTH SWITCH

COMPUTER REF. NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
7E



NOS.OF RISERS = 2 NOS. PER TOWER



EQUIPMENT EARTHING DETAILS TOWER WITHOUT PEAK

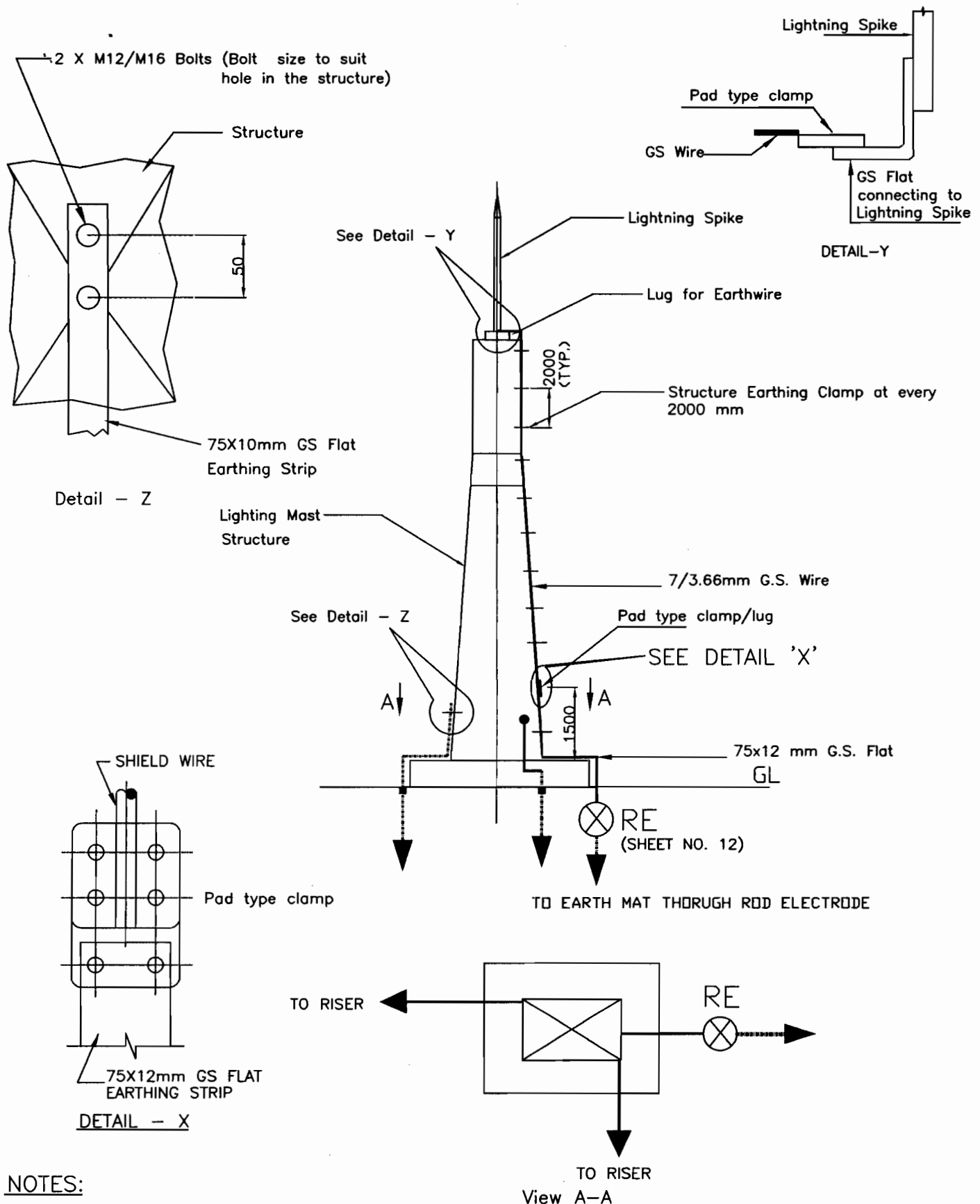
COMPUTERREF.NO.

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
8A

SHEET No.
8B



NOTES:

1. NO. OF RISER FOR LM = 2 Nos.
2. NO. OF RISER FOR ROD ELECTRODE = 1No.



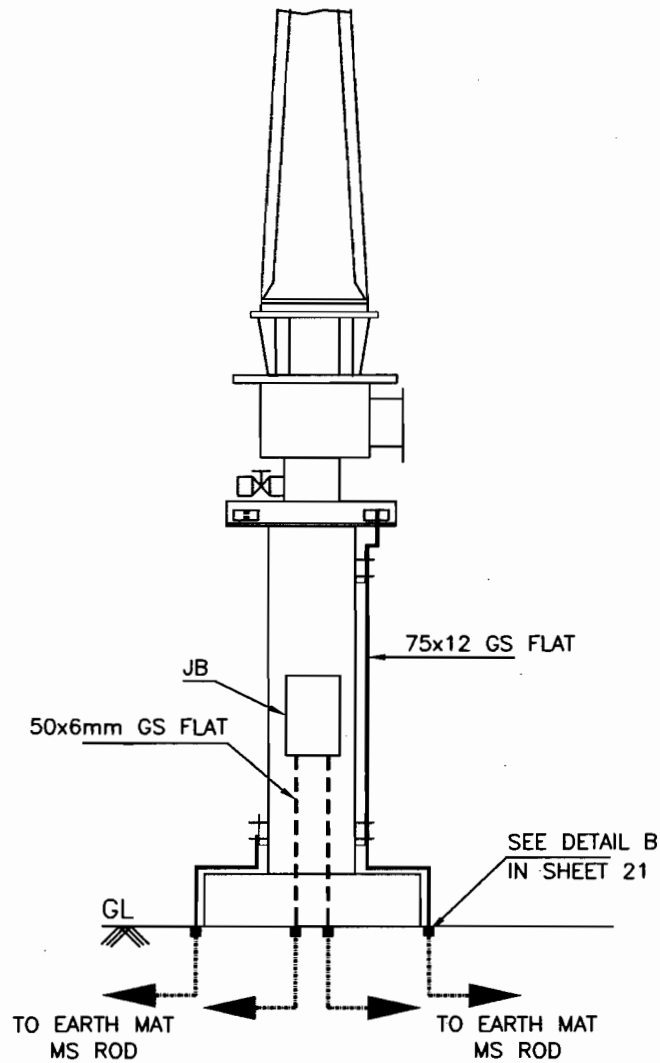
EQUIPMENT EARTHING DETAILS LIGHTENING MAST (LM)

COMPU. DRG. REF.

DRG.NO.

TB-4-359-PVE-E-002

SHEET No.
8C



NOTES:

1. NO. OF RISER FOR CT = 2 Nos.
2. NO. OF RISER FOR CT JB = 2 Nos. (ONLY IN 'Y' PHASE)



EQUIPMENT EARTHING DETAILS
400kV & 220kV Current Transformer

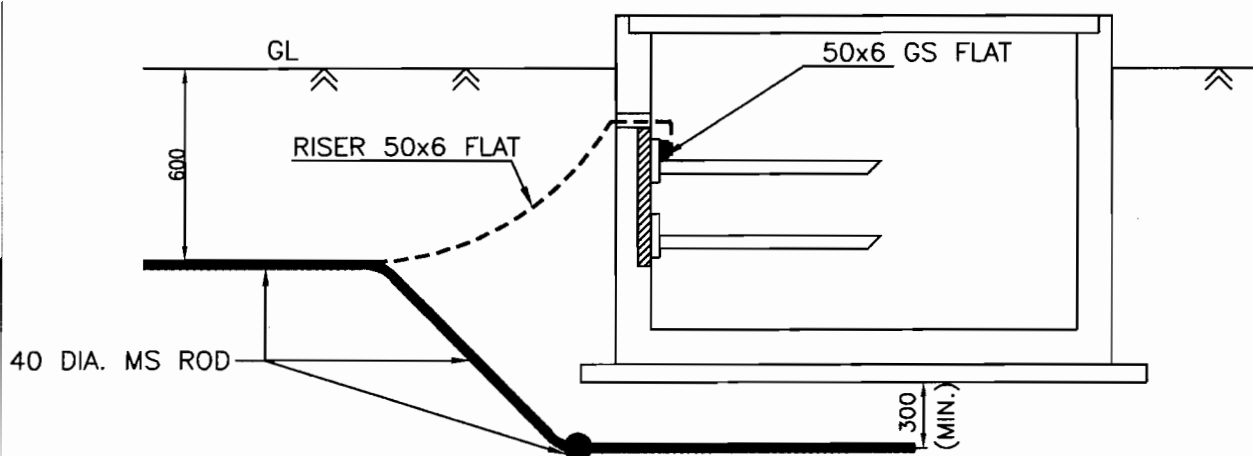
COMPU. DRG. REF.

DRG.NO.

TB-4-359-PVE-E-002

SHEET No.

9



NOTE:

1. ALL TRENCHES SHALL BE EARTHED AT AN INTERVAL OF 30M ALONG THE LENGTH OF TRENCH & FREE ENDS.
2. THE EARTH STRIP (50x6 G.S. FLAT) SHALL BE WELDED TO EMBEDDED PLATE AT EVERY 1.5M INTERVAL.
3. THE CABLE RACKS ARE PROVIDED ON BOTH SIDES OF THE TRENCH, BOTH SIDES SHALL BE EARTHED AS PER ABOVE.
- 4.



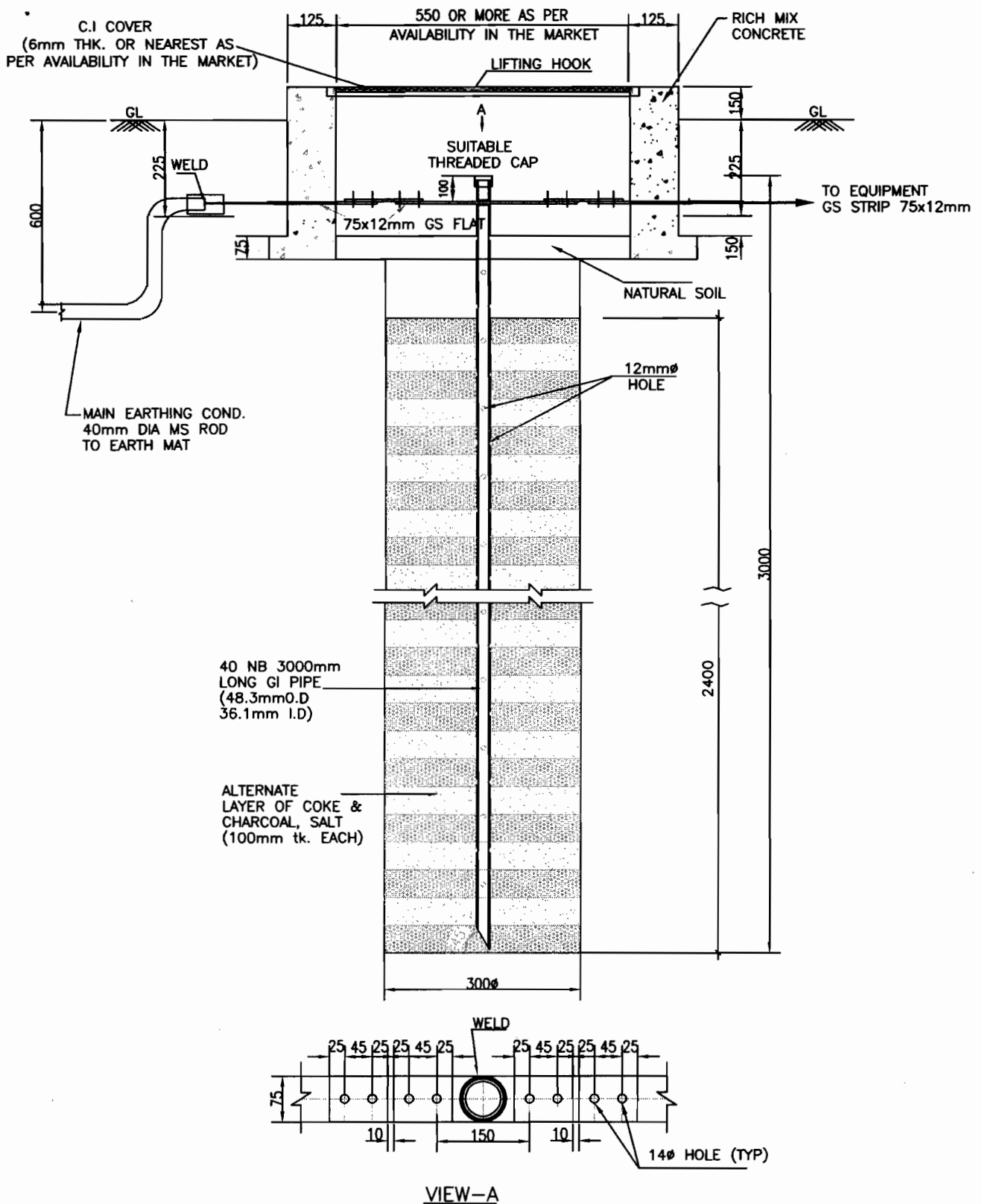
EQUIPMENT EARTHING DETAILS CABLE TRENCH

COMPU. DRG. REF.

DRG. NO.

TB-4-359-PVE-E-002

SHEET
10

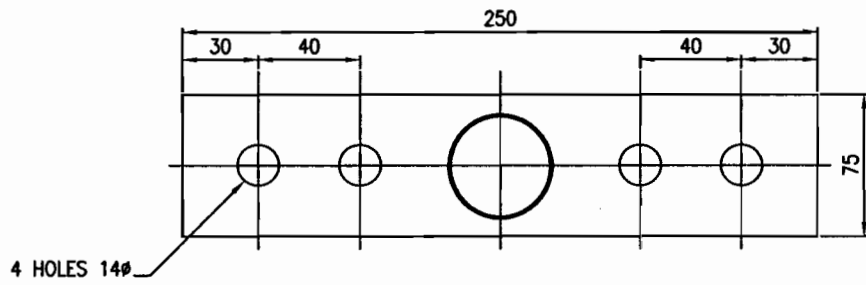


NOTE:

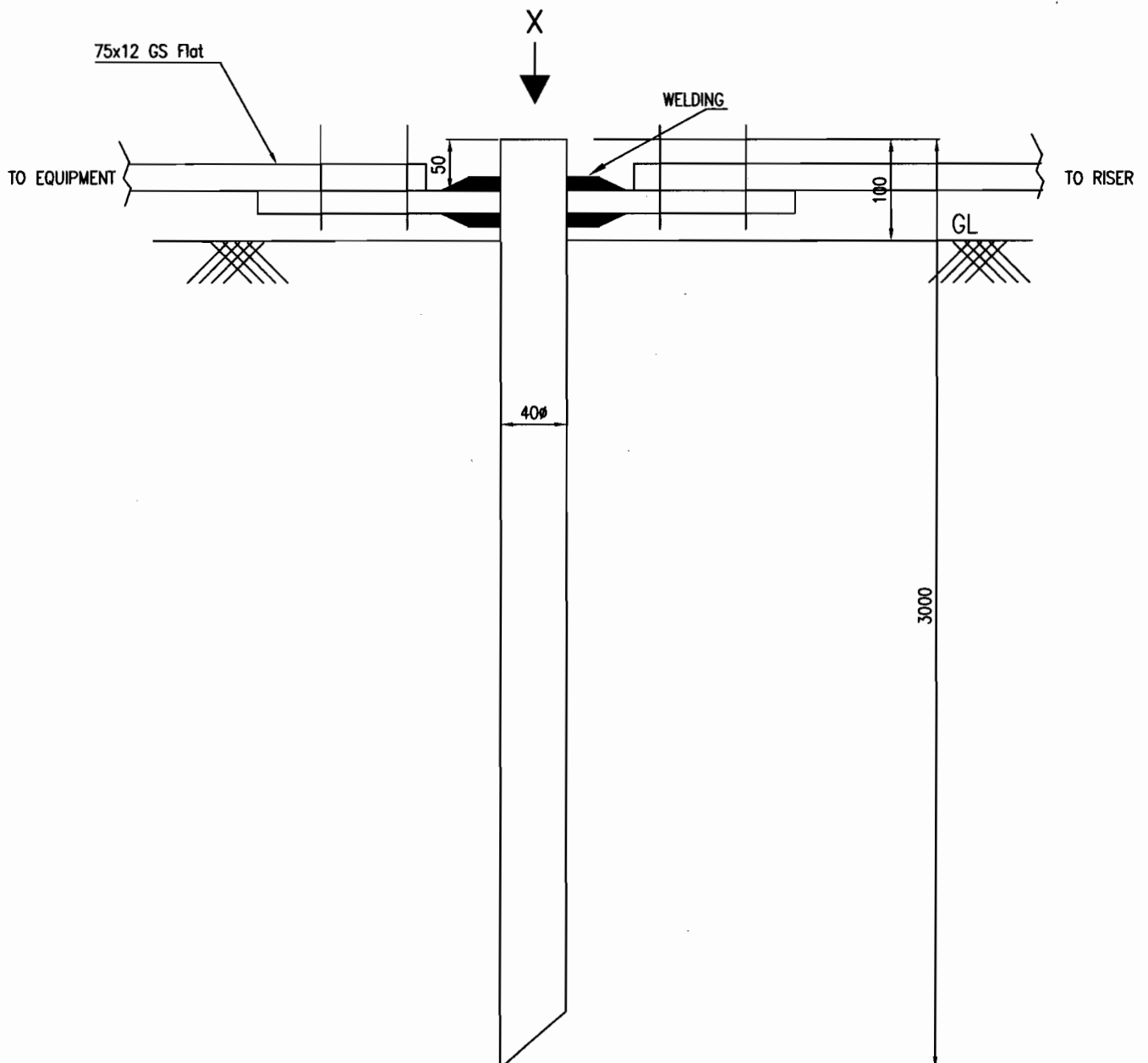
1. ALL NUTS,BOLTS AND WASHERS SHALL BE GALVANISED AS PER SPECIFICATION.



EQUIPMENT EARTHING DETAILS PIPE EARTH ELECTRODE WITH TREATED PIT



DETAIL-X



EQUIPMENT EARTHING DETAILS
ROD ELECTRODE WITHOUT PIT

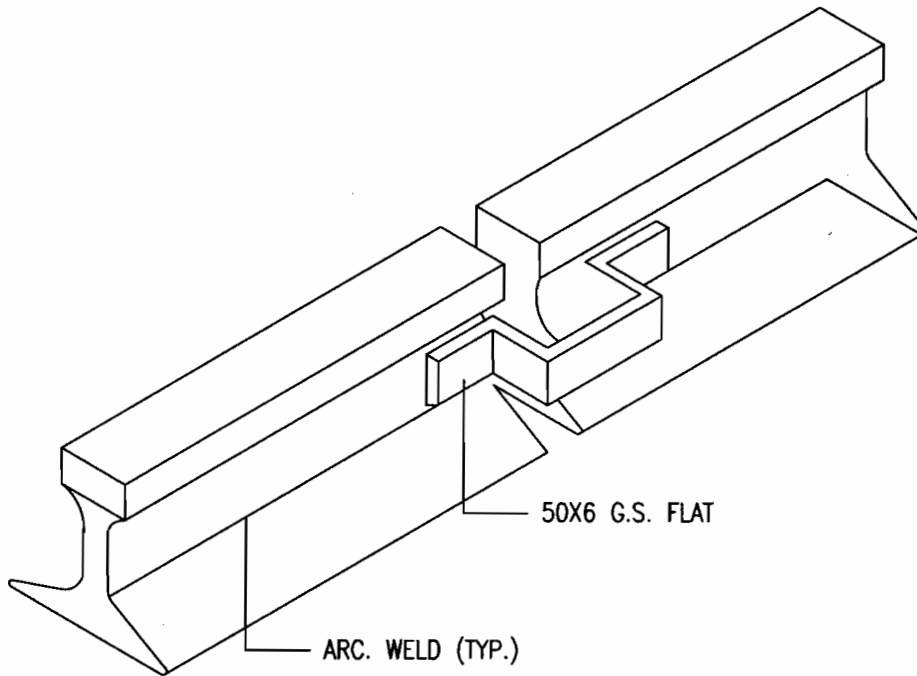
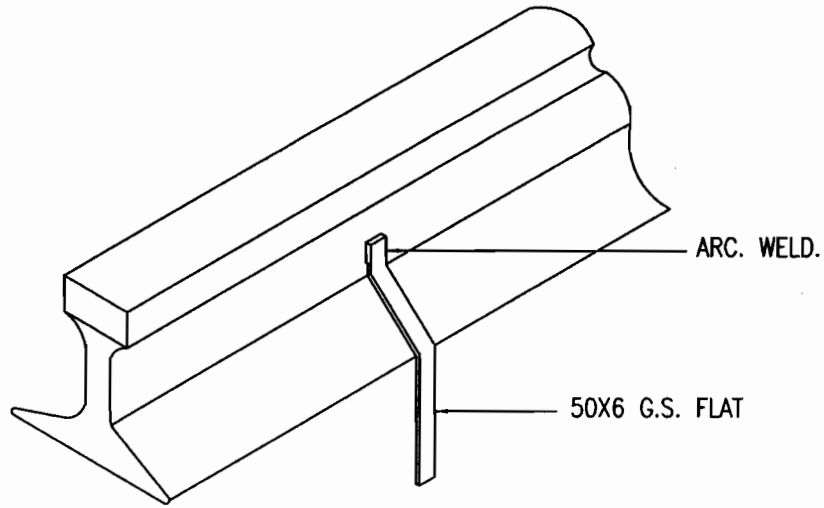
COMPU. DRG. REF.

DRG.NO.

TB-4-359-PVE-E-002

SHEET No.

12



NOTE:—

1. RAILWAY TRACKS WITHIN SWITCHYARD AREA SHALL BE EARTHED AT A SPACING OF 30 m AND ALSO AT BOTH ENDS.



EQUIPMENT EARTHING DETAILS

RAIL BONDING

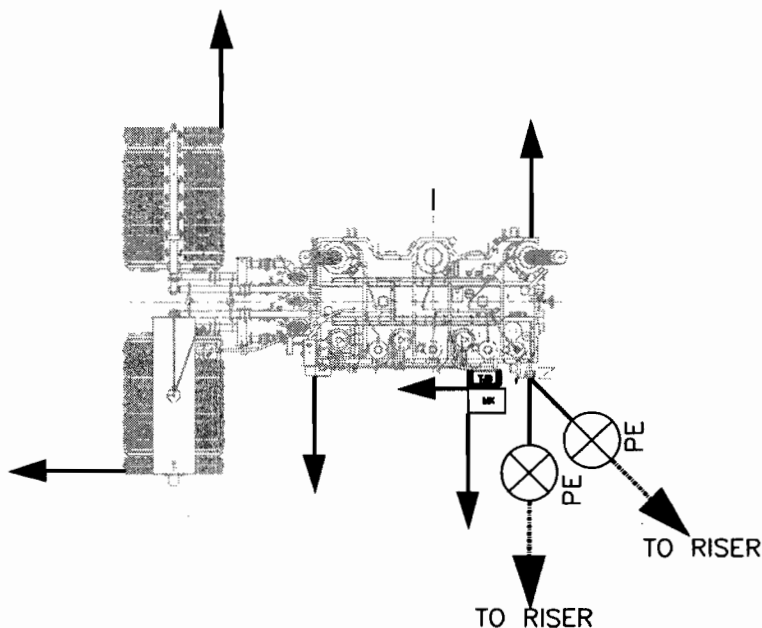
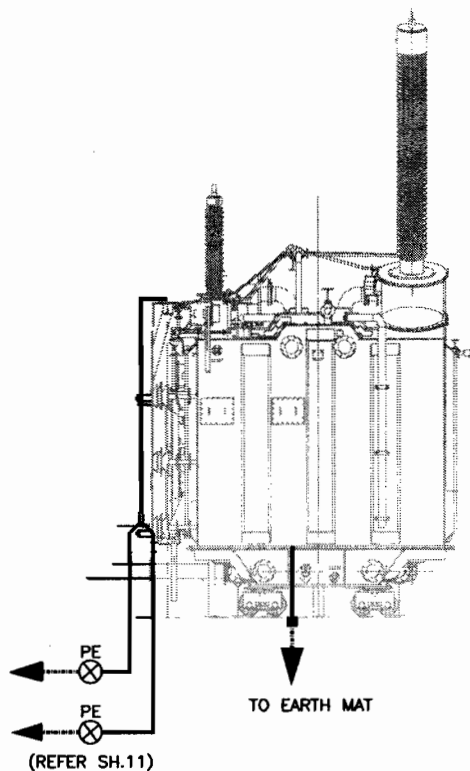
COMPU. DRG. REF.

DRG. NO.

TB-4-359-PVE-E-002

SHEET No.

13



MINIMUM DISTANCE OF 6000MM SHALL BE MAINTAINED BETWEEN TWO TREATED (PIPE) ELECTRODES.
 NO.OF PIPE EARTH ELECTRODE WITH TREATED PIT (REFER SHEET NO. 11) = 2 NOS.
 NO.OF RISERS = 8 NOS. FOR EARTHING OF FOLLOWING PARTS OF IBT TRANSFORMER
 BY 75X12 GI FLAT (TWO EARTHING STRIPS CAN BE CONNECTED TO ONE RISER):

MAIN TANK	2 Nos.
RADIATOR BANK	4 Nos.
MARSHALLING BOX	2 Nos.
NEUTRAL EARTHING	2 Nos.



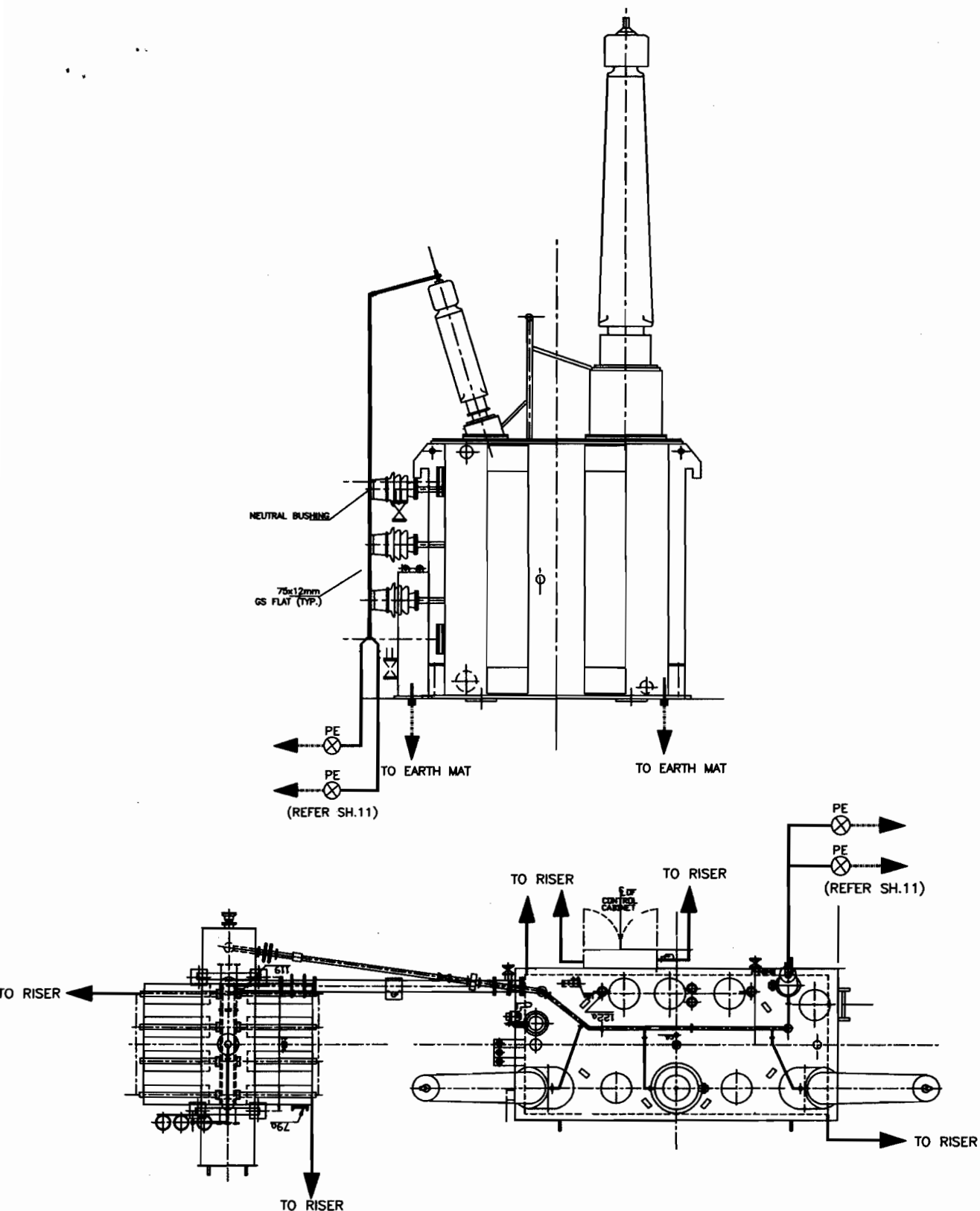
EQUIPMENT EARTHING DETAILS TRANSFORMER

COMPU. DRG. REF.

Report No.

TB-4-359-PVE-E-002

SHEET No.
14A



MINIMUM DISTANCE OF 6000MM SHALL BE MAINTAINED BETWEEN TWO TREATED (PIPE) ELECTRODES.
 NO. OF PIPE EARTH ELECTRODE WITH TREATED PIT (REFER SHEET NO. 11) = 2 NOS.
 NO.OF RISERS = 6 NOS. FOR EARTHING OF FOLLOWING PARTS OF 400KV BUS REACTOR
 BY 75X12MM GI FLAT :

- | | |
|------------------|----------|
| MAIN TANK | - 2 Nos. |
| RADIATOR SUPPORT | - 2 Nos. |
| CONTROL CABINET | - 2 Nos. |
| NEUTRAL EARTHING | - 2 Nos. |



EQUIPMENT EARTHING DETAILS

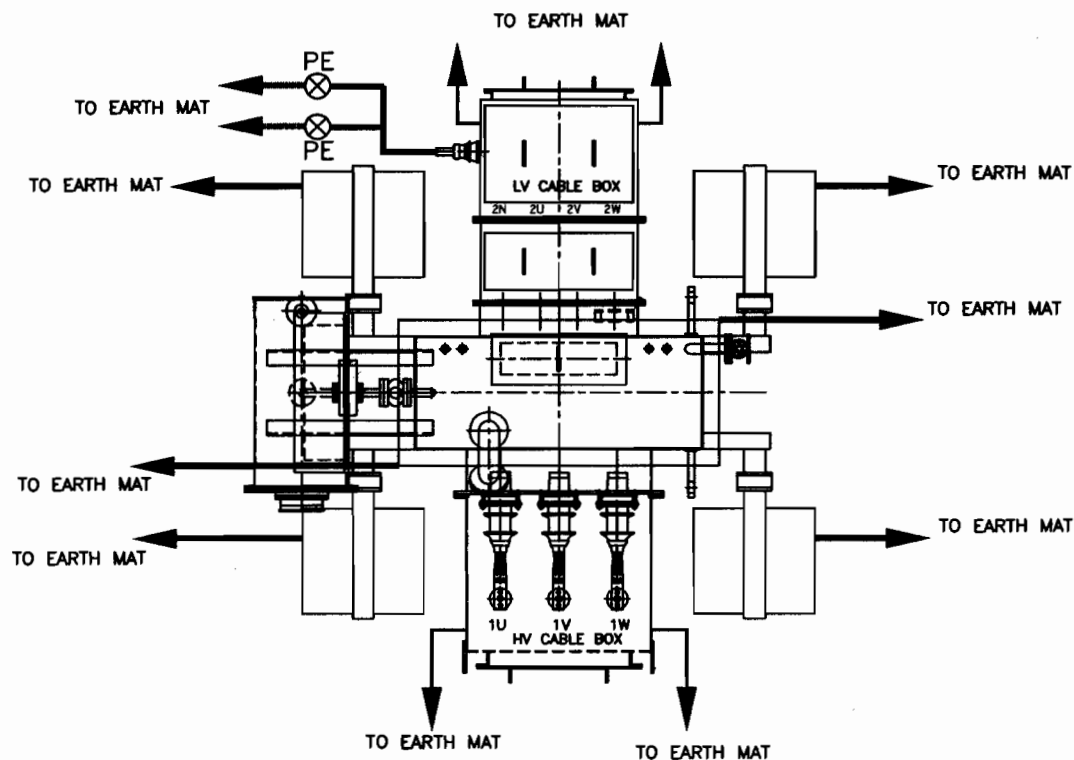
BUS REACTOR

COMPU. DRG. REF.

DRG. NO.

TB-4-359-PVE-E-002

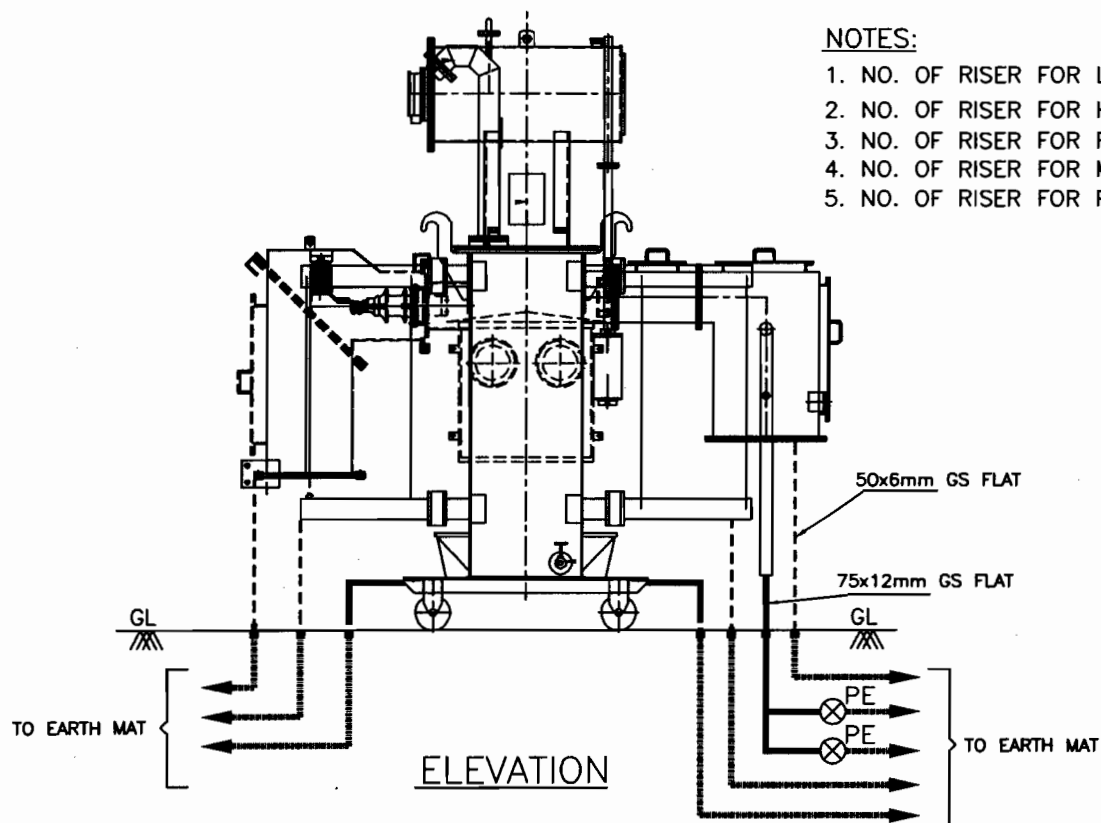
SHEET
14B



PLAN

NOTES:

1. NO. OF RISER FOR LV CABLE BOX. = 2 Nos.
2. NO. OF RISER FOR HV CABLE BOX. = 2 Nos.
3. NO. OF RISER FOR RADIATOR = 4 Nos.
4. NO. OF RISER FOR MAIN TANK = 2 Nos.
5. NO. OF RISER FOR PIPE ELECTRODE = 2 Nos.



MINIMUM DISTANCE OF 6000MM SHALL BE MAINTAINED BETWEEN TWO TREATED (PIPE) ELECTRODES.

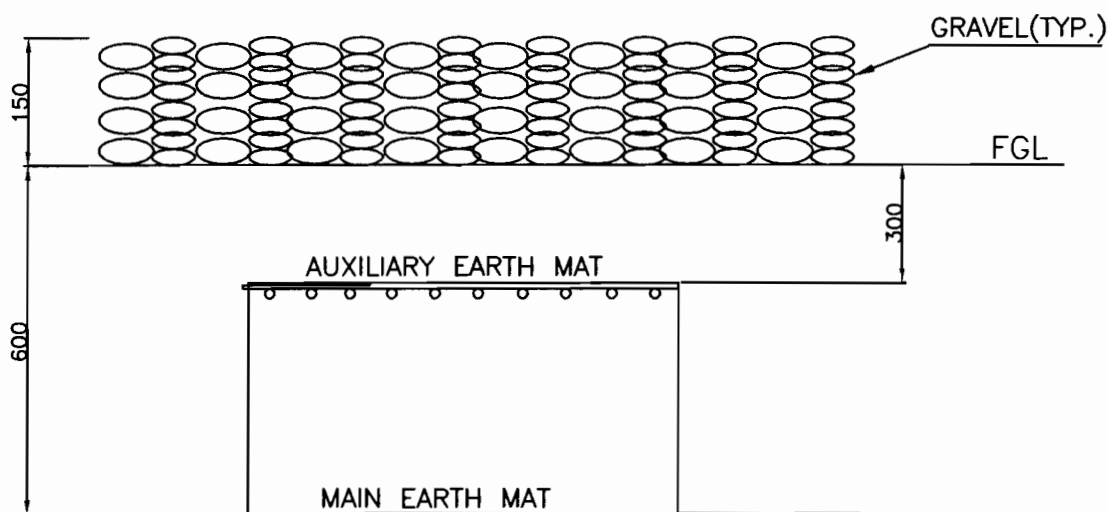
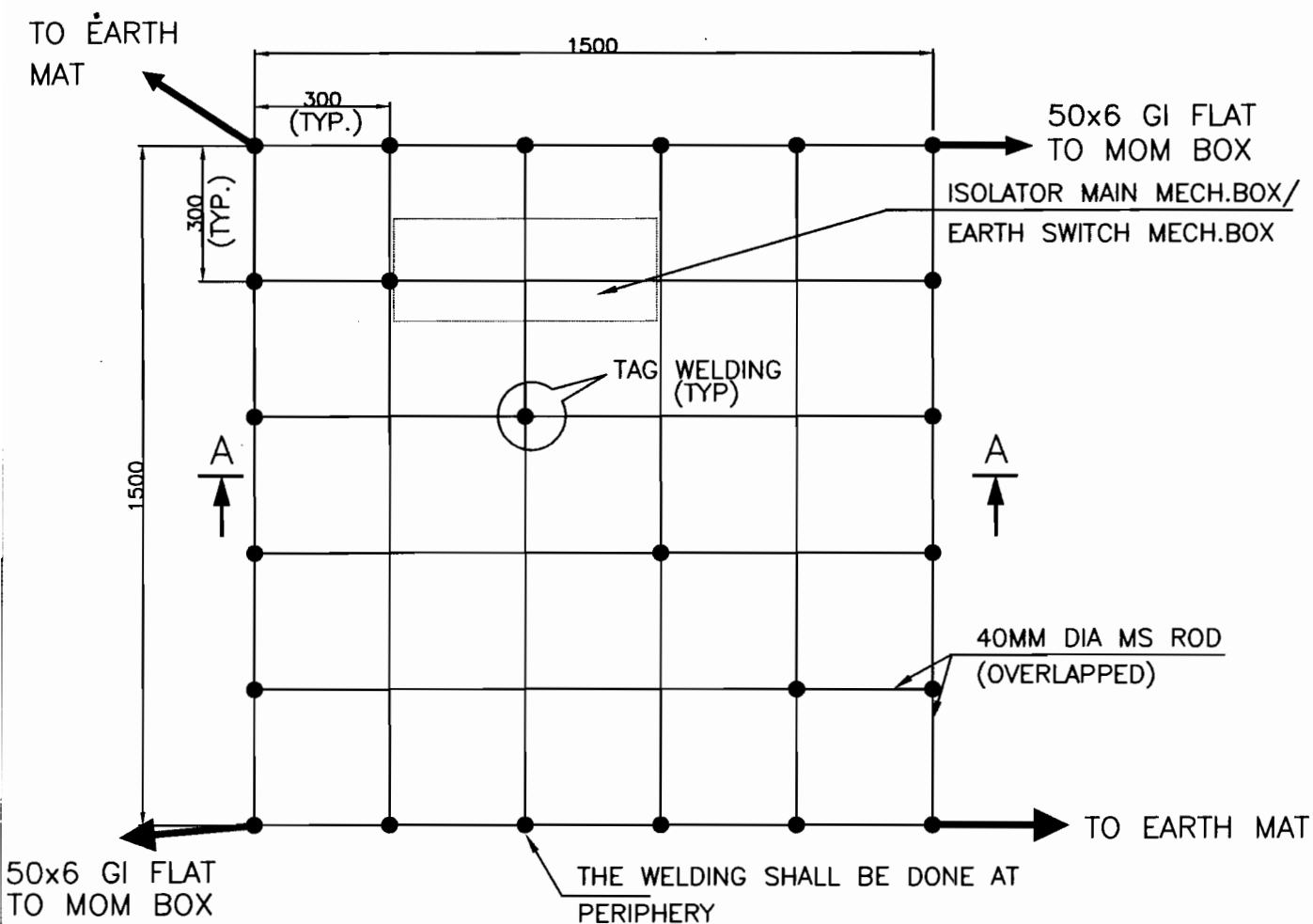


EQUIPMENT EARTHING DETAILS
AUXILIARY TRANSFORMER

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
14C



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 THE CABLE TRENCH ROUTING SHALL BE PLANNED ACCORDINGLY.



EQUIPMENT EARTHING DETAILS

AUXILIARY EARTH MAT FOR ISOLATOR MAIN MECH., E/S MECH. BOX

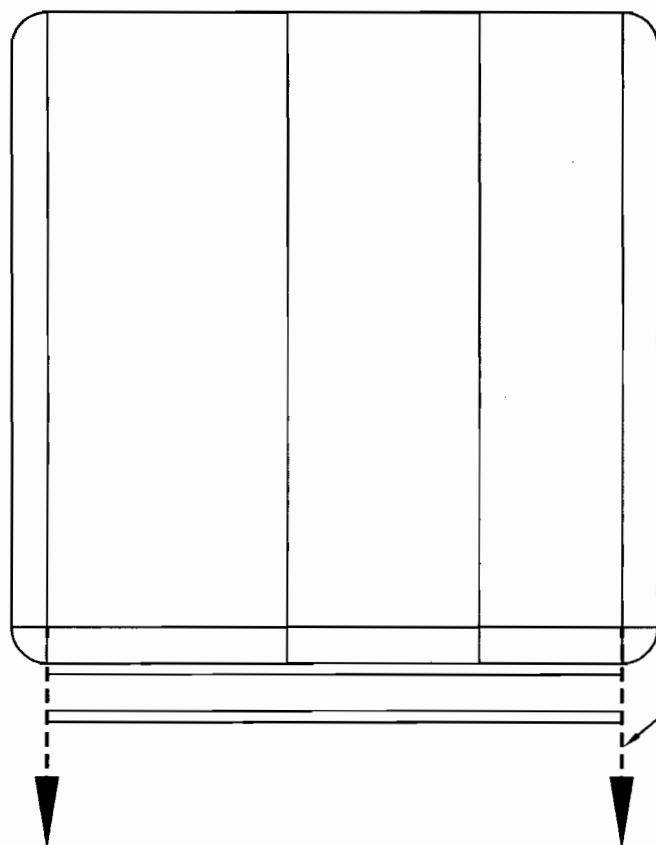
COMPU. DRG. REF.

Report No.

TB-4-359-PVE-E-002

SHEET No.

15



GS FLAT 50x6mm

TO EARTH FLAT IN THE TRENCH BELOW

TO EARTH FLAT IN THE TRENCH BELOW



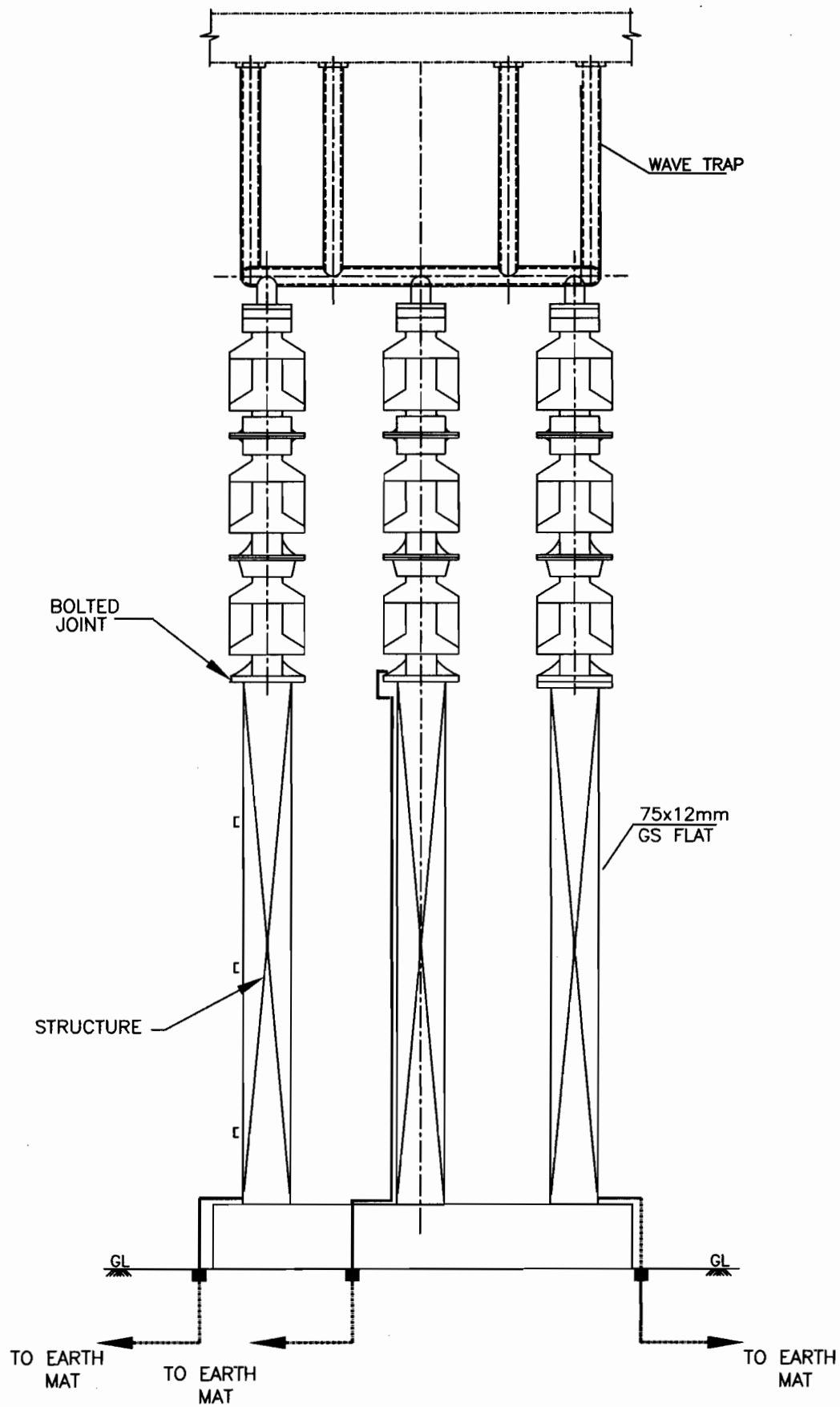
EQUIPMENT EARTHING DETAILS

CONTROL AND RELAY PANELS/BATTERY CHARGER/AC DC BOARDS/MLDB

DRG. No.

TB-4-359-PVE-E-002

SHEET No.
16



RISERS PER 1-PH WT= 3 NOS.



EQUIPMENT EARTHING DETAILS

400 WAVE TRAP

COMPUTERREF.NO.

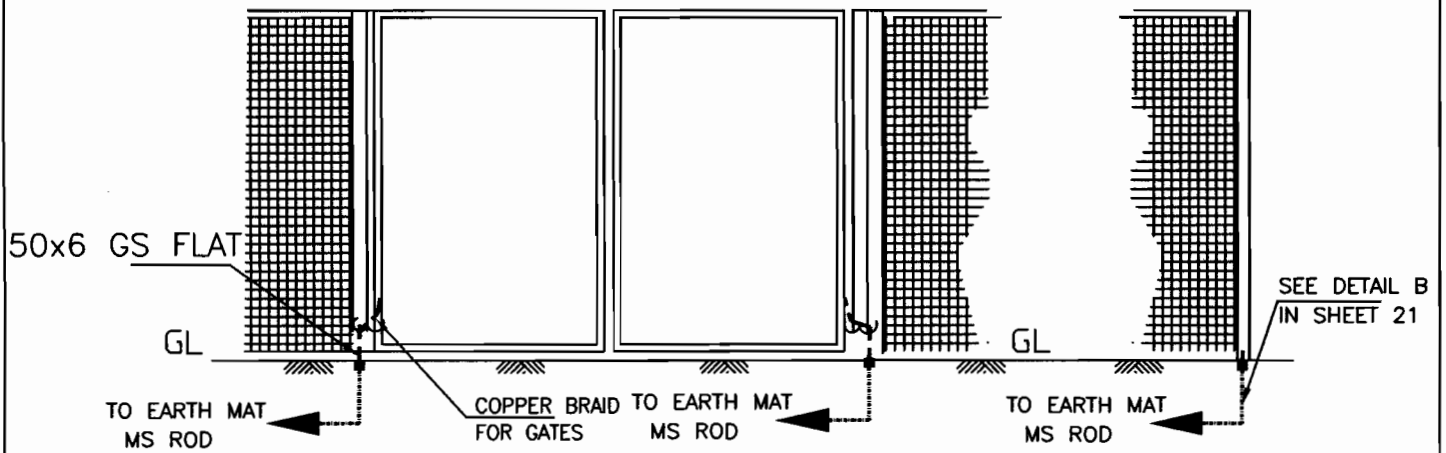
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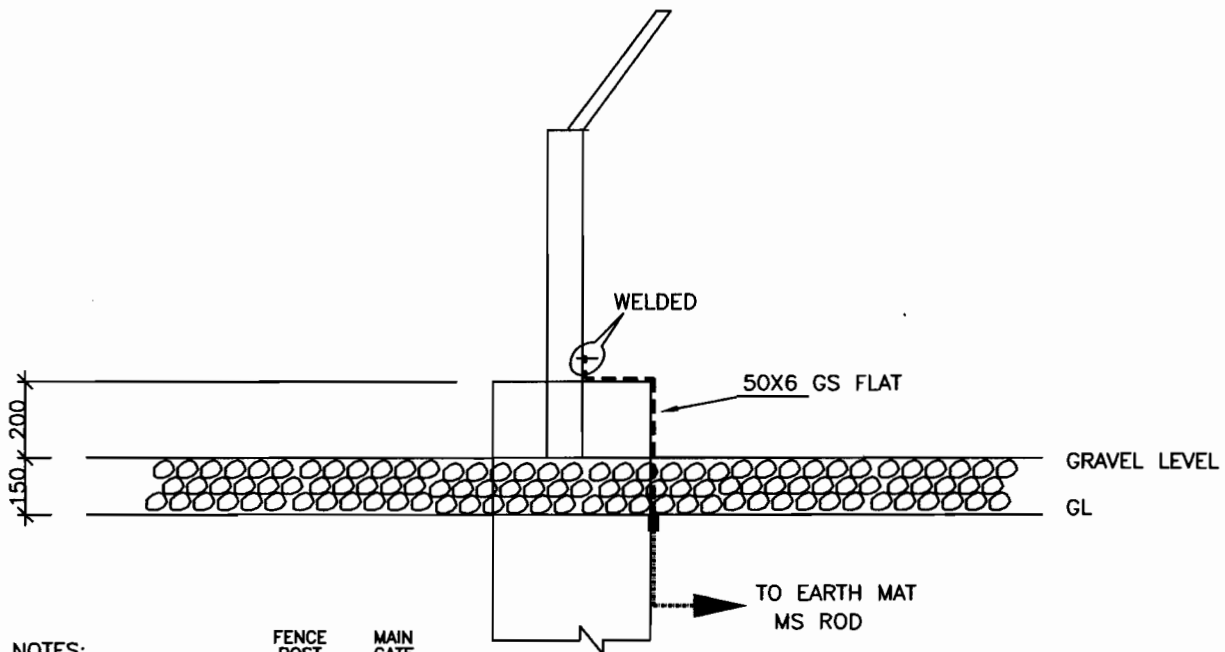
SHEET No.
17

FENCE GATE

FENCE GROUNDING



FENCE EARTHING



NOTES:

- | | FENCE POST | MAIN GATE |
|---|------------|-----------|
| 1. NO. OF RISERS = | 1 | 2 |
| 2. EVERY ALTERNATE FENCE POSTS SHALL BE EARTHED BY 50X6 MM GS FLAT. | | |
| 2. ALL GATES SHALL BE CONNECTED TO EARTH GRID. | | |

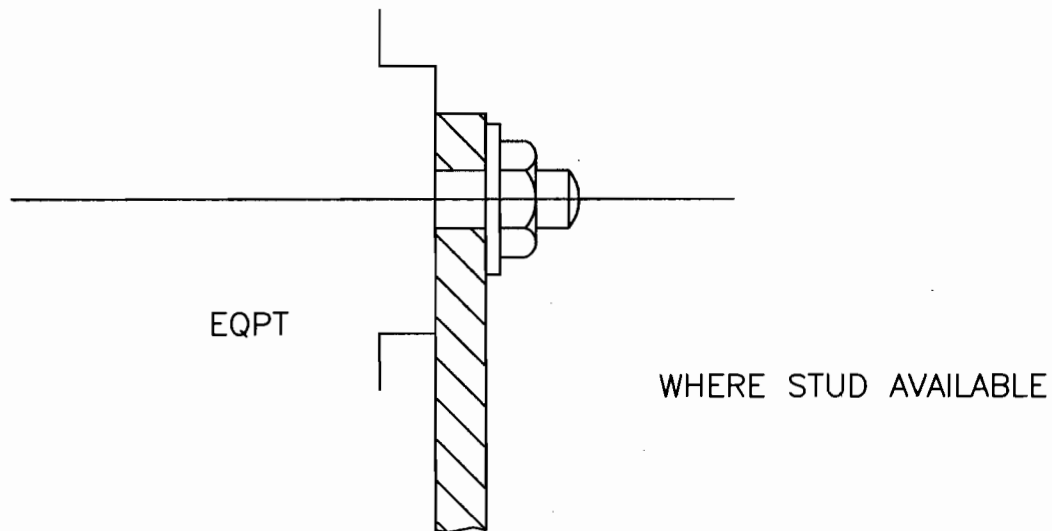


EQUIPMENT EARTHING DETAILS GATE/FENCE POST

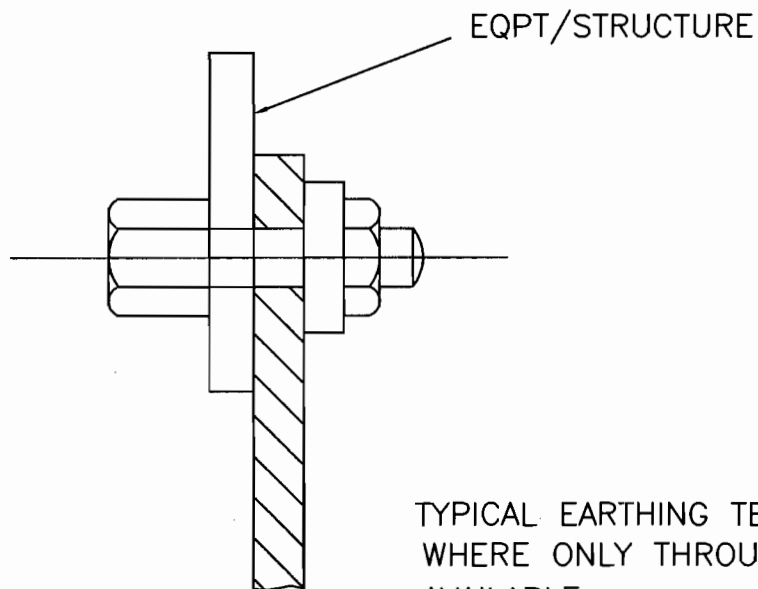
DRG. No.

TB-4-359-PVE-E-002

SHEET No.
18



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

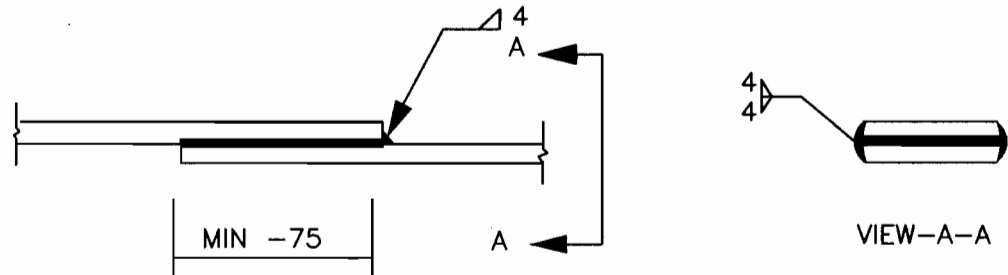
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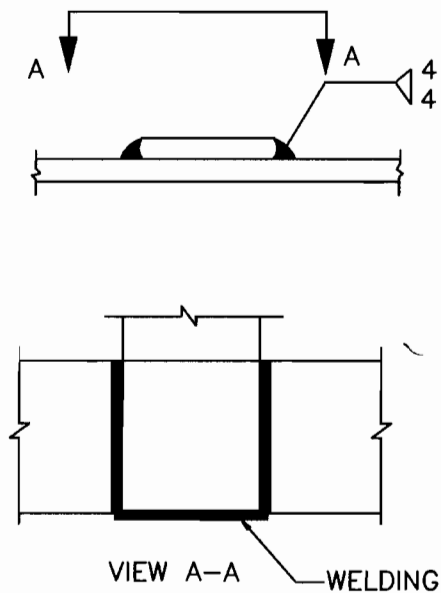
SHEET No.
19

STRIP TO STRIP (50X6 MS FLAT)

1. STRAIGHT LAP JOINT/RISER



2. CROSS LAP JOINT



EQUIPMENT EARTHING DETAILS

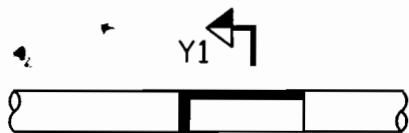
WELDING DETAILS

COMPUTERREF.NO.

DRG. No.

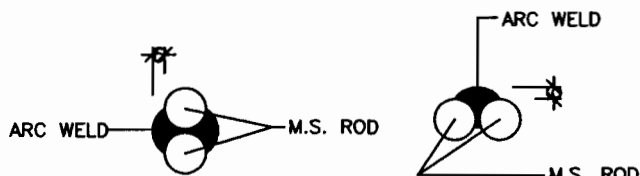
TB-4-359-PVE-E-002

SHEET No.
20



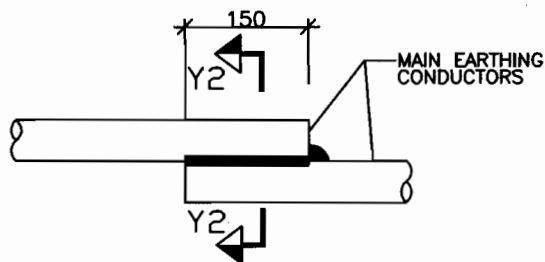
ELEVATION

(CONDUCTOR IN HORIZONTAL PLANE)



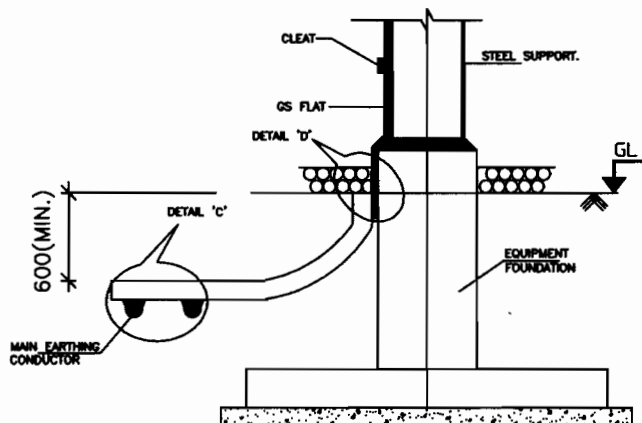
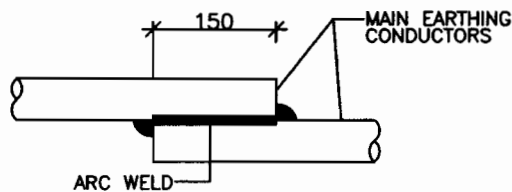
SECTION Y2-Y2

SECTION Y1-Y1

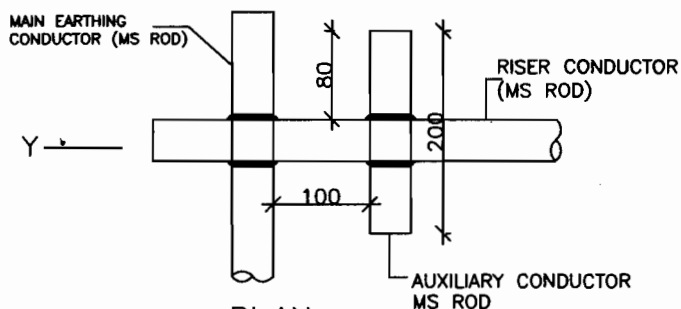


ELEVATION

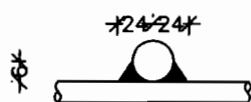
(CONDUCTOR IN VERTICAL PLANE)



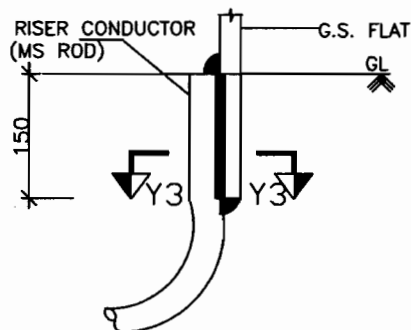
TYPICAL DETAILS OF RISER



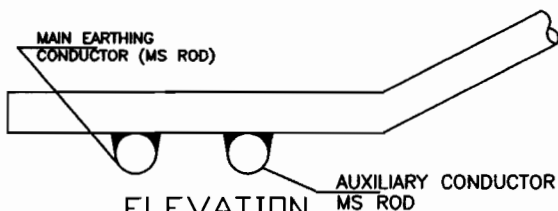
PLAN



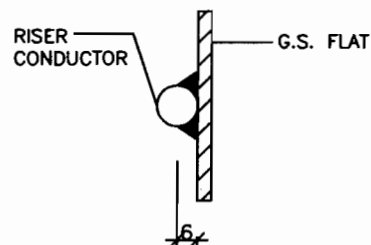
VIEW-Y



ELEVATION
DETAIL-D



ELEVATION
DETAIL-C



SECTION Y3-Y3

TYPICAL OVERLAPPING JOINT OF TWO CONDUCTORS



EQUIPMENT EARTHING DETAILS

WELDING DETAILS