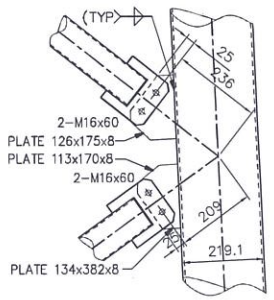
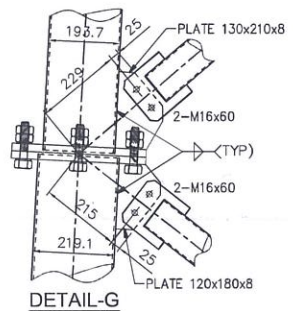
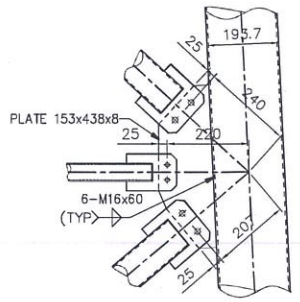


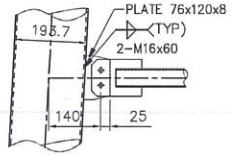
DETAIL-F
(SCALE 1:5)



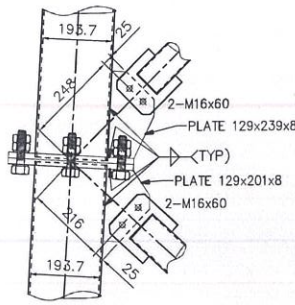
DETAIL-G
(SCALE 1:5)



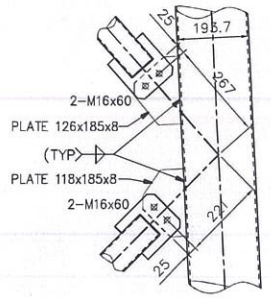
DETAIL-H
(SCALE 1:5)



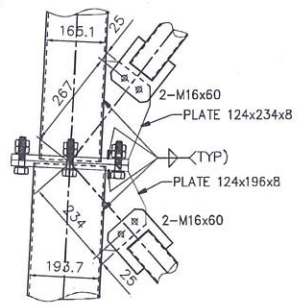
DETAIL-J
(SCALE 1:5)



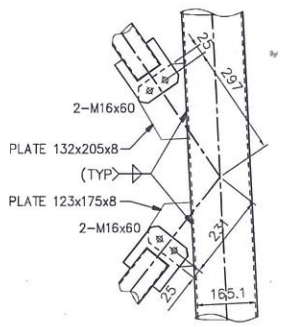
DETAIL-K
(SCALE 1:5)



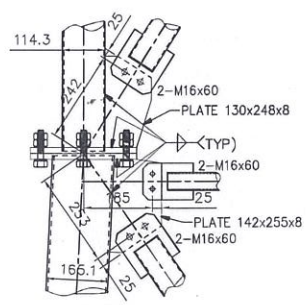
DETAIL-L
(SCALE 1:5)



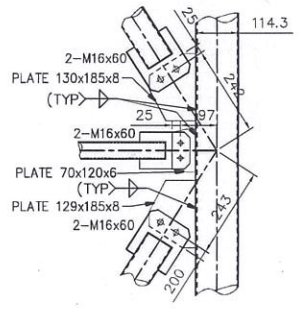
DETAIL-M
(SCALE 1:5)



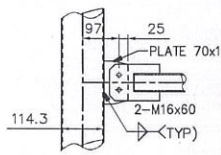
DETAIL-N
(SCALE 1:5)



DETAIL-P
(SCALE 1:5)



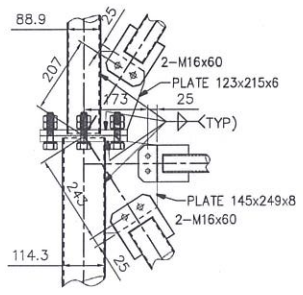
DETAIL-Q
(SCALE 1:5)



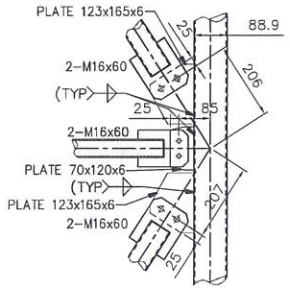
DETAIL-R
(SCALE 1:5)

PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ★ HYD.

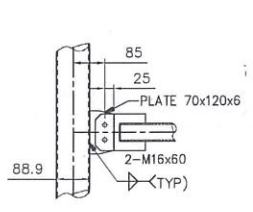
DESIGN & DRAWING BY		RDSO/TC/TOWER/L/40/180/T/6.5				
Sandeep Mirmire Director	Proof checking by RDSO	Uma Shankar SSE/SB2	Aneet Kumar SSE/SB2	Sandeep Agarwal ADE/SB2	Mohit Verma Dir./SB1	R K Srivastava ED/B&S/STEEL
Principle ACS Engineering India Pvt. Ltd, Plot No.27, Rao & Raju Colony, Banjara Hills, Hyderabad					28.12.21	



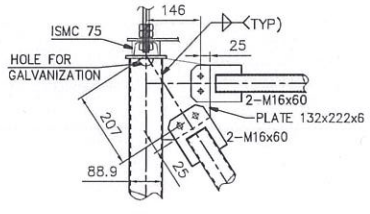
DETAIL-S
(SCALE 1:5)



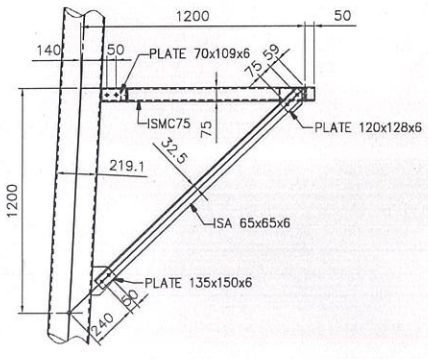
DETAIL-T
(SCALE 1:5)



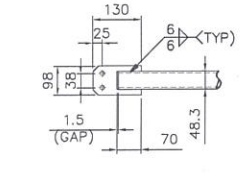
DETAIL-U
(SCALE 1:5)



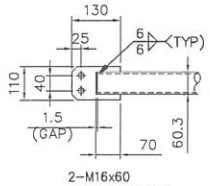
DETAIL-V
(SCALE 1:5)



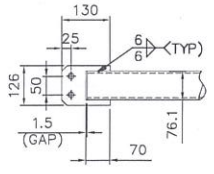
DETAIL-W
(SCALE 1:10)



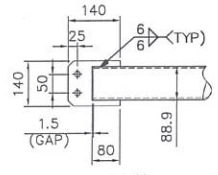
2–M16x60
PLATE 98x130x6
END PLATE CONNECTION
(FOR PIPE 48.3x2.9)
(SCALE 1:5)



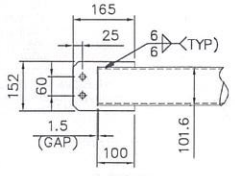
2–M16x60
PLATE 110x130x6
END PLATE CONNECTION
(FOR PIPE 60.3x2.9)
(SCALE 1:5)



2–M16x60
PLATE 126x130x8
END PLATE CONNECTION
(FOR PIPE 76.1x2.9)
(SCALE 1:5)



2–M16x60
PLATE 140x140x8
END PLATE CONNECTION
(FOR PIPE 88.9x3.2)
(SCALE 1:5)



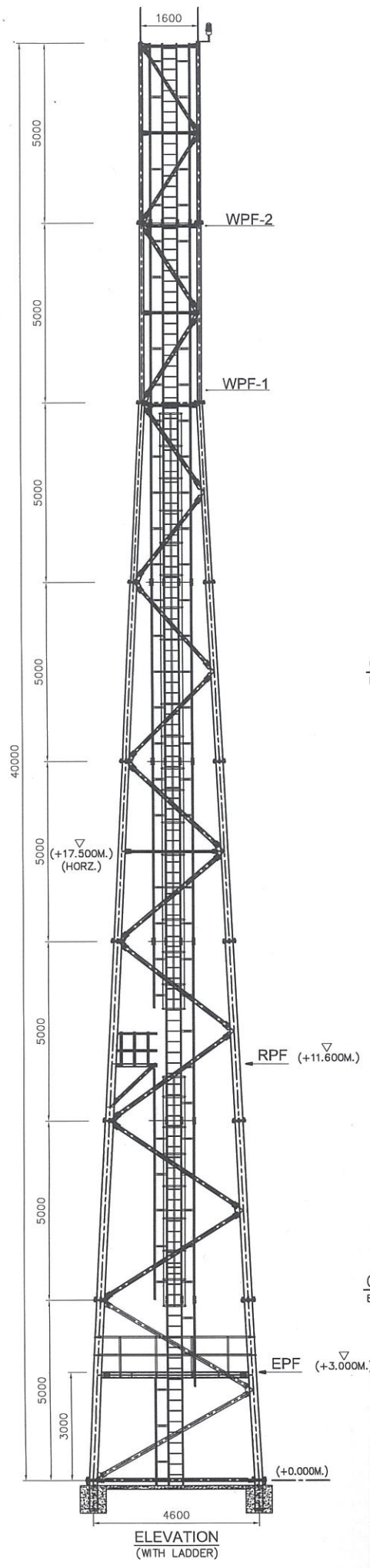
2–M20x65
PLATE 152x165x8
END PLATE CONNECTION
(FOR PIPE 101.6x3.6)
(SCALE 1:5)

SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

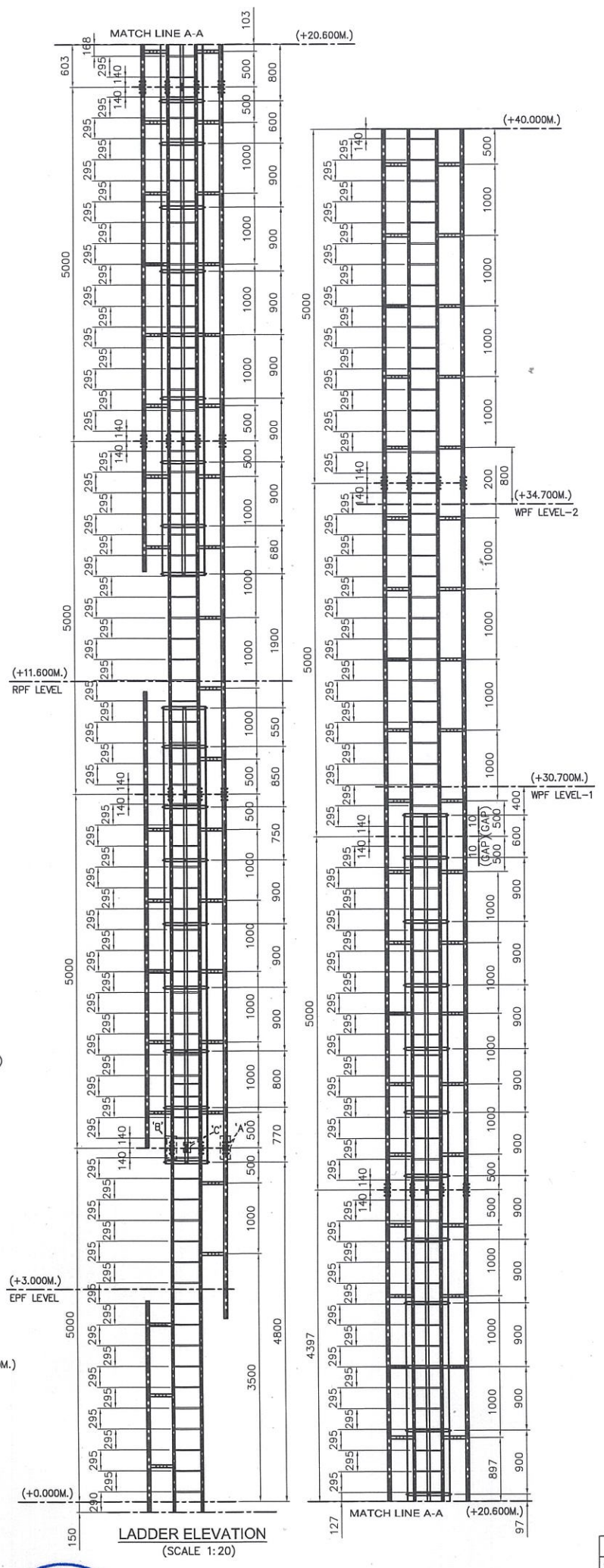
Principle ACS
Audits, Engineering And Services

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

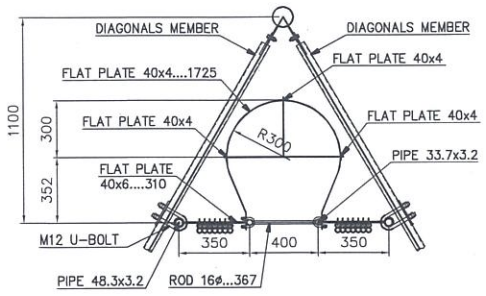
DRAWN	B.P	SPIRE 407RH			
CHECKED AND VERIFIED	A.R.J	ELEVATION OF TOWER & CONNECTION DETAIL			
APPROVED	P.M	SCALE – 1:40	SHEET	REV.	SIZE
DATE	20.12.2021	2021–PACS–SPIRE 407RH–001	003	0	A3



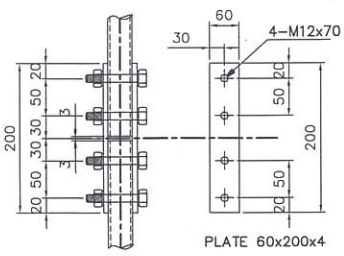
ELEVATION
(WITH LADDER)



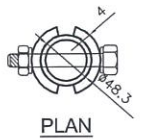
LADDER ELEVATION
(SCALE 1:20)



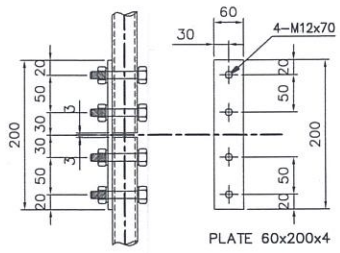
LADDER ASSEMBLY
(SCALE 1:10)



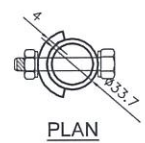
DETAIL-A
(SCALE 1:5)



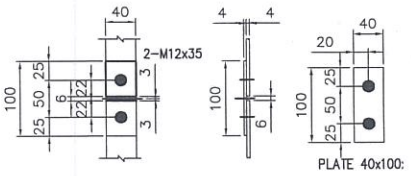
PLAN
(SCALE 1:3)



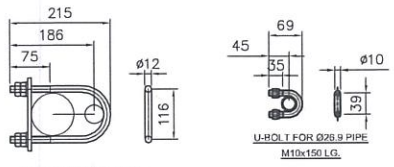
DETAIL-B
(SCALE 1:5)



PLAN
(SCALE 1:3)



DETAIL-C
(SCALE 1:5)



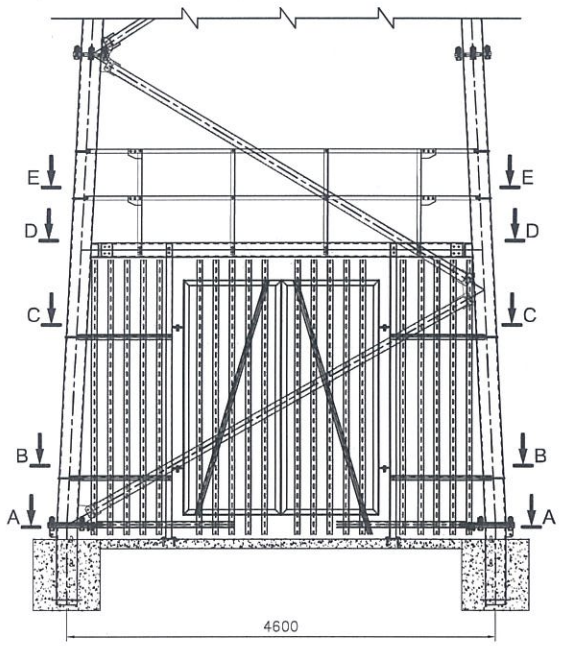
	✓				
SUBMITTED FOR	APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

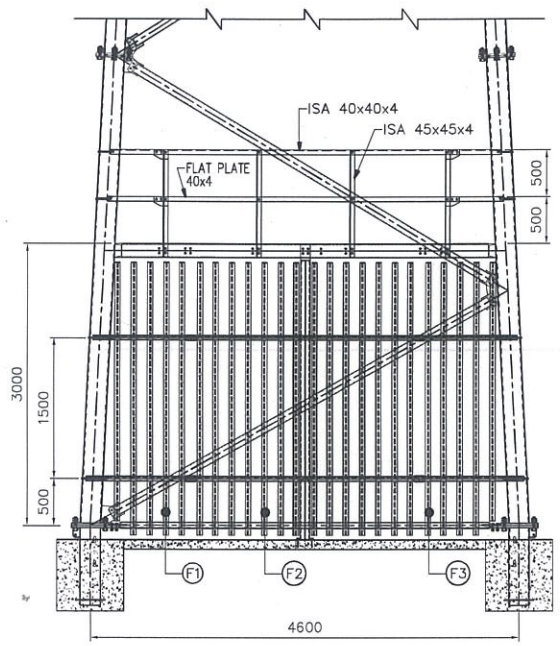
DRAWN	B.P	SPIRE 407RH LADDER DETAILS			
CHECKED AND VERIFIED	A.R.J				
APPROVED	P.M	SCALE – 1:40	SHEET	REV.	SIZE
DATE	20.12.2021	2021-PACS-SPIRE 407RH-001	004	0	A3

PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ★ HYD.

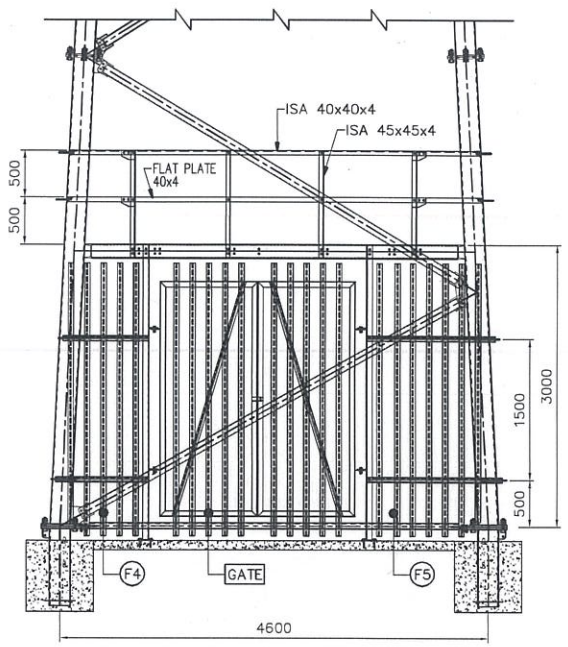
DESIGN & DRAWING BY		RDSO/TC/TOWER/L/40/180/T/6.5				
Sandeep Mirmire Director, Principle ACS Engineering India Pvt. Ltd, Plot No:27, Rao & Raju Colony, Banjara Hills, Hyderabad	Proof checking by RDSO	Uma Shanker SSE/SB2	Aneet Kumar SSE/SB2	Sandeep Agarwal ADE/SB2	Mohit Verma Dir./SB1	R K Srivastava ED/B&S/STEEL



ELEVATION OF FENCING ARRANGEMENT
(SCALE 1:20)



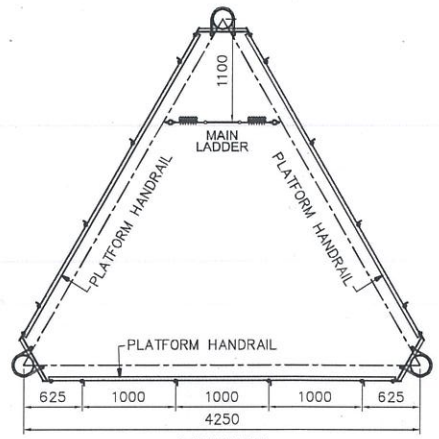
VIEW 1-1
(SCALE 1:20)



VIEW 2-2
(SCALE 1:20)

DISCLAIMER:

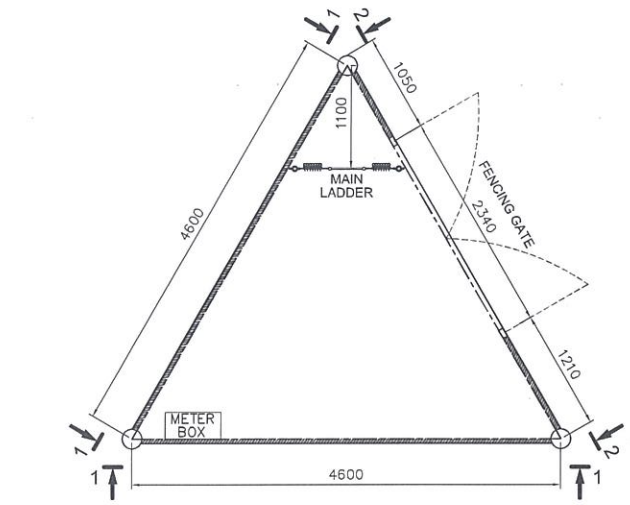
THE RESPONSIBILITY OF PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ONLY TO THE TECHNICAL CONTENT OF THIS DRAWING. CO-RELATION OF THIS DOCUMENT WITH SITE DATA, ALL PROCEDURAL /LEGAL/ OPERATIONAL MATTERS WOULD BE RESPONSIBILITY OF THE CLIENT, PRINCIPLE ACS SHALL NOT BE IN ANY WAY BE RESPONSIBLE FOR THE CONSEQUENTIAL EFFECTS (IF ANY) DUE TO THE USAGE OF THIS DRAWING CONTENT AND SHALL NOT BE LIABLE TO CARRY OUT ANY POST IMPLEMENTATION STUDIES INCLUDING DAMAGE STUDIES (IF ANY).



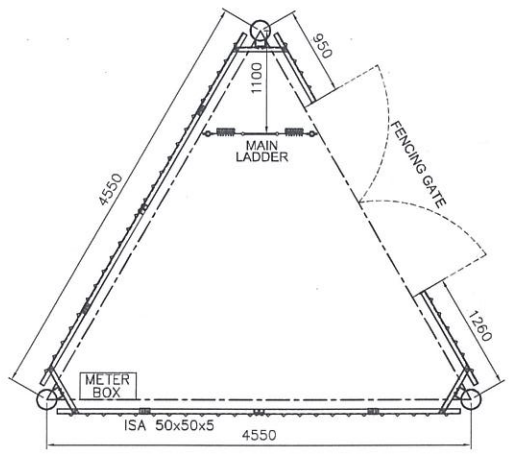
VIEW E-E
(SHOWING PLATFORM HANDRAIL)
(SCALE 1:20)

TABLE OF DIAGONAL & HORIZONTAL MEMBER				
MKD.	SIZE OF MEMBER	BOLT DIA(mm)	NOS. OF BOLT	GRADE OF BOLT
D1	PIPE ø101.6x3.6	20	2	8.8
D2	PIPE ø101.6x3.6	20	2	8.8
D3	PIPE ø88.9x3.2	16	2	8.8
D4	PIPE ø88.9x3.2	16	2	8.8
D5	PIPE ø88.9x3.2	16	2	8.8
D6	PIPE ø88.9x3.2	16	2	8.8
D7	PIPE ø88.9x3.2	16	2	8.8
D8	PIPE ø88.9x3.2	16	2	8.8
D9	PIPE ø76.1x2.9	16	2	8.8
D10	PIPE ø76.1x2.9	16	2	8.8
D11	PIPE ø76.1x2.9	16	2	8.8
D12	PIPE ø76.1x2.9	16	2	8.8
D13	PIPE ø76.1x2.9	16	2	8.8
D14	PIPE ø76.1x2.9	16	2	8.8
D15	PIPE ø60.3x2.9	16	2	8.8
D16	PIPE ø60.3x2.9	16	2	8.8
H1	PIPE ø88.9x4.0	16	4	8.8
H2	PIPE ø48.3x2.9	16	2	8.8
H3	PIPE ø48.3x2.9	16	2	8.8
H4	PIPE ø48.3x2.9	16	2	8.8
H5	PIPE ø48.3x2.9	16	2	8.8
H6	PIPE ø48.3x2.9	16	2	8.8
H7	PIPE ø48.3x2.9	16	2	8.8

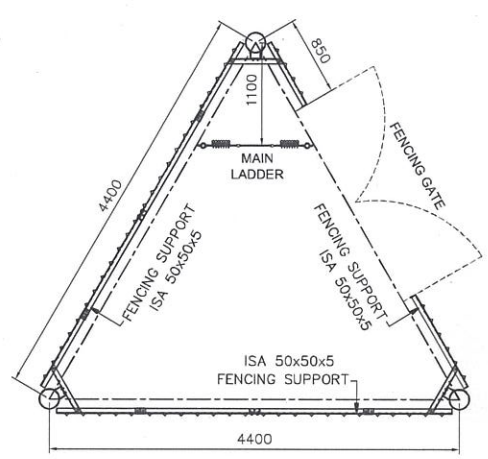
NOTE: IN CASE OF DISCREPANCY IN DETAILS ELSEWHERE, DETAILS PROVIDED ABOVE TABLE SHALL PREVAIL.



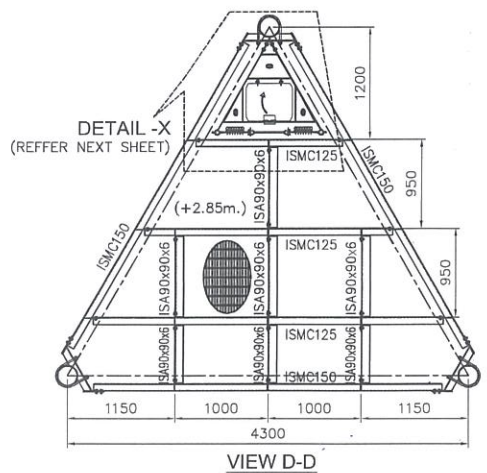
VIEW A-A
(SCALE 1:20)



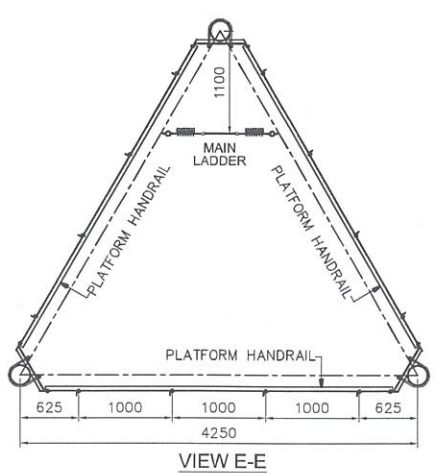
VIEW B-B
(SCALE 1:20)



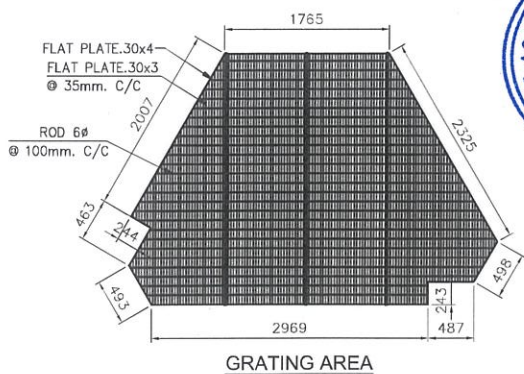
VIEW C-C
(SCALE 1:20)



VIEW D-D
(ONLY PLATFORM ARRANGEMENT)
(SCALE 1:20)



VIEW E-E
(SHOWING PLATFORM HANDRAIL)
(SCALE 1:20)



GRATING AREA
(8.2m²)
(SCALE 1:20)

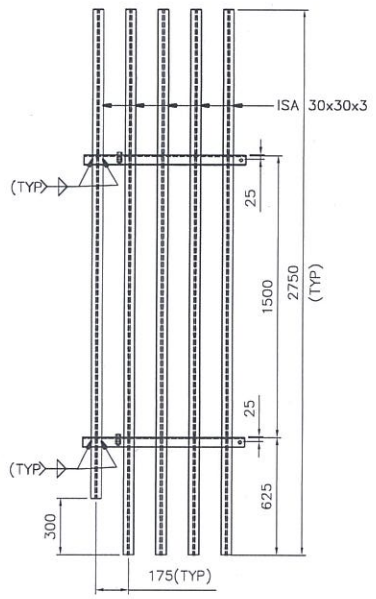
PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ★ HYD.

DESIGN & DRAWING BY	Proof checking by RDSO	RDSO/TC/TOWER/L/40/180/T/6.5				
Sandeep Mirmire Director, Principle ACS Engineering India Pvt. Ltd, Plot No:27, Rao & Raju Colony, Banjara Hills, Hyderabad		Uma Shanker SSE/SB2	Aneet Kumar SSE/SB2	Sandeep Agarwal AOE/SB2	Mohit Verma Dir./SB1	R K Srivastava ED/B&S/STEEL

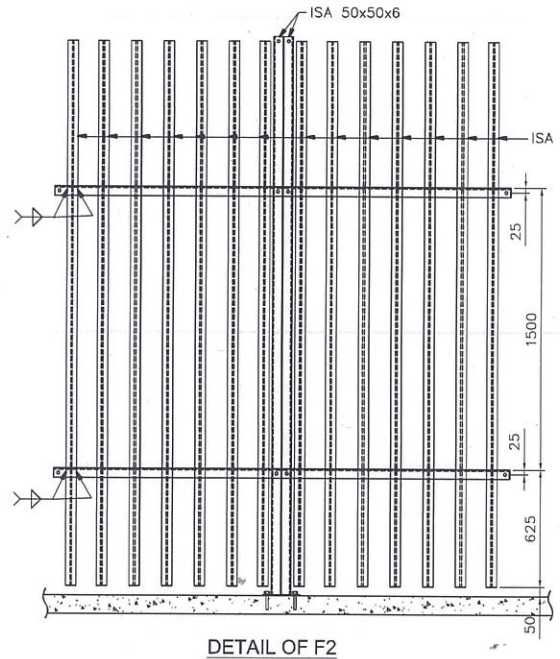
SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

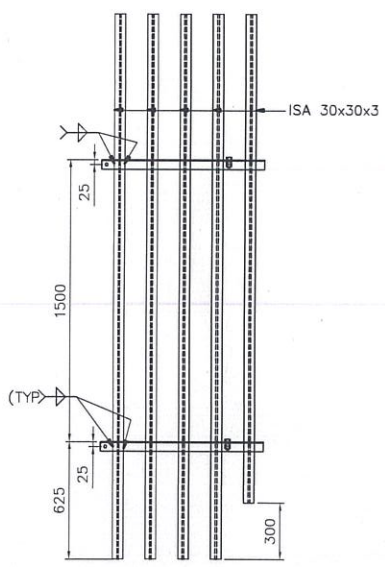
DRAWN	B.P	SPIRE 407RH DETAILS OF EPF			
CHECKED AND VERIFIED	A.R.J				
APPROVED	P.M	SCALE – 1:40	SHEET	REV.	SIZE
DATE	20.12.2021	2021–PACS–SPIRE 407RH–001	005	0	A3



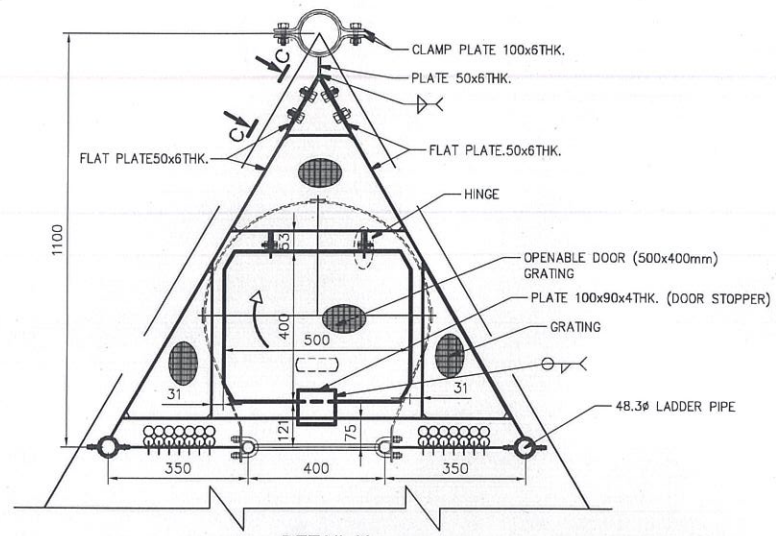
DETAIL OF F1
(SCALE 1:10)



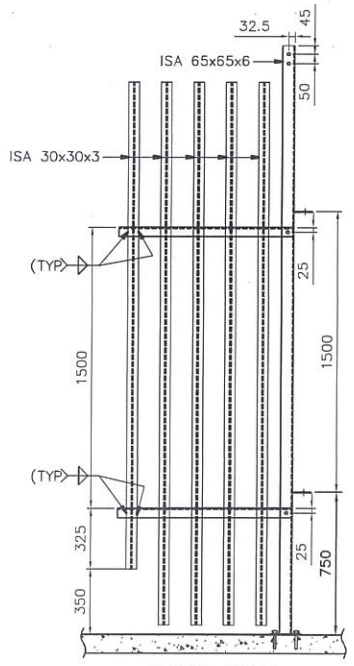
DETAIL OF F2
(SCALE 1:10)



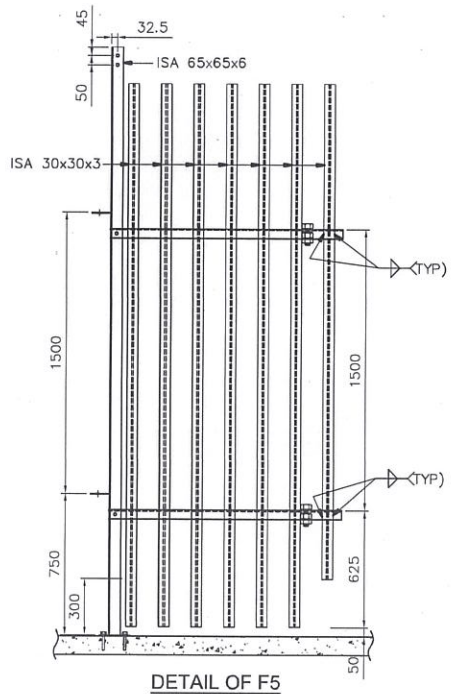
DETAIL OF F3
(SCALE 1:10)



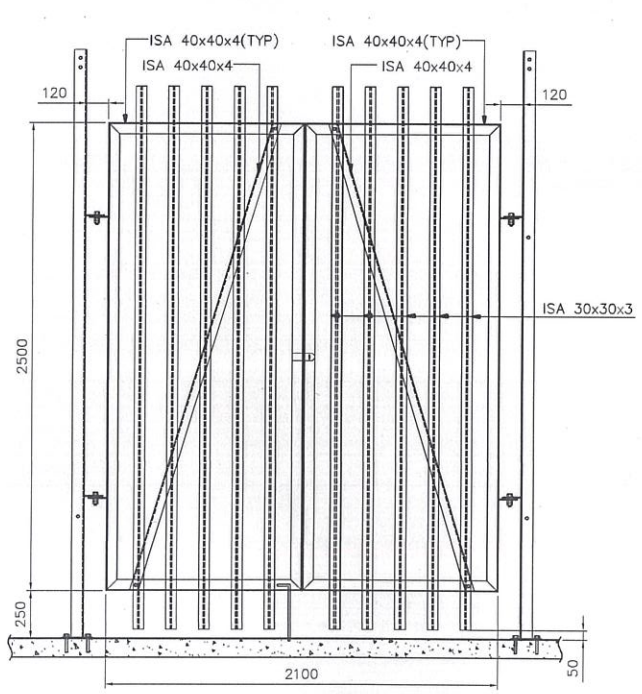
DETAIL-X
(EQUIPMENT PLATFORM)
(SCALE 1:5)



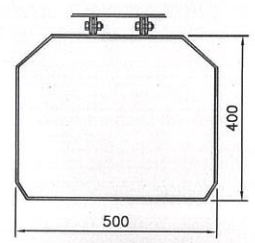
DETAIL OF F4
(SCALE 1:10)



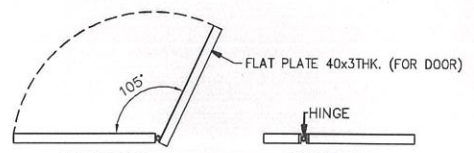
DETAIL OF F5
(SCALE 1:10)



DETAIL OF GATE
(SCALE 1:10)



RPF ACCESS DOOR
(SCALE 1:5)



VIEW X-X
OPEN VIEW
ACCESS DOOR
(NTS)

VIEW X-X
CLOSED VIEW
ACCESS DOOR
(NTS)

PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. HYD.

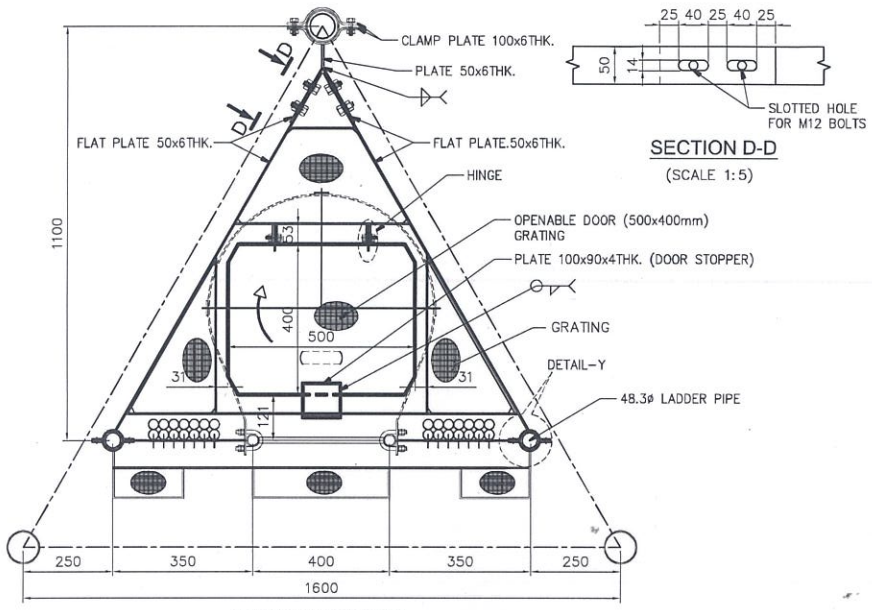
DESIGN & DRAWING BY	Proof checking by RDSO	RDSO/TC/TOWER/L/40/180/T/6.5				
Sandeep Mirmire Director, Principle ACS Engineering India Pvt. Ltd, Plot No:27, Rao & Raju Colony, Banjara Hills, Hyderabad		Uma Shanker SSE/SB2	Aneet Kumar SSE/SB2	Sandeep Agarwal ADE/SB2	Mohit Verma Dir./SB1	R K Srivastava ED/B&S/STEEL

SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

Principle ACS
Audits, Engineering And Services

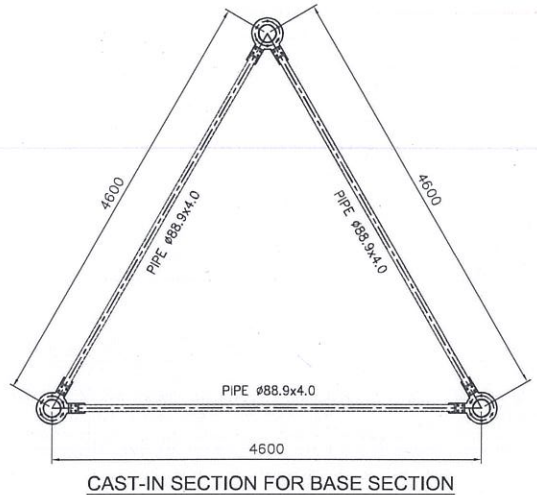
CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

DRAWN	B.P	SPIRE 407RH DETAILS OF EPF			
CHECKED AND VERIFIED	A.R.J				
APPROVED	P.M	SCALE – 1:40	SHEET	REV.	SIZE
DATE	20.12.2021	2021–PACS–SPIRE 407RH–001	006	0	A3

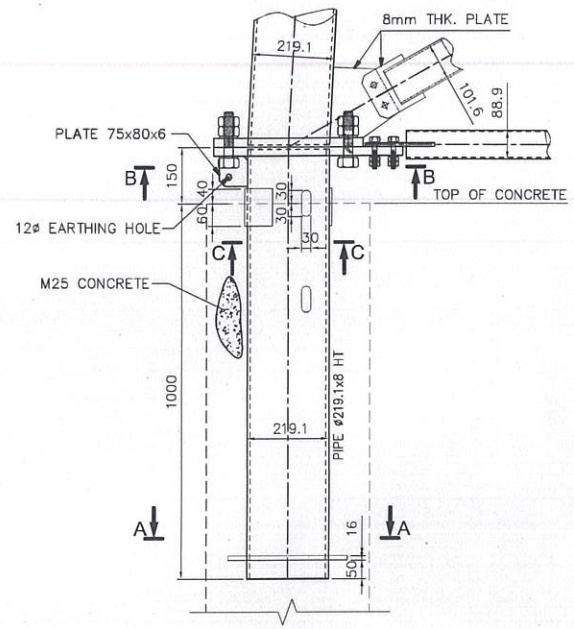


WORK PLATFORM
(SCALE 1:5)

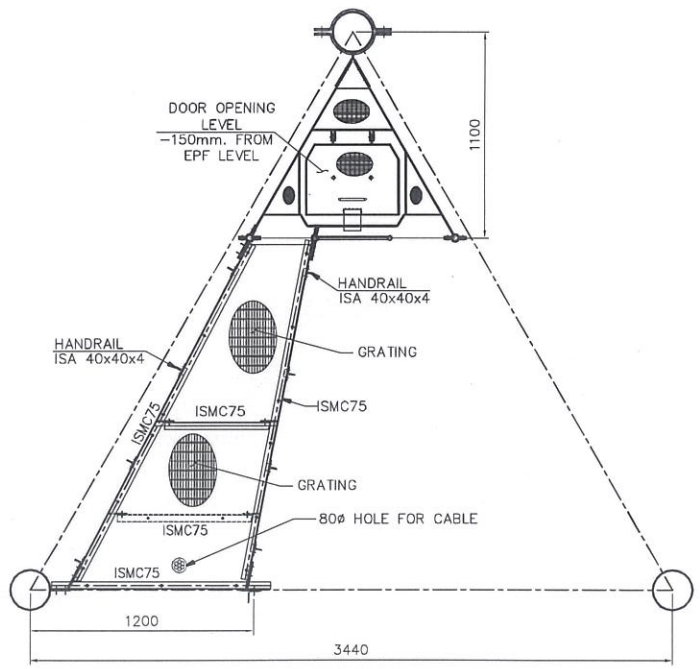
SECTION D-D
(SCALE 1:5)



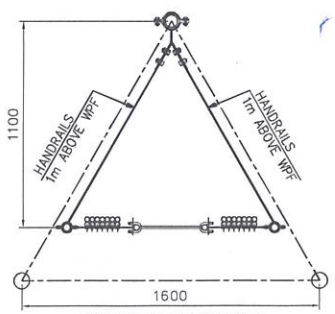
CAST-IN SECTION FOR BASE SECTION
(SCALE 1:20)



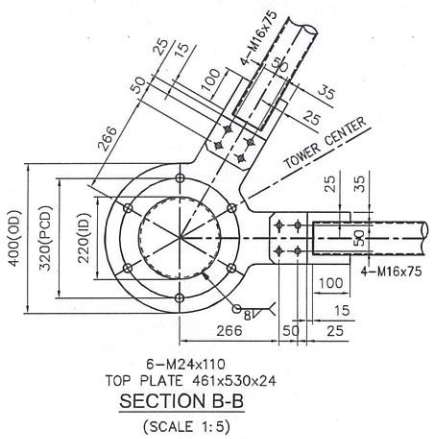
CAST-IN-PART
(SCALE 1:5)



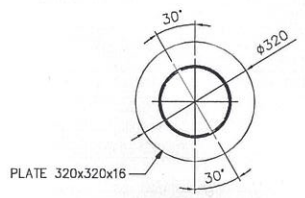
REST PLATFORM
(SCALE 1:10)



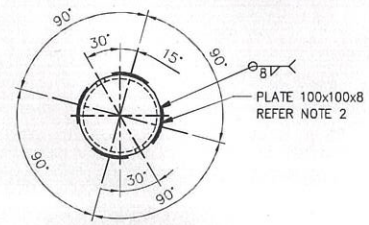
HANDRAILS IN WPF
(SCALE 1:10)



SECTION B-B
(SCALE 1:5)



SECTION A-A
(SCALE 1:5)



SECTION C-C
(SCALE 1:5)

GENERAL NOTES:
1. ALL DIMENSIONS ARE IN MILIMETERS, EXCEPT OTHERWISE SHOWN.
2. PLATES AT CIP SHALL BE CUT PART FROM PIPE SECTION HAVING YIELD STRESS NOT LESS THAN Yst240.

PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. HYD.

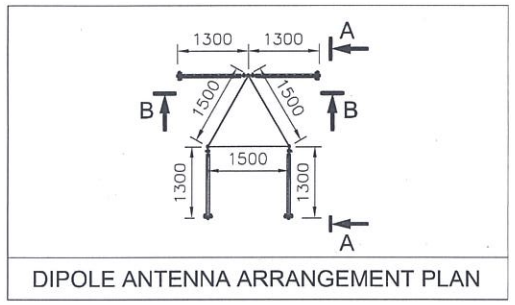
DESIGN & DRAWING BY		RDSO/TC/TOWER/L/40/180/T/6.5				
Sandeep Mirmire Director, Principle ACS Engineering India Pvt. Ltd, Plot No:27, Rao & Raju Colony, Banjara Hills, Hyderabad	Proof checking by RDSO	Uma Shanker SSE/SB2	Aneet Kumar SSE/SB2	Sandeep Agarwal ADE/SB2	Mohit Verma Dir/SB1	R K Srivastava ED/B&S/STEEL

SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

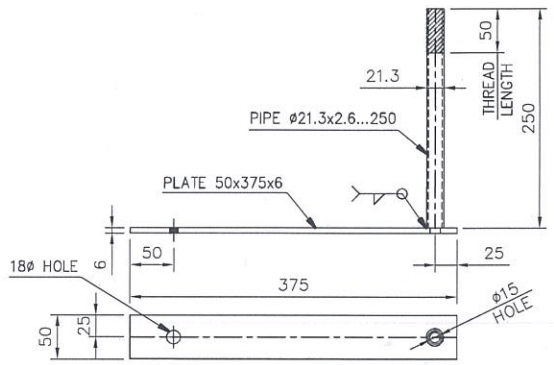
Principle ACS
Audits, Engineering And Services

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

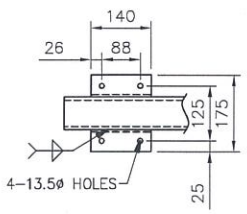
DRAWN	B.P	SPIRE 407RH CAST-IN PART DETAILS & WPF DETAILS			
CHECKED AND VERIFIED	A.R.J				
APPROVED	P.M	SCALE – 1:40	SHEET	REV.	SIZE
DATE	20.12.2021	2021-PACS-SPIRE 407RH-001	007	0	A3



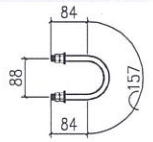
DIPOLE ANTENNA ARRANGEMENT PLAN

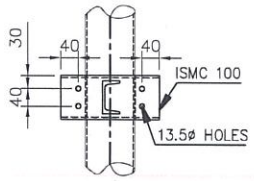


AVATION LAMP CONNECTION DETAIL
(SCALE 1:2.5)

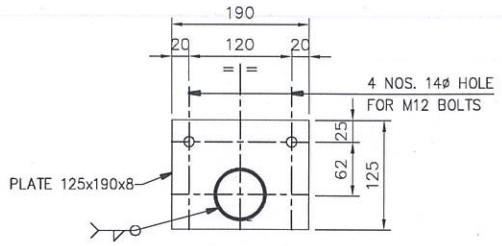


SECTION 6-6
(SCALE 1:5)

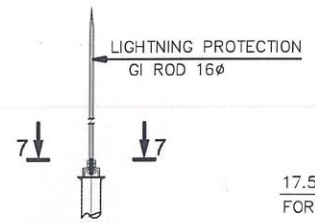




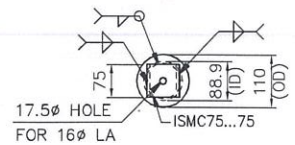
SECTION 5-5
(SCALE 1:5)



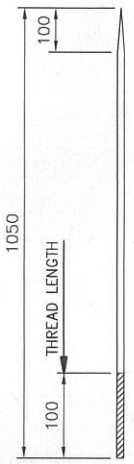
SECTION 3-3
(SCALE 1:10)



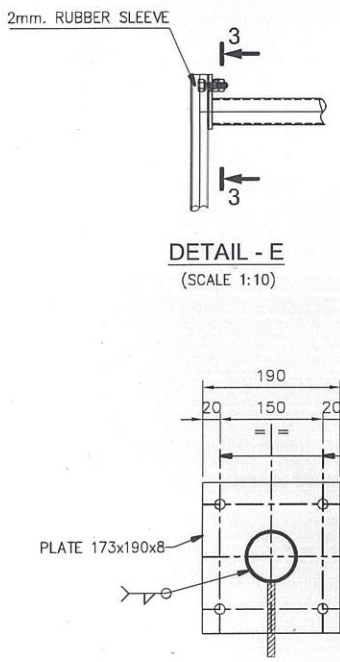
LA DETAILS
(SCALE 1:10)



SECTION 7-7
(PLATE 110x110x6)
(SCALE 1:5)



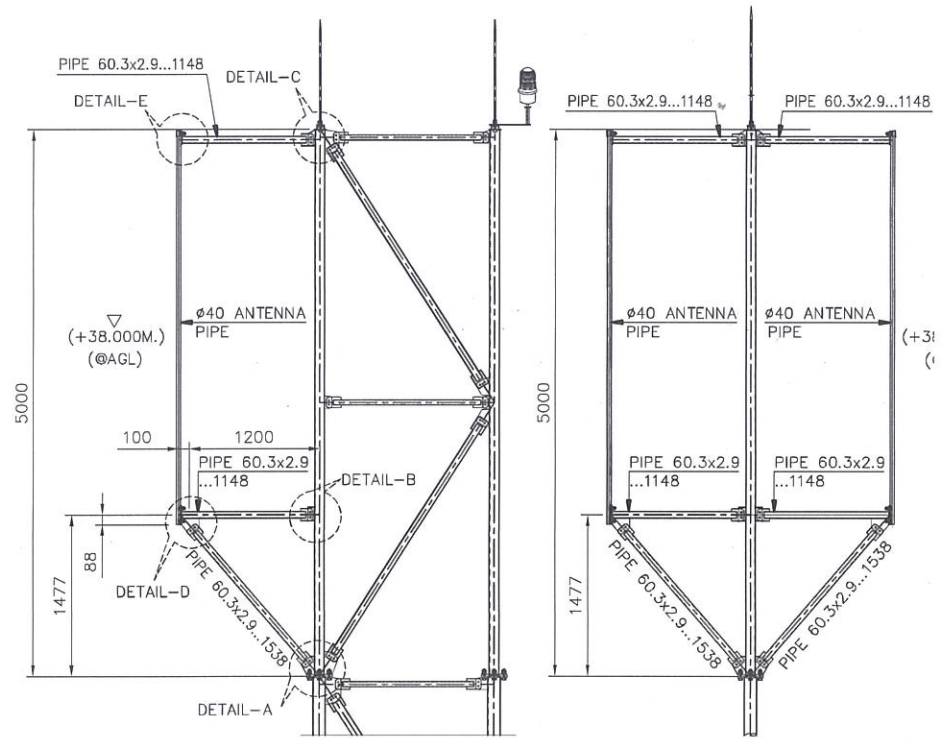
GI ROD 16Ø
(SCALE 1:5)



SECTION 4-4
(SCALE 1:5)

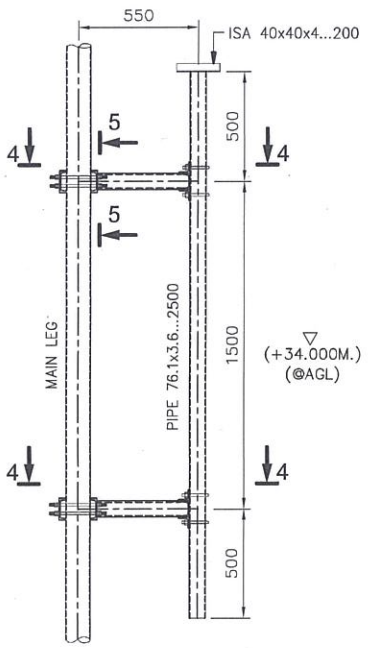
DETAIL - E
(SCALE 1:10)

SECTION 2-2
(SCALE 1:10)

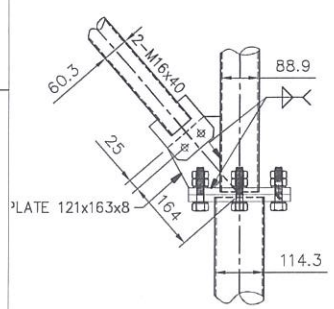


VIEW A-A
(SCALE 1:20)

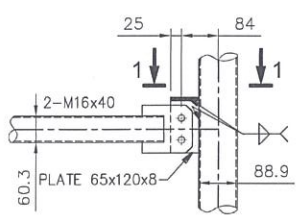
VIEW B-B
(SCALE 1:20)



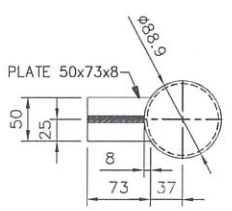
LTE ANTENNA ARRANGEMENT DETAILS
(SCALE 1:10)



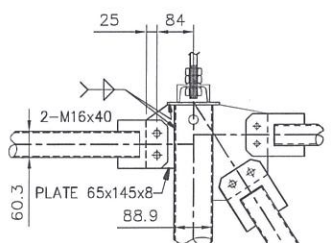
DETAIL - A
(SCALE 1:10)



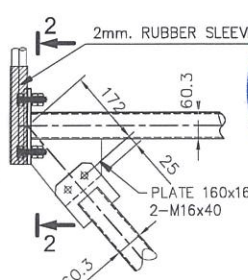
DETAIL - B
(SCALE 1:10)



SECTION 1-1
(SCALE 1:5)



DETAIL - C
(SCALE 1:10)



DETAIL - D
(SCALE 1:10)

DISCLAIMER:

THE RESPONSIBILITY OF PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ONLY TO THE TECHNICAL CONTENT OF THIS DRAWING. CO-RELATION OF THIS DOCUMENT WITH SITE DATA, ALL PROCEDURAL /LEGAL/ OPERATIONAL MATTERS WOULD BE RESPONSIBILITY OF THE CLIENT, PRINCIPLE ACS SHALL NOT BE IN ANY WAY BE RESPONSIBLE FOR THE CONSEQUENTIAL EFFECTS (IF ANY) DUE TO THE USAGE OF THIS DRAWING CONTENT AND SHALL NOT BE LIABLE TO CARRY OUT ANY POST IMPLEMENTATION STUDIES INCLUDING DAMAGE STUDIES (IF ANY).

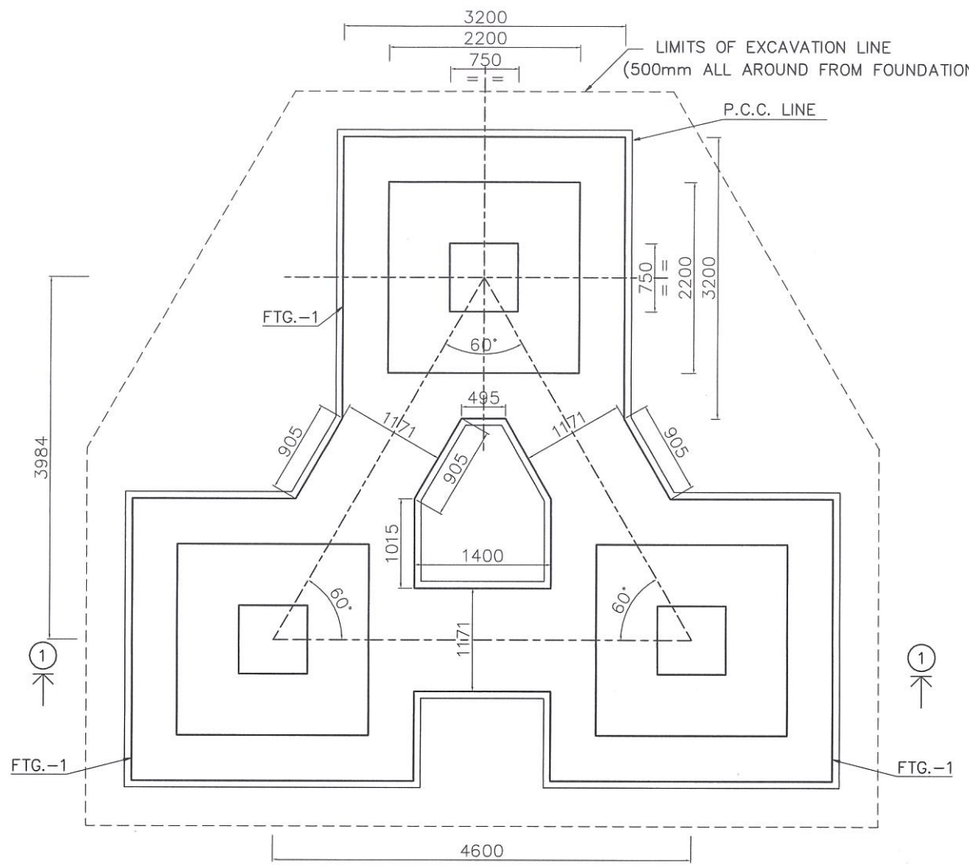
PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. * HYD.

DESIGN & DRAWING BY		RDSO/TC/TOWER/L/40/180/T/6.5				
Sandeep Mirmire Director, Principle ACS Engineering India Pvt. Ltd, Plot No:27, Rao & Raju Colony, Banjara Hills, Hyderabad	Proof checking by RDSO	Uma Shanker SSE/SB2	Aneet Kumar SSE/SB2	Sandeep Agarwal ADE/SB2	Mohit Verma Dir./SB1	R K Srivastava ED/B&S/STEEL

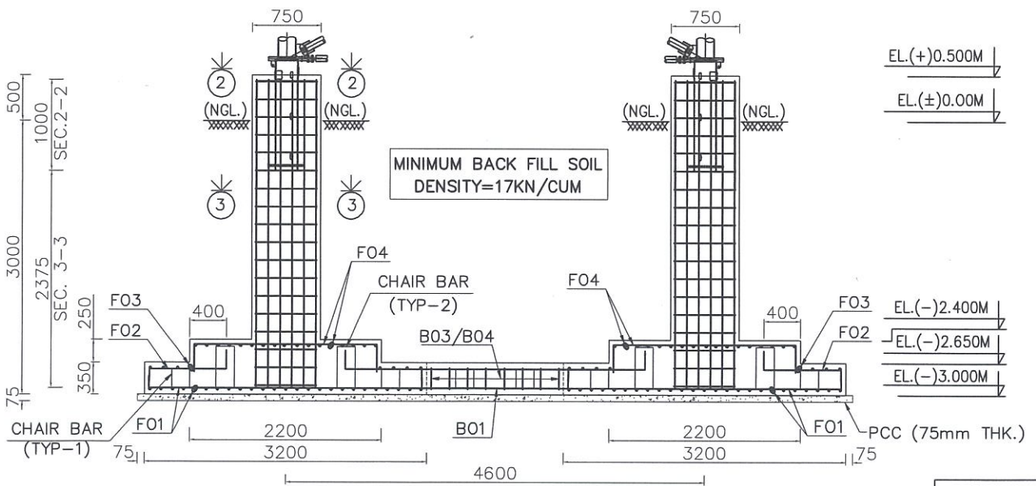
SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

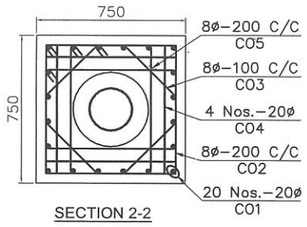
DRAWN	B.P	SPIRE 407RH			
CHECKED AND VERIFIED	A.R.J	ERECTION DRAWING OF ANTENNA ARRANGEMENT, ACWL DETAILS & LIGHTNING PROTECTION DETAILS			
APPROVED	P.M	SCALE – 1:40	SHEET	REV.	SIZE
DATE	20.12.2021	2021-PACS-SPIRE 407RH-001	008	0	A3



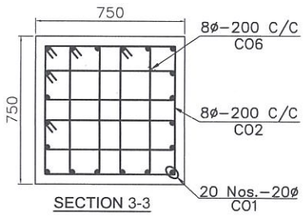
FOUNDATION PLAN



SECTION 1-1



SECTION 2-2



SECTION 3-3

QUANTITIES	
DESCRIPTION	TOWER FOUNDATION
EXCAVATION	195.0 Cum.
P.C.C	2.9 Cum.
CONCRETE	20.6 Cum.
STEEL	2221.2 Kgs.
SHUTTERING	45.6 Sqm.
LEG FORCES (UNFACTORED)	
COMPRESSION(C)	489.4 kN
TENSION(T)	435.0 kN
SHEAR(V)	55.7 kN

DISCLAIMER:

THE RESPONSIBILITY OF PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ONLY TO THE TECHNICAL CONTENT OF THIS DRAWING. CO-RELATION OF THIS DOCUMENT WITH SITE DATA, ALL PROCEDURAL /LEGAL/ OPERATIONAL MATTERS WOULD BE RESPONSIBILITY OF THE CLIENT, PRINCIPLE ACS SHALL NOT BE IN ANY WAY BE RESPONSIBLE FOR THE CONSEQUENTIAL EFFECTS (IF ANY) DUE TO THE USAGE OF THIS DRAWING CONTENT AND SHALL NOT BE LIABLE TO CARRY OUT ANY POST IMPLEMENTATION STUDIES INCLUDING DAMAGE STUDIES (IF ANY).

LEGEND

NGL. = NATURAL GROUND LEVEL
EL. = ELEVATION
C/C = CENTER TO CENTER
AVG = AVERAGE
T&B = TOP & BOTTOM
TYP. = TYPICAL

NOTES :

1. THIS DRAWING IS SUITABLE FOR 40M 3–LEGGED TUBULAR TOWER WITH 6.5 SQ.M ANTENNA LOADING AND 180KMPH WIND SPEED. (SPIRE 407RH) AS PER GAD NO. : RDSO/TC/TOWER/L/40/180/T/6.5, SHEET NO. – 1.
2. ALL DIMENSIONS ARE IN MM & LEVELS COORDINATES ARE IN METERS.
3. EL.(±)0.00M CORRESPONDS TO NATURAL / FINISHED GROUND LEVEL.
4. FOLLOWING ARE THE ASSUMED PARAMETERS CONSIDERED WHILE DESIGNING THE FOUNDATION :–
   NET SAFE BEARING CAPACITY :– 100 KPA
   WATER TABLE LEVEL :– NO WATER TABLE
   DRY DENSITY OF SOIL :– 17.0 kN/M^3
5. DETAILED SOIL INVESTIGATION SHALL BE CARRIED OUT BEFORE COMMENCEMENT OF CONSTRUCTION WORK. TOTAL / DIFFERENTIAL SETTLEMENT LIMIT AS SPECIFIED IN IS:11233 NEED TO BE SUPPLIED AND ENSURED BY TOWER USER.
6. IF ANY LEVEL DIFFERENCE IN NATURAL GROUND IS FOUND AT SITE, THE SOIL EXCAVATION FOR FOUNDATION SHALL BE STARTED WITH REFERENCE TO THE LOWER LEVEL.
7. VERIFY THE ADJACENT SITE FEATURES BEFORE EXCAVATION, PROPER CARE SHALL BE TAKEN TO AVOID DAMAGE TO THE ADJACENT STRUCTURE.
8. ANY DISCREPANCY IN THE DRAWING & SITE CONDITIONS SHALL BE BROUGHT TO THE NOTICE OF SITE ENGINEER.
9. FOUNDATION PIT SHALL BE KEPT DRY (FREE FROM WATER) DURING LAYING OF LEAN CONCRETE, PLACING STEEL AND CONCRETING WORK. APPROPRIATE DEWATERING SCHEME SHALL BE ADOPTED WHEREVER REQUIRED.
10. LEAN CONCRETE GRADE SHALL BE M10 AS PER IS: 456.
11. CONCRETE GRADE SHALL BE M25 CONSIDERING MODERATE EXPOSURE CONDITION AS PER IS: 456.
12. CONCRETING SHALL CONFORM TO IS: 456
13. MECHANISED VIBRATION TO BE DONE BY USING NEEDLE VIBRATOR OR ANY OTHER SUITABLE METHOD DURING CASTING.
14. GRADE OF REINFORCEMENT STEEL SHALL BE MINIMUM Fe500 AS PER IS: 1786.
15. MINIMUM CLEAR COVER TO REINFORCEMENT SHALL BE AS FOLLOWS:

ITEMS	TOP(mm)	BOTTOM(mm)	SIDES(mm)
FOUNDATION	50	50	50
COLUMN	50	–	50

16. LAP/DEVELOPMENT LENGTH FOR REINFORCEMENT SHALL BE 50TIMES DIA OF LARGER BAR LAPPED.
17. CHAIR BAR TO BE PROVIDED AT EVERY 1000mm OR LESS TO KEEP TOP REINFORCEMENT IN PLACE.
18. IT IS IMPORTANT THAT THE CAST–IN PART IS PLACED IN LEVEL AND THE CAST–IN PART PIPE TO BE FILLED WITH CONCRETE UP TO MIDDLE OF THE TOP MOST HOLE AS SHOWN IN THE CAST–IN PART DRAWING NO. : RDSO/TC/TOWER/L/40/180/T/6.5, SHEET NO. – 7.
19. BARS SHALL BE ADJUSTED SUITABLY AT CROSSINGS.
20. THIS FOUNDATION SHALL NOT BE USED IN CASE ORGANIC SILT, ORGANIC CLAY OR PEAT LAYERS ARE FOUND AT ANY DEPTH.
21. THIS FOUNDATION DESIGN SHALL NOT BE ADOPTED AT SITES WHERE SOIL IS SUBJECTED TO GROUND IMPROVEMENT/LIQUIFICATION, AND IN SUCH CASES SPECIAL FOUNDATION SHALL BE DONE.
22. LOOSE POCKETS OF SOIL FOUND, (IF ANY) IN FOUNDATION PITS SHALL BE COMPLETELY REMOVED AND FILLED WITH LEAN CONCRETE AND COMPACTED WELL BEFORE FOUNDATIONS ARE LAID.
23. THIS FOUNDATION IS DESIGNED SUCH THAT TENSION IS NOT ALLOWED ON EDGES OF FOUNDATION UNDER HORIZONTAL FORCES ACCORDING TO IS:11233.
24. IN DESIGN OF FOUNDATIONS, A FACTOR OF SAFETY OF 2.0 IS CONSIDERED AT EVERY STAGE ACCORDING TO IS:11233.
25. BENDING AND FIXING OF BARS FOR FOUNDATION IS DONE AS PER IS: 2502.
26. THE SUPPORT AT TOWER BASE HAS BEEN IDEALISED AS PINNED, THUS NO ADDITIONAL MOMENT HAS BEEN TAKEN INTO DESIGN OF TOWER FOUNDATION.
27. FENCING (3m HEIGHT) SHALL BE PROVIDED BETWEEN TOWER LEGS FOR LATTICE TOWERS AND AROUND MONOPOLE.
28. EARTH FILL OVER FOUNDATION SHALL BE IN LAYERS AND WELL COMPACTED.
29. THIS DESIGN SHOULD BE USED ONLY AT THOSE LOCATIONS WHERE GROUND WATER TABLE WILL REMAIN (D+B)m BELOW THE BASE OF FOUNDATION DURING THE LIFE TIME OF FOUNDATION AS PER GAD NO. : RDSO/TC/TOWER/L/40/180/T/6.5, SHEET – 1. HERE D IS THE DEPTH AND B IS THE WIDTH OF FOUNDATION.
30. THIS IS A SAMPLE DESIGN OF FOUNDATION FOR A GIVEN EXPOSURE CONDITION AND ASSUMED WATER TABLE. ANY OTHER SUITABLE TYPE OF FOUNDATION CAN BE DESIGNED AS PER SITE CONDITION BASED ON FOUNDATION LOAD GIVEN.

SUBMITTED FOR	APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION
	✓				

FOUNDATION DESIGN OF 40m TOWER FOR TCAS PROJECT

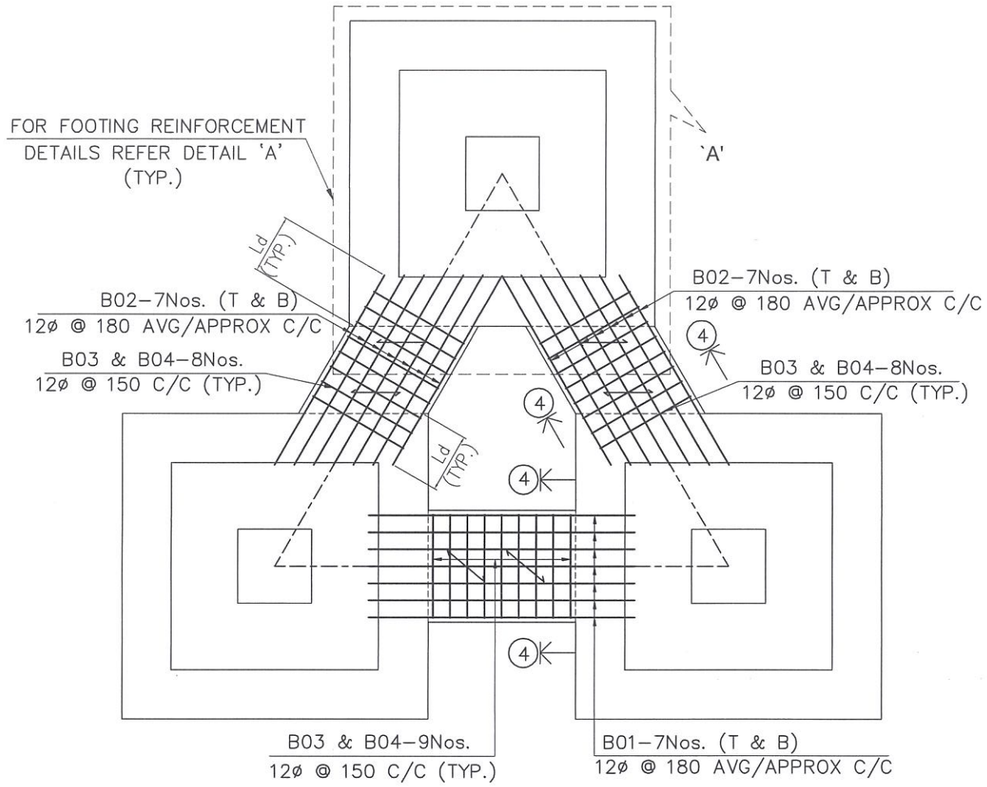
RDSO DWG. NO. : RDSO/TC/TOWER/L/40/100/F/NWT

DESIGN & DRAWING BY	Proof checking by RDSO					
Sandeep Mirmire, Director, Principle ACS Engineering India Pvt. Ltd, Plot No: 27, Rao & Raju Colony, Banjara Hills, Hyderabad		Shweta Suman, SSE/CB2	S. N. Prasad, SSRE/CB2	A. K. Pandey, ADE/CB1	A .K. Ojha, Dir./CB2	V K Srivastava, ED/STRUCTURES

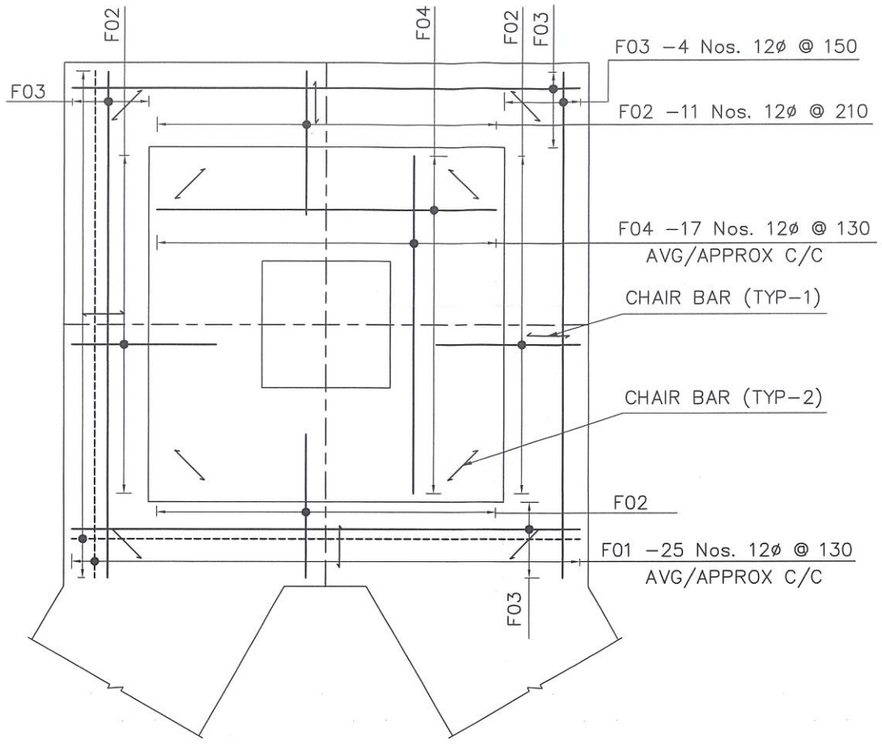
PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. HYD.

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

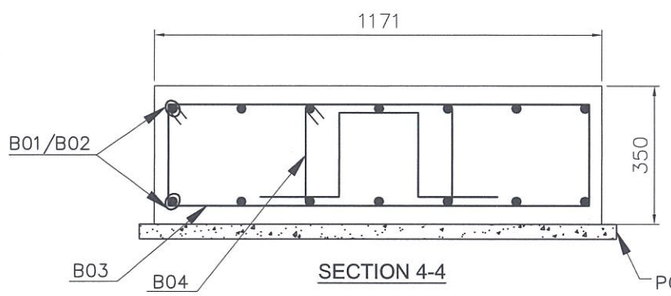
DRAWN	S.M	SPIRE 407RH			
CHECKED AND VERIFIED	S.J.R	FOUNDATION DETAIL FOR 40m GBT (100 KPA–NO WATER TABLE)			
APPROVED	P.M	SCALE – N.T.S	SHEET	REV.	SIZE
DATE	20.12.21	2021–PACS–SPIRE 407RH–40M–100KPA–GBT–NWT_FDN–001	10F3	R0	A3



FOUNDATION REINFORCEMENT PLAN



DETAIL `A'
(TYP.)
FTG.–1



SECTION 4-4

PRINCIPLE ACS ENGINEERING PVT. LTD. ★ HYD.

DESIGN & DRAWING BY						
Sandeep Mirmire Director	Proof checking by RDSO	Shweta Suman SSE/CB2	S. N. Prasad SSRE/CB2	A. K. Pandey ADE/CB1	A .K. Ojha Dir./CB2	V K Srivastava ED/STRUCTURES
Principle ACS Engineering India Pvt. Ltd, Plot No: 27, Rao & Raju Colony, Banjara Hills, Hyderabad						

SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

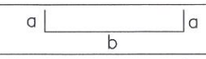
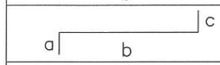
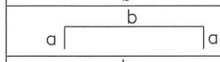
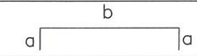
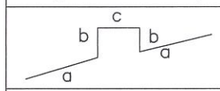
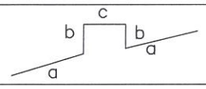
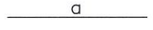
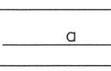
FOUNDATION DESIGN OF 40m TOWER FOR TCAS PROJECT

RDSO DWG. NO. : RDSO/TC/TOWER/L/40/100/F/NWT

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

DRAWN	S.M	SPIRE 407RH FOUNDATION DETAIL FOR 40m GBT (100 KPA–NO WATER TABLE)			
CHECKED AND VERIFIED	S.J.R				
APPROVED	P.M	SCALE – N.T.S	SHEET	REV.	SIZE
DATE	20.12.21	2021–PACS–SPIRE 407RH–40M–100KPA–GBT–NWT_FDN–001	2OF3	R0	A3

FOUNDATION BAR BENDING SCHEDULE

SL. NO.		BAR	LENGTH a	LENGTH b	LENGTH c	TOTAL LENGTH(mm)	Nos.	DIA(mm)	UNIT WT (kg/m)	TOTAL WT (kg)
F01	FOOTING		175	3100	–	3450	150	12	0.89	460.6
F02			175	850	200	1225	132	12	0.89	143.9
F03			175	3100	–	3450	48	12	0.89	147.4
F04			300	2100	–	2700	102	12	0.89	245.1
CHAIRS (TYP–1)			200	200	200	1000	42	12	0.89	37.4
CHAIRS (TYP–2)			200	450	200	1500	12	12	0.89	16.0
C01	COLUMN		500	3375		3875	60	20	2.47	574.3
C02			650	650	–	2800	54	8	0.40	60.5
C03			365	135	–	2200	33	8	0.40	29.0
C04			1100	650	–	2850	12	20	2.47	84.5
C05			650	400	–	2300	36	8	0.40	33.1
C06			650	150	–	1800	144	8	0.40	103.7
B01	BEAM		2600	–	–	2600	14	12	0.89	32.4
B02			2105	–	–	2105	28	12	0.89	52.5
B03			1071	250	–	2842	25	12	0.89	63.2
B04			365	250	–	1430	25	12	0.89	31.8
										2115.4
SCRAP WEIGHT = 105.8 Kgs.										
TOTAL WEIGHT = 2221.2 Kgs.										

PRINCIPLE ACS ENGINEERING INDIA PVT. LTD. ★ HYD.

DESIGN & DRAWING BY						
Sandeep Mirmire Director Principle ACS Engineering India Pvt. Ltd, Plot No: 27, Rao & Raju Colony, Banjara Hills, Hyderabad	Proof checking by RDSO	Shweta Suman SSE/CB2	S. N. Prasad SSRE/CB2	A. K. Pandey ADE/CB1	A .K. Ojha Dir./CB2	V K Srivastava ED/STRUCTURES

SUBMITTED FOR	✓ APPROVAL	INFORMATION	REFERENCE	RECORD	FABRICATION

FOUNDATION DESIGN OF 40m TOWER FOR TCAS PROJECT

RDSO DWG. NO. : RDSO/TC/TOWER/L/40/100/F/NWT

CONSULTANT:
Principle ACS Engineering India Pvt. Ltd.
Hyderabad, India

DRAWN	S.M	SPIRE 407RH DETAIL OF BAR BENDING SCHEDULE (100 KPA–NO WATER TABLE)			
CHECKED AND VERIFIED	S.J.R				
APPROVED	P.M	SCALE – N.T.S	SHEET	REV.	SIZE
DATE	20.12.21	2021–PACS–SPIRE 407RH–40M–100KPA–GBT–NWT_FDN–001	3OF3	R0	A3

File No. EPD-ENGG0INTR(APPR)/134/2025-SBD-RAGANESDA-I (Computer No. 229778)
Generated from eOffice by Ajeet Kumar Jaiswal, MANAGER(AKJ)-WC-SBD, MANAGER(Works Contract), SBD-SOLAR BUSINESS DIVISION on 28/09/2025 01:26 pm

Comprehensive Planning of TCAS (KAVACH) Towers

V N M Rao, IRSSE, CSTE/Projects/SC/SCR
Manoj Kumar Gupta, IRSSE, CSE/SCR
C. Sivakumar Kashyap, IRSSE, DSTE/TCAS/SC/SCR

Abstract

With the advent of high speed and high density Rail Networks over IR, implementation of Automatic Train Protection (ATP) systems has become a sine qua non for ensuring safety of trains. Most ATP systems provide an additional layer of safety over the existing interlocking systems so as to aid the loco pilots. All the ATP systems need radio communication towers for functioning. This paper discusses the rationale behind the decision making learnt during the course of TCAS implementation in South Central Railway.

1 Need for Communication Towers

Communication between locomotive TCAS and stationary TCAS is exclusively through radio waves. At present, TCAS uses spot frequencies in 400 MHz to 450 MHz band (f0 – 441.8 MHz, f1 – 456.8 MHz, f2 – 416.8 MHz, f3 – 466.8 MHz, f4 – 426.8 MHz). Considering the scenario where a loco is moving from block station A to block station B, it should communicate with stations A and B for approximately half the distance of block section each. Without loss of generality, a block section can safely be assumed to be around 10 km. This means that one stationary TCAS equipment should cater to around 5 km communication. An antenna at ground level can simply not perform the job. Here arises the need for communication towers to increase the range of radio coverage.

2 Initial Reconnaissance Survey for Towers and their Feasibility

The most important initial step in taking up tower works is to carry out initial survey studying the feasibility of towers keeping in mind factors such as height of tower, signal strength, ease of construction and maintenance of sites. During this survey, sites could be classified into Green, Amber and Red based on the difficulty of implementation
A typical survey format detailing various geographical and technical factors for identifying tower plot location is given below. **Name of the Station / IBS / LC Gates for the proposed Tower location :**

3 Selection of Tower

3.1 Selection of Type of Tower

Based on the initial planning, drone survey, Radio Signal Strength Indicator (RSSI), site reconnaissance survey, tower types are chosen. The types of towers are discussed below.

(a) Self Supporting Lattice Towers – They can be angular, tubular or a hybrid of both angular and tubular. Similarly, self supporting towers are either 3 or 4 legged.

(b) Self Supporting Monopole – It is a single self supporting pole. This design is generally used to minimise foot print at the site which is easily accessible.

(c) Narrow Based Self Supporting Lattice Tower – It is generally a 4 legged tubular tower upto 40 m height with very low foot print. It is used as a substitute to monopole when there are no aesthetic constraints.

Classification	Green	Amber	Red
Plot Size	No limitation	Poses limitation in Tower Height / Design Selection	Serious Constraints
Plot Access	No limitation	Poses possibility of Head Load	Serious Constraints
Ground Water	No limitation	Moderate saturation posing limitation in selection of tower	Extreme saturation
Soil / Rock Conditions	Good soil and non-rocky conditions	Moderately good soil	Extreme limitation in soil strength
Summary Action	None	Tackling with Design Modifications	Find alternatives before contract is awarded.

Table 1:

S.No	Survey Item Description	Remarks
a	Any High Rise Buildings/trees available near proposed tower location	Yes/No
b	Type of Soil-Rocky/Clay/Black Cotton/Sand etc	
c	Soil is natural mother earth or filled soil	
d	Nearest Airport available to the station/LC gate/IB& Distance in Kms	
e	Is Station/LC gate/IB situated in Forest area	Yes/No
f	Is Station/LC gate/IB situated in Coastal area(with in 15 Kms from Coast)	Yes/No
g	Tower shall be placed 46 m (Horizontal Distance) away from the Nearest track as far as possible. Is 46 m Horizontal Railway Boundary clearance available	Available/Not Available Distance between tower and nearest track centre -
h	Availability of high tension wires in near vicinity	Yes / No
i	Any water pipelines in near vicinity of tower location	Yes / No
j	Availability of staff quarters/houses nearby	Yes / No
k	Availability of underground Signalling / Telecom, / Power cables / OFC	Yes / No
l	Interdistance Distance between proposed tower and Relay room	
m	Interdistance Distance between nearest track centre to railway boundary	
n	Quad cable, OFC, signalling cable paths (same side/other side of tower location)	Quad - OFC - Signalling -
o	Longitude & Lattitude coordinates of proposed tower site for Ligowave software / WPC / MSL	Longitude - Latitude - MSL - Pincode -
p	Attachment of site photos	Yes / No
q	Motorable access to the proposed site for transportation of fabricated tower materials	Yes / No
r	Any future plans by other departments for utilisation of proposed tower plot area	
s	Any sanction of ROB / RUB in lieu of LC gate	Yes / No
t	Sanction of new interlocked LC gate	
u	Other information if any	

Table 2:

Characteristic	**4 Legged Angular**	**3 Legged Angular**	**Narrow Based**	**Monopole**
Foot Print	4	3	2	1
Visual Appeal	4	3	2	1
Ease of Fabrication	1	2	3	4
Ease of Erection	3	1	2	4
Overall Cost	**2**	**1**	**3**	**4**
Remarks	**(1 denotes lowest / cheapest / easiest) (4 denotes highest / costliest / difficult)**			

Table 3:

Figure 1: Three Legged Angular Tower

Figure 2: Four Legged Angular Tower

Figure 3: Tubular Tower

Figure 4: Monopole Tower

Figure 5: Narrow Based Tower

Monopole tower requires motorable road access to site, long boom cranes, space for horizontal assembly of monopole at site and lifting of monopole using crane. This means that monopole is not a recommended option over lattice tower at constrained site locations. At such locations, narrow based lattice towers are preferable. As such, it is opined that three legged tubular tower of 40 m height is preferable in line with RDSO guidelines to have uniformity and standardisation.

3.2 Selection of Height of Tower and Number of Towers

The height of tower and number of towers can be decided based on the following inputs.

(a) Geological conditions of site – Soil Bearing Capacity, Water Table, Drainage etc

(b) Accessibility of site for carrying material

(c) Radio network link calculations. The received signal strength should not be poorer than (-)85 dBm throughout the communication mandatory zones. It may be ensured that there are no obstructions in 60% of the First Fresnel Zone as shown in Figure 6.

(d) The antennae for communication system of stationary TCAS system shall be able to provide a minimum range of communication upto 1.5 km beyond the the first signal of the stationary TCAS unit. This is typically 4.5 km in case of double distant territory. In the case of IBS / Mid-section Interlocked LC Gates, this is much smaller and hence, 15 m / 20 m tower could also be explored based on survey details.

(e) Design Basis Report of complete route containing the following

  (i) Confirmation of tower (3 legged, angular / Tubular, Monopole, etc.,)

  (ii) Elevation of antenna on the tower structure

  (iii) Wind speed

  (iv) Terrain condition

  (v) Seismic conditions

  (vi) IR Code of Practice issued by RDSO to be followed for structural designs, fabrication and erection of towers. Reference to RDSO's B&S Directorate checklist on Design of Super-structure for TCAS tower vide document dated RDSO-BnS0EBS(SB-2)/16/2020-O/o ED/BnS/RDSO dated 11/01/2021.

  (vii) Material specification

(f) Above details can be finalized by

  (i) Reconnaissance (Walk over survey)

  (ii) Ligowave software to decide the antenna height

  (iii) Drone survey to have the exact locations of stations, Signal structure, IBS and Auto goomties, kilometer stones, traction masts etc.

(g) RSSI (Received Signal Strength Indicator) Survey is required to fine tune the antennas light, which is already available with the help of Ligowave software using the longitude and latitude of tower location at stations, IBS and Auto-goomties, LC gates, etc.

(h) If we fine tune the antennas height also in the beginning, then only RSSI survey in advance of inviting EPC tender is required.

Site Information			
TX Site Name	Secundrabad Jn	RX Site Name	Sitafalmandi
Radio Type	LigoPTP 6-N RapidFire	Radio Type	LigoPTP 5-23 RapidFire
Latitude	17.434	Latitude	17.428
Longitude	78.508	Longitude	78.520
TX Power	40.0 dBm	RX Threshold	-85.0 dBm
Ant. Gain	5.0 dBi	Ant. Gain	3.0 dBi
Ant. Height	35.0 meter	Ant. Height	5.0 meter
Parameters			
Frequency	441.0 MHz	Climate	Continental Temperate
Ant. Polarization	Vertical	Measurement System	Metric System
Misc. Loss	5.0 dBm	Rain Rate	0.0 mm/hr
Results			
Total Path Loss	93 dB	Thermal Fade Margin	40 dB
RX Signal Level	-44.879 dBm	Distance between sites	1.437 km
EIRP	45.0 dBm	Link availability due to rain	N/A

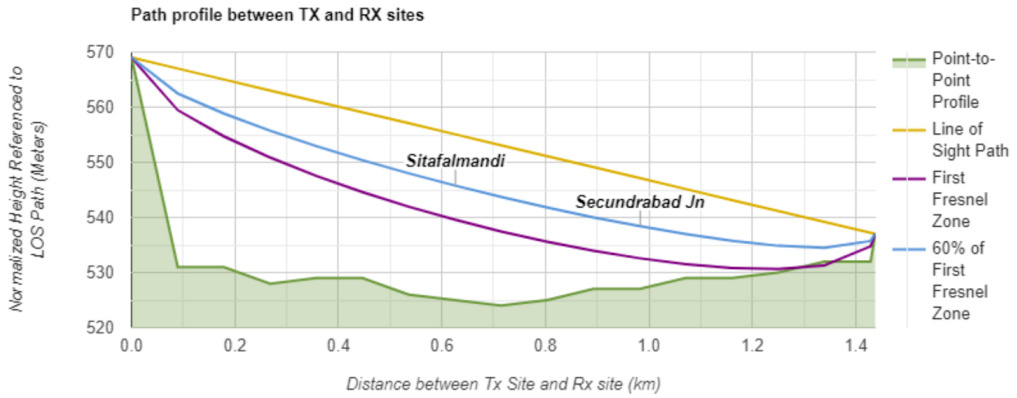


Figure 6: Sample RSSI Survey using Ligowave Software

4 Design Engineering Activities

4.1 Design Approval Process

Design approval process can be summarised as below.

(a) Preparation of designs of tower sub-structure (foundation) and super-structure (tower) based on Wind Speed (IS 875 Part 3), Soil Bearing Capacity (SBC), Water Table (With / Without Saturation), Factor of Safety (2.0 as per IR Standard Code of Practice for the Structural Design of Microwave Towers of Self Supporting Type, 1982) etc.

(b) Proof checking of design by third party like CPRI / IITs.

(c) Railway approval of design by Chief Bridge Engineer (CBE).

(d) The tower designs are specific to each design agency and hence, separate approvals need to be obtained for each agency.

4.2 Site Specific Activities

(a) Identification of site for tower erection free from infringements and approval by division duly recommended by all stakeholders / departments.

(b) Collection of soil samples at the identified locations and their lab testing

(c) Submission of Soil Investigation Report stating SBC to railways along with relevant foundation drawing for review and approval.

(d) Final approval for "Fit for Construction" by project executing unit.

4.3 Site Execution Activities and Timelines

Note : Tower construction would take approximately 45 days per tower. By engaging four teams each of Civil, Tower and Site supervision, approximately 12 towers sites can be completed in a month with concurrent management. However, the above parallel activities will become effective after initial period of 6 to 8 weeks from the commencement of the project activities.

5 Inspections and Testing of Tower

5.1 Inspection and Tests for Foundation and Tower

5.2 Tower Super-structure Material Inspection by RITES – Quality Assurance Plan (QAP)

Tower super-structure material inspection is done by RITES at two stages.

1. Raw material inspection for super-structure of tower

2. Inspection of finished goods (members) of tower super-structure

RITES inspection shall be carried out in accordance with Quality Assurance Plan (QAP) that has been prepared and agreed by all the stakeholders – Railway, Tower Designer, Contractor Agency and Tower Fabricator. Necessary approvals shall be obtained from CBE. The broad guidelines of QAP and manufacturing process right from raw material to finished product are elaborated below.

table

6 Cable Connectivity for Tower at Stationary TCAS Locations

Cable shall be provided at stationary TCAS locations for tower catering to the power supply radio modems, aviation lamp and RF transmission of data. Cable connectivity diagram is shown below.
Notes for Figure 8

1. Two diversified cable paths shall be provided as far as possible, from STCAS to the tower to avoid common mode failures.

2. 6/24 OFC cable in diverse path shall be provided from STCAS to the tower to avoid common mode failures.

3. 12 Core Signalling cable or Power cable for operating Radio of aviation lamp.

4. 12 Core Signalling cable between SMOCIP to Stationary TCAS.

5. OFC cable for NMS purpose

6. LMR-600 RF coaxial cable from the two radio modems to antennae shall be routed in the different paths.

7 WPC / SACFA Clearance Process

Wireless Planning and Coordination (WPC) clearance is necessary for the operation of radios in India. This clearance is for the operation of radio. Site specific clearances such as defence areas, airport area etc., are given through SACFA clearance. Revised process for the application is given below.

(a) SARALSANCHAR (Simplified Application For Registration and Licenses) a Web based Portal, for Issuing of various types of Licenses and Registration certificates is part of various Digital initiatives being taken by Department of Telecommunications.

(b) Applications to be processed in SARALSANCHAR online portal through sub-user creation

(c) A Master User has been created for Ministry of Railways for creation of Sub-Users on Saral Platform of WPC (SACFA), who can then apply further for allotment of frequencies

S.No.	Description	Items for Testing	Remarks
1	**Tests on Foundation**		
1.1	Raw Material	Reinforcement sample for Tensile strength as per IS 1786 Coarse and Fine Aggregate for fineness modulus as per IS 383	Laboratory report to be submitted
		Cement conforming to IS standard for strength as per IS 269	
1.2	During foundation works	Slump Cone test on fresh concrete for workability to be performed at site during each stage of concreting as per IS 456	Slump value shall be between 75 to 90 and witness by Railway
		Collection of Cube samples from fresh concrete for strength check to be performed at site during each stage of concreting as per IS 456	1 sample (3 specimen) for every 5 Cu.m to be tested at lab after 28 days and report to be submitted to Railways
2	**Inspections on Foundation**		
2.1	During foundation works	1st inspection – Depth check of foundation and layout of foundation at PCC	Witness by Railway and recorded in Site Register
		2nd inspection – Reinforcement check before casting of Footing and supervision of concreting of footing and 1st lift of column / pedestal	
		3rd inspection – Checking of Template fixing and supervision of concreting of final lift of column / pedestal	
3	**Tests on Tower – at Factory by RITES as per Quality assurance Plan (QAP)**		
3.1	Raw material to workmanship	The Tests at the Factory by RITES shall be as per agreed QAP – Refer table below for details	RITES inspector shall visit the Factory for Raw material inspection and Finished Goods inspection and submit the certificate of clearance.
4	**Inspections on Tower – at Site**		
4.1	Material inspection at site	4th inspection - Checking of materials for good condition, quantity as per packing list and coating thickness	Railway inspector to verify and record observations in site register
4.2	Tower Post erection	5th inspection – Checking of tightening of bolts (Randomly) and verticality check.	

S. No.	Activity	Description	Reference IS Codes - For Supply and Acceptance Criteria	Remarks
1	Raw Material Procurement	Pipes, Plates, Angles, ISMC, Hardware (HDG Bolts of Gr 8.8 and nuts)	IS 2062 for all hot rolled sections; IS 1161 / IS 1239 / IS 3601 for Pipes IS 12427 Or other equivalent	Along with supply MTC is normally expected; Also samples are usually collected and tested for Chemical and Mechanical properties at the time fabrication as a usual process
2	In Process Fabrication	Dimensional cut of members, assemblies, hole punching / drilling	IS 10748; IS 2062; IS 1161; IS 7215	Use of Jigs and Fixtures for assembly of sections shall be ensured.
3	Welding	Welding shall be carried out in accordance to WPS / Drawings	IS 816; IS 822; AWS D1.1	Welding shall be visually inspected and samples randomly tested by NDT methods of DPT / MPI
4	Final Inspection	Inspection of fabricated tower	Drawings	Post Fabrication final inspection of material is usually carried out
5	Galvanization	Galvanization of tower	IS 6745; IS 2633; IS 2629; Drawings	Coating thickness shall be as per drawing usually between 45 to 85 Microns depending on thickness
6	Packing and Loading	Tower despatch to site	Packing List and Drawings	Loading shall be inspected and supply quantities shall be ensured as per drawing

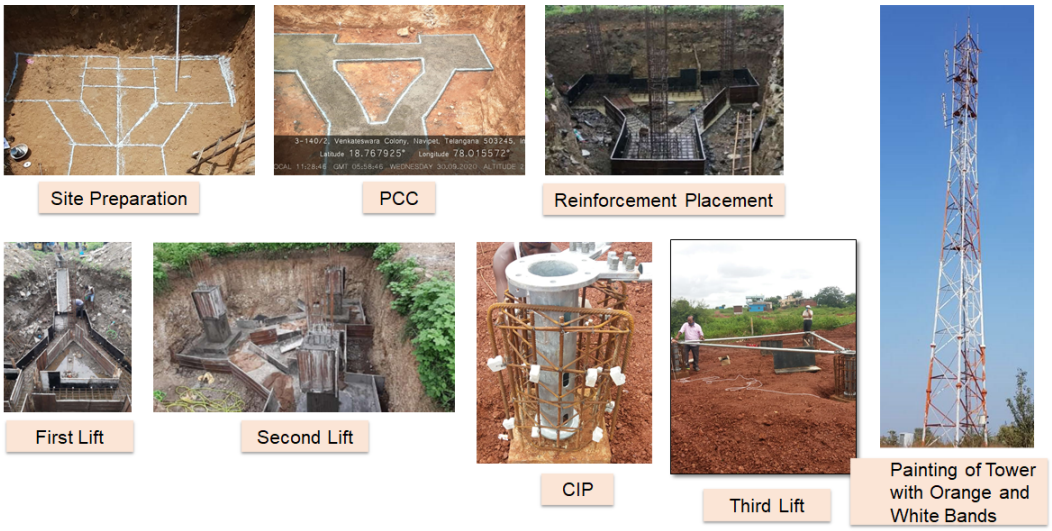


Figure 7: Typical Tower Site Photographs

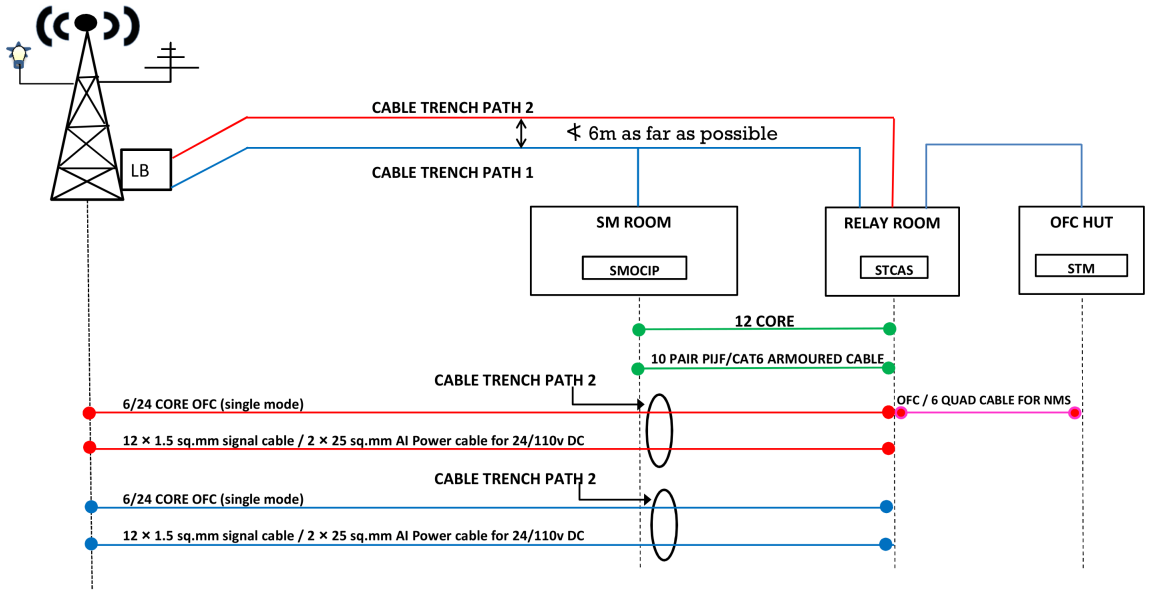


Figure 8: Cable Connectivity Diagram for TCAS at Stationary TCAS Locations

(d) TCAS uses FIVE frequency spots in 400 MHz to 450 MHz band. (f0 - 441.8 MHz, f1 - 456.8 MHz, f2 - 416.8 MHz, f3 - 466.8 MHz and f4 - 426.8MHz).

(e) SCR has initially processed applications for the WPC clearance for TCAS frequencies during December 2020 after introduction of Portal.

(f) Two Radios for each STCAS/LC TCAS and Two radios for each Loco TCAS and 10

(g) There is a restriction of maximum 99 nos. of radios per application in the portal, hence processed with multiple applications (Six) to cater the entire 1200km on-going TCAS project.

(h) Approval process takes 6 to 8 months and hence Railways shall initiate the process well in advance

(i) With Dealer Possession License (DPL), OEMs can import TCAS Radios, but for supply and operation WPC license is required.

(j) Main aim of Standing Advisory Committee on Radio Frequency Allocation (SACFA) is to ensure aviation safety and security and addressed by clearance for a tower/ antenna / site (Heights ¿ 30 Meters)

(k) Initiation of SACFA clearance after obtaining the Decision letter from WPC which is a prerequisite to fill the online application for SACFA clearance in the portal.

8 Maintenance of Towers

Once TCAS towers are erected, it is essential that they are kept in "fit" condition through regular maintenance. It generally consists of general inspection, fault tracing, checking of tower aviation lights, quarterly checking of condition of foundation, corrosion, tilt, nut and bolt tightness, distortion of members, cabling intactness, earthing, half yearly verticality check and other need based maintenance. Painting of tower is also needed every three years. SCR has addressed the issue by entering into a Memorandum of Understanding (MoU) with RailTel for maintenance of towers.

9 Experience of SCR in KAVACH Deployment

SCR has faced many challenges in KAVACH tower installation. Some of them are summarised below.

10 Conclusion

Successful deployment of TCAS needs timely erection of communication tower for establishing connectivity between Stationary TCAS and Loco TCAS. One of the critical activities of KAVACH deployment is construction of towers and none of the testing activities could be initiated without the erection of towers. South Central Railway has successfully erected more than 100 Lattice towers within a year overcoming the above challenges and paved the way for implementation of TCAS in 1200 RKM in SCR. Initial reconnaissance survey for towers and their feasibility, meticulous planning, regular progress reviews with tower contractors, resolving site issues, concurrent management of tower activities are some of the key areas for meeting the targets. ADEN or SSE/Works possessing adequate competency in Civil foundations and steel structures shall be deputed under the administrative control of S&T department for authorised working.

Nature of Challenge	S.No.	Description
COVID-19	a)	Work halted abruptly due to intermittent COVID-19 lockdowns in TCAS work areas encompassing various states of the country
Nature Fury	b)	Intermittent rains halted work due to inundation of work sites and concomitant access cut-off.
Repetitive Works	c)	Repetitive nature of works such as soil testing due to multi-departmental dependence for tower location finalisation.
	d)	Repeated excavation due to problems such as soil collapse.
Geographical Conditions and External Agency Clearances	e)	Type of soil severely limited the design choice (e.g. black cotton soil).
	f)	Cost overruns due to heavy machinery requirement and additional works. For example, breaking of sheet rock at 1 m depth, breaking of ½ m thick concrete etc.,
	g)	Remote locations far away from motorable roads
	h)	Necessity of new designs for locations due to filled up soil, seepage due to water bodies, and other site specific conditions.
Railway Limitations	i)	Necessity of new designs for locations due to non-availability of adequate railway land clear of infringements to IRSOD (e.g. LC Gates).
	j)	Delay in Aviation Clearances for locations with close proxiity of airports
	k)	Restrictions for placement for locations in defense area
	l)	Allotment of railway land for tower where old structures had to be dismantled.
	m)	Local labour issues associated with any construction projects

Figure 9:

Shri V.N.M. Rao is an IRSSE 1996 Batch officer joined Indian Railways in 1998 after completing his Masters Degree from IIT, Roorkee. He has 23 Years of experience in Railway Signalling field. He has worked in the southern part of Indian Railways as In-charge Maintenance Engineer as well as Project Executing Officer. He has handled various modern signalling projects like TPWS(ETCS-L1),EI, AFTC, and MSDAC in Southern Railway as CSTE/Projects, Chennai. He has successfully commissioned TPWS projects of M/s Ansaldo make at Chennai Beach Gummidipundi Section and M/s Thales make TPWS system at Basin Bridge Junction-Arakkonam Section with interoperability between the vendors. He has four years Signalling Design experience in UK Signalling while working for UK Railways under M/s Atkins, Sharjah. He possesed an IRSE (UK) license for Signalling Scheme Designer, Signalling Principles Designer and Signalling Design Verifier. He was instrumental in successful commissioning of important Global projects such as Rugby and Nuneaton (RuN) SSI Project with Centralized Traffic Control etc, while on deputation. He is an Executive Council Member for IRSTELO which is responsible to operate Licensing Scheme for Competence assessment in S&T field of Indian Railways. He is currently working as CSTE/Projects/South Central Railway, looking after TCAS & other modern S&T projects in SCR and spearheaded for successful deployment of KAVACH in 600Kms in the current year in SC Railway.

Shri Manoj Kumar Gupta is an officer of Indian Railway Service of Signal Engineers 1998 batch. He completed his Master of Engineering (Electronics and Communication) from Malviya Regional Engineering College, Jaipur (renamed as Malviya National Institute of Technology) in 1998. He has 21 years of experience of working on Indian Railways. He has held various positions in open line, construction, drawing and design and headquarters at various places in Western, North Western and South Central Railway. He has considerable experience of execution and commissioning of various targeted works like traffic facilities, gauge conversion, new lines and yard remodelling works apart from the maintenance of signal and telecommunication assets. He has last worked as Chief Signal Engineer - II, South Central Railway.

Shri C Sivakumar Kashyap is an IRSSE 2013 Batch officer joined Indian Railways in 2014 after completing his Bachelor's Degree from IIT Kharagpur. He has 7 years of experience in Railway Signalling field. He is handling Train Collision Avoidance System deployment in South Central Railway as a Divisional Signal and Telecom Engineer. He was the engineer-in-charge for maintenance activities of Signal and Telecom department in Secunderabad and Guntakal Divisions at Kazipet and Raichur.

File No.RDSO-SIG0TCAS(TAN)/1/2021-SIGNAL-DIRECTORATE/RDSO

भारत सरकार – रेल मंत्रालय
Government of India –
Ministry of Railways
अनुसंधान अभिकल्प और मानक संगठन
Research Designs & Standards
Organization
लखनऊ–226011
LUCKNOW – 226011

सत्यमेव जयते

अग्रमा संRDSO
रेल अग्रदूत Transforming Railways
Fax : 91-522-2452332
Rly phone : 032.42652
BSNL phone : 0522-2465750
E-mail : gpavan.123@gov.in
tcasphase2@gmail.com

No. RDSO-SIG0TCAS(TAN)/1/2021 **Date:** 18.10.2021

1.	AM/Signal, Railway Board, New Delhi	सदस्य/संकेत, रेलवे बोर्ड, नईदिल्ली
2.	**The PCSTE**	**प्र सी.एस.टी.ई.,**
(i)	Central Rly., Mumbai, CST – 400001	मध्य रेलवे, मुम्बईसी.एस.टी.– 400 001
(ii)	Western Rly, Churchgate, Mumbai – 400020	पष्चिमरेलवे, चर्चगेट, मुम्बई– 400 020
(iii)	Eastern Rly., Fairlie Place, Kolkata 700001	पूर्वरेलवे, फेयरलीप्लेस, कोलकाता– 700 001
(iv)	South Eastern Rly., Garden Reach, Kolkata -700043	दक्षिणपूर्वरेलवे, गार्डनरीच, कोलकाता– 700 043
(v)	Northern Rly. Baroda House, New Delhi-110001	उत्तररेलवे, बड़ौदाहाउस, नईदिल्ली– 110 001
(vi)	North Eastern Rly., Gorakhpur- 273012	पूर्वोत्तररेलवे, गोरखपुर– 273 012
(vii)	North East Frontier Rly., Maligaon, Guwahati	पूर्वोत्तरसीमान्तरेलवे, मालीगांव, गुवाहाटी– 781 011
(viii)	Southern Rly. Park Town, Chennai – 600003	दक्षिणरेलवे, पार्कटाउन, चेन्नई– 600 003
(ix)	South Central Rly., Secunderabad – 500371	दक्षिण मध्य रेलवे, सिकन्दराबाद–500 371
(x)	East Central Railway, Hajipur	पूर्व मध्य रेलवे, हाजीपुर
(xi)	East Coast Railway, Rail Vihar BDA Rental Colony, Chandrasekharpur, Bhubneshwar	पूर्वतटीय रेलवे, रेलविहारबी.डी.ए. रेन्टलकालोनी, चन्द्रषेखरपुर, भुवनेष्वर–751023
(xii)	North Central Railway, Ganga Complex, Subedarganj, Allahabad.	उत्तर मध्य रेलवे, गंगाकमपलेक्स, सुबेदारगंज, इलाहाबाद
(xiii)	North Western Railway, Jaipur – 300206	उत्तरपष्चिमरेलवे, जयपुर–300206
(xiv)	South Western Railway, New Zonal HQs office, 1st Floor, West Block, Gadag Road, Hubli – 580020.	दक्षिणपष्चिमरेलवे, प्रथमतल, वेस्टब्लाक, गदगरोड, हुबली–580020
(xv)	West Central Railway, OSD Office, Jabalpur	पष्चिम मध्य रेलवे, ओ0एस0डी0 कार्यालय, जबलपुर
(xvi)	South East Central Railway, R.E. Office Complex, Bilaspur – 495004	दक्षिणपूर्व मध्य रेलवे, आर0ई0 ऑफिसकाम्पलेक्स, बिलासपुर– 495004
3.	The PCSTE, Metro Railway, 23-A, Jawaharlal Nehru Road, Kolkata – 700071	प्र सी.एस.टी.ई./मैट्रोरेलवे, 23–ए, जवाहरलालनेहरू रोड, कोलकाता– 71

Sub: Technical Advisory Note for System improvement regarding installation for Stationary KAVACH (Train Collision Avoidance System).

Ref.: TCAS specification RDSO/SPN/196/2012 ver 3.2

Vide reference above, the Technical Advisory Note no. RDSO-SIG0TCAS (TAN)/01/2021 ver 1.0 has been revised and issued with approval of competent authority as SIG0TCAS (TAN)/01/2021 ver 2.0 dated 11.10.2021 regarding installation for KAVACH (Train Collision Avoidance System) & shall be implemented in all the future works.

DA: As Above

Signed by Pavan Kumar Gudavalleti
Date: 18-10-2021 11:37:26
Reason: Approved

(G. Pavan Kumar)
Executive Director/Tele-II
For Director General/Signal

Copy to:

i. CSTE(P)/SCR South Central Railway, Rail Nilayam, Secunderabad, Telangana-500025.

ii. Medha Servo Drives Pvt. Ltd., P-4/5 P-4/5B, Industrial Park, Nacharam, Hyderabad- 500076.

iii. Kernex Microsystems (India) Ltd. “Technopolis” Plot No.38 to 41, Hardware Technology Park, TSIIC Layout, Imarath Kanch, Raviryal , Maheswaram Mandal, R.R.(Dist), Hyderabad, Telegana-501510

iv. HBL Power Systems Limited, 8-2-601, Road No.10, Banjara Hills,Hyderabad-500034 (A.P.)

Government of India - Ministry of Railways

Research Designs and Standards Organisation

TECHNICAL ADVISORY NOTE			
Subject	**System Improvements regarding Installation and Maintenance for KAVACH**		
Document No.	**RDSO-SIG0TCAS(TAN)-1-2021**	**Version**	**2.0**
Date	**11.10.2021**	**Pages**	**07**

1. Scope:-

These guidelines are issued based on field experiences of KAVACH during the development project and 1200 KM project period in SCR. These guidelines shall be followed by the Zonal Railways and OEM during the installation and maintenance to improve the reliability of system.

2. RFID Tags:-

2.1 Installation of RFID Tag in sleeper: -

The RFID tag enclosure shall be good quality of FRP material and fitment clamp shall be made of stainless steel of grade 316 to avoid the corrosion and environmental effect.

Reason:

As the clamps are being used on sleepers, these are prone to different environmental conditions such as dampness, wetness, heating, UV-IR exposure, human excreta; it is proposed to use high quality metallic as well as non metallic material for fitment.

2.2 The duplicate RFID tag must be installed at a minimum distance of 3 to 5 meters between tags except for Signal foot tag.

Reason:

With this practice of installation, the direction will be set with reading of one set of duplicate tag.

2.3 Placement of adjustment tag/ junction tags:-

Adjustment tag shall be placed beyond 350 meter of Communication Mandatory Zone.

Reason:

This will remove the unnecessary EBs or SOS Messages (Fault code) as Onboard unit is not in communication mandatory zone i.e., minimum 1850m beyond the Last Stop Signal (Clause 6.8.3.1 a).

2.4 Distance between the two Normal Tags:-

The maximum distance between the two normal tags shall not be more than 1000m.

Reason:

To minimize the accumulated odometry error.

2.5 Provision of S-type Tags at the Block Section limits (Yard exits):-

S-type tags shall be provided at the Yard Exits not protected by signals like BSLB etc.,.

Reason:

To protect the Kavach equipped train not to enter into block section in shunt mode.

2.6 Provision of Normal-Tags in lieu of Signal Approach Tags:-

Normal Tags only can be linked. Hence, to ensure linking up to the nearest location to the approaching signal, Normal Tags shall be provided in lieu of Signal Approach Tag in future installations.

2.7 Marking of RFID Tag number and Type at the bottom:-

The tag number may be painted over the sleeper for easy recognition during maintenance. All RFID tags shall be marked at the side with tag number and tag type. The marking shall be as follows:-

RFID NO: Type : Location :

Reason:

To facilitate easy identification for re-installation of RFID Tags removed during PQRS works.

2.8 Replacement of RFID Tags after PQRS works need to be done accurately

Reason:

Wrong placement of RFID Tags may result in extension or reduction of communication mandatory zones or cause spurious EBs if they are placed on other lines.

3. Installation of stationary unit :-

3.1 **Numbering Scheme for Stationary unit:**-

The **first two digits** are allotted to each zonal railway as shown in the table below and Zonal railways may decide the **last three digits** for the stations. A proper record shall be maintained by the Zonal Railways to avoid repetition of number as station ID should be unique number.

Sl. No	Name of the Railway Zone	Allotted code	Sl. No	Name of the Railway Zone	Allotted code
1.	South Central Railway	00-02	**11.**	North Western Railway	30-32
2.	Northern Railway	03-05	**12.**	West Central Railway	33-35
3.	North Eastern Railway	06-08	**13.**	North Central Railway	36-38
4.	Northeast Frontier Railway	09-11	**14.**	South East Central Railway	39-41
5.	Eastern Railway	12-14	**15.**	East Coast Railway	42-44
6.	South Eastern Railway	15-17	**16.**	East Central railway	45-47
7.	Southern railway	18-20	**17.**	Metro Railway Kolkata	48
8.	Central railway	21-23	**18.**	Konkan Railway	49
9.	Western Railway	24-26	**19.**	RDSO, Lucknow	50
10.	South Western Railway	27-29	20	South Cost Railway	51-53
			21	IRISET SC	54

3.2 Kavach Wiring Diagram and configuration detail shall form part the S&T circuit diagrams issued by Zonal Headquarters and these documents shall be placed in all the relay rooms and shall be treated as part of station S&T documents.

Reason:

This will ensure that Kavach circuits are also altered whenever signal alterations are carried out by the Zonal Railways.

3.3 Zonal Railways shall ensure non-blanking of signal during signal aspect changing due to cascading feature.

3.4 Parallel Wiring of Relay Contacts read by Stationary unit shall be carried out.

Reason:

To minimize the failure of Movement Authority/out of correspondence of signal aspect at site and Loco OCIP, due to high contact resistance of relays, the parallel wiring of relay contacts.

3.5 **Unavailability of repeaters ECRs for inner Distant and Distant Signal of IB:-** If such IBs are available, the OFC need to be tapped at the signals and RIU can be installed or the aspects of these permissive signal can be deduced. Zonal Railways can choose either of these options.

3.6 Executing field units/SrDSTEs undertaking S&T work in TCAS territory should make appropriate TCAS modifications while carrying out activities like shifting of signals by few meters, shifting of turnout, closure of LCs, interlocking of LCs, insertion of Key locked points on loop lines, modification of PSR.

Reason:

To avoid spurious braking, non-correspondence of the Movement Authority/out of correspondence.

3.7 **Wiring of SM OCIP**:- 12 Core Signalling cable shall be used for button, counter & power supply. CAT-6 armoured or shielded twisted pair cables shall be used for communication portion.

3.8 **Diverse Path for routing of GSM and GPS Cables**:- The cables for one set of GSM/GPS Antenna shall be routed in one path and another set shall be routed in shortest diverse path to avoid failures due to cable cuts at a single location.

3.9 **Diverse path for wiring of RIU**:- In Auto-Section, IBS, Gate, RIU shall be connected to stationary Kavach with diverse path of OFC media only in redundant manner.

3.10 All the cable entry and exit at relay room and location box near tower shall be completely sealed to avoid rodent entry.

3.11 **Rodent proof OFC Patch cords** are to be provided at all Stations, IBS, LC and RIUs.

3.12 **Power Supply arrangement:**- The 110 volt DC supply from IPS room to Kavach rack at Interlocked Stations shall be provided with duplicated cable with suitable gauge (Min 10 Sq. mm) so as to ensure that voltage drop in cable shall not be more than 1.0

volt from integrated power supply (IPS). Each cable shall be protected with an individual isolator and fuse of suitable capacity. Existing 24V internal supply may be extended to additional relays for TCAS for better reliability and integrity.

Reason: *Duplicated cable is provided from IPS to Kavach to have redundancy of power supply connection to equipment and to prevent failure due to rat cut or any other damage.*

Cable voltage drop is restricted to 1 volt to avoid overloading of cable & also ensure correct AWG and quality wires.

3.13 Reliable Power supply such as mini IPS with backup of 8-10 hour shall be provided at mid-section, LC gates especially in Non-RE area section to avoid failure due to non-availability of power.

3.14 The DC-DC converters provided for stationary Kavach unit shall be systems along with segregation of cabling and termination for power supply up to DC-DC converters shall be in N+1 configuration. Additional DC-DC converters modules in existing IPS may be planned for STCAS/LC TCAS/ RIU as far as possible..

3.15 It shall be ensured that the Kavach equipments are earthed with shortest path to common earth bus bar in Relay equipment room. It shall be also ensured that front and back doors of Kavach cabinet shall be earthed using copper braid.

3.16 All the connectors on trackside equipment (Stationary Kavach, RIU, Radio) shall be of M-12 type connector.

Reason:

This will ensure that failures on account of loose connections are avoided.

4. Communication

4.1 Proper Radio Survey shall be carried out before deciding up on the location and height of towers to avoid failure due to obstructions like buildings, terrain etc.

4.2 Adoption of 20m/15m tower shall be permitted at midsection interlocked LC gates/IBS to overcome the geographical limitations.

4.3 The mounting of all the antennae on the tower shall be at same level as far as possible..

4.4 RF Cable length optimization in towers using Radio Box fitted at tower to reduce the dB losses in RF cable.

4.5 RF coaxial cable for the two Radios shall be routed in the different path. The coaxial cable shall be minimum LMR-600 of Amphenol/ heliax. As connectors are open to environment, they shall be provided with weather proof sealing.

4.6 The Radio tower shall be provided with lightening arrester (Franklin rod) and connected to earth along with aviation lamp.

4.7 Cable joints shall not be permitted from location box to antennae. The patch cords used shall be of minimum length.

4.8 Weather proofing to be done at all the exposed connections and it shall be monitored on monthly basis.

4.9 Radio Modems shall be installed with Modified firmware (Version no. V1.1 RC3)

4.10 Dual OFC and dual power cable in diverse path shall be provided from Stationary unit to the location box near tower to avoid common mode failures.

4.11 The frequency pairs allotted for two adjacent stations shall be different. The loco time slots for the same station shall not be adjacent to each other (minimum one time slot gap shall be kept). Also slots, P2, P27, P41 and P65 shall be kept as reserved.

4.12 Radio Receive Signal Strength measurement to be carried out on quarterly basis to identify new shadow regions developed and facilitate attention.

4.13 RF Alignment to be done periodically means quarterly to avoid loss of RF packet.

5. Mapping Scheme of PSR, Gradient Data for Offset Problem

5.1. PSR/TSR and gradient data, which is the reference for speed supervision of the train is required to be provided with respect to the available kilometer stones/traction mast number.

5.2. Centre line of the station building shall be the reference point for the mapping scheme. The centre line shall be finalized as per the actual site condition and shall not be based on SIP or ESP.

5.3. All the locations of kilometer stones/traction mast number are to be mapped to the absolute locations based on the above reference point by carrying out survey using drone/Loco mounted camera.

5.4. Fractional distances shall be mapped to captured absolute locations during survey by using the principle of proportionality considering distance between the two adjacent kilometer stones/traction masts.

6. Onboard:

6.1. Locos shall be installed with Modified firmware of IPICO RFID reader (Version no. V1.b or upgrade version V 1.C).

Reason:

This will ensure that reliability improvements are incorporated in the RFID reader.

6.2. Loco antennae shall be installed with min 3dBi antennae and LMR 400 cable. The RF cable shall be routed through the shortest possible path.

Reason:

This will ensure that RF losses on Loco front to be minimum.

6.3. Braking parameters are to be fine-tuned in alignment with Railways operational requirements.

Reason:

This will ensure that the braking is not reducing the operational efficiency.

6.4. Maintenance to be done periodically including calibrating wheel dia.

Reason:

This will ensure that the odometer is working properly.

7. **General:**

7.1. A policy at Zonal Railway shall be issued to get the changes in SIP/Table of control/field relay interface circuit/location change of signal post /PSR/LC Gates/Gradient is reflected in Stationary Kavach circuit.

7.2. It shall be ensured that Zonal Railway SIP and Table of Control shall be adhered for deducing the signal aspects and Movement Authority in Kavach.

7.3. The Factory Acceptance Test (FAT) shall be verified by Railway official and Sample verification shall be done by minimum JS/SS officer during SAT (Site Acceptance Test)

7.4. The pre-installation and pre-commissioning checklist for concerned Kavach shall be thoroughly checked at the site at the minimum Assistant officers' level jointly with the executing OEM.

7.5. The modification in the application logic, Kavach control table, RFID layout shall be controlled with version control software station wise to avoid human error.

7.6. The quality and integrity of the installation remains complete responsibility of the OEM. The firm must provide an OEM certificate regarding this before commissioning of any installation, any deficiency pointed out later, shall be done free of cost by OEM, this shall be confirmed by OEM before commissioning.

7.7. Typical drawing for fixing RFID scheme in Apron area (duly approved by track directorate) is enclosed as Annexure.

7.8. Continuous analysis as part of RAMS requirement for the lifecycle is to be done by OEMs and the details are to be shared to Railways and RDSO.

7.9. Initial and refresher training for Loco Inspectors/Pilots shall be ensured. Common group for Loco Operational staff, Maintenance and Firms shall be formed to discuss operational issues and arrive at solutions.

7.10. Equipment course shall be started by IRISET, IREEN, IRMEE and all ZRTIs/ETTCs/STTCs/DTTCs.

7.11. Maintenance procedure without affecting trains or with affecting trains is to be prescribed by Zonal Railways.

7.12. Computerized Test report using Maintenance Simulator shall be provided to facilitate Loco Shed level testing after Periodic Maintenance of Loco. Collection of health parameters (Modules, Radio and Tags) are to be ensured in NMS.

7.13. To avoid rework, new installations shall use tag data format suitable for LTE communication.

7.14. Inter Stationary unit communication channel on OFC shall be provided to avoid RIU duplication and reliability enhancement.

7.15. Provision of TCAS shall be included in all the estimates of S&T works in TCAS territory.

7.16. Identification of stations where no Mobile coverage shall be carried out through GPS based GSM/LTE Signal Strength measurement system and accordingly SIMs of service provider shall be allocated. eSIM shall be preferred over conventional SIMs.

7.17. A joint procedure order at zonal level for tag handling during p-way works shall be prepared and implemented to avoid failure due to missing tags etc.

gpkumar

(G. Pavan Kumar)
Exe Director/Tele-II
for Director General/Signal

Encl : As above

- For any issues related to this TAN (Technical Advisory Note) please contact RDSO, Lucknow (Rly phone- 032-42652, DOT-0522-2465750, Email: *tcasphase2@gmail.com*
- For continuous update on Kavach, please visit the intranet site: http://10.100.2.19/signal/policy/Indian%20Railway%20Automatc%20Train%20Protecton%20System%20(IRATP).htm

549708/2021/O/o ED/TRACK DESIGN-3/RDSO

TRACK DESIGN DIRECTORATE-III

No. CT/SRC/S&T Date 01.06.2021

Sub: Approval of fitment of RFID Tags in CC apron area of station in TCAS installation station.

Ref: i. Signal Directorate's note no. RDSO-SIG0TCAS(GEN)/2/2020 dated 17.02.2021& 12.03.2021.

ii. This office note no. No. CT/SRC/S&T dated 31.03.2021

iii Signal Directorate's note no. RDSO-SIG0TCAS(GEN)/2/2020 dated 19.04.2021/04.05.2021.

iv. Joint minutes of meeting between Track, Track machine and Signal Dte of 27.08.2015 vide Note No. STS/E/TCAS/Tender/Part-VIII dated 27.08.2015 (copy enclosed)

With reference to above, a schematic drawing showing the fitment of RFID tags in CC Apron was sent by Signal Dte for examination and approval from Track Dte (ref-i). The drawing was examined and the deficiencies were communicated vide this office note under ref-ii.

In response, Signal Dte, submitted a revised drawing (ref-iii), which was examined by Track Dte (unit-III) and accordingly it is communicated that Track Design Dte has no objection to the proposed fixing arrangement of RFID tags in CC Apron area using mounting clamps, as shown in the drawing no. TCAS/2021_02_15 dated 14.04.2021 duly approved by ED/Tele-II on 04.05.2021 (submitted vide ref-iii), subject to fulfillment of conditions laid down in the joint minutes of meeting held on 27.08.2015 on similar subject as applicable (ref-iv). It should also be ensured that there is no infringement to Max. moving dimensions / IRSOD due to the proposed installation .

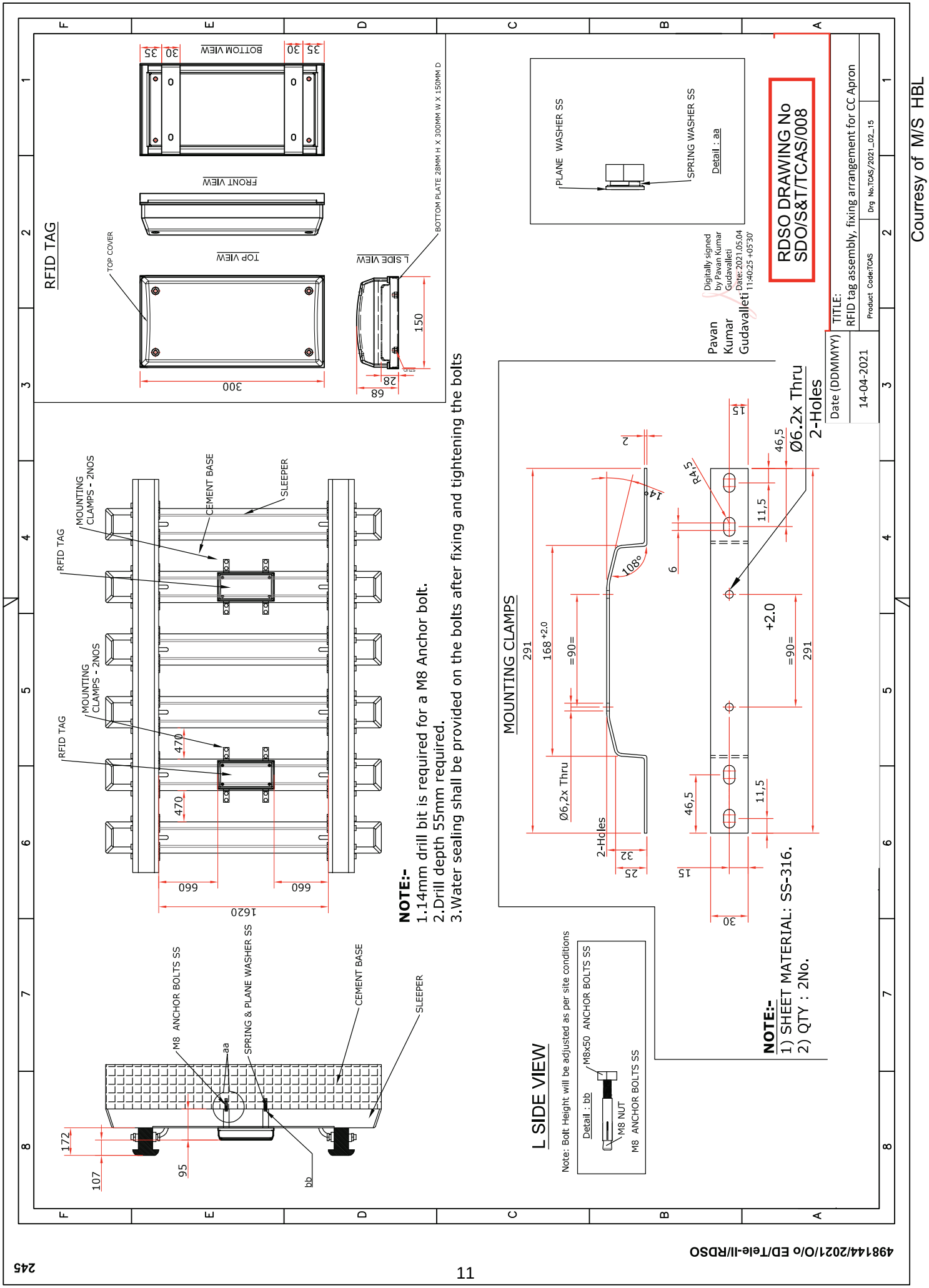
DA: As above

01/6/2021
(M.K. Singh)
ADE/Track/S&F

Director/Track-IV 01.6.2021

ED/Track-III 01/06/21

ED/Tele-II



549708/2021/O/o ED/TRACK DESIGN-3/RDSO

Original Copy 1 of 3 (Signal Dte)

Research Designs & Standards Organization

No. STS/E/TCAS/Tender/Part-VIII Date : 27.08.2015

Sub: Development of Train Collision Avoidance System (TCAS) : RFID Fixing Arrangement for use in Secunderabad – Vikarabad – Wadi (excluding) – Bidar section of SC Railway

Ref: (i) Signal Directorate Note No STS/E/TCAS/Tender/Part-V dated 16.05.2014 & 10.09.2014
(ii) Joint Meeting between Track, Track Machine and Signal Directorates of RDSO on 03.07.2015 & 27.08.2015

1.0 Through notes under reference, it has been advised by Signal directorate that the RFID Tags are to be installed on track in connection with TCAS. These RFID tags shall be fixed at the centre of PSC Sleepers and emit RF signal only when corresponding type of RFID Antenna is in vicinity (Normally underneath a Locomotive). The normal spacing of RFID tags will be about 1 Km, which may get reduced in vicinity of stations.

2.0 The typical drawings proposed by signal directorate for RFID Fixing on PSC Sleepers were studied. For fixing the RFID installation, following shall be ensured:

2.1 No holes shall be drilled in the Sleepers and the arrangement of fixing must be through clamps only. Due care shall be taken that damage/ puncturing to PSC sleepers is not caused.

2.2 In order to avoid vandalism, the nut-bolts shall be planned on the side face of the sleeper at bottom end, which shall get covered by crib ballast. The projection below the sleeper shall be restricted only to strip thickness and nut bolts shall be fixed on side of sleeper, so that working of BCM is not affected.

However, for developmental work of TCAS in Secunderabad – Vikarabad – Wadi (excluding) – Bidar section of SC Railway, as the material had already been manufactured and used for installation to expedite the progress, the clamps of alternative design, which may have nut & bolts on bottom, may also be used as the material had already been manufactured and used for installation.

2.3 The fixing arrangements shall be strong enough to withstand impact during normal ballast unloading.

2.4 The RFID tags shall be fixed at the centre of the PSC Sleeper. The topmost portion of the Fixing Arrangement, when installed, should not be more than 75 mm above top surface of PSC Sleeper at centre. The installation would be done in such a way that the width of the RFID Fixing Arrangement along the length of the PSC Sleeper does not exceed 380 mm.

3.0 While deciding the location for RFID installation following aspects shall be kept in view:

3.1 RFID tags & fixtures shall be avoided in turnout portion in general. In any case, these shall not be located in switch portion of turnout i.e. from Actual Toe of Switch (ATS) to heel of switch.

3.2 The installation of RFID Tag & fixture should be avoided at locations susceptible to ballast accumulation at the centre of sleeper such as level crossing etc. This aspect needs to be taken care at the time of survey itself.

3.3 The performance of RFID tag may get degraded during RFID Fixture getting submerged in water. Therefore, installation should be done considering this fact.

DTM-1 DTM-3 Dir/Track-1 Dir/Track-2 Dir/Track-3 Dir/Track-4 Dir/Signal-5

549708/2021/O/o ED/TRACK DESIGN-3/RDSO

Original Copy 1 of 3 (Signal Dte)

4.0 Following issues are clarified:

4.1 The RFID Technologies being used in Track Recording Cars and Train Collision Avoidance System (TCAS) are different and non-interfering to each other.

4.2 During working of Rail Grinding Machine (RGM), the temperature of Rail at grinding location might go upto 350^0 C whereas the RFID arrangement on track is suitable up to 85^0 Celsius. These RFID tags in Fixtures are installed at the centre of sleeper away from Rail. On the basis of an experiment conducted, no short term functional deterioration in RFID was observed after normal functioning of RGM. RFID tags of same temperature endurance are provided for the purpose of Track Monitoring through Track Recording Cars (TRC) also. As such, there is no need to remove RFID tags for RGM working.

4.3 In case of mobile flash butt welding of rails, the rail temperature may increase to 800 - 900° C and sometimes hot splinters may also hit the fixture with pressure. So RFID tag installation should be planned well away from Rail Joints. In case of subsequent need of welding on account of in-service failure/ defect removals of rail/welds in vicinity of RFID location (about 5 sleepers on either side of RFID Tags), the removal of RFID will be necessary before undertaking mobile flash butt welding. In such cases, Track Staff would inform Signal staff in advance so that Signal staff can attend the site for removal & re-fixing of RFID as required.

4.4 The RFID tags and fixtures will not affect the machine maintenance of track in any way and their performance is not likely to get affected due to working of track tamping machine, DGS, ballast regulators etc. The fixture with side bolts is also not likely to affect the working of Ballast cleaning machine, as cutter chain will not obstruct the same. So, their removal will not be required for working of Ballast cleaning machine. However, initially, the BCM work at locations having RFID tags shall be done under supervision of signal staff, which shall be reviewed subsequently based on actual field experience.

4.5 In case of complete track renewal work requiring replacement of sleepers on which RFID fixtures are installed, Signal staff shall be advised in advance so that they can attend the site for removal & re-fixing.

4.6 TCAS RFID tags do not control conventional Lineside Railway Signals i.e. absence or damage or deterioration of RFID tags does not cause these Lineside Railway Signals to exhibit aspects more restrictive than they otherwise do so in accordance with signal interlocking. Absence or damage or deterioration of RFID tags of TCAS RFID tags would, however, render non-availability of supervision provided by TCAS. However, Loco Pilot can still run the train without any route-specific speed restrictions by selecting "Staff Responsible" in which the train is completely run under staff (Loco Pilot) responsibility. Therefore, in order to avoid undue adverse effect on train operations, TCAS trains shall be run under "Staff Responsible" Mode until RFID tags & fixtures restoration is completed.

This is issued with the approval of ED/Signal/RDSO, ED/Track/RDSO and ED/Track Machine/RDSO

27-08-15 27/8/15 23.8.15 27.08.15

DTM-1 DTM-3 Dir/Track-1 Dir/Track-2 Dir/Track-3 Dir/Track-4 Dir/Signal-5

GENERAL CONDITIONS

OF

CONTRACT

SOLAR BUSINESS DIVISION
BHARAT HEAVY ELECTRICALS LIMITED
(A Govt. of India Undertaking)
PROF. CNR RAO CIRCLE, IISc POST
MALLESHWARAM
BENGALURU - 560012

CONTENTS

2. Chapter-2

CHAPTER -1

1. GENERAL INSTRUCTION TO TENDERERS

1.1. DESPATCH INSTRUCTION

i) The General Conditions of Contract form part of the Tender specifications. All pages of the tender documents shall be duly signed, stamped and submitted along with the offer in token of complete acceptance thereof. The information furnished shall be complete by itself. The tenderer is required to furnish all the details and other documents as required in the following pages

ii) Tenderers are advised to study all the tender documents carefully. Any submission of tender by the tenderer shall be deemed to have been done after careful study and examination of the tender documents and with the full understanding of the implications thereof. Should the tenderers have any doubt about the meaning of any portion of the Tender Specification or find discrepancies or omissions in the drawings or the tender documents issued are incomplete or shall require clarification on any aspects, the scope of work etc., he shall contact the authority inviting the tender well in time (so as not to affect last date of submission) for clarification before the submission of the tender. Tenderer's request for clarifications shall be with reference to Sections and Clause numbers given in the tender documents. The tender specifications and terms and conditions shall be deemed to have been accepted by the tenderer in the offer. Pre requirements and conditions shall be liable for rejection.

iii) Integrity pact (IP): If NIT calls for Integrity Pact, the same shall be duly signed & stamped by the authorised signatory & submitted along with tender document.

1.2. SUBMISSION OF TENDERS

1.2.1 The tenderers must submit their tenders as per instructions in the NIT

1.2.2 BHEL takes no responsibility for delay, loss or non-receipt of tenders sent by post/courier. The tenders received after the specified time of their submission are treated as 'Late Tenders' and shall not be considered under any circumstances. Offers received by Fax/Email/Internet shall be considered as per terms of NIT.

1.2.3 Tenders shall be opened by authorised Officer of BHEL at his office at the time and date as specified in the NIT, in the presence of such of those tenderers or their authorised representatives who may be present

1.2.4 Tenderers whose bids are found techno commercially qualified shall be informed the date and time of opening of the Price Bids and such Tenderers may depute their representatives to witness the opening of the price bids. BHEL's decision in this regard shall be final and binding.

1.2.5 Before submission of Offer, the tenderers are advised to inspect the site of work and the environments and be well acquainted with the actual working and other prevalent conditions, facilities available, position of material and labour, means of transport and access to Site, accommodation, etc. No claim will be entertained later on the grounds of lack of knowledge of any of these conditions.

1.3. ***LANGUAGE***

1.3.1 The tenderer shall quote the rates in English language and international numerals. These rates shall be entered in figures as well as in words. For the purpose of the tenders, the metric system of units shall be used.

1.3.2 All entries in the tender shall either be typed or written legibly in ink. Erasing and overwriting is not permitted and may render such tenders liable for rejection. All cancellations and insertions shall be duly attested by the tenderer.

1.4 ***PRICE DISCREPANCY:***

1.4.1 Conventional (Manual) Price Bid opening:

i) If, in the price structure quoted for the required goods/services/works, there is discrepancy between the unit price and the total price (which is obtained by multiplying the unit price by the quantity), the unit price shall prevail and the total price corrected accordingly, unless in the opinion of BHEL there is obvious misplacement of decimal point in the unit price, in which case the total price as quoted shall govern and the unit price corrected accordingly

ii) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected;

iii) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject of (i) and (ii) above.

iv) If there is such discrepancy in an offer, the same shall be conveyed to the bidder with target date up to which the bidder has to send his acceptance on the above lines and if the bidder does not agree to the decision of BHEL, the bid is liable to be ignored.

v) In case of lump sum price, if there is any difference between the amount in figures and in words, the amount quoted by the bidder in words shall be taken as correct.

vi) In case of omission in quoting any rate for one or more items, the evaluation shall be done considering the highest quoted rate obtained against the respective items by other tenderers for the subject tender. If the tenderer becomes L-1, the notional rates for the omission items shall be the lowest rates quoted for the respective items by the other tenderers against the respective omission items for the subject job and the 'Total quoted price (loaded for omissions)' shall be arrived at. However, the overall price remaining the same as quoted originally, the rates for all the items in the 'Total quoted price (loaded for omissions)' shall be reduced item wise in proportion to the ratio of 'Original' total price and the 'Total quoted price (loaded for omissions)''.

1.4.2 Reverse Auction: In case of Reverse Auction, the successful bidder shall undertake to execute the work as per overall price offered by him during the Reverse Auction process. In case of omission of rates, the procedure shall be as per 'Guidelines for Reverse Auction' enclosed.
i) Offers from tenderers who are under suspension (banned) by any Unit/Region/Division of BHEL shall not be considered. ii) Offers from tenderers who do not comply with the latest guidelines of Ministry/ Commissions of Govt of India shall not be considered.

*1.5. **EVALUATION OF BIDS***

i) Technical Bids submitted by the tenderer will be opened first and evaluated for fulfilling the Pre-Qualification criteria and other conditions in NIT/Tender documents, based on documentary evidences submitted along with the offer, BHEL reserves the right to ask for proofs/documents, clarification in relation to Technical/commercial data during tender evaluation

ii) Price Bids of shortlisted bidders shall only be opened either through the conventional price bid opening or through electronic Reverse Auction, at the discretion of BHEL

iii) Price Bids of unqualified bidders shall not be opened. Reasons for rejection shall be intimated to the vendor before the opening of Price bid.

*1.6. **DATA TO BE ENCLOSED***

The following information in full shall be furnished by the tenderer. Non-submission of this information may lead to rejection of the offer.

i) INCOME TAX PERMANENT ACCOUNT NUMBER, GSTIN, SAC, HSN Certified copies of PAN, GSTIN shall be furnished along with tender. The names, addresses and contact information of the Directors/Partners shall be furnished along with the offer.

ii) An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor.

iii) IN CASE OF INDIVIDUAL TENDERER:

His / her full name, address, PAN, GSTIN and place & nature of business to be furnished. iv)

IN CASE OF PARTNERSHIP FIRM

The names of all the partners and their addresses, a copy of the partnership deed/instrument of partnership shall be enclosed.

v) IN CASE OF COMPANIES:

Date and place of registration including date of commencement certificate in case of Public Companies (certified copies of Memorandum and articles of Association are also to be furnished). Nature of business carried on by the Company and the provisions of the Memorandum relating thereof.

*1.7. **AUTHORISATION AND ATTESTATION***

Tenders shall be signed by a person duly authorised/empowered to do so. An attested copy of the Power of Attorney, in case the tender is signed by an individual other than the sole proprietor shall be submitted along with the tenders

*1.8. **EARNEST MONEY DEPOSIT***

1.8.1 Every tender must be accompanied by the prescribed amount of Earnest Money Deposit (EMD) in the manner described herein.

The EMD may be accepted only in the following forms:

(i) Electronic Fund Transfer credited in BHEL account (before tender opening)

(ii) Banker's cheque/ Pay order/ Demand draft, in favour of BHEL (along with offer) In case total EMD amount is more than Rs.20 Lakh, the amount in excess of Rs.20 lakh maybe accepted in the form of Bank Guarantee from scheduled bank. The Bank Guarantee in such cases shall be valid for at-least six months.

(iii) Through SBI collect/RTGS (before tender opening)

(iv) No other form of EMD remittance shall be acceptable to BHEL

1.8.2 EMD by the bidder will be forfeited as per Tender Documents if

i) After opening the tender and within the offer validity period, the tenderer revokes his/her tender or makes any modification in his tender which is not acceptable to BHEL.

ii) The Contractor fails to deposit the required Security deposit or commence the work within the period as per LOI/ Contract.

iii) EMD by the tenderer shall be withheld in case any action on the tenderer is envisaged in derailing the tender process by unlawful means.

1.8.3 EMD shall not carry any interest.

1.8.4 In the case of unsuccessful bidders, the Earnest Money will be refunded to them within a reasonable time after acceptance of award by successful tenderer.

1.8.5 EMD of successful tenderer will be converted as part of Security Deposit

*1.9. **SECURITY DEPOSIT***

"Bidder agrees to submit performance security required for execution of the contract within the time period mentioned. In case of delay in submission of performance security, enhanced performance security which would include interest (SB/ rate + 6%) for the delayed period, shall be submitted by the bidder. Further, if performance security is not submitted till such time the first bill becomes due, the amount of performance security due shall be recovered as per terms defined in NIT I contract, from the bills along with due interest "

The total amount of Security Deposit will be 5% of the contract value (including all applicable taxes) EMD of the successful tenderer shall be converted and adjusted towards the required amount of Security Deposit.

1.9.1 Modes of Security deposit:

The balance amount to make up the required Security Deposit of 5% of the contract value may be accepted in the following forms:

i) Cash (as permissible under the extant Income Tax Act) ii) Local cheques of Scheduled Banks (subject to realization)/ Pay Order/ Demand Draft/ Electronic Fund Transfer in favour of BHEL

iii) Bank Guarantee from Scheduled Banks/ Public Financial Institutions as defined in the Companies Act. The Bank Guarantee format should have the approval of BHEL iv) Fixed Deposit Receipt issued by Scheduled Banks/ Public Financial Institutions as defined in the Companies Act (FDR should be in the name of the Contractor, a/c BHEL)

v) Securities available from Indian Post offices such as National Savings Certificates, Kisan Vikas Patras etc. (held in the name of Contractor furnishing the security and duly endorsed/ hypothecated/ pledged, as applicable, in favour of BHEL) (Note: BHEL will not be liable or responsible in any manner for the collection of interest or renewal of the documents or in any other matter connected therewith) vi) 50% of the required Security Deposit, including the EMD, should be paid before start of the work. Balance of the Security Deposit can be collected by deducting10% of the gross amount progressively from each of the running bills of the Contractor till the total amount of the required Security Deposit is collected. If the value of work done at any time exceeds the contract value, the amount of Security Deposit shall be correspondingly enhanced and the additional Security Deposit shall be immediately deposited by the Contractor or recovered from payment/s due to the Contractor. Security Deposit shall be released to the Contractor upon fulfilment of contractual obligations as per terms of the contract.

1.9.2 The Security Deposit shall not carry any interest.

1.9.3 The validity of Bank Guarantees towards Security Deposit shall be initially up to the completion period as stipulated in the Letter of Intent/Award (plus maintenance period if applicable), and 03 months claim period. The same shall be kept valid by proper renewal till the acceptance of Final Bills of the Contractor, by BHEL

1.9.4 BHEL reserves the right of forfeiture of Security Deposit in addition to other claims and penalties in the event of the Contractor's failure to fulfil any of the contractual obligations or in the event of termination of contract as per terms and conditions of contract. BHEL reserves the right to set off the Security Deposit against any claims of other contracts with BHEL.

1.10. ***REFUND OF SECURITY DEPOSIT***

50% of the security deposit may be refunded on completion of the work after payment of the final bill and the balance 50% of the security deposit is refunded only after the expiry of the maintenance period from date of completion of work as stipulated in the contract concerned.

1.10.1 *DEFECTS LIABILITY PERIOD:*

The contractor shall be responsible to make good and remedy at his own expenses within such period as may be stipulated by the Engineer-in-charge, any defect which may develop or may be noticed before the expiry of the maintenance period of six months or as stipulated in NIT hereto from the certified date of completion and intimation of which has been sent to the contractor within seven days of the expiry of the said period by a letter sent by hand delivery or by registered post or Email. If contractor fails to attend to the above, defect will be rectified at contractor's risk & cost and same will be deducted from the security deposit/payable amounts available with BHEL.

1.11. ***BANK GUARANTEES***

Where ever Bank Guarantees are to be furnished/submitted by the contractor, the following shall be complied with

i) Bank Guarantees shall be from Scheduled Banks / Public Financial Institutions as defined in the Companies Act. ii) The Bank Guarantees shall be as per prescribed BHEL formats.

iii) It is the responsibility of the bidder to get the Bank Guarantees revalidated/extended for the required period (subject to a minimum period of six months), as per the advice of BHEL. BHEL shall not be liable for issue of any reminders regarding expiry of the Bank Guarantees.

iv) In case extension/further extensions of any Bank Guarantees are not required, the bidders shall ensure that the same is explicitly endorsed by BHEL

v) In case the Bank Guarantees are not extended before the expiry date, BHEL reserves the right to invoke the same by informing the concerned Bank in writing, without any advance notice/communication to the concerned bidder.

vi) Bidders to note that any corrections to Bank Guarantees shall be done by the issuing Bank, only through an amendment in an appropriate non judicial stamp paper.

vii) The Original Bank Guarantee shall be sent directly by the Bank to BHEL under Registered Post (Acknowledgement Due).

*1.12. **VALIDITY OF OFFER***

The rates in the Tender shall be kept open for acceptance for a minimum period of Ninety (90) DAYS from latest due date of offer submission (including extension, if any). In case BHEL calls for negotiations, such negotiations shall not amount to cancellation or withdrawal of the original offer which shall be binding on the tenderers.

*1.13 **EXECUTION OF CONTRACT AGREEMENT***

The successful tenderer's responsibility under this contract commences from the date of issue of the Letter of Intent by BHEL. The Tenderer shall submit an unqualified acceptance to the Letter of Intent/Award within the period stipulated therein.

The successful tenderer shall be required to execute an agreement in the prescribed form, with BHEL, within fifteen days (15 days) after the acceptance of the Letter of Intent/Award, and in any case before releasing the first running bill. The contract agreement shall be signed by a person duly authorized/empowered by the tenderer. The expenses for preparation of agreement document shall be borne by Tenderer.

*1.14. **REJECTION OF TENDER AND OTHER CONDITIONS***

1.14.1 The acceptance of tender will rest with BHEL which does not bind itself to accept the lowest tender or any tender and reserves to itself full rights for the following without assigning any reasons whatsoever: -

a. To reject any or all of the tenders.

b. To split up the work amongst two or more tenderers as per NIT

c. To award the work in part if specified in NIT

d. In case of either of the contingencies stated in (b) and (c) above, the time for completion as stipulated in the tender shall be applicable.

1.14.2 Conditional tenders, unsolicited tenders, tenders which are incomplete or not in the form specified or defective or have been materially altered or not in accordance with the tender conditions, specifications etc., are liable to be rejected.

1.14.3 Tenders are liable to be rejected in case of unsatisfactory performance of the tenderer with BHEL, or tenderer under suspension (hold/banning /delisted) by any unit / region / division of BHEL or tenderers who do not comply with the latest guidelines of Ministry/Commissions of Govt of India. BHEL reserves the right to reject a bidder in case it is observed that they are overloaded and may not be in a position to execute this job. The decision of BHEL will be final in this regard.

1.14.4 If a tenderer who is a proprietor expires after the submission of his tender or after the acceptance of his tender, BHEL may at their discretion, cancel such tender. If a partner of a firm expires after the submission of tender or after the acceptance of the tender, BHEL may then cancel such tender at their discretion, unless the firm retains its character.

1.14.5 BHEL will not be bound by any Power of Attorney granted by changes in the composition of the firm made subsequent to the execution of the contract. They may, however, recognize such power of Attorney and changes after obtaining proper legal advice, the cost of which will be chargeable to the contractor concerned.

1.14.6 If the tenderer deliberately gives wrong information in his tender, BHEL reserves the right to reject such tender at any stage or to cancel the contract if awarded and forfeit the Earnest Money/Security Deposit/any other money due.

1.14.7 Canvassing in any form in connection with the tenders submitted by the Tenderer shall make his offer liable to rejection.

1.14.8 In case the Proprietor, Partner or Director of the Company/Firm submitting the Tender, has any relative or relation employed in BHEL, the authority inviting the Tender shall be informed, along with the Offer. Failing to do so, BHEL may, at its sole discretion, reject the tender or cancel the contract and forfeit the Earnest Money/Security Deposit.

1.14.9 The successful tenderer should not sub-contract part or complete work detailed in the tender specification undertaken by him without written permission of BHEL's Construction Manager/Site Incharge. The tenderer is solely responsible to BHEL for the work awarded to him.

1.14.10 The Tender submitted by a techno commercially qualified tenderer shall become the property of BHEL who shall be under no obligation to return the same to the bidder. However unopened price bids and late tenders shall be returned to the bidders after finalization of contract.

1.14.11 Unsolicited discount received after the due date and time of Bid Submission shall not be considered for evaluation. However, if the party who has submitted the unsolicited

discount/rebate becomes the L-I party, then the awarded price i.e contract value shall be worked out after considering the discount so offered.

1.14.12 BHEL shall not be liable for any expenses incurred by the bidder in the preparation of the tender irrespective of whether the tender is accepted or not.

1.15 ***BHEL Fraud Prevention Policy:***

The bidder along with its associate/ collaborators/sub-contractors/ Sub-Vendors/ Consultants/service providers shall strictly adhere to BHEL Fraud Prevention Policy displayed on BHEL website http://www.bhel.com and shall immediately bring to the notice of BHEL Management about any fraud or suspected fraud as soon as it comes to their notice. Fraud prevention policy and list of Nodal officers shall be hosted on BHEL website, vendor portals of Units/Regions Internet.

CHAPTER-2

2.1 DEFINITION: The following terms shall have the meaning hereby assigned to them except where the context otherwise requires

i) BHEL shall mean Bharat Heavy Electricals Limited, a company registered under Companies Act 1956, with its Registered Office at BHEL HOUSE, SIRI FORT, NEW DELHI – 110 049, or its Authorised Officers or its Site Engineers or other employees authorised to deal with any matters with which these persons are concerned on its behalf.

ii) "EXECUTIVE DIRECTOR" or 'GROUP GENERAL MANAGER' or "GENERAL MANAGER (Incharge)" or "GENERAL MANAGER" shall mean the Officer in SOLAR BUSINESS DIVISION, Prof. CNR Rao Circle, IISc Post, Malleshwaram, BENGALURU - 560012

iii) "COMPETENT AUTHORITY" shall mean Executive Director or Group General Manager or General Manager (In-charge) or General Manager or BHEL Officers who are empowered to act on behalf of the Executive Director or General Manager (In-charge) or General Manager of BHEL.

iv) "ENGINEER" or "ENGINEER IN CHARGE" shall mean an Officer of BHEL as may be duly appointed and authorized by BHEL to act as "Engineer" on his behalf for the purpose of the Contract, to perform the duty set forth in this General Conditions of Contract and other Contract documents. The term also includes 'CONSTRUCTION MANAGER' or 'SITE

INCHARGE' as well as Officers

v) *"SITE" shall mean the places or place at which the plants/equipment are to be erected and services are to be performed as per the specification of this Tender.*

vi) *"CLIENT OF BHEL" or "CUSTOMER" shall mean the project authorities with whom BHEL has entered into a contract for supply of equipment or provision of services.*

vii) *"CONTRACTOR" shall mean the successful Bidder/Tenderer who is awarded the Contract and shall include the Contractor's successors, heirs, executors, administrators and permitted assigns.*

viii) *"CONTRACT" or "CONTRACT DOCUMENT" shall mean and include the Work Order, Contract Agreement, the accepted appendices of Rates, Schedules, Quantities if any, General Conditions of Contract, Special Conditions of Contract, Instructions to the Tenderers, Drawings, Technical Specifications, the Special Specifications if any, the Tender documents, subsequent amendments mutually agreed upon and the Letter of Intent/Acceptance issued by BHEL. Any conditions or terms stipulated by the contractor in the tender documents or subsequent letters shall not form part of the contract unless, specifically accepted in writing by BHEL in the Letter of Intent/Award and incorporated in the agreement.*

ix) *"GENERAL CONDITIONS OF CONTRACT" shall mean the 'Instructions to Tenderers' and 'General Conditions of Contract' pertaining to the work for which above tenders have been called for.*

x) *"TENDER SPECIFICATION" or "TENDER" or "TENDER DOCUMENTS" shall mean General Conditions, Common Conditions, Special Conditions, Price Bid, Rate Schedule, Technical Specifications, Appendices, Annexures, Corrigendum's, Amendments, Forms, procedures, Site information, etc and drawings/documents pertaining to the work for which the tenderers are required to submit their offers. Individual specification number will be assigned to each Tender Specification.*

xi) *"LETTER OF INTENT" shall mean the intimation by a Post/Fax/email to the tenderer that the tender has been accepted in accordance with provisions contained in the letter. The responsibility of the contractor commences from the date of issue of this letter and all terms and conditions of the contract are applicable from this date.*

xii) *"COMPLETION TIME" shall mean the period by 'date/month' specified in the 'Letter of Intent/Award' or date mutually agreed upon for handing over of the intended scope of work, the erected equipment/plant which are found acceptable by the Engineer, being of required standard and conforming to the specifications of the Contract.*

xiii) *"PLANT" shall mean and connote the entire assembly of the plant and equipment's covered by the contract.*

xiv) "EQUIPMENT" shall mean equipment, machineries, materials, structural, electrical and other components of the plant covered by the contract.

xv) "TESTS" shall mean and include such test or tests to be carried out on the part of the contractor as are prescribed in the contract or considered necessary by BHEL, in order to ascertain the quality, workmanship, performance and efficiency of the contractor or part thereof.

xvi) "APPROVED", "DIRECTED" or "INSTRUCTED" shall mean approved, directed or instructed by BHEL.

xvii) "WORK or CONTRACT WORK" shall mean and include supply of all categories of labour, specified consumables, tools and tackles and Plants required for complete and satisfactory site transportation, handling, stacking, storing, erecting, testing and commissioning of the equipment's to the entire satisfaction of BHEL.

xviii) "SINGULAR AND PLURALS ETC" words carrying singular number shall also include plural and vice versa, where the context so requires. Words imparting the masculine Gender shall be taken to include the feminine Gender and words imparting persons shall include any Company or Associations or Body of Individuals, whether incorporated or not.

xix) "HEADING" – The heading in these General Conditions are solely for the purpose of facilitating reference and shall not be deemed to be part thereof or be taken as instructions thereof or of the contract.

xx) "MONTH" shall mean calendar month unless otherwise specified in the Tender.

xxi) Day' or 'Days' unless herein otherwise expressly defined shall mean calendar day or days of twenty-four (24) hours each. A week shall mean continuous period of seven (7) days.

xxii) "COMMISSIONING" shall mean the synchronization testing and achieving functional operation of the Equipment with associated system after all initial adjustments, trials, cleaning, re-assembly required at site if any, have been completed and Equipment with associated system is ready for taking into service.

xxiii) "WRITING" shall include any manuscript type written or hand written or printed statement or electronically transmitted messages, under the signature or seal or transmittal of BHEL.

xxiv) "TEMPORARY WORK" shall mean all temporary works for every kind required in or for the execution, completion, maintenance of the work.

xxv) 'CONTRACT PRICE' or 'CONTRACT VALUE' shall mean the sum including applicable taxes mentioned in the LOI/LOA/Contract Agreement subject to such additions thereto or deductions there from as may be made under provisions hereinafter contained

xxvi) "COMMENCEMENT DATE" or "START DATE" shall mean the commencement/start of work at Site as per terms defined in the Tender

xxvii) "SHORT CLOSING" or "FORE CLOSING" of Contract shall mean the premature closing of Contract, for reasons not attributable to the contractor and mutually agreed between BHEL and the contractor

xxviii) "TERMINATION" of Contract shall mean the pre mature closing of contract due to reasons as mentioned in the contract

*2.2 **LAW GOVERNING THE CONTRACT AND COURT JURISDICTION***

The contract shall be governed by the Law for the time being in force in the Republic of India. The Civil Court having original Civil Jurisdiction at Bengaluru, shall alone have exclusive jurisdiction in regard to all claims in respect of the Contract. No other Civil Court shall have jurisdiction in case of any dispute, under this contract

*2.3 **ISSUE OF NOTICE***

2.3.1 Service of notice on contractor: Any notice to be given to the Contractor under the terms of the contract shall be served by sending the same by Registered Post / Speed Post/ FAX / Email to or leaving the same at the Contractor's last known address of the principal place of business (or in the event of the contractor being a company, to or at its Registered Office). In case of change of address, the notice shall be served at changed address as notified in writing by the Contractor to BHEL. Such posting or leaving of the notice shall be deemed to be good service of such notice and the time mentioned to the condition for doing any act after notice shall be reckoned from the date so mentioned in such notice.

2.3.2 Service of notice on BHEL Any notice to be given to BHEL in-charge under the terms of the Contract shall be served by sending the same by post or Email or leaving the same at BHEL address or changed address as notified in writing by BHEL to the Contractor.

2.4 USE OF LAND

No land belonging to BHEL or their Customer under temporary possession of BHEL shall be occupied by the contractor without written permission of BHEL.

2.4.1 STORES AND MATERIALS:

The contractor shall, at his own expense, supply all stores and materials required for the contract, other than those which may be provided by BHEL at the rates detailed therein subject to their availability at the place of issue indicated therein. All stores and materials to be supplied by the Contractor shall be of the best kind as described in the Specifications and the Contractor shall, if required by the Engineer –in- charge furnish him with proof to his satisfaction that the store and materials so comply with the specifications.

The contractor shall, at his own expense and without delay, supply samples of stores and materials proposed to be used in the execution of the work for the approval of the Engineer-in charge, who may reject all stores and materials not corresponding either in quality or character to the approved samples.

In the case of stores provided by BHEL, the Contractor shall bear the cost of loading, transporting to site, unloading, storing under cover as required, assembling & jointing the several parts together as necessary and incorporating & fixing these stores & materials in the work, including all preparatory work of whatever description that may be required, and closing, preparing, loading and returning empty cases or containers to the place of issue without any extra charges.
Contractor is responsible for safe & secure storage of above material.

2.4.2 PATENT RIGHTS:

The contractor shall fully indemnify BHEL, or the agent, servant, or employee of BHEL, against any action, claim or proceeding relating to infringement or the use of any patent or design or any alleged patent or design rights, and shall pay any royalties which may be payable in respect of any article/ or part thereof included in the contract.

In the event of any claims being made or action brought against BHEL, or any agent, or servant or employee of BHEL., in respect of any of the matters aforesaid, the contractor shall not apply when such increment has taken place in complying with the specific directions issued by the BHEL but the contractor shall pay any royalties payable in respect of any such use.

2.4.3 WATER:

The contractor shall allow in his tender and provide at his cost all water required for the work or his employees on the work, together with all pipes and fittings or other means that may be necessary or required to ensure a proper and ample supply of water for all purpose connected with the work.

In the event of a provision existing in the Tender documents for supply of water on payment by BHEL, water will be supplied from the BHEL supply System, or other sources at any points fixed by the Site Engineer/ Engineer-in-charge on the site of work. The contractor shall make necessary arrangement for lifting, pumping, carrying or conveying the water as required at his own cost. The levy of water charges to be borne by the Contractor in such case shall be specifically mentioned in the Tender documents.

2.4.4 TEMPORARY WORKSHOPS, STORES ETC:

The Contractor shall, during the progress of the work provide, erect and maintain at his own expense all necessary temporary workshops, store, offices, toilets etc., required for the proper and efficient execution of the work. The planning, siting and erection of these building shall have the approval of the Engineer-in-charge and the Contractor shall at all times keep them in a clean and sanitized condition to the entire satisfaction of the Engineer-in-charge.

On completion of the work all such temporary buildings shall be cleared and the site restored to its original state in a clean and tidy condition to the entire satisfaction of the Engineer-incharge.

2.5 COMMENCEMENT OF WORK

2.5.1 Time is essence of contract and is specified in the tender document or in each individual work order.

2.5.2 The contractor shall commence the work within seven (07) days from LOI/work order or as intimated by BHEL and shall proceed with the same with due expedition without delay.

2.5.3 If the contractor fails to start the work within stipulated time as per LOI or as intimated by BHEL, then BHEL at its sole discretion will have the right to cancel the contract. The Earnest Money and/or Security Deposit with BHEL will stand forfeited without any further reference to him without prejudice to any and all of BHEL's other rights and remedies in this regard.

2.5.4 All the work shall be carried out under the direction and to the satisfaction of BHEL.

2.6 MEASUREMENT OF WORK AND MODE OF PAYMENT:

2.6.1 All payments due to the contractors shall be made by electronic mode only, unless otherwise found operationally difficult.

2.6.2 For progress running bill payments: - The Contractor shall present detailed measurement sheets in triplicate, duly indicating all relevant details based on technical documents and connected drawings for work done during the month/period under various categories in line with terms of payment as per contract. The basis of arriving at the quantities, weights shall be relevant documents and drawings released by BHEL. These measurement sheets shall be prepared jointly with BHEL Engineers and signed by both the parties.

2.6.3 These measurement sheets will be checked by BHEL Engineer and quantities and percentage eligible for payment under various groups shall be decided by BHEL Engineer.

The abstract of quantities and percentage so arrived at based on the terms of payment shall be entered in Measurement Book and signed by both the parties.

2.6.4 Based on the above quantities, contractor shall prepare the bills in prescribed format and work out the financial value. These will be entered in Measurement Book and signed by both the parties. Payment shall be made by BHEL after effecting the recoveries due from the contractor.

2.6.5 All recoveries due from the contractor for the month/period shall be effected in full from the corresponding running bills unless specific approval from the competent authorities is obtained to the contrary.

2.6.6 Measurement shall be restricted to that portion of work for which it is required to ascertain the financial liability of BHEL under this contract.

2.6.7 The measurement shall be taken jointly by persons duly authorized on the part of BHEL and by the Contractor.

2.6.8 The Contractor shall bear the expenditure involved if any, in making the measurements and testing of materials to be used/used in the work. The contractor shall, without extra charges, provide all the assistance with appliances and other things necessary for measurement.

2.6.9 If at any time due to any reason whatsoever, it becomes necessary to re-measure the work done in full or in part, the expenses towards such re measurements shall be borne by the contractor unless such re measurements are warranted solely for reasons not attributable to contractor.

2.6.10 Passing of bills covered by such measurements does not amount to acceptance of the completion of the work measured. Any left out work has to be completed, if pointed out at a later date by BHEL.

2.6.11 Final measurement bill shall be prepared in the final bill format prescribed for the purpose based on the certificate issued by BHEL Engineer that entire works as stipulated in tender specification has been completed in all respects to the entire satisfaction of BHEL. Contractor shall give unqualified "No Claim" Certificate. All the tools and tackles loaned to him should be returned in satisfactory condition to BHEL. The abstract of final quantities and financial values shall also be entered in the Measurement Books and signed by both parties to the contract. The Final Bill shall be prepared and paid within a reasonable time after completion of work.

2.7 ***RIGHTS OF BHEL***

BHEL reserves the following rights in respect of this contract during the original contract period or its extensions if any, as per the provisions of the contract, without entitling the contractor for any compensation.

2.7.1 To withdraw any portion of work and/or to restrict/alter quantum of work as indicated in the contract during the progress of work and get it done through other agencies to suit BHEL's commitment to its customer or in case BHEL decides to advance the date of completion due to other emergent reasons/ BHEL's obligation to its customer.

2.7.2 To terminate the contract or get any part of the work done through other agency or deploy BHEL's own/hired/otherwise arranged resources, at the risk and cost of the contractor after due notice of a period of two weeks by BHEL, in the event of: -

i) Contractor's continued poor progress

ii) Withdrawal from or abandonment of the work before completion of the work iii)

Contractor's inability to progress the work for completion as stipulated in the contract

iv) Poor quality of work

v) Corrupt act of Contractor

vi) Insolvency of the Contractor

vii) Persistent disregard to the instructions of BHEL

viii) Assignment, transfer, sub-letting of contract without BHEL's written permission

ix) Non fulfilment of any contractual obligations / non-compliance of statutory requirements

x) In the opinion of BHEL, the contractor is overloaded and is not in a position to execute

the job as per required schedule

2.7.3 To meet the expenses including BHEL overheads of 35% & Liquidated damage/penalties arising out of "Risk & Cost" as explained above under Sl.No. 2.7.2. BHEL shall recover the amount from any money due from Contractor, from any money due to the Contractor including Security Deposit or by forfeiting any T&P or material of the contractor under this contract or any other contract of BHEL or by any other means or any combination thereof

2.7.4 To terminate the contract or to restrict the quantum of work and pay for the portion of work executed in case BHEL's contract with their customer are terminated for any reason, as per mutual agreement.

2.7.5 To effect recovery from any amounts due to the contractor under this or any other contract or in any other form, the moneys BHEL is statutorily forced to pay to anybody, due to contractor's failure to fulfil any of his obligations. BHEL shall levy overheads of 35% on all such payments.

2.7.6 While every endeavour will be made by BHEL to this end, they cannot guarantee uninterrupted work due to conditions beyond their control. The Contractor will not be normally entitled for any compensation/extra payment on this account unless otherwise specified elsewhere in the contract.

2.7.7 In case the execution of works comes to a complete halt or reaches a stage wherein worthwhile works cannot be executed and there is no possibility of commencement of work for a period of not less than two months, due to reasons not attributable to the contractor and other than Force Majeure conditions, BHEL may consider permitting the contractor to de mobilize forthwith and re mobilize at an agreed future date. Cost of such demobilization/remobilization shall be mutually agreed. ORC (Over run Charges) in such cases shall not be applicable for the period between the period of demobilization and re mobilisation. The duration of contract/time extension shall accordingly get modified suitably. In case of any conflict, BHEL decision in this regard shall be final and binding on the contractor.

2.7.8 In the unforeseen event of inordinate delay in receipt of materials, drawings, fronts, etc, due to which inordinate discontinuity of work is anticipated, BHEL at its discretion may consider contractor's request to short close the contract, provided that the balance works are minor vis a vis the scope of work envisaged as per the contract. At the point of requesting for short closure, contractor shall establish that he has completed all works possible of completion and he is not able to proceed with the balance works due to constraints beyond his control. In such a case, the estimated value of the unexecuted portion of work as mutually agreed, shall however be reduced from the final contract value.

2.7.9 ***LIQUIDATED DAMAGES/PENALTY***

COMPENSATION FOR DELAY:

If the contractor fails to maintain the required progress in terms of condition 2.10 or to complete the work and clear the site on or before the contracted or extended the period of completion, he shall, without prejudice to any other right or remedy of the BHEL on account of such breach, pay as agreed compensation an amount calculated as stipulated below

For unfinished anticipated value of work where finished portion is fit for use

Rate of compensation as follows:

- *Completion period (as originally stipulated) not exceeding 6 months. ……@ 1 percent per week*
- *Completion period (as originally stipulated) Exceeding 6 months and not exceeding 2 years…@ 0.5 percent per week*
- *Completion period (as originally stipulated) exceeding 2 years…….. @ 0.25 percent per week*

Provided always that the total amount of compensation for delay to be paid under condition shall not exceed the under noted percentage of the anticipated contract value

- *Completion period (as originally stipulated) not exceeding 6 months. ……..@ 10 percent of anticipated value of work*
- *Completion period (as originally stipulated) Exceeding 6 months and not exceeding 2 years…@ 7.5 percent of anticipated value of work*
- *Completion period (as originally stipulated) Exceeding 2 years……..@ 5 percent of anticipated value of work*

The amount of compensation may be adjusted or set off against any sum payable to the Contractor under this or any other contract with the BHEL.

2.7.10 ***POST TECHNICAL AUDIT OF WORK AND BILLS****: BHEL reserve the right to carry out a post-payment audit and technical examination of the work and final bill including all supporting vouchers, abstract etc., and to enforce recovery of any sums becoming due as a result thereof in the manner provided in the proceeding sub-paragraph's provided however that no such recovery shall be enforced after three years of passing the final bill*

2.8 ***RESPONSIBILITIES OF THE CONTRACTOR IN RESPECT OF LOCAL LAWS, EMPLOYMENT OF WORKERS ETC****.*

The following are the responsibilities of the contractor in respect of observance of local laws, employment of personnel, payment of taxes etc. The subcontractor shall fully indemnify BHEL against any claims of whatsoever nature arising due to the failure of the contractor in discharging any of his responsibilities hereunder:

2.8.1 The contractor at all times during the continuance of this contract shall, in all his dealings with local labour for the time being employed on or in connection with the work, have due regard to all local festivals and religious and other customs.

2.8.2 The contractor shall comply with all applicable State and Central Laws, Statutory Rules, Maternity act, Regulations etc. such as contract labour(R&A) Act 1970, Minimum wage Act 19748, Payment of wages Act 1936,ESI Act 1948, EPF Act 1952, Employees' compensation Act 1923, Provision of Companies Act 1948 & rules thereof, The interstate Migrant Workmen 1979, The Karnataka Factories Rules 1969, Payment of Bonus Act 1965, Payment of Gratuity Act 1972. Child labour Prohibition act 1986, Karnataka Minimum Wage Act , Prevention of sexual harassment at work place Act 2013, Guidelines/notification related to Safai Karamchari Act , Equal Remuneration Act 1976, The company's instructions as

issued from time to time in regard to working hours, wages, leaves, holidays etc. for labour as may be enacted by the Government during the tenure of the Contract and having force or jurisdiction at Site. The Contractor shall also give to the local Governing Body, Police and other relevant Authorities all such notices as may be required by the Law.

The contractor shall produce the following registers and forms:

- *Form XIII- Register of work men employed by contractor(Rule 75)*
- *Form XIV- Employment Card issued by contractor(Rule 76)*
- *Form XVI- Muster Roll (Rule 78(1) (a)(i))*
- *Form XVII- Register of Wages (Rule 78(1) (a)(i))*
- *Form XVIII- Register of wages cum Muster Roll(in case of weekly payment)*
- *Form XIX- Wage slip (Rule 78(b))*
- *Form XX- Register of deduction for damages Or Loss Rule 78(1) (a)(ii))*
- *Form XXI- Register of files Rule 78(1) (a)(ii))*
- *Form XXII- Register of Advance Rule 78(1) (a)(ii))* x *Form XXIII- Register of Overtime Rule 78(1) (a)(iii))*
- *Form XXIV- Return to be sent by the contractor to the Licensing officer (Rule 82(1))*

2.8.3 The contractor shall obtain independent License under the Contract Labour (Regulations and Abolition Act) as required from the concerned Authorities based on the certificate (Form-
V) issued by the Principal Employer/Customer

2.8.4 The contractor shall pay all taxes, fees, license charges, deposits, duties, tolls, royalties, commission or other charges which may be levied on account of his operations in executing the contract.

2.8.5 While BHEL would pay the inspection fees and Registration fees of Boiler & explosive/Electrical Inspectorate, all other arrangements for site visits periodically by the Inspectorate to site, Inspection certificate etc. will have to be made by contractor. However, BHEL will not make any payment to the Inspectorate in connection with contractor's Welders/Electricians qualification tests etc.

2.8.6 Contractor shall be responsible for provision of Health and Sanitary arrangements (more particularly described in Contract Labour Regulation & Abolition Act), Safety precautions etc. as may be required for safe and satisfactory execution of contract.

2.8.7 The contractor shall be responsible for proper accommodation including adequate medical facilities for personnel employed by him.

2.8.8 The contractor shall be responsible for the proper behavior and observance of all regulations by the staff employed by him.

2.8.9 The contractor shall ensure that no damage is caused to any person/property of other parties working at site. If any such damage is caused, it is responsibility of the contractor to make good the losses or compensate for the same.

2.8.10 All the properties/equipment/components of BHEL/their Client loaned with or without deposit to the contractor in connection with the contract shall remain properties of BHEL/their Client.

2.8.11 The contractor shall use such properties for the purpose of execution of this contract. All such properties/equipment/components shall be deemed to be in good condition when received by the contractor unless he notifies within 48 hours to the contrary. The contractor shall return them in good condition as and when required by BHEL/their Client. In case of non-return, loss, damage, repairs etc, the cost thereof as may be fixed by BHEL Engineer will be recovered from the contractor

2.8.12 Any delay in completion of works/or non-achievement of periodical targets due to the reasons attributable to the contractor, the same may have to be compensated by the contractor either by increasing manpower and resources or by working extra hours and/or by working more than one shift. All these are to be carried out by the contractor at no extra cost.

2.8.13 The contractor shall arrange, coordinate his work in such a manner as to cause no hindrance to other agencies working in the same premises.

2.8.14 All safety rules and codes applied by the Client/BHEL at site shall be observed by the contractor without exception. The contractor shall be responsible for the safety of the equipment/material and works to be performed by him and shall maintain all light, fencing guards, slings etc. or other protection necessary for the purpose. Contractor shall also take such additional precautions as may be indicated from time to time by the Engineer with a view to prevent pilferage, accidents, fire hazards. Due precautions shall be taken against fire hazards and atmospheric conditions. Suitable number of Clerical staff, watch and ward, store keepers to take care of equipment/materials and construction tools and tackles shall be posted at site by the contractor till the completion of work under this contract. The contractor shall arrange for such safety devices as are necessary for such type of work and carry out the requisite site tests of handling equipment, lifting tools, tackles etc. as per prescribed standards and practices. Contractor has to ensure the implementation of Health, Safety and Environment (HSE) requirements as per directions given by BHEL/Customer. The contractor has to assist in HSE audit by BHEL/Customer and submit compliance Report. The contractor has to generate and submit record/reports as per HSE plan/activities as per instruction of BHEL/Customer. All tools, plant and equipment brought to the site shall become the property of BHEL and shall not be removed from the site without the prior written approval from BHEL. When the work is finally completed or the Contractor is determined for reasons other than the defaults of the contract, he shall forthwith remove from the site all tools, plants, equipment etc., (other than those as may have been provided by BHEL) and upon such removal, the same shall revert in, and become the property of the contractor.

2.8.15 The contractor will be directly responsible for payment of wages to his workmen on specified date of respective month declared as per applicable Labour Act. A pay roll sheet giving all the payments given to the workers and duly signed by the contractor's representative should be furnished to BHEL site for record purpose.

2.8.16 In case of any class of work for which there is no such specification as laid down in the contract, such work shall be carried out in accordance with the instructions and requirements of the Engineer.

2.8.17 Also, no idle charges will be admissible in the event of any stoppage caused in the work resulting in contractor's labour and Tools & Plants being rendered idle due to any reason at any time.

2.8.18 The contractor shall take all reasonable care to protect the materials and work till such time the plant/equipment has been taken over by BHEL or their Client whichever is earlier.

2.8.19 The contractor shall not stop the work or abandon the site for whatsoever reason of dispute, excepting force majeure conditions. All such problems/disputes shall be separately discussed and settled without affecting the progress of work. Such stoppage or abandonment shall be treated as breach of contract and dealt with accordingly

2.8.20 The contractor shall keep the area of work clean and shall remove the debris etc. while executing day-to-day work. Upon completion of work, the contractor shall remove from the vicinity of work, all scrap, packing materials, rubbish, unused and other materials and deposit them in places specified by the Engineer. The contractor will also demolish all the hutments, sheds, offices, etc. constructed and used by him and shall clean the debris. In the event of his failure to do so, the same will be arranged to be done by the Engineer and the expenses recovered from the contractor. If the work is executed in Factory premises, no hutment will be allowed.

2.8.21 The contractor shall execute the work in the most substantial and workman like manner in the stipulated time. Accuracy of work and timely execution shall be the essence of this contract. The contractor shall be responsible to ensure that the quality, assembly and workmanship conform to the dimensions and clearance given in the drawings and/ or as per the instructions of the Engineer.

2.8.22 The Contractor to note that some of BHEL's T&Ps/MMDs may not be insured. The Contractor will take necessary precautions and due care to protect the same while in his custody from any damage/ loss till the same is handed over back to BHEL. In case the damage / loss is due to carelessness/ negligence on the part of the contractor, the Contractor is liable to get them repair/ replaced immediately and in case of his failure to do so within a reasonable time, BHEL will reserve the right to recover the loss from the contractor.

2.8.23 The contractor shall provide all watchmen necessary, for the protection of the site, the work, the materials, the tools, plant, equipment and anything else lying on the site during the progress of the work. He shall solely be responsible for and shall take all reasonable and proper steps for protecting, securing, lighting and watching all places on or about the work and the site which may be dangerous to any person whom so ever.

2.8.24 SITE DRAINAGE: All water that may accumulate on the site during the process of the work, or in trenches and excavations shall be removed to the entire satisfaction of the Engineering-charge and at Contractors expense.

2.8.25 INSPECTION OF THE WORK: BHEL Officers concerned with the Contract shall have power at any time to inspect and examine any part of the work and the contractor shall give such facilities as may be required to given for such inspection and examination.

2.8.26 In case the contractor is required to undertake any work outside the scope of this contract, the rates payable shall be those mutually agreed upon if the item rates are not mentioned in existing contract

i. *For any item of wok required to be carried out after the contract has been awarded and which is not covered by Contractors Schedule but is covered by C.P.W.D. schedule of rates the rate payable for such a fresh item will be derived from updated C.P.W.D. schedule of rates by the method of proportion as follows:*

ii. *Rate as per estimated updated C.P.W.D DSR and loading tender excess (plus or minus) on pro–rata basis for nearest analogous items. For other items rate as per estimated C.P.W.D DSR and loading tender excess(plus or minus) iii.If rates are not available in C.P.W.D. DSR, deviated item rates will be derived from market rate with 15% profit and overheads.*

2.9 ***PROGRESS MONITORING, MONTHLY/ WEEKLY REVIEW AND PERFORMANCE EVALUATION***

2.9.1 A detailed plan/programme for completion of the contractual scope of work as per the time schedule given in the contract shall be jointly agreed between BHEL and Contractor, before commencement of work. The above programme shall be supported by month/ week wise deployment of resources viz Manpower, T&P, Consumables, etc. Progress will be reviewed periodically (Daily/Weekly/Monthly) vis a vis this jointly agreed programme. The Contractor shall submit periodical progress reports (Daily/Weekly/Monthly) and other reports/information including manpower, consumables, T&P mobilization etc as desired by BHEL.

2.9.2 Monthly/ weekly progress review between BHEL and Contractor shall be based on the agreed programme as above, availability of inputs/fronts etc, and constraints if any, as per prescribed formats. Manpower, T&P and consumable reports as per prescribed formats shall

be submitted by contractor every month. Release of RA Bills shall be contingent upon certification by BHEL Site Engineer of the availability of the above prescribed formats duly filled in and signed.

2.9.3 The burden of proof that the causes leading to any shortfall is not due to any reasons attributable to the contractor is on the contractor himself. The monthly progress review shall record shortfalls attributable to (i) Contractor, (ii) Force Majeure Conditions, and (iii) BHEL

2.10 ***TIME OF COMPLETION***

2.10.1 Time is essence of the contract. The time schedule shall be as prescribed in the Contract. The time for completion shall be reckoned from the date of commencement of work at Site as certified by BHEL Engineers

2.10.2 The entire work shall be completed by the contractor within the time schedule or within such extended periods of time as may be allowed by BHEL under clause 2.11

2.11 ***EXTENSION OF TIME FOR COMPLETION***

2.11.1 If the completion of work as detailed in the scope of work gets delayed beyond the contract period, the contractor shall request for an extension of the contract and BHEL at its discretion may extend the Contract.

2.11.2 Based on the monthly reviews jointly signed, the works balance at the end of original contract period less the backlog attributable to the contractor shall be quantified, and the number of months of 'Time extension' required for completion of the same shall be jointly worked out. Within this period of 'Time extension', the contractor is bound to complete the portion of backlog attributable to the contractor. Any further 'Time extension' or 'Time extensions' at the end of the previous extension shall be worked out similarly.

2.11.3 However if any 'Time extension' is granted to the contractor to facilitate continuation of work and completion of contract, due to backlog attributable to the contractor alone, then it shall be without prejudice to the rights of BHEL to impose penalty/LD for the delays attributable to the contractor, in addition to any other actions BHEL may wish to take at the risk and cost of contractor.

2.11.4 A joint programme shall be drawn for the balance amount of work to be completed during the period of 'Time Extension', along with matching resources (with weightages) to be deployed by the contractor as per specified format. Review of the programme and record of shortfall shall be done every month of the 'Time extension' period in the same manner as is done for the regular contract period.

2.11.5 During the period of 'Time extension', contractor shall maintain their resources as per mutually agreed program

2.11.6 At the end of total work completion as certified by BHEL Engineer, and upon analysis of the total delay, the portion of time extensions attributable to (i) Contractor, (ii) Force majeure conditions, and (iii) BHEL, shall be worked out and shall be considered to be exhausted in the same order. The total period of time extensions shall be the sum of (i), (ii) and (iii) above and shall be equal to period between the scheduled date of completion and the actual date of completion of contract. LD shall be imposed/levied for the portion of time extensions attributable to contractor and recoverable from the dues payable to the contractor.

*2.12 **OVERRUN COMPENSATION (THIS CLAUSE IS NOT APPLICABLE IN BHEL FACTORY & TOWNSHIP PREMISES)***

2.12.1 Over Run Compensation (ORC) is payable by way of rate revisions for periods beyond original, contract period subject to the following terms and conditions.

2.12.2 Rates shall be increased by 10% for the first twelve months of one or more extensions beyond original contract period. For the next twelve months of further extensions if any, rates shall be increased as above by 10% over the previous twelve months, and similarly for each subsequent twelve months extension.

2.12.3 Should there be any 'Time extension' for reasons attributable only to the contractor, then the work shall be executed by the contractor at the rates applicable for the period the work was planned

2.12.4 Payment of ORC shall be regulated as follows:

i) Contractor is entitled to Over Run Compensation (ORC) only for the portion of backlog attributable to BHEL.

ii) 50% of the compensation is allocated for deployment of resources agreed as per the joint programme drawn vide 2.11.4. Payment shall however be based on the actual deployment of resources for the month as certified by BHEL, as per weightages assigned therein

iii) 50% of the compensation, is allocated for achieving of planned progress agreed as per the joint programme drawn vide 2.11.4. Payment shall be on pro rata basis for actual achieved quantities

iv) Total Over Run Compensation shall be limited to 10% of the executed contract value as certified in Final Bill. For this purpose, executed contract value excludes PVC, ORC, Supplementary/Additional Items and Extra Works done on Man-day rate basis

2.12.5 Contractor shall not be entitled for any Over Run Compensation (ORC) for the portion of backlog attributable to the contractor. Such works shall be executed at the rates applicable for the period the work was planned

2.13 ***QUANTITY VARIATION***

2.13.1 The quoted rates shall remain firm irrespective of any variations in the individual quantities*.*

2.14 ***EXTRA WORKS***

2.14.1 All rectifications/modifications, revamping, and reworks required for any reasons not attributable to the contractor, or needed due to any change in deviation from drawings and design of equipment, operation/maintenance requirements, mismatching, or due to damages in transit, storage and erection/commissioning, and other allied works which are not very specifically indicated in the drawings, but are found essential for satisfactory completion of the work, will be considered as extra works.

2.14.2 Extra works arising on account of the contractor's fault, irrespective of time consumed in rectification of the damage/loss, will have to be carried out by the contractor free of cost. Under such circumstances, any material and consumable required for this purpose will also have to be arranged by the contractor at his cost.

2.14.3 All the extra work should be carried out by a separately identifiable gang, without affecting routine activities. Daily log sheets in the pro-forma prescribed by BHEL should be maintained and shall be signed by the contractor's representative and BHEL engineer. No claim for extra work will be considered/entertained in the absence of the said supporting documents i.e. daily log sheets. Signing of log sheets by BHEL engineer does not necessarily mean the acceptance of such works as extra works.

2.14.4 BHEL retains the right to award or not to award any of the major repair/ rework/modification/rectification/fabrication works to the contractor, at their discretion without assigning any reason for the same

2.14.5 After eligibility of extra works is established and finally accepted by BHEL engineer/designer, payment will be released on competent authority's approval at the following rate.

MAN-HOUR RATE FOR ELIGIBLE EXTRA WORKS: Single composite average labour manhour rate, including overtime if any, supervision, use of tools and tackles and other site expenses and incidentals, consumables for carrying out any major rework/ repairs/ rectification/ modification/ fabrication as certified by site as may arise during the course of erection, testing, commissioning or extra works arising out of transit, storage and erection damages, payment , if found due will be as per applicable minimum wage act

2.14.6 The above composite labour man hour rate towards extra works shall remain firm and not subject to any variation during execution of the work. PVC will not be applicable for extra works. Rate revision, Over Run Charges/compensation etc will not be applicable due to extra works.

2.14.7 Extra Works for Civil Packages shall be regulated as follows

i) Rates for Extra Works arising due to (1) non availability of BOQ (Rate Schedule), OR (2) change in Specifications of materials/works (3) rectification/modification/dismantling & re-erecting etc due to no fault of Contractor, shall be in the order of the following:

a) Item rates are to be derived from similar nature of items in the BOQ (Rate Schedule) with applicable escalation derived from All India Consumer Price Index for Whole Sale Commodities.

b) As per applicable updated CPWD-DSR (or latest edition) with applicable escalation derived, Notification issued by the office of CPWD for 'Cost Index' in that Region where the project is being executed,

c) Item rates are to be worked out on the basis of prevailing market rates mutually agreed between BHEL and Contractor, plus 15% towards Contractor's overheads and profit.

ii) PVC and ORC will not applicable be for (i) above.

2.15 ***SUPPLEMENTARY ITEMS***

2.15.1 For NON Civil Works

Supplementary items are items/works required for completion of entire work but not specified in the scope of work. Subject to certification of such items/works as supplementary items by BHEL Engineer, rates shall be derived on the basis of any one of the following on mutual agreement:

i) Based on percentage breakup/rates indicated for similar/nearby items

ii) In case (i) above does not exist, then BHEL/site may derive the percentage breakup/rates to suit the type of work

2.15.2 For Civil Works

i) Rates for Supplementary Works/Additional Works arising out due to additions/alterations in the original scope of works as per contract subject to certification of BHEL Engineer shall be worked out as under:

a) Item rates which are available in existing BOQ (Rate Schedule) shall be operated with applicable escalation derived from All India Consumer Price Index for Whole Sale Commodities

b) Items of works which are not available in existing BOQ shall be operated as an 'Extra Works' and rate shall be derived as per clause no 2.14

ii) Execution of Supplementary Works/Additional Works through the Contractor shall be at the sole discretion of BHEL, and shall be considered as part of executed contract value for the purpose of Quantity Variation as per clause 2.13

iii) BHEL Engineer's decision regarding fixing the rate as above is final and binding on the contractor. iv) PVC and ORC will not be applicable for (i) above.

2.16 ***STRIKES & LOCKOUT***

2.16.1 The contractor will be fully responsible for all disputes and other issues connected with his labour/employee. In the event of the contractor's labour/employee resorting to strike or the Contractor resorting to lockout and if the strike or lockout declared is not settled within a period of 15 days, BHEL shall have the right to get the work executed through any other agencies and the cost so incurred by BHEL along with Overhead charges of 35% shall be deducted from the Contractor's bills along with overhead of 35%

2.16.2 For all purposes whatsoever, the employees of the contractor shall not be deemed to be in the employment of BHEL

2.17 FORCE MAJEURE

The following shall amount to Force Majeure: -

2.17.1 Acts of God, act of any Government, War, Sabotage, Riots, Strike, Civil commotion, Police action, Revolution, Flood, Fire, Cyclones, Earth quake and Epidemic and other similar causes over which the contractor has no control.

2.17.2 If the contractor suffers delay in the due execution of the contractual obligation due to delays caused by force majeure as defined above, the agreed time of completion of the job covered by this contract or the obligations of the contractor shall be extended by a period of time equal to period of delay, provided that on the occurrence of any such contingency, the contractor immediately reports to BHEL in writing the causes of delay and the contractor shall not be eligible for any compensation.

2.18 ***ARBITRATION & RECONCILIATION***

2.18.1 In case amicable settlement is not reached in the event of any dispute or difference arising out of the execution of the Contract or the respective rights and liabilities of the parties or in relation to interpretation of any provision by the Contractor in any manner touching upon the Contract, such dispute or difference shall (except as to any matters, the decision of which is specifically provided for therein) be referred to the sole arbitration of the arbitrator appointed by BHEL/In charge.

The award of the Arbitrator shall be binding upon the parties to the dispute Subject as aforesaid, the provisions of Arbitration and Reconciliation Act 1996 (India) or statutory

modifications or reenactments thereof and the rules made there under and for the time being in force shall apply to the arbitration proceedings under this clause. The venue of the arbitration shall be the place from which the contract is issued or such other place as the Arbitrator at his discretion may determine

2.18.2 In case of Contract with Public Sector Enterprise (PSE) or a Government Department, the following shall be applicable:

In the event of any dispute or difference relating to the interpretation and application of the provisions of the Contract, such dispute or difference shall be referred to by either party to the arbitration of one of the arbitrators in the department of public enterprises. The award of the arbitrator shall be binding upon the parties to the dispute, provided, however, any party aggrieved by such award may make further reference for setting aside or revision of the award to the Law Secretary, Department of Legal Affairs, Ministry of Law and Justice, Government of India. Upon such reference the dispute shall be decided by the Law Secretary or the Special Secretary or Additional Secretary when so authorized by the Law Secretary, whose decision shall bind the parties hereto finally and conclusively.

2.18.3 The cost of arbitration shall be borne equally by the parties.

2.18.4 Work under the contract shall be continued during the arbitration proceedings

2.19 ***PAYMENTS***

Payments to Contractors are made in any one of the following forms

2.19.1 Running Account Bills (RA Bills)

i) These are for interim payments when the contracts are in progress. The bills for such interim payments are to be prepared by Contractor in prescribed formats (RA Bill forms).

ii) Payments shall be made according to the extent of work done as per measurements taken up to the end of the calendar month and in line with the terms of payments described in the Tender documents along with relevant statutory documents applicable for the work.

iii) Recoveries on account of electricity, water, statutory deductions, etc are made as per terms of contract

iv) Full rates for the work done shall be allowed only if the quantum of work has been done as per the specifications stipulated in the contract. If the work is not executed as per the stipulated specifications, BHEL may ask the contractor to re do the work according to the required specifications, without any extra cost. However, where this is not considered necessary 'OR' where the part work is done due to factors like non-availability of material to be supplied by BHEL 'OR' non availability of fronts 'OR' non availability of drawings, fraction payment against full rate, as is considered reasonable, may be allowed with due regard for

the work remaining to be done. BHEL decision in this regard will be final and binding on the contractor.

v) In order to facilitate part payment, BHEL Site Engineer at his discretion may further split the contracted rates/percentages to suit site conditions, cash flow requirements according to the progress of work

2.19.2 Final Bill

Final Bill' is used for final payment on closing of Running Account for works or for single payment after completion of works. 'Final Bill' shall be submitted as per prescribed format after completion of works as per scope and upon material reconciliation, along with the following.

i) 'No Claim Certificate' by contractor

ii) Clearance certificates where ever applicable viz Clearance Certificates from Customer, various Statutory Authorities like Labour department, PF Authorities, Commercial Tax Department, etc

iii) Indemnity bond as per prescribed format BHEL shall settle the final bills after deducting all liabilities of Contractor to BHEL

2.20 ***PERFORMANCE GUARANTEE FOR WORKMANSHIP***

2.20.1 Even though the work will be carried out under the supervision of BHEL Engineers the Contractor will be responsible for the quality of the workmanship and shall guarantee the work done for a period of as mentioned in the contract/NIT from the date of commencement of guarantee period as defined in Technical Conditions of Contract, for good workmanship and shall rectify free of cost all defects due to faulty erection detected during the guarantee period. In the event of the Contractor failing to repair the defective works within the time specified by the Engineer, BHEL may proceed to undertake the repairs of such defective works at the Contractor's risk and cost, without prejudice to any other rights and recover the same from the balance security deposit.

2.20.2 BHEL shall release the balance security deposit subject to the following

i) Contractor has submitted 'Final Bill'

ii) Guarantee period as per contract has expired

iii) Contractor has furnished 'No Claim Certificate' in specified format

iv) BHEL Site Engineer/Construction Manager has furnished the 'No Demand Certificate'

in specified format

v) Contractor has carried out the works required to be carried out by him during the period of Guarantee and all expenses incurred by BHEL on carrying out such works is included for adjustment from the Guarantee money refundable.

*2.21 **CLOSING OF CONTRACTS***

The Contract shall be considered completed and closed upon completion of all contractual obligations and settlement of Final Bill or completion of Guarantee period whichever is later. Upon closing of Contract, BHEL shall issue a completion certificate as per standard format, based on specific request of Contractor.

*2.22 **REVERSE AUCTION/PRICE BID OPENING:***

- *BHEL reserves the right to go for reverse auction at any point of time before opening of Price Bid.*
- *Bids with non-acceptance of reverse auction will be liable for rejection.*
- *Opening of Price Bid at discretion of BHEL.*
- *BHEL shall be at liberty to cancel the tender at any time, before ordering, without assigning any reason.*

*2.23 **SUSPENSION OF BUSINESS DEALINGS***

BHEL reserves the right to take action against Contractors who either fail to perform or Tenderers/Contractor who indulge in malpractices, by suspending business dealings with them in line with BHEL guidelines issued from time to time.

2.24 OTHER ISSUES

2.24.1 Value of Non judicial Stamp Paper for Bank Guarantees and for Contract Agreement shall be not less than Rs 200/- unless otherwise required under relevant statutes.

2.24.2 In case of any conflict between the General Conditions of Contract and Special Conditions of Contract, provisions contained in the Special Conditions of Contract shall prevail.

2.24.3 Unless otherwise specified in NIT, offers from consortium/JVs shall not be considered.

2.24.4 BHEL may not insist for signing of Contract Agreements in respect of low value and short time period contracts

GUIDELINES FOR REVERSE AUCTION - 2024

(AA:SSP:RA:00 dated 05.12.2024)

BHEL, New Delhi

Guidelines for Reverse Auction – 2024

Doc. No. AA:SSP:RA:00
Dated: 05.12.2024

1.0 Scope

This document describes the guidelines to be followed by BHEL for conducting Reverse Auction (RA) for procurement of material/ works/ services. The RA shall follow the philosophy of English Reverse (No ties).

English Reverse (No ties) is a type of auction where the starting price and bid decrement are announced before start of online reverse auction. The interested bidders can thereupon start bidding in an iterative process wherein the lowest bidder at any given moment can be displaced by an even lower bid of a competing bidder, within a given time frame. The bidding is with reference to the current lowest bid in the reverse auction. All bidders will see the current lowest quoted price and their rank. The term 'No ties' is used since more than one bidder cannot give an identical price, at a given instant, during the reverse auction. In other words, there shall never be a tie in the bids.

3.0 Upfront declaration in NIT

Decision to go for RA would be taken before floating of the tender. In case it is decided to go for RA, same shall be declared upfront in NIT by inserting the following **clause:**

"BHEL shall be resorting to Reverse Auction (RA) (Guidelines as available on www.bhel.com) for this tender. RA shall be conducted among the techno-commercially qualified bidders.

Price bids of all techno-commercially qualified bidders shall be opened and same shall be considered for RA. In case any bidder(s) do(es) not participate in online Reverse Auction, their sealed price bid along with applicable loading, if any, shall be considered for ranking."

6.0 Business rules for RA

Model Annexure-I is attached.

7.0 Role of Service Provider

(1) Acknowledge the receipt of mandate from BHEL.
(2) Contact the bidders, provide business rules and train them, as required.
(3) Get the process compliance form (annexure III) signed by all the

participating bidders before RA event.

(4) Conduct the event as per the contract and business rules.

(5) Submit the Login Reports, Results, History sheet and authorized final bid from the bidders.

(6) To obtain price breakup from successful bidder and submit the same to BHEL.

10.0 Reverse Auction Process

10.1. Reverse Auction will be conducted if two or more bidders are techno-commercially qualified.

10.2. Wherever RA is opted in a tender, the techno-commercially qualified H1 will not be allowed to participate in RA. In case more than one H1 bidder quote the same rate, the Price Offer received last, as per the time log of the Portal, shall be removed first, on the principle of last in, first out by the system.

10.3. However, H1 will be allowed to participate in RA in the following cases:

a) If number of techno-commercially qualified bidders are only 2 or 3.

b) In case Primary product of only one OEM is left in contention for participation in RA on elimination of H1.

c) For cases where there are more than 3 techno-commercially qualified bidders, if lowest bidder in sealed price bid is non-MSE and H-1 is eligible MSE and H-1 price is coming within price band of 15% of Non-MSE lowest bidder.

d) For cases where there are more than 3 techno-commercially qualified bidders, if lowest bidder in sealed price bid is non-MII and H-1 is eligible MII and H-1 price is coming within price band of 20% of Non-MII lowest bidder.

10.4. Only those bidders who submit the online sealed bid within the scheduled time shall be eligible to participate further in the RA process.

10.7. During RA, all bidders will see their rank and current L1 price on the screen. Once the RA is done, the ranking status would be based on the last quoted price of the bidder(s) irrespective of the quote received in RA or sealed price bid.

10.8 No bidder shall be allowed to lower its bid below the current L1 by more than 5 decrements at one go.

13.0 Others

13.2 In case of enquiry through e-Procurement, the sealed electronic price bid (e-bid) is to be treated as sealed price bid.

13.3 BHEL will inform bidders the details of service provider who will provide business rules, all necessary training and assistance before commencement of online bidding.

13.4 Bidders will be advised to read the 'Business Rules' indicating details of RA event carefully, before reverse auction event.

---xxx---

Doc. No. AA:SSP:RA:00
Dated: 05.12.2024

Business Rules for Reverse Auction

Annexure – I

This has reference to tender no ***{tender number….date***…}. BHEL shall finalise the Rates for the supply of {*item name}* through Reverse Auction mode. BHEL has made arrangement with M/s. {*Service provider},* who shall be BHEL's authorized service provider for the same. Bidders should go through the instructions given below and submit acceptance of the same.

The technical & commercial terms are as per (a) BHEL Tender Enq. No. {…} dated {...}, (b) Bidders' technical & commercial bid (in case of two part bid) and (c) subsequent correspondences between BHEL and the bidders, if any.

1. Procedure of Reverse Auctioning

i. Price bids of all techno-commercially qualified bidders shall be opened.

ii. **Reverse Auction**: The 'bid decrement' will be decided by BHEL.

iii. The lowest bidder in sealed price bid shall be shown as current L1 automatically by the system and no acceptance of that price is required. System shall have the provision to indicate this bid as current L1.

iv. Bidders by offering a minimum bid decrement or the multiples thereof can displace a standing lowest bid and become "L1" and this continues as an iterative process. However, no bidder shall be allowed to lower its bid below the current L1 by more than 5 decrements at one go.

v. After the completion of the reverse auction, the Closing Price shall be available for further processing.

vi. Wherever the evaluation is done on total cost basis, after Reverse Auction, prices of individual line items shall be reduced on pro-rata basis.

2. Schedule for reverse auction: The Reverse Auction is tentatively scheduled on *{date}: ;{start time}: ;{Close Time: }*.

3. Auction extension time: If a bidder places a bid in the last {…} minutes of closing of the Reverse Auction and if that bid gets accepted, then the auction's duration shall get extended automatically for another {…} minutes,

for the entire auction (i.e. for all the items in the auction), from the time that bid comes in. Please note that the auto-extension will take place only if a bid comes in those last {…} minutes and if that bid gets accepted as the lowest bid. If the bid does not get accepted as the lowest bid, the auto-extension will not take place even if that bid might have come in the last {…} minutes. In case, there is no bid in the last {…} minutes of closing of Reverse Auction, the auction shall get closed automatically without any extension. However, bidders are advised not to wait till the last minute or last few seconds to enter their bid during the auto-extension period to avoid complications related with internet connectivity, network problems, system crash down, power failure, etc.

The above process will continue till completion of Reverse Auction.

Complaints/ Grievances, if any, regarding denial of service or any related issue should be given in writing thru e-mail/ fax to M/s. {Service provider} with a copy to BHEL within 15 minutes prior to initial closing time of Reverse Auction.

4. **Bid price:** The Bidder has to quote the {……} Price inclusive of Packing & Forwarding charges, all the routine & type tests as per tender scope, taxes, duties, freight and insurance as specified in tender document. including loading (if indicated by BHEL due to deviations in technical/ commercial terms) for the Items specified. Details are as shown in Excel Sheet for calculation of total cost to BHEL (To be specified by Unit as per NIT conditions).

5. **Bidding currency and unit of measurement:** Bidding will be conducted in *Indian Rupees* per *Unit* of the material as per the specifications {...}

   In case of foreign currency bids, exchange rate (TT selling rate of State Bank of India) as on scheduled date of tender opening (Part-I bid) shall be considered for conversion in Indian Rupees. If the relevant day happens to be a Bank holiday, then the forex rate as on the previous bank (SBI) working day shall be taken.

6. **Validity of bids:** Price shall be valid for {… *days}* from the date of reverse auction. These shall not be subjected to any change whatsoever.

7. **Lowest bid of a bidder**: In case the bidder submits more than one bid, the lowest bid at the end of Reverse Auction will be considered as the bidder's final offer to execute the work.

8. Unique user IDs shall be used by bidders during bidding process. All bids made from the Login ID given to the bidders will be deemed to have been made by the bidders/ bidders' company.

9. **Post auction procedure**: BHEL will proceed with the Lowest Bid in the Reverse Auction for further processing.

10. Any commercial/ technical loading shall be separately intimated to respective bidders prior to RA. The excel sheet provided in this regard shall cover all these aspects. Commercial/ technical loading if any, shall be added by the respective bidder in its price during Reverse Auction. Modalities of loading & de-loading shall be separately intimated to the bidders. The responsibility for correctness of total cost to BHEL shall lie with the bidders.

11. Reverse auction shall be conducted by BHEL (through M/s {*Service Provider*}), on pre-specified date, while the bidders shall be quoting from their own offices/ place of their choice. Internet connectivity shall have to be ensured by bidders themselves.

    During the RA process if a bidder is not able to bid and requests for extension of time by FAX/ email/ phone then time extension of additional 15 minutes will be given by the service provider provided such requests come before 5 minutes of auction closing time. However, only one such request per bidder can be entertained.

    In order to ward-off contingent situation of connectivity failure bidders are requested to make all the necessary arrangements/ alternatives whatever required so that they are able to circumvent such situation and still be able to participate in the reverse auction successfully. Failure of power or loss of connectivity at the premises of bidders during the Reverse auction cannot be the cause for not participating in the reverse auction. On account of this, the time for the auction cannot be extended and neither BHEL nor M/s. {*Service provider*} is responsible for such eventualities.

12. Proxy bids: Proxy bidding feature is a pro-bidder feature to safe guard the bidder's interest of any internet failure or to avoid last minute rush. The proxy feature allows bidders to place an automated bid in the system directly in an auction and bid without having to enter a new amount each time a competing bidder submits a new offer. The bid amount that a bidder enters is the minimum that the bidder is willing to offer. Here the software bids on behalf of the bidder. This obviates the need for the bidder participating in the bidding process until the proxy bid amount is decrementally reached by other bidders. When proxy bid amount is reached, the bidder (who has submitted the proxy bid) has an option to start participating in the bidding process.

The proxy amount is the minimum amount that the bidder is willing to offer. During the course of bidding, the bidder cannot delete or change the amount of a proxy bid.

Bids are submitted in decrements (decreasing bid amounts). The application automates proxy bidding by processing proxy bids automatically, according to the decrement that the auction originator originally established when creating the auction, submitting offers to the next bid decrement each time a competing bidder bids, regardless of the fact whether the competing bids are submitted as proxy or standard bids. However, it may please be noted that if a manual bid and proxy bid are submitted at the same instant manual bid will be recognized as the L1 at that instant.

In case of more than one proxy bid, the system shall bid till it crosses the threshold value of 'each lowest proxy bid' and thereafter allow the competition to decide the final L1 price.

Proxy bids are fed into the system directly by the respective bidders. As such this information is privy only to the respective bidder(s).

13. Bidders are advised to get fully trained and clear all their doubts such as refreshing of Screen, quantity being auctioned, tender value being auctioned etc from M/s {*Service provider*}.

14. M/s. {*Service provider*}, shall arrange to demonstrate/ train the bidder or bidder's nominated person(s), without any cost to bidders. M/s. {*Service provider*}, shall also explain the bidders, all the business rules related to the

Reverse Auction. Bidders are required to submit their acceptance to the terms/ conditions/ modalities before participating in the Reverse Auction in the process compliance form as enclosed. Without this, the bidder will not be eligible to participate in the event.

15. Successful bidder shall be required to submit the final prices (L1) in prescribed format (Annexure – VI) for price breakup, quoted during the Reverse Auction, duly signed and stamped as token of acceptance without any new condition (other than those already agreed to before start of auction), after the completion of auction to M/s. {*Service provider*} besides BHEL within two working days of Auction without fail.

16. Any variation between the final bid value and that in the confirmatory signed price breakup document will be considered as tampering the tender process and will invite action by BHEL as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

17. Bidders' bid will be taken as an offer to execute the work/ supplies the item as per enquiry no. {…} dt. {…}. Bids once made by the bidder, cannot be cancelled/ withdrawn and bidder shall be bound to execute the work as mentioned above at bidder's final bid price. Should bidder back out and not execute the contract as per the rates quoted, BHEL shall take action as per extant guidelines for suspension of business dealings (as available on www.bhel.com).

18. Bidders shall be able to view the following on their screen along with the necessary fields during Reverse Auction:

a. Leading (Running Lowest) Bid in the Auction (only total price of package)
b. Bid Placed by the bidder
c. Start Price
d. Decrement value
e. Rank of their own bid during bidding as well as at the close of auction.

19. BHEL's decision on award of contract shall be final and binding on all the Bidders.

20. BHEL reserves the right to extend, reschedule or cancel the Reverse Auction process at any time, before ordering, without assigning any reason, with

intimation to bidders.

21. BHEL shall not have any liability to bidders for any interruption or delay in access to the site irrespective of the cause. In such cases, the decision of BHEL shall be binding on the bidders.

22. Other terms and conditions shall be as per bidder's techno-commercial offers and other correspondences, if any, till date.

23. If there is any clash between this business document and the FAQ available, if any, in the website of M/s. {*Service provider*}, the terms & conditions given in this business document will supersede the information contained in the FAQs. Any changes made by BHEL/ service provider (due to unforeseen contingencies) after the first posting shall be deemed to have been accepted if the bidder continues to access the portal after that time.

24. Bidder shall not divulge either his Bids or any other exclusive details of BHEL to any other party. If the Bidder or any of his representatives are found to be involved in Price manipulation/ cartel formation of any kind, directly or indirectly by communicating with other bidders, action *as per extant BHEL guidelines for suspension of business dealings (as available on www.bhel.com)*, shall be initiated by BHEL.

ANNEXURE A

PROFORMA OF BANK GUARANTEE FOR EARNEST MONEY

(On non-Judicial paper of appropriate value)

Bank Guarantee No……..

Date……..

To

(Employer's Name and Address)

……..

Dear Sirs,

In accordance with the terms and conditions of Invitation for Bids/Notice Inviting Tender No……1(Tender Conditions), M/s. …….. having its registered office at ……2 (hereinafter referred to as the 'Tenderer'), is submitting its bid for the work of**……..3** invited by ……4.(name of the Employer) through its Unit at ……(

The Tender Conditions provide that the Tenderer shall pay a sum of Rs …… as Earnest Money Deposit in the form therein mentioned. The form of payment of Earnest Money Deposit includes Bank Guarantee executed by a Scheduled Bank.

In lieu of the stipulations contained in the aforesaid Tender Conditions that an irrevocable and unconditional Bank Guarantee against Earnest Money Deposit for an amount of .....5 ..... is required to be submitted by the Tenderer as a condition precedent for participation in the said Tender and the Tenderer having approached us for giving the said Guarantee,

we, the .....[Name & address of the Bank] ..... having our Registered Office at ……..(hereinafter referred to as the Bank) being the Guarantor under this Guarantee, hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer without any demur, merely on your first demand any sum or sums of Rs. 5 .....(in words Rupees.....) without any reservation, protest, and recourse and without the beneficiary needing to prove or demonstrate reasons for its such demand.

Any such demand made on the Bank shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ _____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Vendor/Contractor/Vendors in any suit or proceeding pending before any Court or Tribunal, Arbitrator or any other authority, our liability under this present being absolute and unequivocal.

The payment so made by us under this Guarantee shall be a valid discharge of our liability for payment hereunder and the Tenderer shall have no claim against us for making such payment.

We …….. Bank further agree that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Tender or to extend the time of submission of from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said Tenderer and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Tenderer or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said Tenderer or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Tenderer and notwithstanding any security or other guarantee that the Employer may have in relation to the Tenderer's liabilities.

This Guarantee shall be irrevocable and shall remain in force upto and including……..6 and shall be extended from time to time for such period as may be desired by the Employer.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Tenderer but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms hereof. However, unless a demand or claim under this Guarantee is made on us in writing on or before the ……. [7] we shall be discharged from all liabilities under this Guarantee.

We, …… Bank lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.

Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed……..5…..
b) This Guarantee shall be valid up to ……6
c) Unless the Bank is served a written claim or demand on or before _____7 all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

For and on behalf of

(Name of the Bank)

Date……

Place of Issue……

ANNEXURE B

PROFORMA OF BANK GUARANTEE (in lieu of SECURITY DEPOSIT)

In consideration of Bharat Heavy Electricals Limited (hereinafter referred to as the 'Employer' which expression shall unless repugnant to the context or meaning thereof, include its successors and permitted assigns) incorporated under the Companies Act, 1956 and having its registered office at BHEL House, Siri Fort, New Delhi-110049[1] through its Unit at **BHEL, Solar Business Division, Bangalore** having agreed to exempt_____ (Name of the Vendor / Contractor / Vendors) with its registered office at_____ [2] (hereinafter called the said "Contractor" which term includes vendors), from demand under the terms and conditions of the Contract reference No._____ dated _____ [3] valued at Rs……[4] (Rupees ----------)[4] (hereinafter called the said Contract), of Security Deposit for the due fulfilment by the said Contractor of the terms and conditions contained in the said Contract, on production of a Bank Guarantee for Rs._____[5] (Rupees _____ only),

we ____(indicate the name and address of the Bank) having its Head Office at _____(address of the head Office) (hereinafter referred to as the Bank), , at the request of _____ [Contractor(s)], being the Guarantor under this Guarantee, do hereby irrevocably and unconditionally undertake to forthwith and immediately pay to the Employer, , an amount not exceeding Rs._____ without any demur, immediately on demand from the Employer and without any reservation, protest, and recourse and without the Employer needing to prove or demonstrate reasons for its such demand

Any such demand made on the bank, shall be conclusive as regards the amount due and payable by the Bank under this guarantee. However, our liability under this guarantee shall be restricted to an amount not exceeding Rs._____.

We undertake to pay to the Employer any money so demanded notwithstanding any dispute or disputes raised by the Contractor(s) in any suit or proceeding pending before any Court or Tribunal or Arbitrator or any other authority, our liability under this present being absolute and unequivocal.
The payment so made by us under this guarantee shall be a valid discharge of our liability for payment hereunder and the Contractor(s) shall have no claim against us for making such payment.

We, further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said Contract and that it shall continue to be enforceable till all the dues of the Employer under or by virtue of the said Contract have been fully paid and its claims satisfied & the Employer certifies that the terms and conditions of the said Contract have been fully and properly carried out by the said contractor(s) or acceptance of the final bill or discharge of this guarantee by the Employer, whichever is earlier. This guarantee shall initially remain in force upto and including _____6 and shall be extended from time to time for such period as may be desired by the Employer. Unless a demand or claim under this guarantee

is made on us in writing on or before the _____[7], we shall be discharged from all the liability under this guarantee thereafter.

We, ____(indicate the name of the Bank)____further agree with the Employer that the Employer shall have the fullest liberty without our consent and without affecting in any manner our obligations hereunder to vary any of the terms and conditions of the said Contract or to extend time of performance by the said contractor(s) from time to time or to postpone for any time or from time to time any of the powers exercisable by the Employer against the said contractor(s) and to forbear or enforce any of the terms and conditions relating to the said Contract and we shall not be relieved from our liability by any reason of any such variation or extension being granted to the said contractor(s) or for any forbearance, act or omission on the part of the Employer or any indulgence by the Employer to the said contractor(s) or by any such matter or thing whatsoever which under the law relating to sureties would but for this provision have effect of so relieving us.

The Bank also agrees that the Employer at its option shall be entitled to enforce this Guarantee against the Bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

This Guarantee shall not be determined or affected by liquidation or winding up, dissolution or change of constitution or insolvency of the Contractor but shall in all respects and for all purposes be binding and operative until payment of all money payable to the Employer in terms thereof. This guarantee will not be discharged due to the change in the constitution of the Bank or the Contractor(s).

We,……. BANK lastly undertake not to revoke this guarantee during its currency except with the previous consent of the Employer in writing.
Notwithstanding anything to the contrary contained hereinabove:

a) The liability of the Bank under this Guarantee shall not exceed…… [5]

b) This Guarantee shall be valid up to ……[6]

c) Unless the Bank is served a written claim or demand on or before _____[7] all rights under this guarantee shall be forfeited and the Bank shall be relieved and discharged from all liabilities under this guarantee irrespective of whether or not the original bank guarantee is returned to the Bank.

We, _____ Bank, have power to issue this Guarantee under law and the undersigned as a duly authorized person has full powers to sign this Guarantee on behalf of the Bank.

Date _____ Day of _____

for____(indicate the name of the Bank)__

(Signature of Authorized signatory)

[1] ADDRESS OF THE EMPLOYER. I.e Bharat Heavy Electricals Limited
[2] ADDRESS OF THE VENDOR /CONTRACTOR / SUPPLIER.
[3] DETAILS ABOUT THE NOTICE OF AWARD/CONTRACT REFERENCE
[4] CONTRACT VALUE
[5] BG AMOUNT IN FIGURES AND WORDS
[6] VALIDITY DATE ((At least 3 months more than completion period)
[7] DATE OF EXPIRY OF CLAIM PERIOD (At least 3 months more than the present date of validity of BG)

Notes:

1. The expiry of claim period shall be at least 3 months more than the validity date. It may be ensured that the same is in line with the agreement/ contract entered with the Vendor.
2. The BG should be on Non-Judicial Stamp paper/e-stamp paper of appropriate value as per Stamp Act prevailing in the State(s) where the BG is submitted or is to be acted upon or the rate prevailing in the State where the BG was executed, whichever is higher. The Stamp Paper/e-stamp paper shall be purchased in the name of Vendor/Contractor/Supplier /Bank issuing the guarantee.