







S.N.	EQUIPMENT DESCRIPTION	KV	SYMBOL	OLD SCOPE (QTY.)	NEW SCOPE (QTY.)
1a.	SF6 CIRCUIT BREAKER (3-PH), 1600A	245		13	04
1b.	SF6 CIRCUIT BREAKER (3-PH), 3150A – (552)	245		01	--
2a.	HCB ISOLATOR WITH 2 E/S 3ø, 1600A (MECHANICALLY GANGED)	245		13	04
2b.	HCB ISOLATOR WITH 2 E/S 3ø, 3150A (MECHANICALLY GANGED) (589A, 589AE1, 589AE2, 589B, 589BE1, 589BE2)	245		02	--
3.	HCB ISOLATOR WITH 1 E/S 3ø, 1600A (MECHANICALLY GANGED)	245		15	04
4.	HCB ISOLATOR WITHOUT E/S 3ø, 1600A, TANDEM TYPE (MECHANICALLY GANGED)	245		25	08
5a.	CURRENT TRANSFORMER, 1600A (1-PH), 5 CORE (EXTENDED CURRENT RATING 120%)	245		39	12
5b.	CURRENT TRANSFORMER, 2400 (1-PH), 5 CORE (EXTENDED CURRENT RATING 120%) – (5CT)	245		03	--
6.	198kV SURGE ARRESTOR (1-PH)	198		36	12
7.	WAVE TRAP (1-PH), 1600A, 0.5 mH	245		12	08
8.	4400pF CAPACITOR VOLTAGE TRANSFORMER (1-PH)	245		18	12
9.	EMVT (1-PH)	245		06	--
10.	220/132 KV, 150 MVA ICT	220/132		02	--
11.	120 KV SURGE ARRESTER (1-PH)	120		06	09
12.	145KV, 1250A 3-PHASE, SPRING OPERATED SF6 CIRCUIT BREAKERS SUITABLE FOR 3-PHASE OPERATION.	145		--	06
13.	145KV, 1250A 3-PHASE, DOUBLE BREAK ISOLATOR (MECHANICALLY GANGED MOTOR OPERATED) WITH TWO E/S (MANUALLY OPERATED)	145		--	07
14.	145KV, 1250A 3-PHASE, DOUBLE BREAK ISOLATOR (MECHANICALLY GANGED MOTOR OPERATED) WITH ONE E/S (MANUALLY OPERATED)	145		--	05
15.	145KV, 1250A 3-PHASE, DOUBLE BREAK ISOLATOR (MECHANICALLY GANGED MOTOR OPERATED) W/O E/S	145		--	05
16.	145KV, 1-PHASE 5 CORE CURRENT TRANSFORMER	145		--	18
17.	145KV, 8800 pF, 3ø 400V/500V/500V 1-PHASE CAPACITOR VOLTAGE TRANSFORMER	145		--	12
18.	145KV, 1250A, 0.5mH, 1-PHASE WAVE TRAP	145		--	01

CORE	RATIO	OUTPUT BURDEN	ISF	ACCURACY CLASS	MIN. KNEE POINT VOLTAGE(V <sub>k</sub> )	MAX. EXCITING CURRENT at V <sub>k</sub> /2	R <sub>ct</sub> (ohm) (max)
01	1600—800—400/1			PS	1600/800	30 mA at V <sub>k</sub> /2 at 1600/1 TAP	8/4/2
02	1600—800—400/1			PS	1600/800	30 mA at V <sub>k</sub> /2 at 1600/1 TAP	8/4/2
03	1600—800—400/1	20 VA	≤ 5	0.2S			
04	1600—800—400/1			PS	1600/800/400	30 mA at V <sub>k</sub> /2 at 1600/1 TAP	8/4/2
05	1600—800—400/1			PS	1600/800/400	30 mA at V <sub>k</sub> /2 at 1600/1 TAP	8/4/2

CORE	RATIO	OUTPUT BURDEN	ISF	ACCURACY CLASS	MIN. KNEE POINT VOLTAGE	MAX. EXCITING CURRENT at V <sub>k</sub> /2	Ret (ohm) (max)
01	2400–1600/1			PS	2400–1600/1	30 mA at V <sub>k</sub> /2 at 2400/1 TAP	12/8
02	2400–1600/1			PS	2400–1600/1	30 mA at V <sub>k</sub> /2 at 2400/1 TAP	12/8
03	2400–1600/1	20 VA	≤ 5	0.2	2400–1600/1		
04	2400–1600/1			PS	2400–1600/1	30 mA at V <sub>k</sub> /2 at 2400/1 TAP	12/8
05	2400–1600/1			PS	2400–1600/1	30 mA at V <sub>k</sub> /2 at 2400/1 TAP	12/8

CORE	RATIO	OUTPUT BURDEN	ISF	ACCURACY CLASS	MIN. KNEE POINT VOLTAGE	MAX. EXCITING CURRENT at V <sub>k</sub> /2	R <sub>ct</sub> (ohm) (max)
01	800-400/1			PS	800/400	25 mA at 800/1 TAP 50 mA at 400/1 TAP	8/4
02	800-400/1			PS	800/400	25 mA at 800/1 TAP 50 mA at 400/1 TAP	8/4
03	800-400/1	20 VA	≤ 5	0.2			
04	800-400/1			PS	800/400	25 mA at 800/1 TAP 50 mA at 400/1 TAP	8/4
05	800-400/1			PS	800/400	25 mA at 800/1 TAP 50 mA at 400/1 TAP	8/4

CORE	220/√3KV/ 110/√3V/110/√3V/110/√3V
SEC I	CLASS 3P 100 VA
SEC II	CLASS 3P 100 VA
SEC-III	0.2 50 VA

CORE	220/√3KV/ 110/√3V/110/√3V/110/√3V	
SEC I	CLASS 3P	100 VA
SEC II	CLASS 3P	100 VA
SEC-III	0.2	100 VA

CORE	220/√3KV/ 110/√3V/110/√3V/110/√3V	
SEC I	CLASS 3P	50 VA
SEC II	CLASS 3P	50 VA
SEC-III	0.2	50 VA

I. ELECTRICAL SYSTEM PARAMETERS	245kV	145kV
01. NOMINAL SYATEM VOLTAGE.	220kV	132kV
02. HIGHEST SYATEM VOLTAGE.	245kV	145kV
03. CURRENT RATING (BUS BAR)	3150A	1600A
04. SHORT CIRCUIT CURRENT RATING	40 kA FOR 1 SEC.	31.5 kA FOR 1 SEC.
05. BASIC INSULATION LEVEL	1050kVp	650kVp
06. POWER FREQUENCY WITHSTAND VOLTAGE	460 kV	275 kV
07. CREEPAGE	25mm/kV	25mm/kV
08. SYSTEM EARTHING	EFFECTIVELY EARTHED	EFFECTIVELY EARTHED
II. PHASES ON WHICH WAVE TRAP TO BE MOUNTED TO BE CONFIRMED BY BSPGCL.		

A. NEW SCOPE :INSIDE CHAIN DOTTED LINE  
B. OLD SCOPE :OUTSIDE CHAIN DOTTED LINE

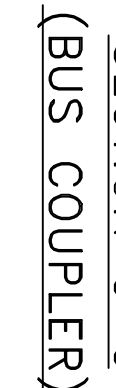
CUSTOMER	BIHAR STATE POWER GENERATION COMPANY LTD
CONSULTANT	STEAG ENERGY SERVICES (INDIA) PVT. LTD.
PROJECT	2 X 250 MW BARAUNI THERMAL POWER STATION

BHARAT HEAVY ELECTRICALS LIMITED			CARD CODE	
TRANSMISSION BUSINESS GROUP				
TITLE			NEXT SHEET	--
SINGLE LINE DIAGRAM OF 220/132KV SWITCHYARD			SHEET No.	01
SCALE	W.O. No.	83009ABJU	DRG. No.	TB-2-374-510-001
				REV. 00



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it must not be used directly or indirectly in anyway detrimental to the interest of the company.

INVENTORY No.	SIGN. & DATE	REF. DRG. No.
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[illegible]



REV.

DATE

ALTERED

CHECKED

APPD

REV.

DATE

ALTERED

CHECKED

APPD

REV.

DATE

ALTERED

CHECKED

APPD

JOB No.

LEGEND

→

CONNECTION TO GROUND MAT THROUGH RISER.

⊗

PE

CONNECTION TO PIPE ELECTRODE.

●

RISER

GENERAL NOTES:

1

EARTH STRIP SHALL BE CLEATED TO LATTICE /PIPE TYPE STRUCTURE AT AN INTERVAL OF 1.0M.

2

FOR WELDING DETAILS REFER SHEET #19, 20 & 21.

3

E/WIRE DOWN CONDUCTOR SHALL BE CLEATED AT AN INTERVAL OF 2.0 M ALONG THE STRUCTURE. NO HOLES IN STRUCTURE ARE ALLOWED FOR THIS PURPOSE.

4

NOT MORE THAN 2 RISERS ARE PERMISSIBLE PER PIG TAIL ( 40mm DIA. ROD.).

5

SUBSTRUCTURE/STOOL SHALL NOT BE USED FOR EARTHING PURPOSE

6

EARTHING LEAD FROM ON EQUIPMENT /STRUCTURE SHALL BE CONNECTED TO DIFFERENT EARTHING GRID.

7

EQUIPMENT SHOWN IN DRAWING IS ONLY SYMBOLIC REPRESENTATION.

SHEET NO.

DESCRIPTION

02.

220kV SF6 CIRCUIT BREAKER

03.

220kV CVT/EMVT

04.

220kV POST INSULATOR (SOLID CORE TYPE)

05.

198/120 LIGHTNING ARRESTER

06.

MARSHALLING KIOSK

07.

220kV HORIZONTAL HCB ISOLATOR WITH ONE EARTH SWITCH

7A.

220kV HORIZONTAL HCB ISOLATOR WITH TWO EARTH SWITCH

7B.

220kV PANTOGRAPH ISOLATOR WITHOUT EARTH SWITCH

08.

SHIELD WIRE TOWER

09.

220kV CURRENT TRANSFROMER

10.

CABLE TRENCH

11.

DETAIL OF PIPE EARTH ELECTRODE IN TREATED EARTH PIT (ET)

12.

RAIL BONDING

13.

LT TRANSFORMER

13A.

AUTO TRANSFORMER

SHEET NO.

DESCRIPTION

14.

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

15.

SWITCHGEAR / MCC / CONTROL AND RELAY BOARD/AC KIOSK

16.

ROD ELECTROD WITH TEST LINK FOR LM, TOWER WITH PEAK AND LA

17.

FENCE POST

18.

TYPICAL ARRANGEMENT OF EQUIPMENT EARTHING WITH MAIN GRID

19.

WELDING DETAILS

20.

WELDING DETAILS

21.

WELDING DETAILS

22.

220kV WAVE TRAP

COMPUTER DRG. PATH NAME :

W.O.NO. 80015ABAU

STATUS

SIGN & DATE

REV.

DATE

ALTD

CHD

APPD

CUSTOMER/CONSULTANT

PROJECT

भारत हेवी इलेक्ट्रिकल्स लिमिटेड

ट्रान्समिशन परियोजना विभाग

BHARAT HEAVY ELECTRICALS LTD.

TRANSMISSION PROJECTS DIVISION

DEPT CODE

DRN

DESN

CHD

APPD

NAME

PR

PR

MK

MK

SIGN.

DATE

23.08.12

23.08.12

23.08.12

23.08.12

TITLE

DEPT.

SCALE

DRAWING NO.

SHEET

OF

REV.

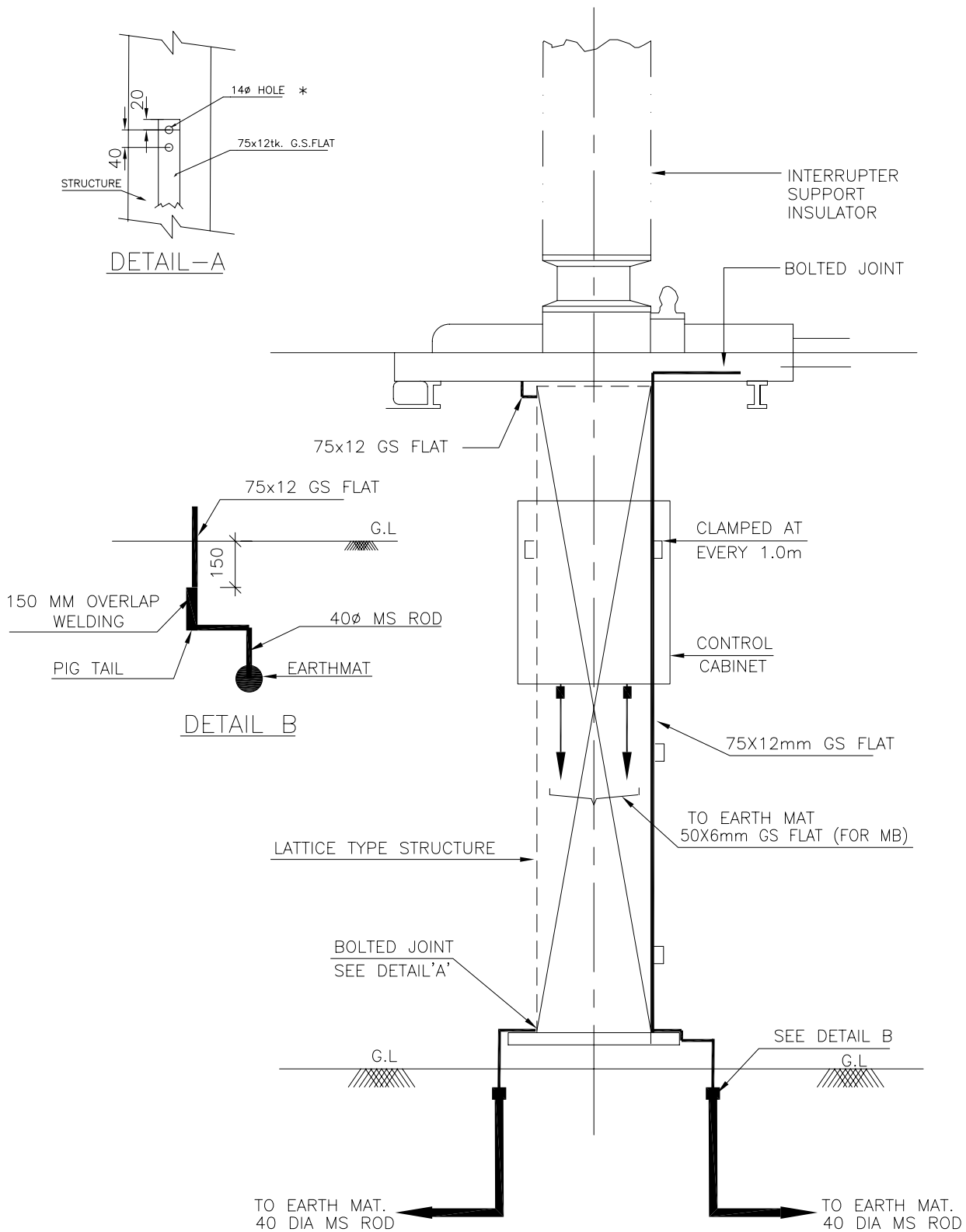
EQUIPMENT & STRUCTURE EARTHING DETAILS

TB-4-345-316-007

1

00





NOTE:

1) \* BOLT SIZE AND HOLE SIZE SHALL BE TO SUIT RESPECTIVE EQPT./STRUCTURE.



## EQUIPMENT EARTHING DETAILS

### 220 kV SF6 CIRCUIT BREAKER

COMPUTERREF.NO.

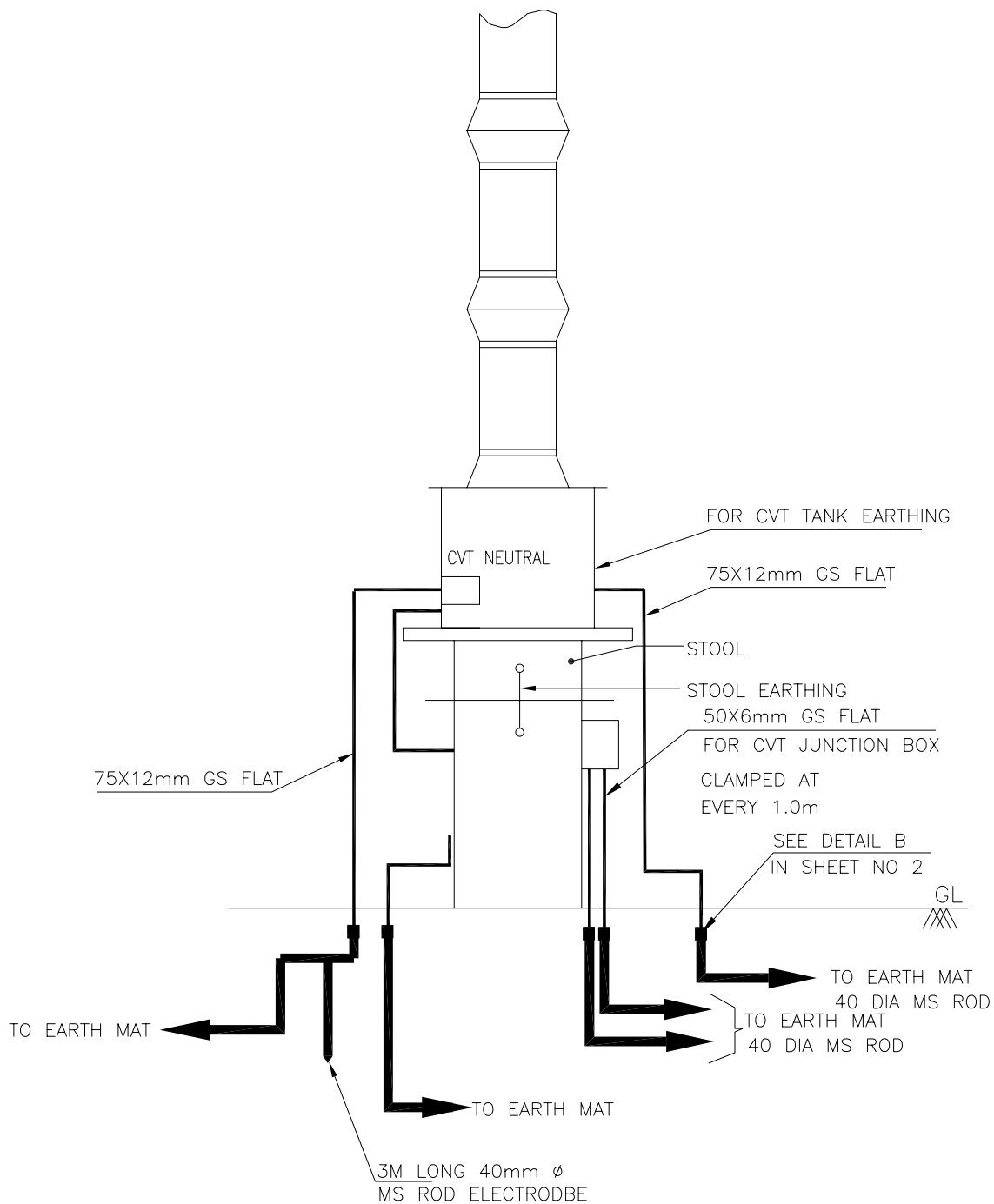
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
2





ROD ELECTRODE = 1 NO.



## EQUIPMENT EARTHING DETAILS

220kV CVT/EMVT

COMPUTERREF.NO.

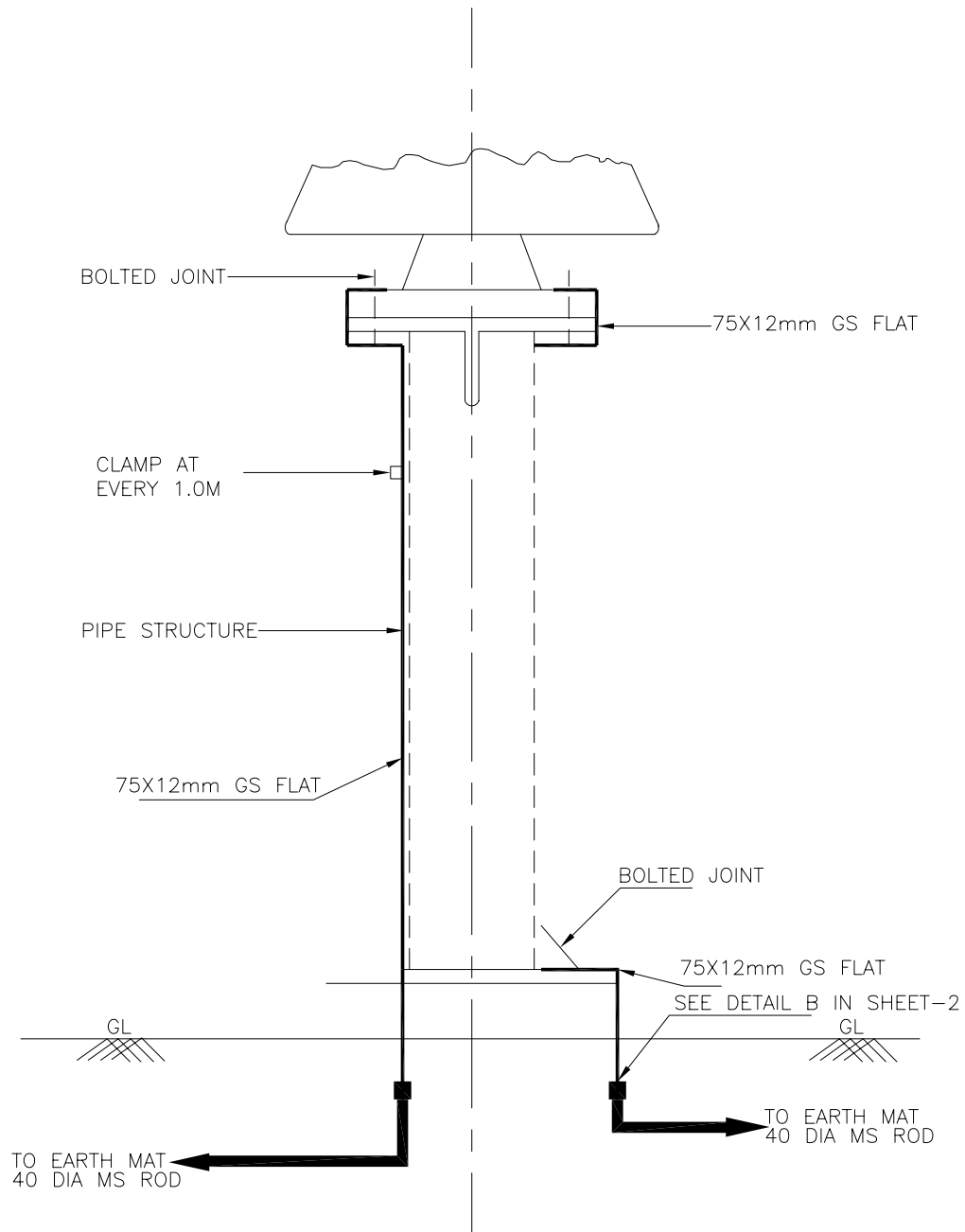
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
3





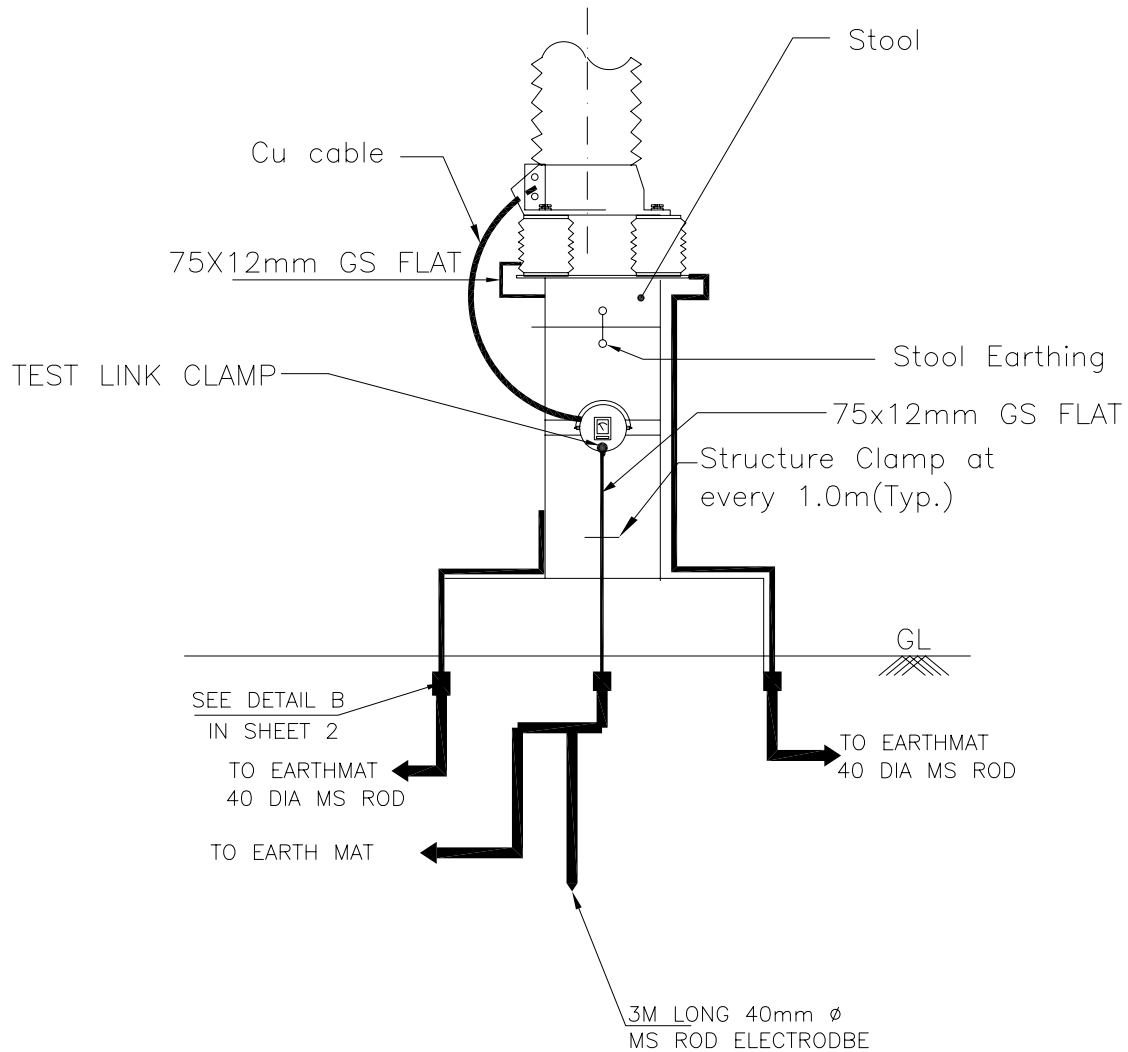
# EQUIPMENT EARTHING DETAILS 220kV POST INSULATOR (SOLID CORE TYPE)

DRG. No. TB-4-345-316-007

REV. 00

SHEET No. 4





# NOTES;

1. LA SHALL BE EARTHED THROUGH EARTH TERMINAL OF SURGE COUNTER
2. NO. OF ROD ELECTRODE 1 NO. PER PHASE,
3. TEST LINK SHALL HAVE PROVISION TO BOLT TEST LEAD BEFORE ISOLATING THE MAIN EARTHING CONNECTIONS (AS PER SKETCH ABOVE) = 1NO.



## EQUIPMENT EARTHING DETAILS LIGHTNING ARRESTER(198/120kV)

COMPU. DRG. REF.

DRG.NO.

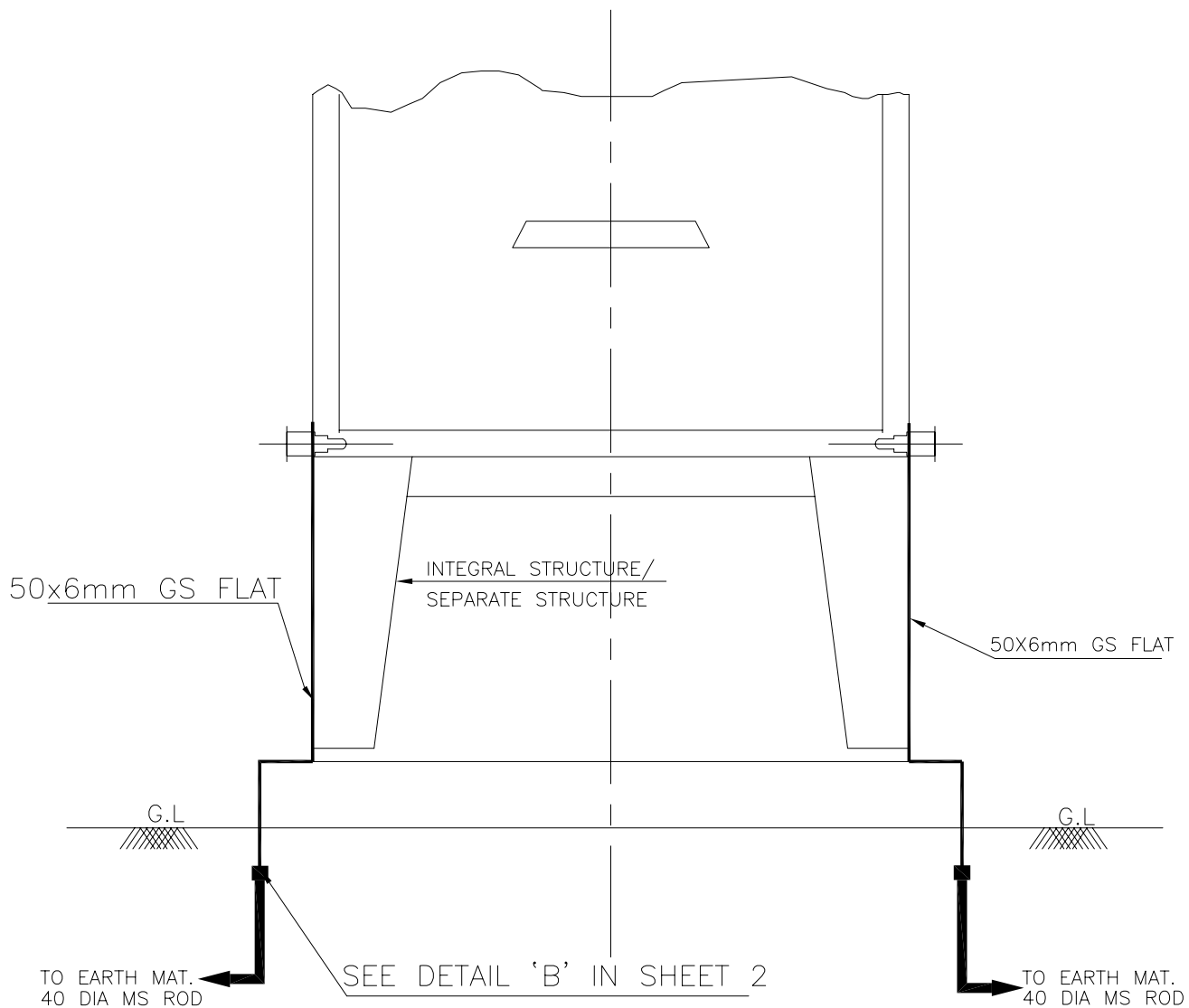
TB-4-345-316-007

REV. 00

SHEET No.

5





# EQUIPMENT EARTHING DETAILS MARSHALLING KIOSK

COMPUTERREF.NO.

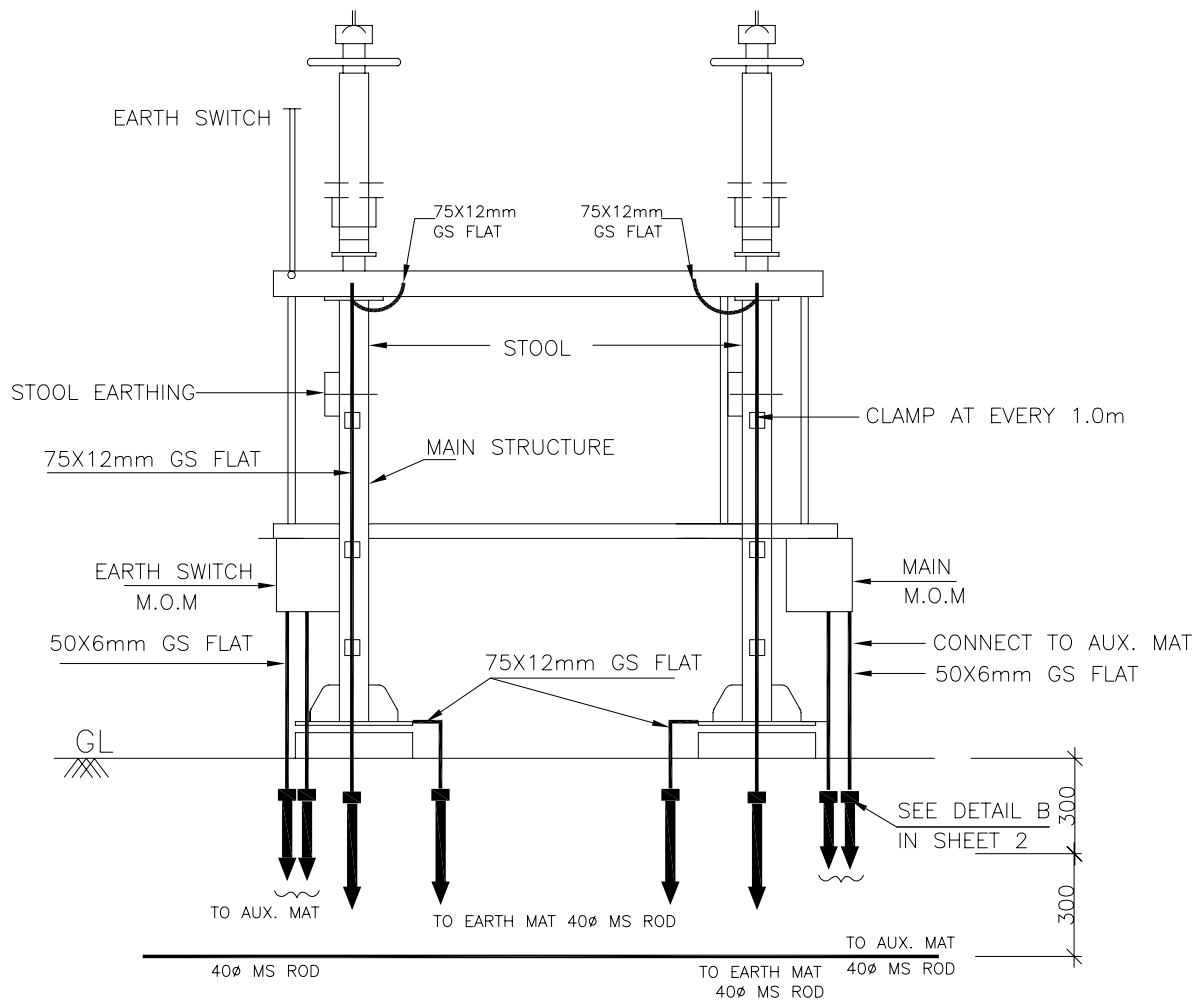
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
6





#### NOTES

1. AUXILIARY EARTH MAT SHALL BE PROVIDED BELOW EVERY MOM BOX (REFER SHEET 14)



## EQUIPMENT EARTHING DETAILS

### 220kV HORIZONTAL CENTER BREAK ISOLATOR (TYPICAL) WITH ONE EARTH SWITCH

COMPUTERREF.NO.

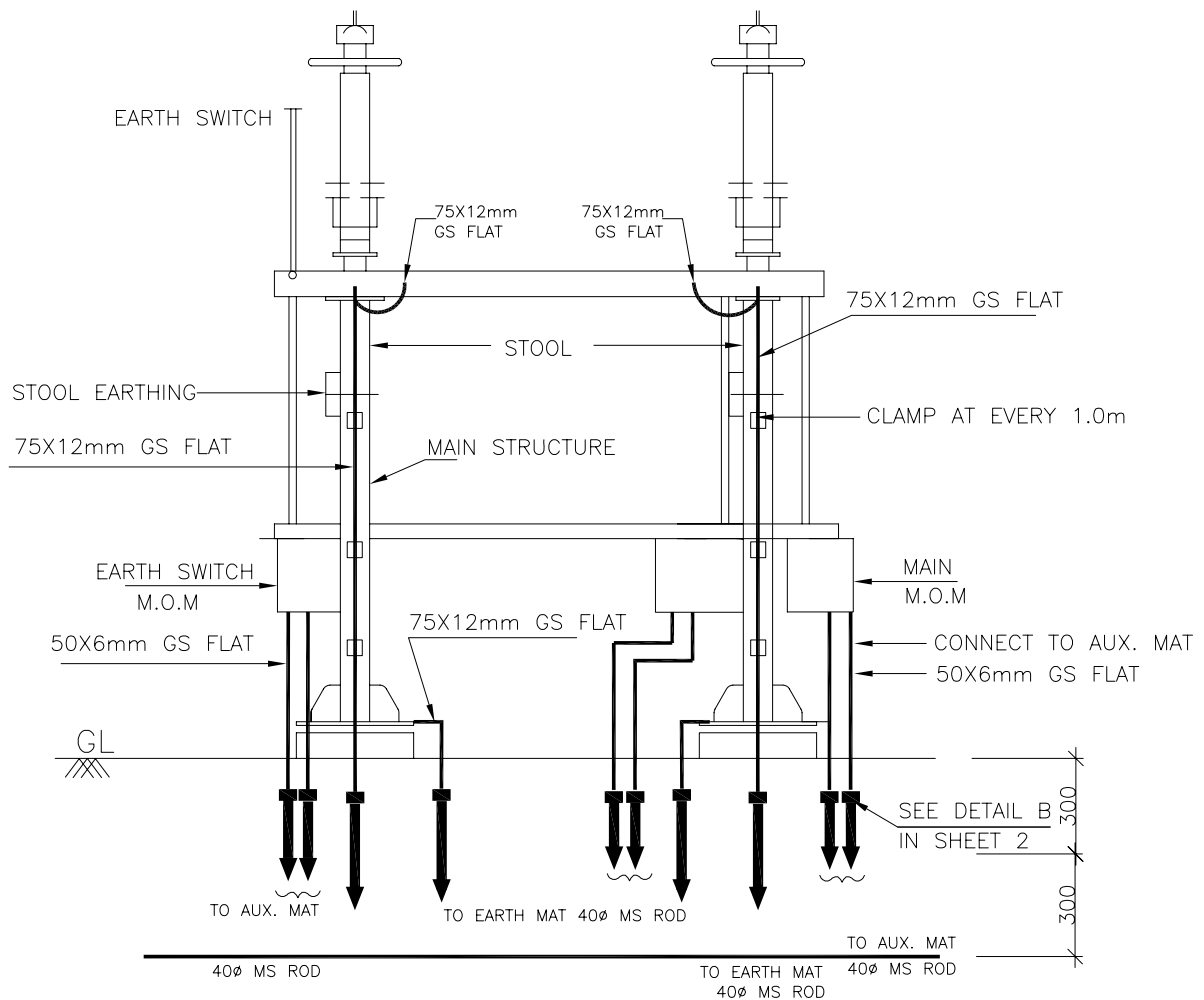
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
7





#### NOTES

1. AUXILIARY EARTH MAT SHALL BE PROVIDED BELOW EVERY MOM BOX (REFER SHEET 14)



## EQUIPMENT EARTHING DETAILS

### 220kV HORIZONTAL CENTER BREAK ISOLATOR (TYPICAL) WITH TWO EARTH SWITCH

COMPUTERREF.NO.

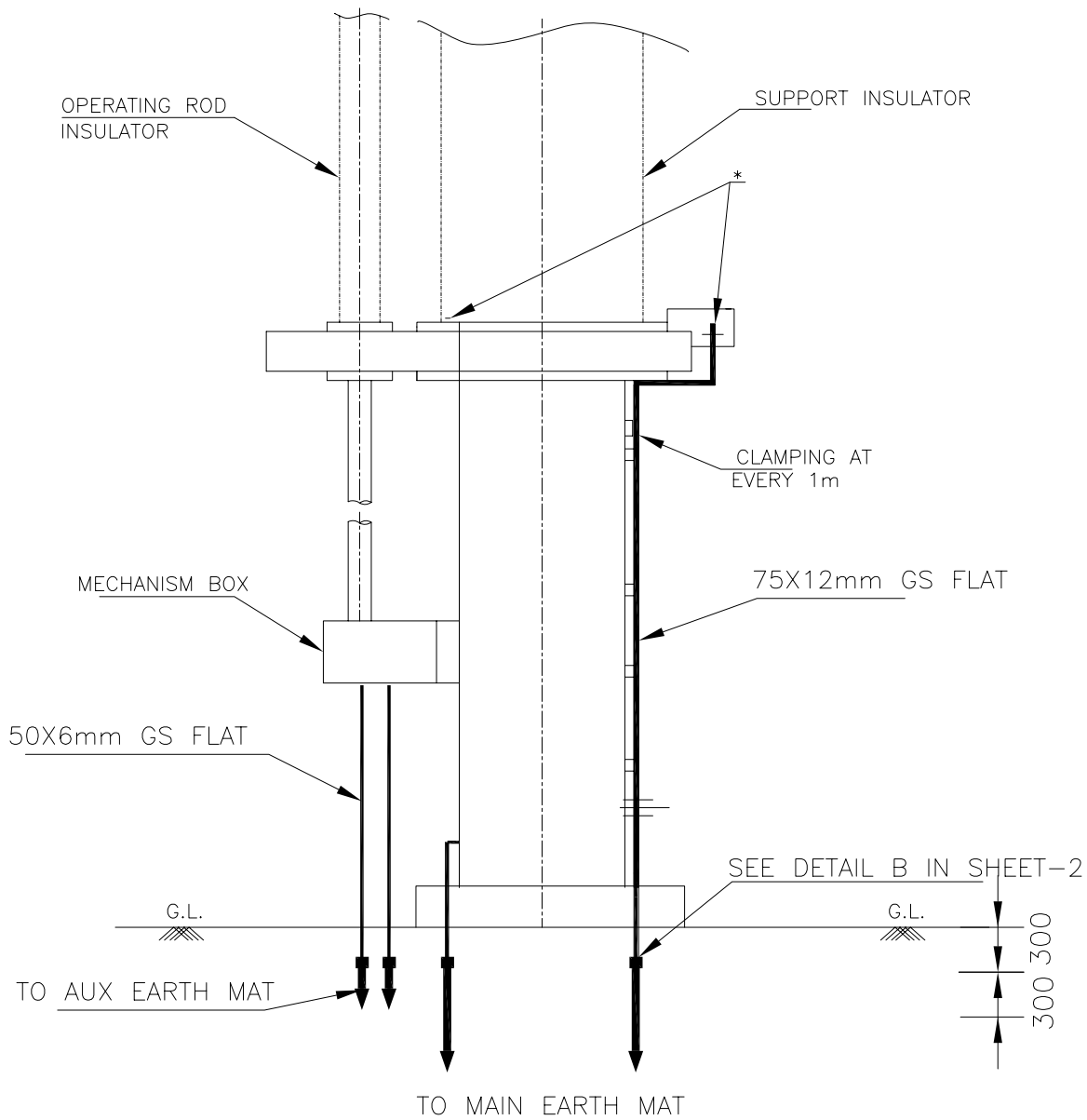
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
7A





#### NOTES

1. AUXILIARY EARTH MAT SHALL BE PROVIDED BELOW EVERY MOM BOX (REFER SHEET 14).



## EQUIPMENT EARTHING DETAILS

### 220kV PANTOGRAPH ISOLATOR WITHOUT E/S

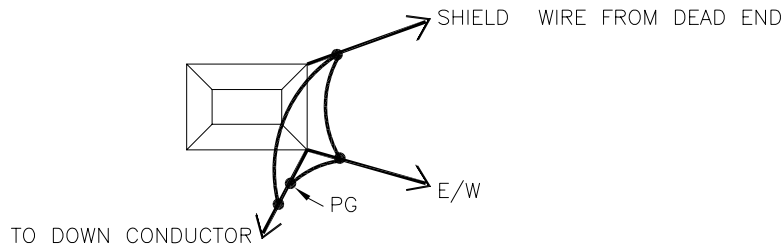
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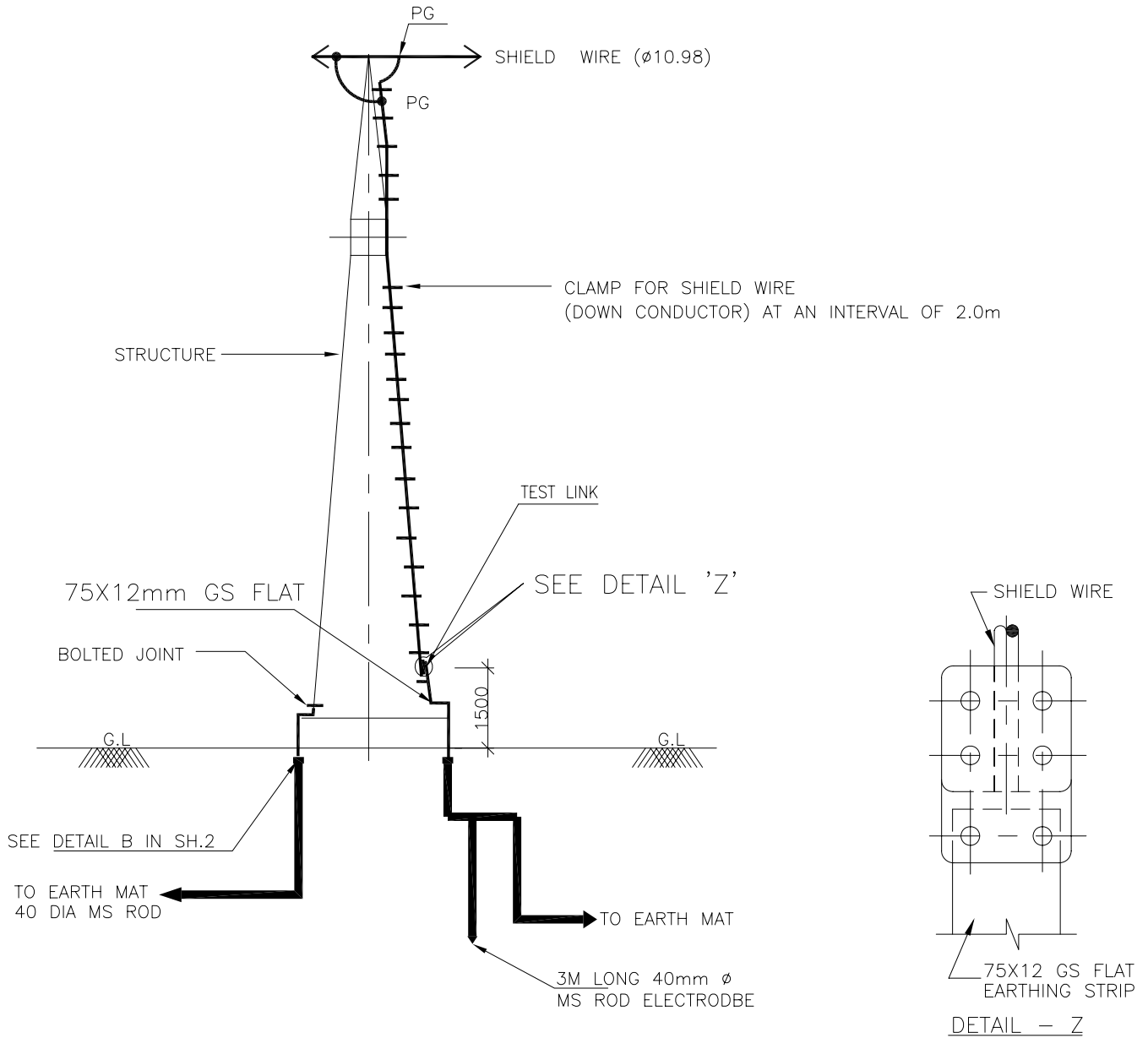
REV. 00

SHEET No.  
7B





DETAIL WHEN 2 & E/WIRE TERMINATES A TOWER



NOTE:

1. NO. OF ROD ELECTRODE : 1 NO. PER TOWER WITH DOWN CONDUCTOR.



## EQUIPMENT EARTHING DETAILS

### SHIELD WIRE TOWER

COMPUTERREF.NO.

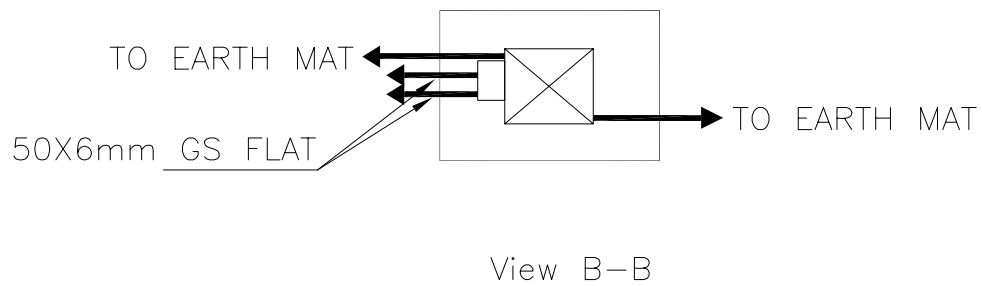
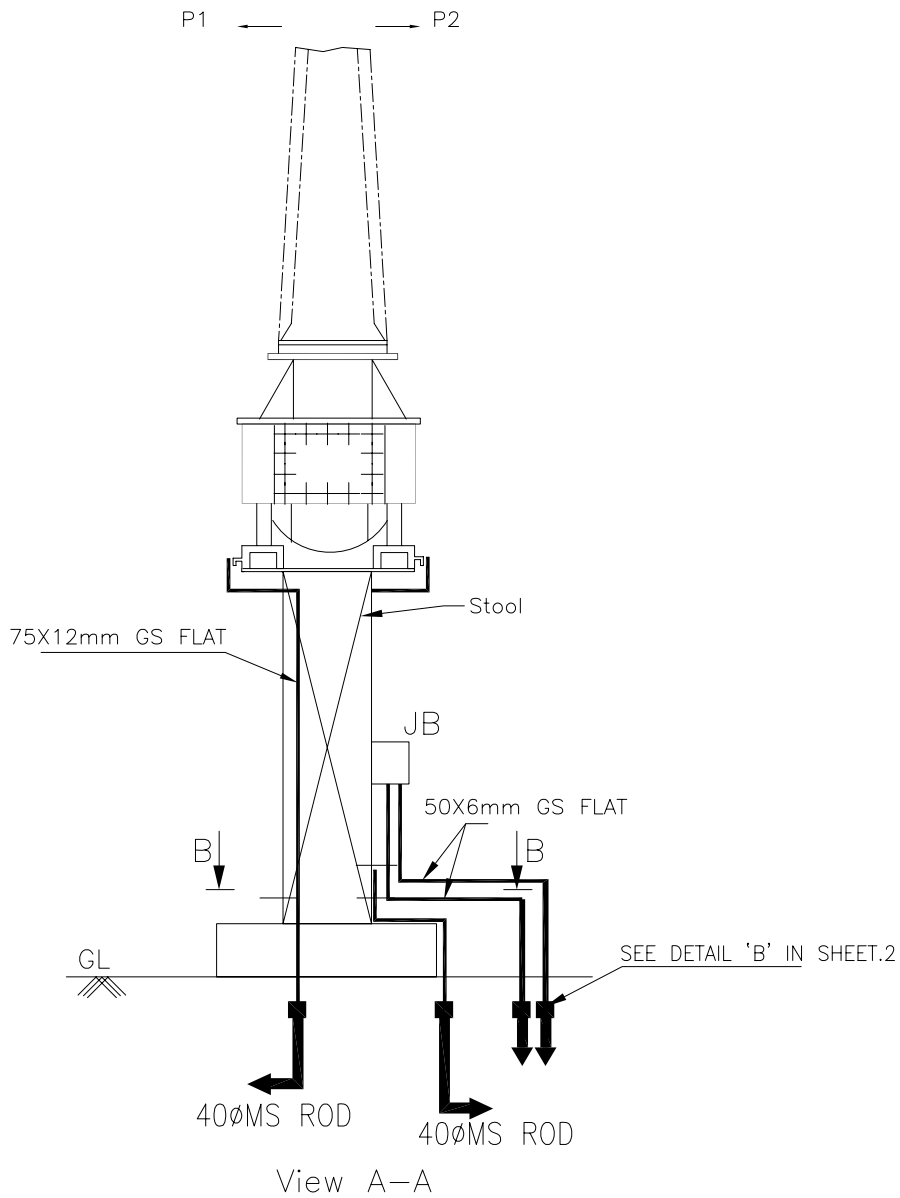
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
8





# EQUIPMENT EARTHING DETAILS 220 kV Current Transformer

COMPU. DRG. REF.

DRG.NO.

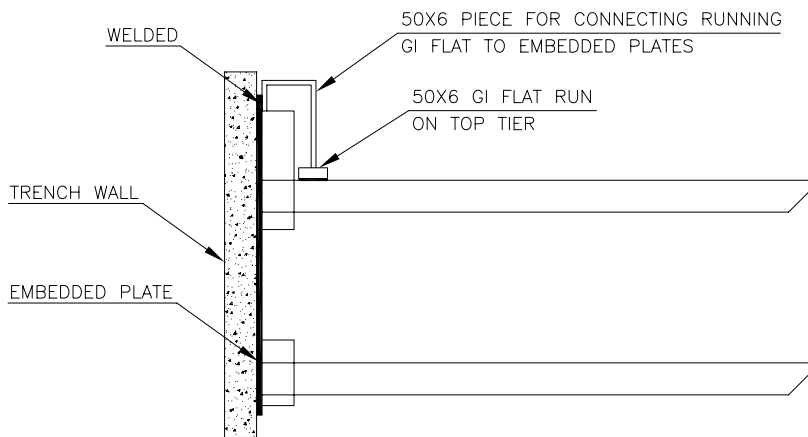
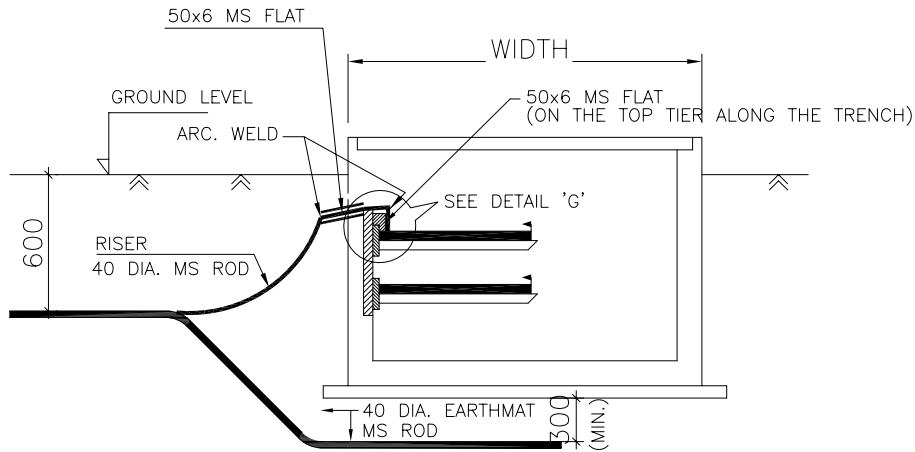
TB-4-345-316-007

REV. 00

SHEET No.

9





DETAIL 'G'

DETAIL FOR CONNECTING GI FLAT RUNNING HORIZONTAL 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 (50x6 MS FLAT) SHALL BE WELDED TO EMBEDDED PLATE AT EVERY 0.75M INTERVAL.
3. WHERE THE CABLE RACKS ARE PROVIDED ON BOTH SIDES OF THE TRENCH, BOTH SIDES SHALL BE EARTHED AS PER ABOVE.
4. THE MS FLAT SHALL BE FINALLY PAINTED WITH TWO COATS OF RED OXIDE PRIMER & TWO COATS OF POST OFFICE RED ENAMEL PAINT.



## EQUIPMENT EARTHING DETAILS CABLE TRENCH

COMPU. DRG. REF.

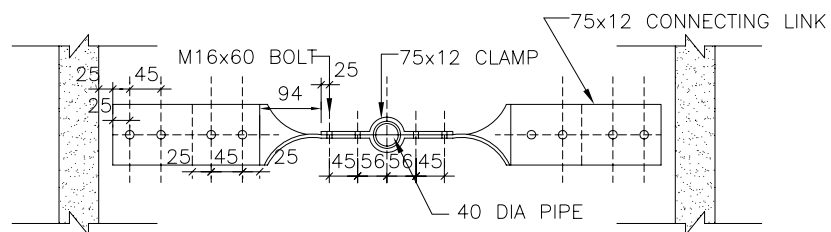
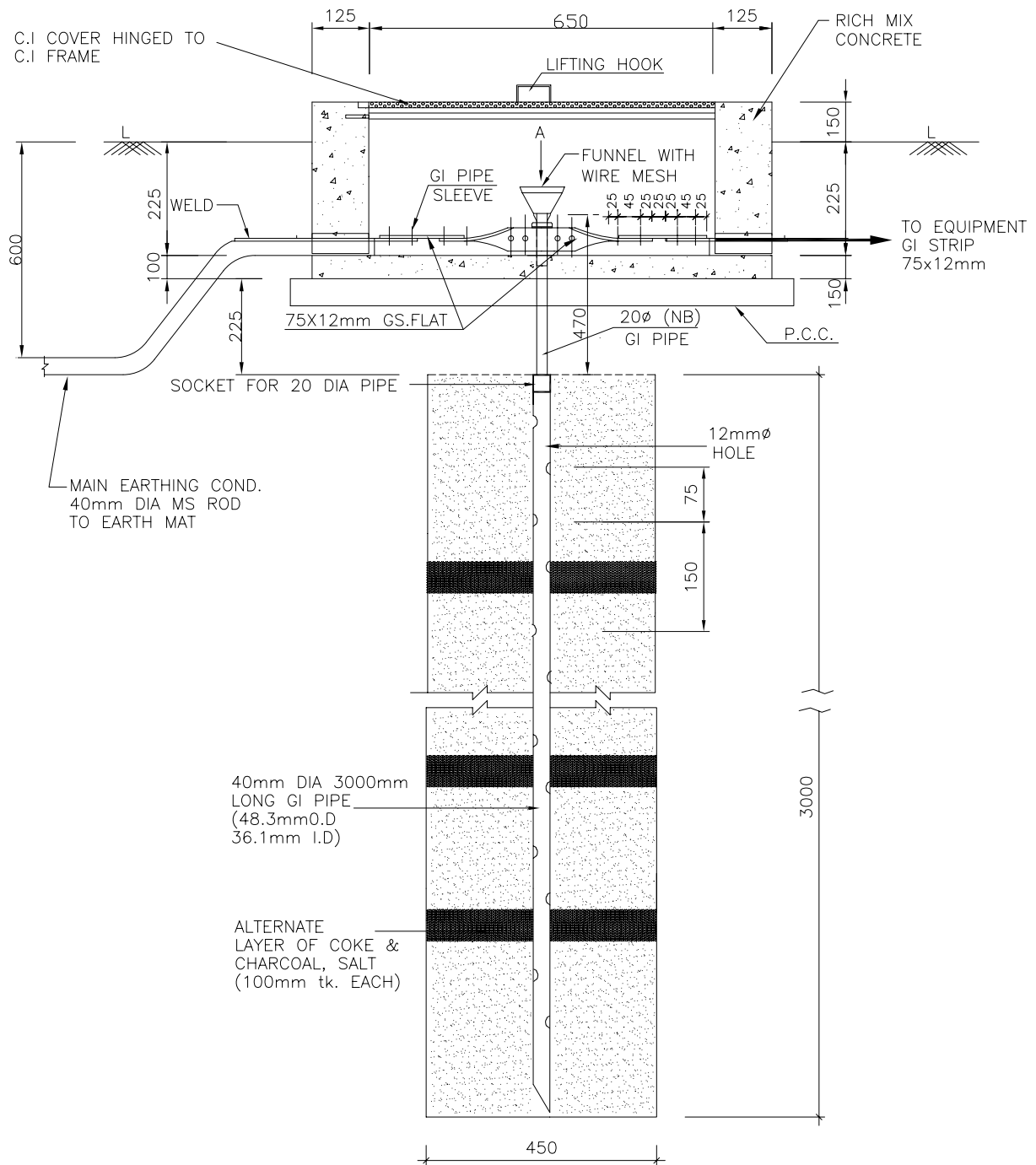
DRG. NO.

TB-4-345-316-007

REV. 00

SHEET  
10





VIEW-A

NOTE:

1. ALL NUTS,BOLTS AND WASHERS, FUNNEL GI PIPE AND WIRE MESH SHALL BE GALVANISED AS PER SPECIFICATION.
2. FUNNEL SHALL BE SECURELY HELD TO THE PIPE.
3. TO BE USED FOR CONNECTING TO NEUTRAL OF POWER TRANSFORMER/REACTOR/NGR



EQUIPMENT EARTHING DETAILS  
DETAILS OF PIPE EARTH ELECTRODE  
IN TREATED EARTH PIT (ET)

COMPUTERREF.NO.

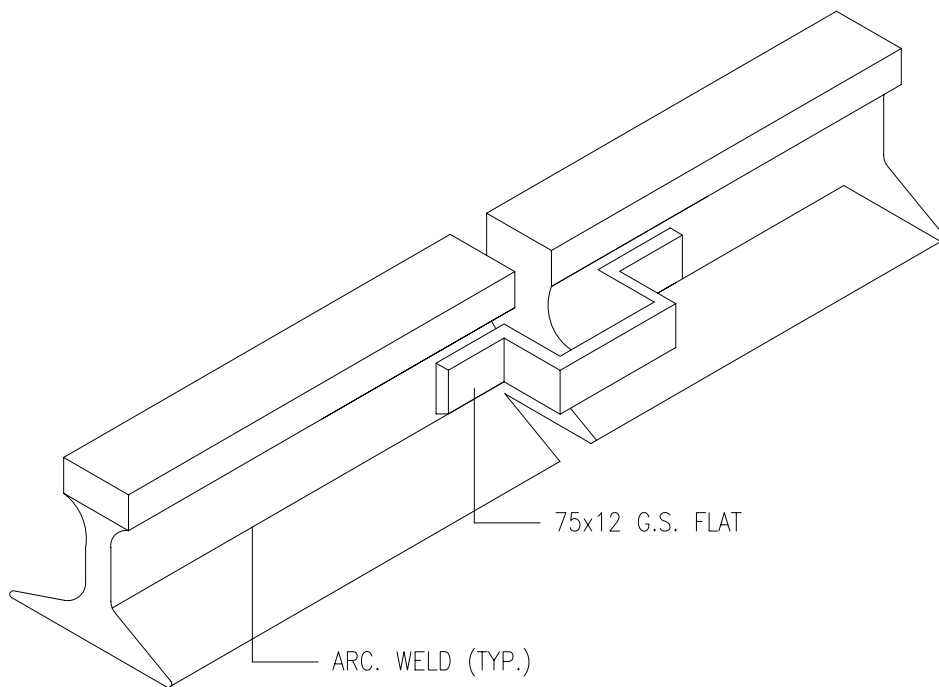
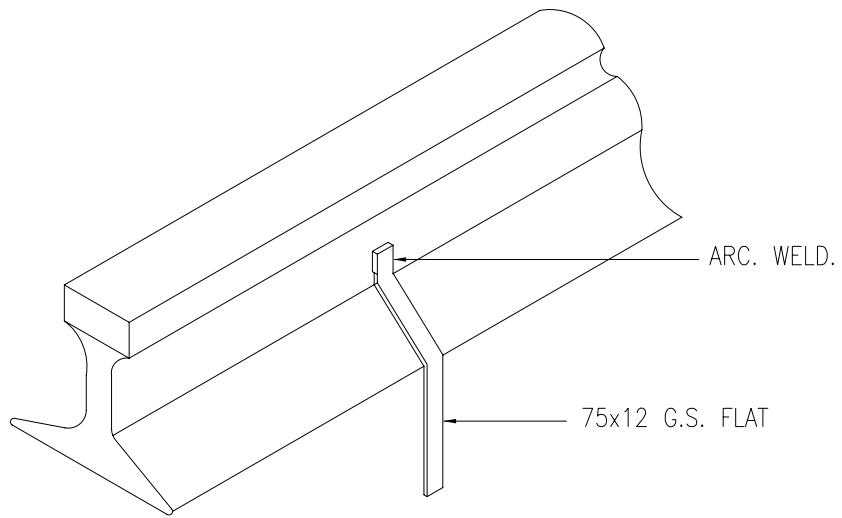
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
11





NOTE:—

1. RAILWAY TRACKS WITHIN SWITCHYARD AREA SHALL BE EARTHED AT BOTH ENDS & AT 30M. SPACING.



## EQUIPMENT EARTHING DETAILS

### RAIL BONDING

COMPU. DRG. REF.

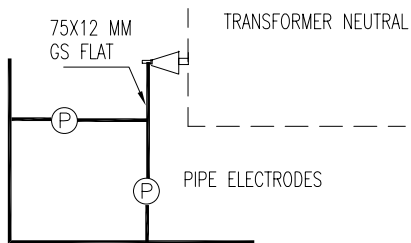
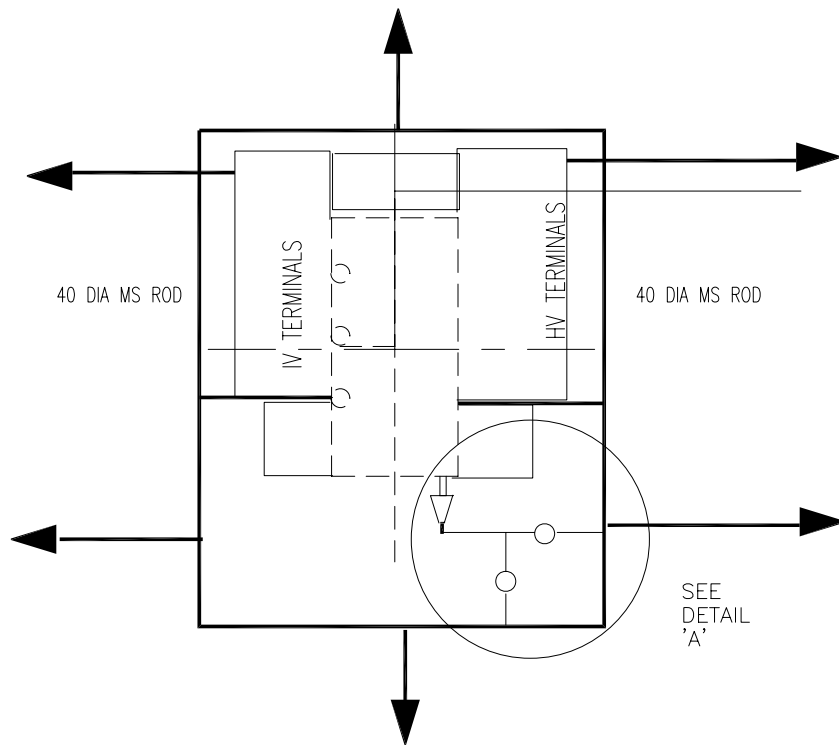
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TB-4-345-316-007

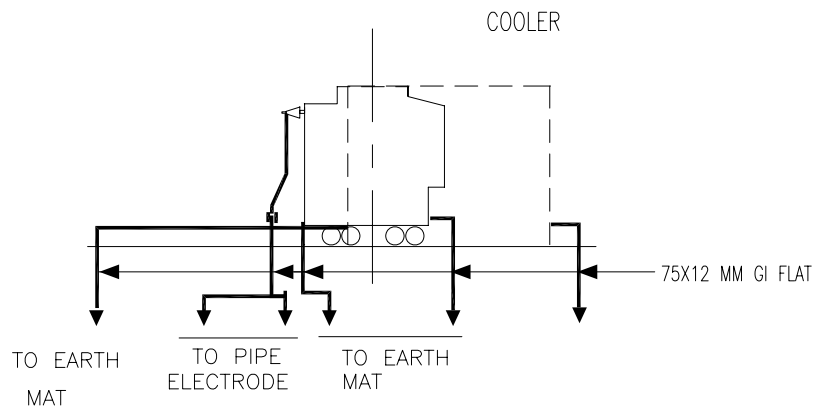
REV. 00

SHEET No.  
12





DETAIL A



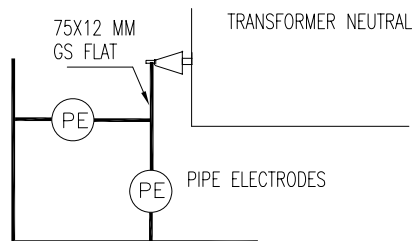
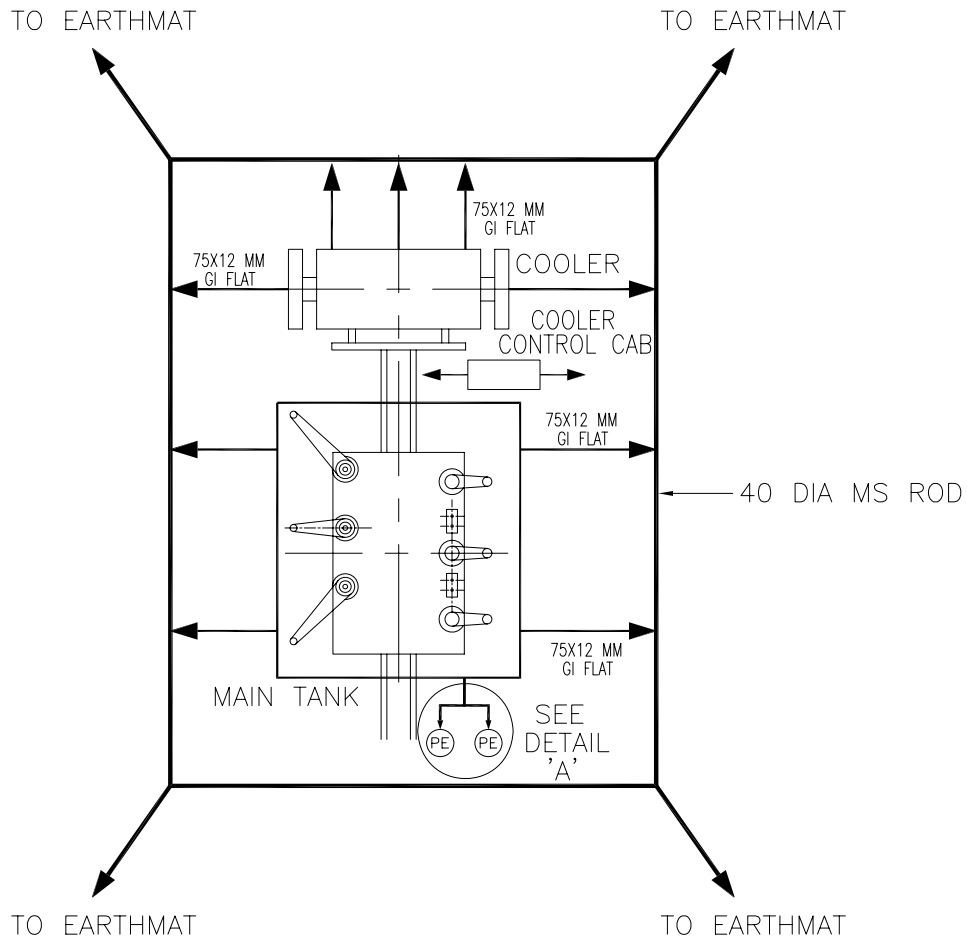
## EQUIPMENT EARTHING DETAILS LT TRANSFORMER

DRG. No. TB-4-345-316-007

REV. 00

SHEET No.  
13





DETAIL A

NOTES:—

1. EARTH CONTINUITY ACROSS GASKETED JOINTS MUST BE ENSURED USING FLEXIBLE OR FLAT.
2. ALL ACCESSORIES ASSOCIATED WITH TRANSFORMER LIKE COOLING BANKS, RADIATORS, MAIN TANK, MARSHALLING KIOX ETC. SHALL BE CONNECTED TO THE EARTHING GRID AT MINIMUM TWO POINTS.



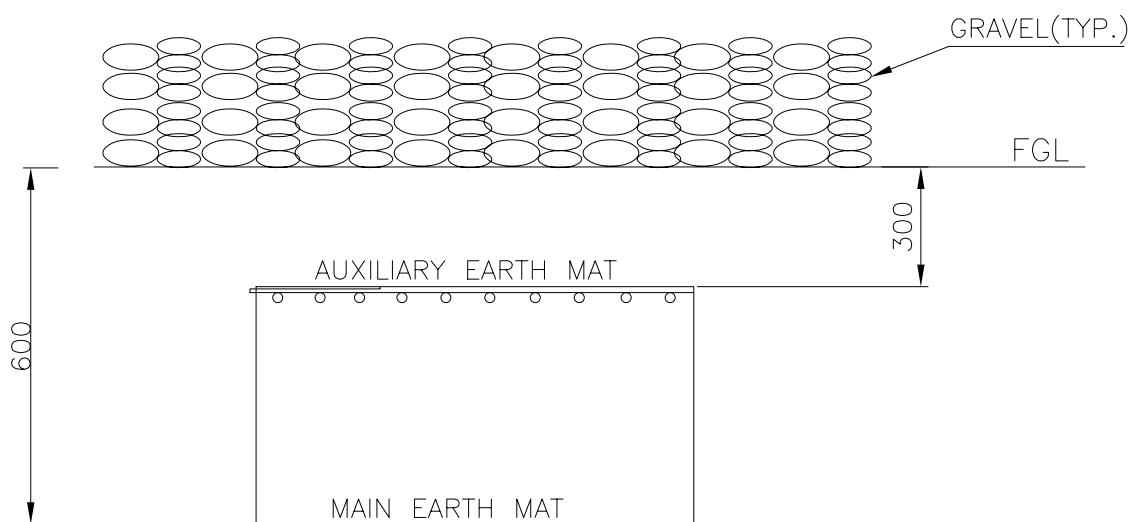
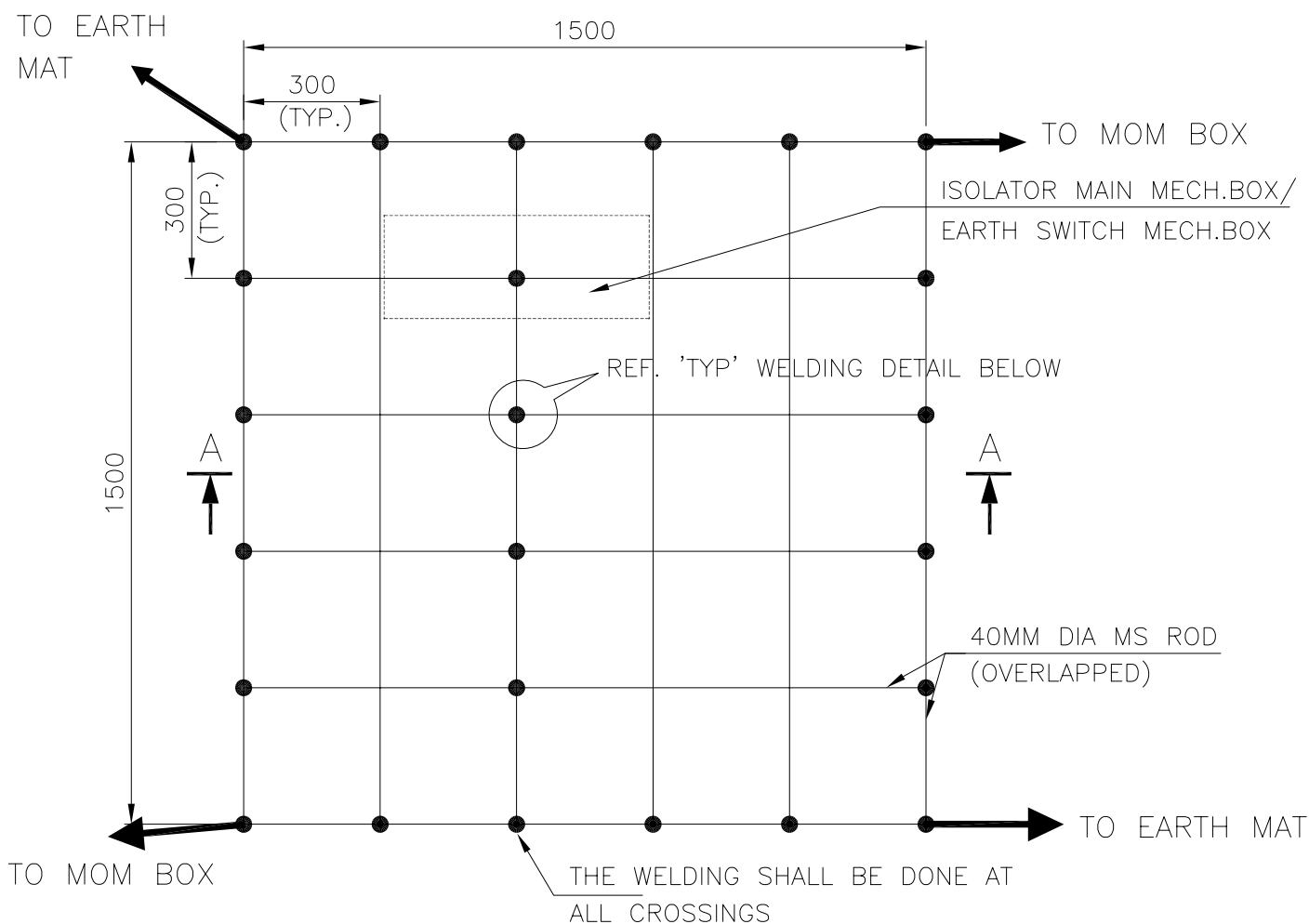
EQUIPMENT EARTHING DETAILS  
AUTO TRANSFORMER

DRG. No. TB-4-345-316-007

REV. 00

SHEET No.  
13A





### 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.



COMPU. DRG. REF.

Report No.

## EQUIPMENT EARTHING DETAILS

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

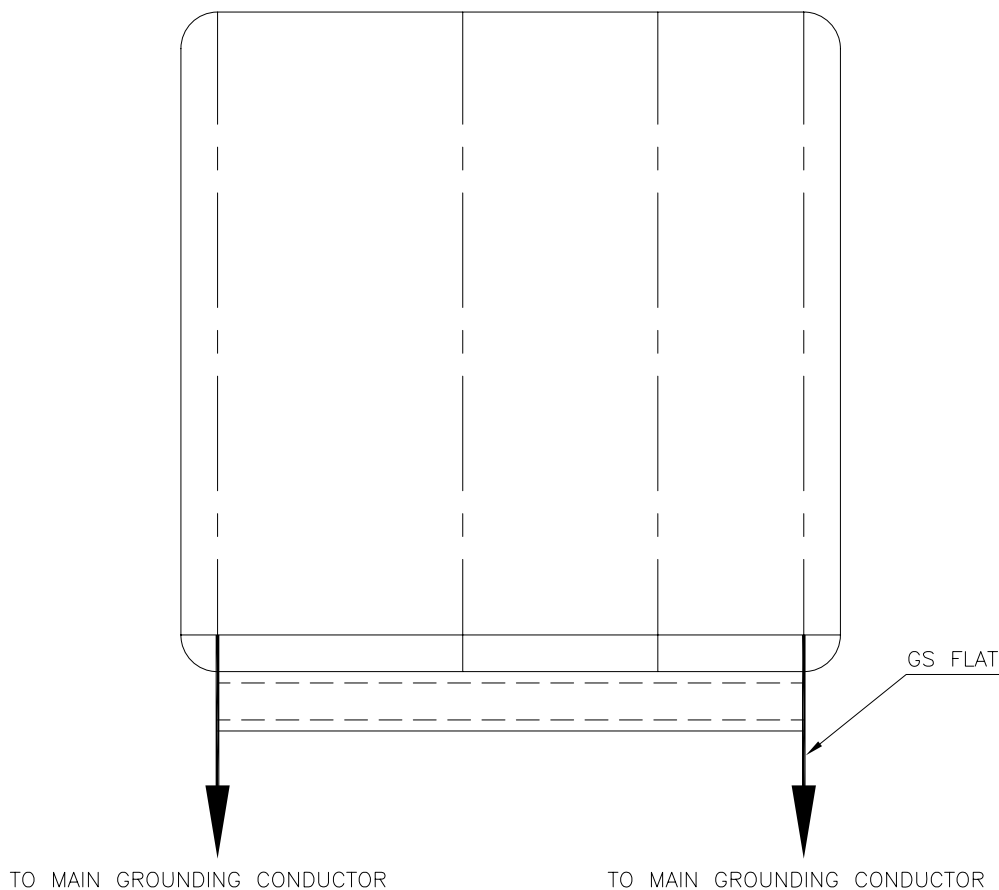
TB-4-345-316-007

REV. 00

SHEET No.

14





#### EQUIPMENT

#### FLAT SIZE

SWITCHGEAR/ MCC	50X6 MM
AC / DC DISTRIBUTION BOARDS	50X6 MM
CONTROL & RELAY PANELS	50X6 MM
AC KIOSK	50X6 MM



### EQUIPMENT EARTHING DETAILS

SWITCHGEAR / MCC / CONTROL AND RELAY BOARD/AC KIOSK

DRG. No. TB-4-345-316-007

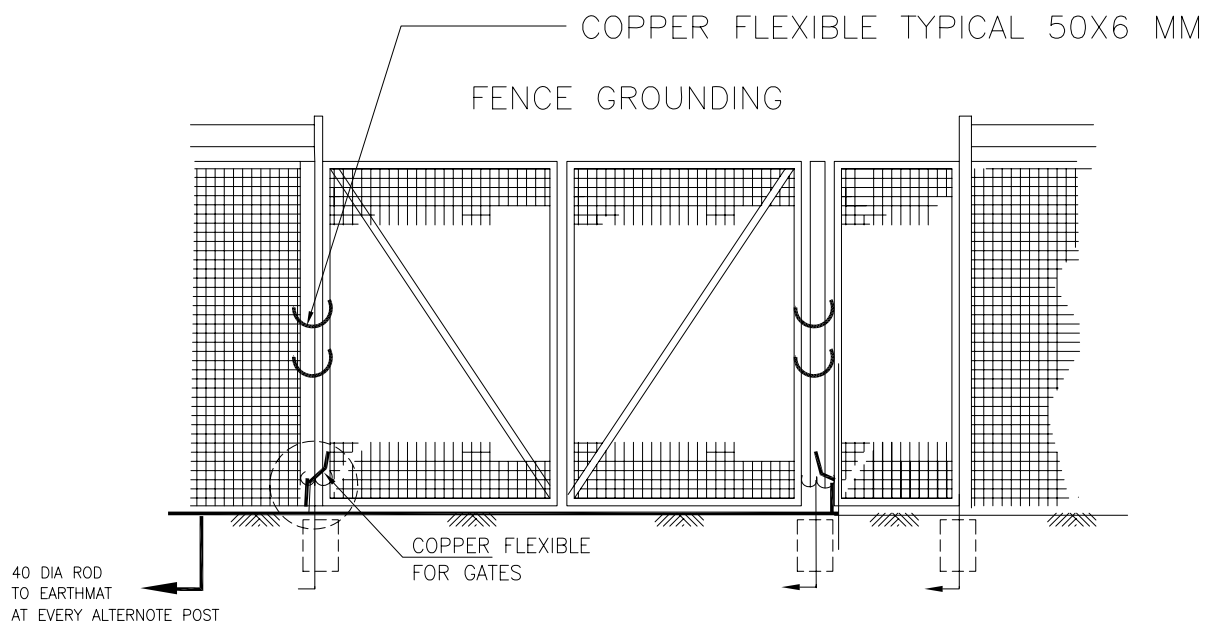
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SHEET No.  
15

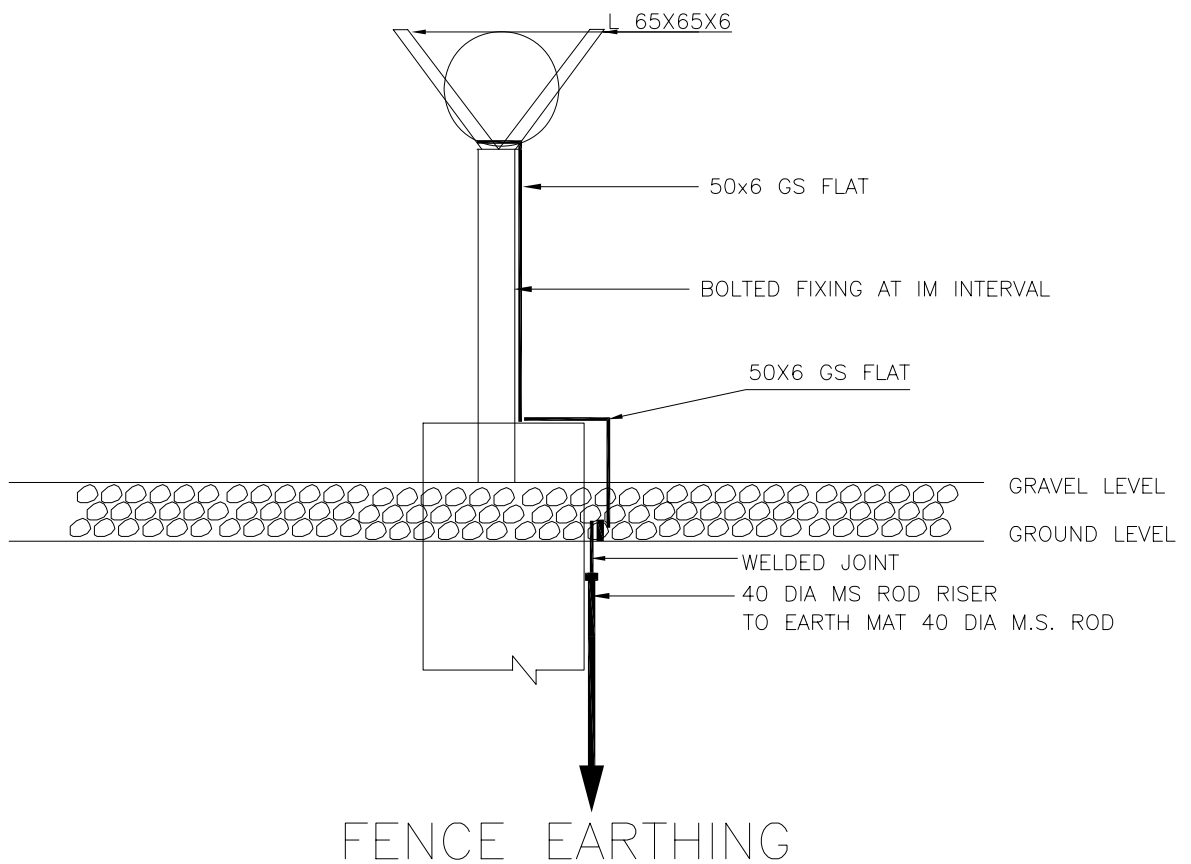








EVERY ALTERNOTE FENCE POSTS SHALL BE EARTHED BY 50X6 MM GS FLAT.  
50X6 FLAT SHALL BE WELDED TO 65X65X6 ANGLES FORMING V-SHAPE AT THE TOP OF FENCE



## EQUIPMENT EARTHING DETAILS FENCE POST

DRG. No.

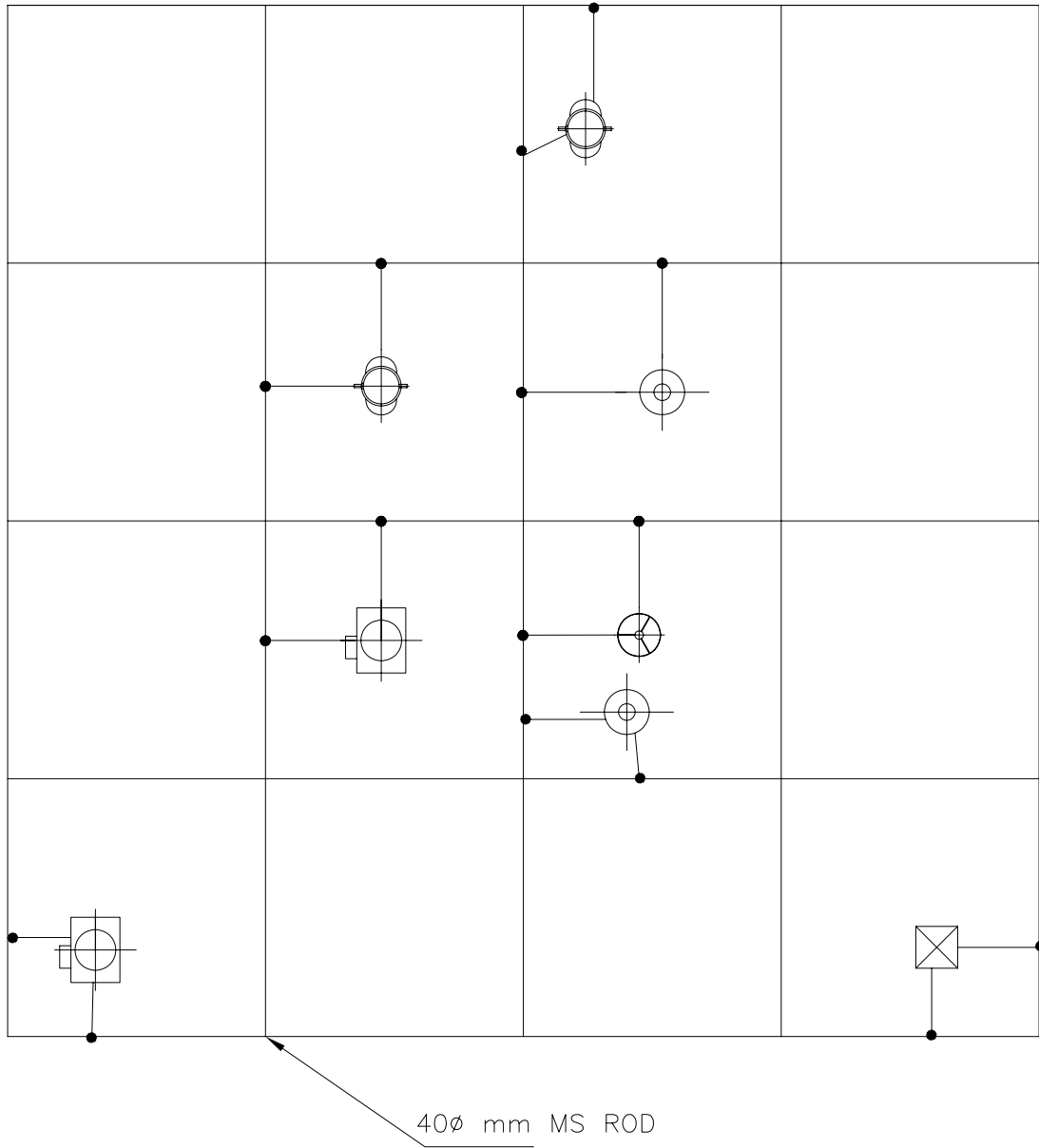
TB-4-345-316-007

REV. 00

SHEET No.  
17



# MAIN EARTHMAT GRID



• — RISER



## EQUIPMENT EARTHING DETAILS

TYPICAL ARRANGEMENT OF EQUIPMENT EARTHING WITH MAIN GRID

COMPU. DRG. REF.

DRG. NO.

TB-4-345-316-007

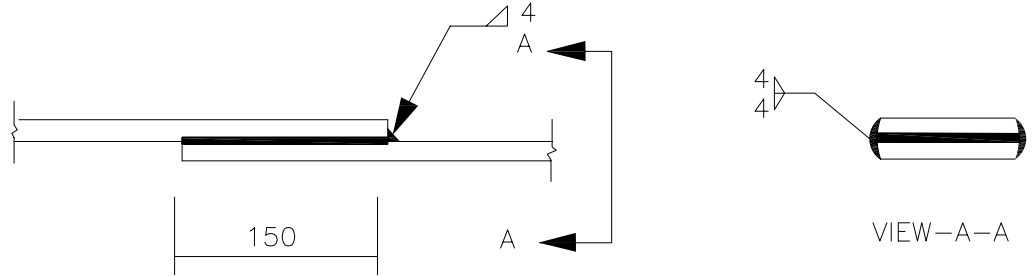
REV. 00

SHEET No.  
18

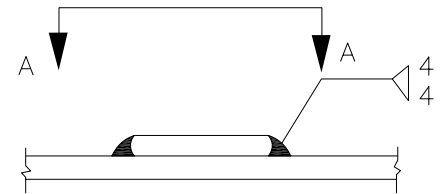
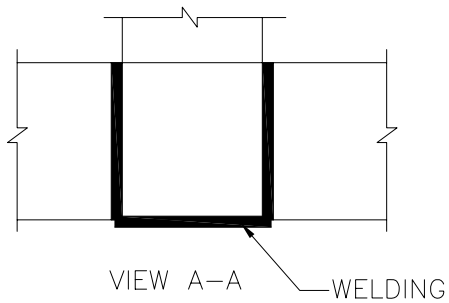


## STRIP TO STRIP

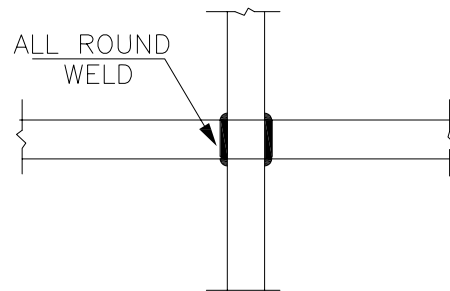
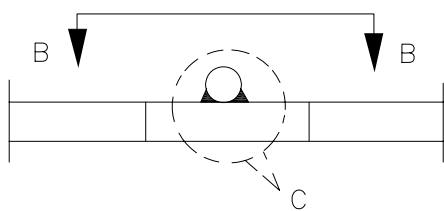
### 1. STRAIGHT LAP JOINT/RISER



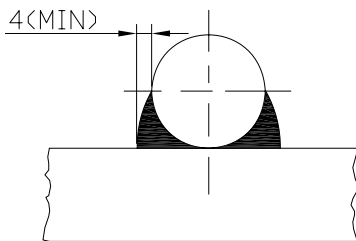
### 2. CROSS LAP JOINT



### RIGHT ANGLED JOINT (ROD TO ROD)



VIEW B-B



VIEW C

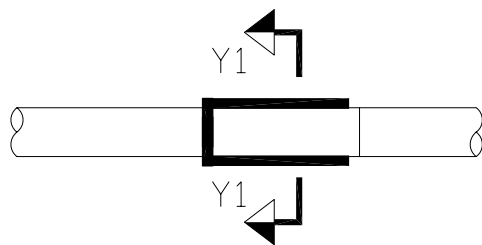


## EQUIPMENT EARTHING DETAILS WELDING DETAIL

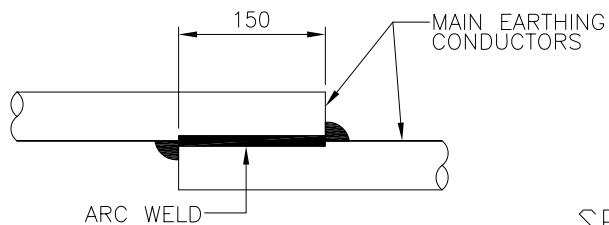




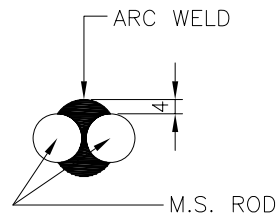




ELEVATION

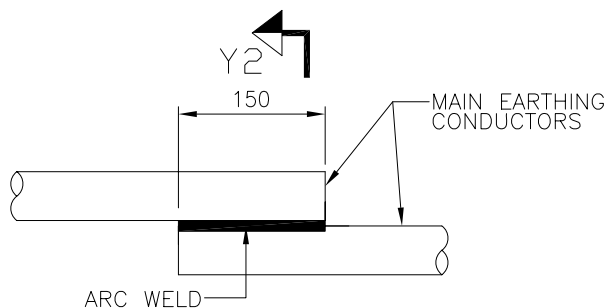


PLAN

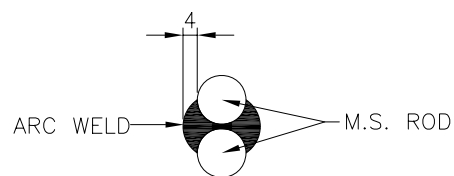


SECTION Y1-Y1

<CONDUCTOR IN HORIZONTAL PLANE>



PLAN



SECTION Y2-Y2

<CONDUCTOR IN VERTICAL PLANE>



# EQUIPMENT EARTHING DETAILS WELDING DETAILS

COMPUTERREF.NO.

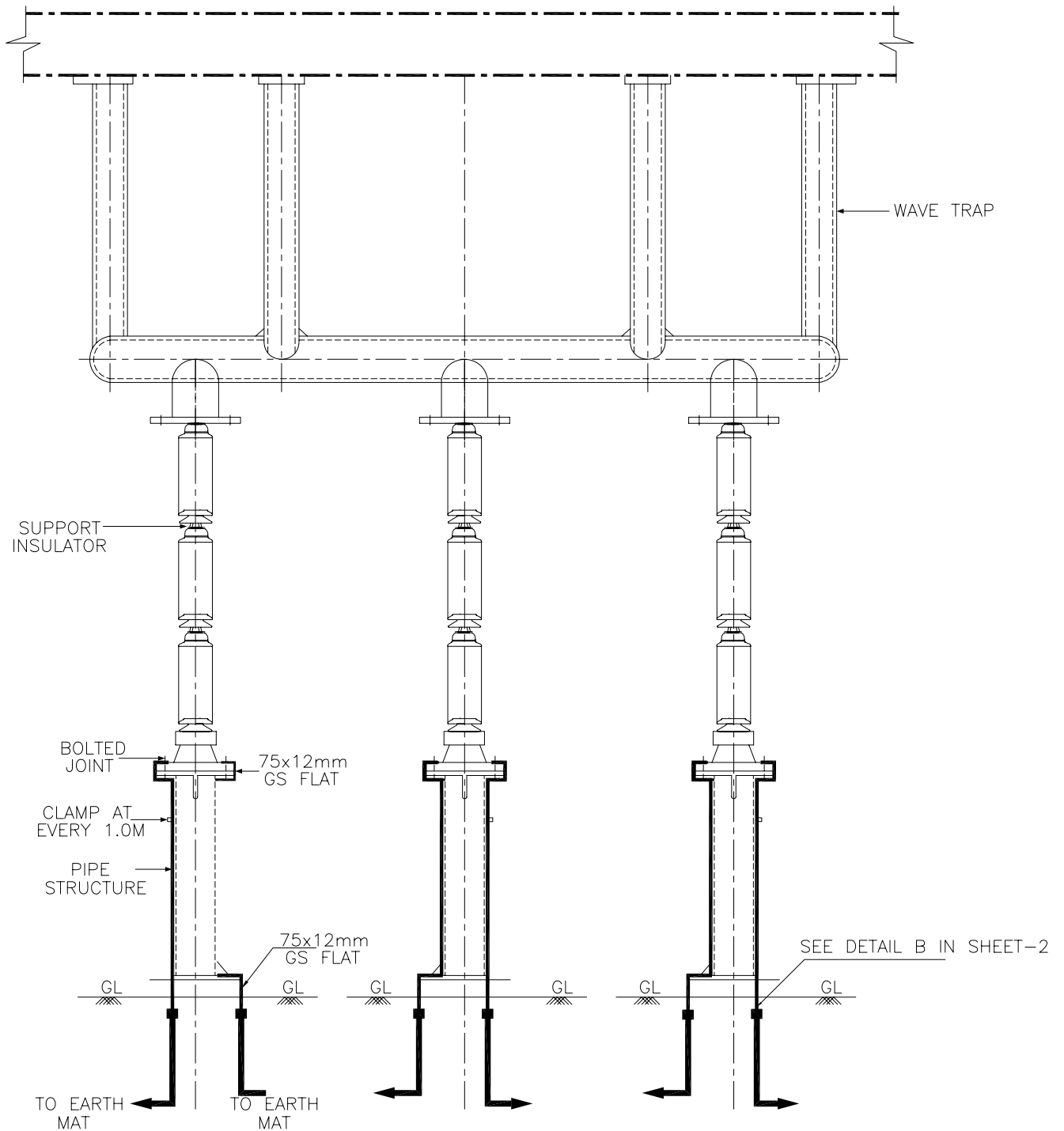
DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
21





NO. OF RISER=6NO. PER PHASE



# EQUIPMENT EARTHING DETAILS 220kV WAVE TRAP

COMPUTERREF.NO.

DRG. No.

TB-4-345-316-007

REV. 00

SHEET No.  
22