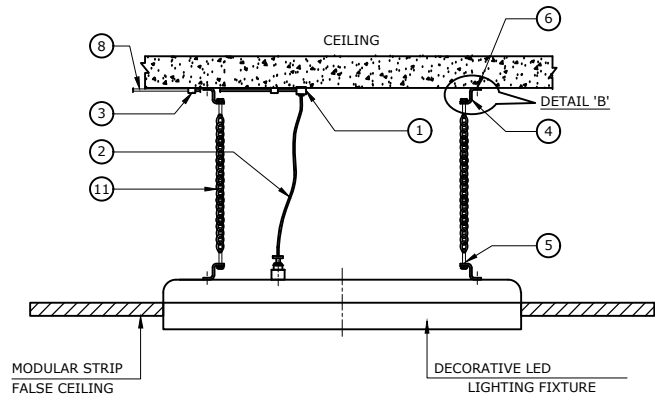
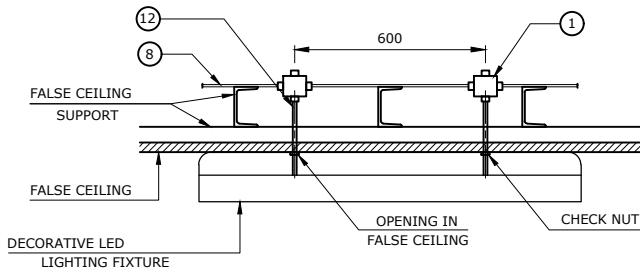


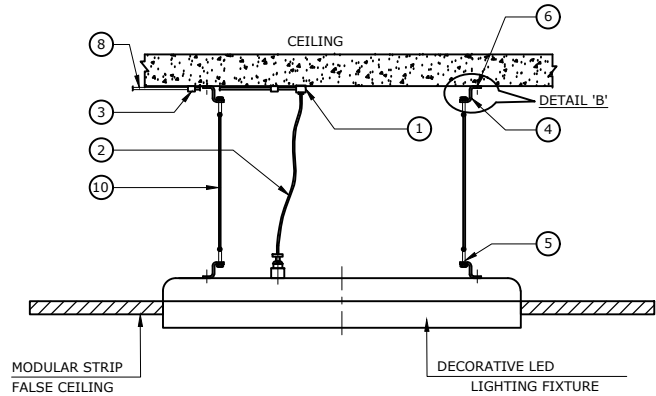
**RECESSED MOUNTING FIXTURE
SUPPORTED ON WOODEN FRAME
TYPE : RM1**



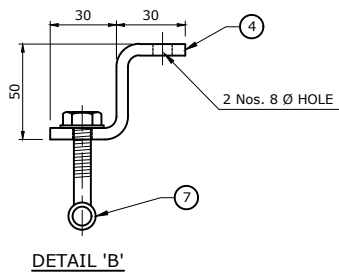
**RECESSED MOUNTING FIXTURE
SUPPORTED ON CHAIN
TYPE : RM1**



**FIXTURE MOUNTED BELOW
FALSE CEILING
TYPE : RM2**



**RECESSED MOUNTING FIXTURE
SUPPORTED WITH G.I. WIRE
TYPE : RM1**

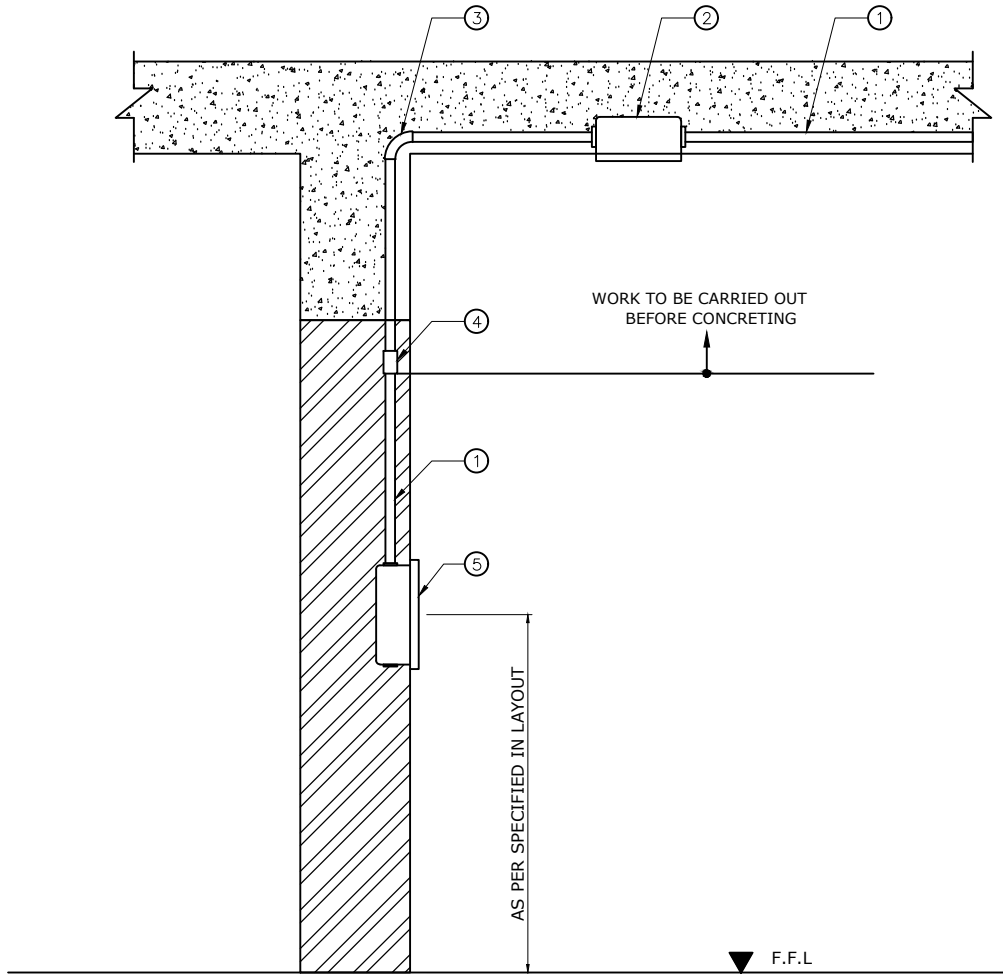


DETAIL 'B'

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX WITH DOME COVER	1 NO.	
2	19 mm DIA PVC FLEXIBLE PIPE WITH 2 Nos. PVC STRAIGHT ADAPTOR	AS REQUIRED	
3	G.I./PVC SADDLE CLEAT WITH SUITABLE SCREWS	AS REQUIRED	
4	32 x 6mm THK. 110 mm LONG M.S. FLAT BEND 'Z' SHAPE	4 NOS.	
5	M6-30mm LONG G.I. EYE BOLT & NUT WITH WASHER	4 NOS.	
6	M6-35mm LONG ANCHOR STUD WITH NUT AND WASHER	2 NOS.	
7	M6-30mm LONG BOLT WITH SWING NUT AND 2 Nos. PLAIN WASHER	2 NOS.	
8	19mm DIA CONDUIT (AS SPECIFIED)	AS REQUIRED	
9	BRACKET MADE OUT OF 25 x 3mm THK. M.S. FLAT	2 NOS.	
10	10 SWG. G.I. WIRE (LENGTH TO SUIT)	2 NOS.	
11	SUPPORTING CHAIN (LENGTH TO SUIT)	2 NOS.	
12	19mm Ø CONDUIT EITH THREAD AT BOTH END AND NUT	2 NOS.	

02	29.01.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

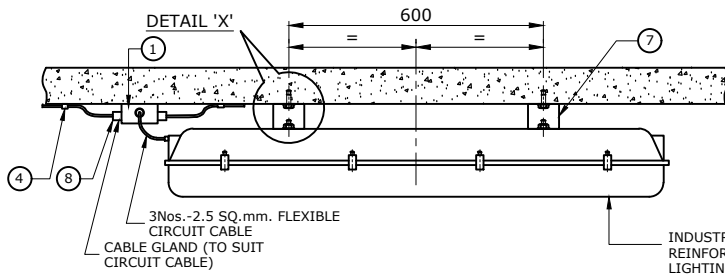


TYPICAL INSTALLATION DETAIL OF CONDUIT ENTRY
FROM R.C.C SLAB INTO THE BRICK WALL

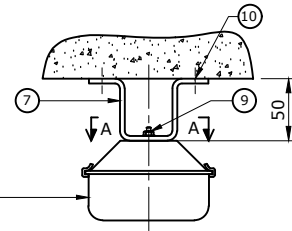
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	PVC/G.I. CONDUIT SIZE AS REQUIRED	AS REQUIRED	
2	WIRE PULL BOX WITH FLAT COVER	AS REQUIRED	
3	PVC/G.I. 90° BEND SIZE AS REQUIRED	AS REQUIRED	
4	PVC/G.I. COUPLING SIZE AS REQUIRED	AS REQUIRED	
5	SWITCH BOARD, SOCKET OUTLET ETC.	AS REQUIRED	

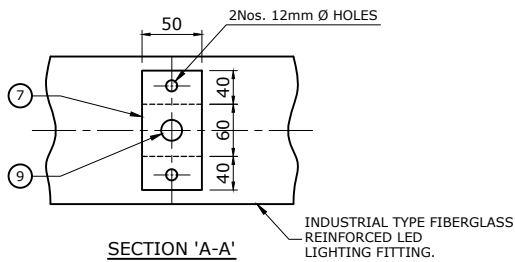
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



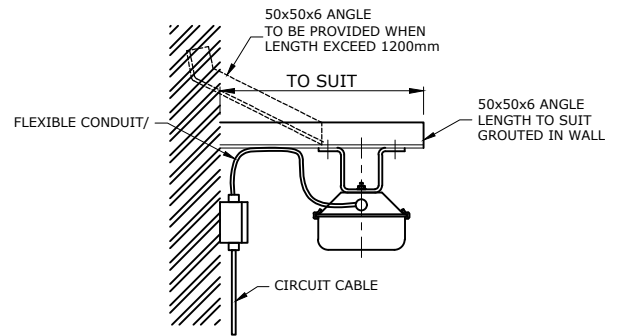
FRONT VIEW
MOUNTING TYPE : CM3



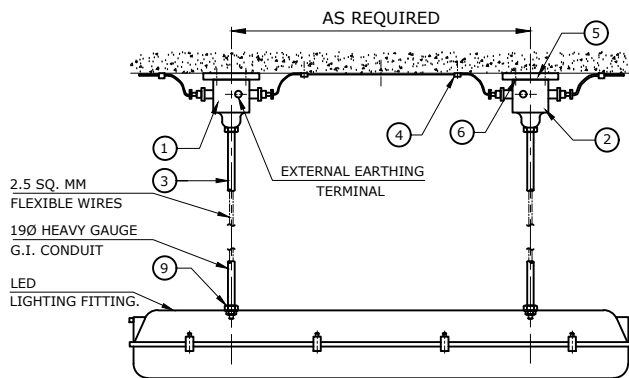
END VIEW



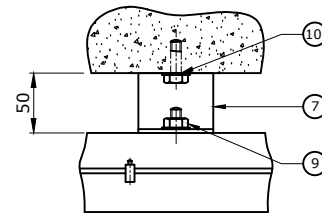
SECTION 'A-A'



BRACKET MOUNTING ON
WALL/COLUMN MTG. TYPE : BM3



FRONT VIEW
MOUNTING TYPE : SM3

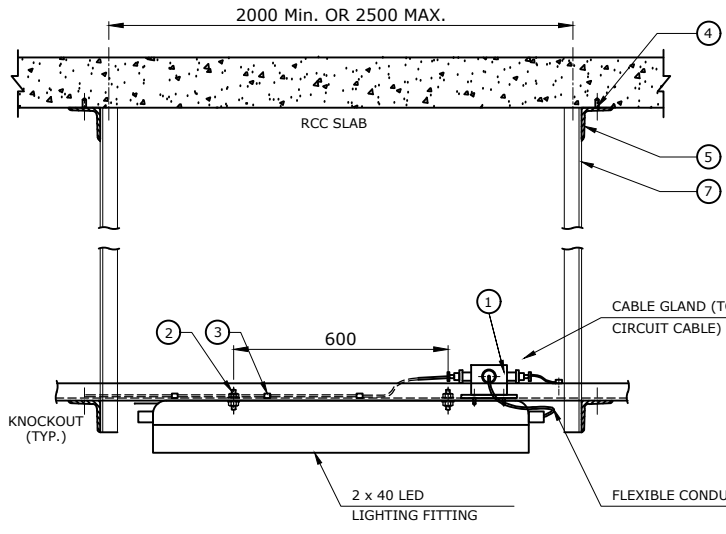


DETAIL 'X'

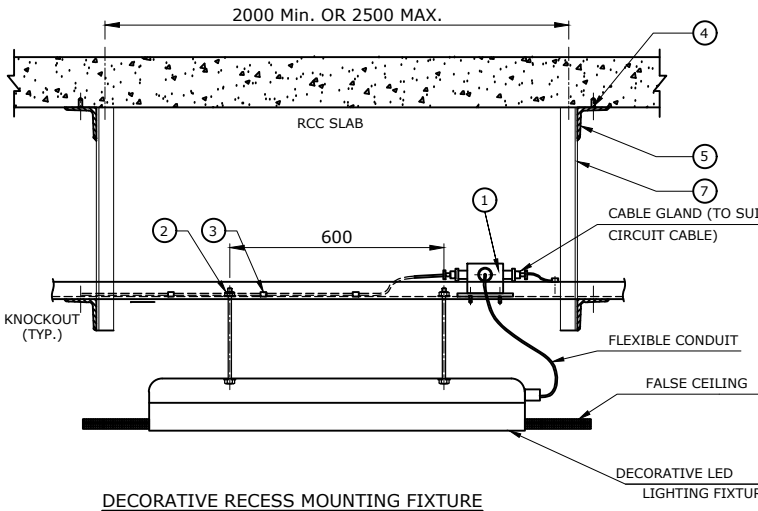
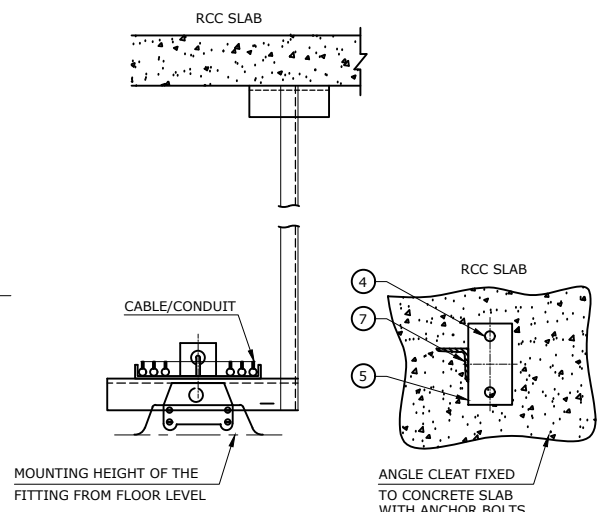
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY-100mm DIA ROUND JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	
2	DUMMY JUNCTION BOX WITH DOME COVER, BALL & SOCKET WITHOUT TERMINAL BLOCK.	1 NO.	
3	19mm Ø HEAVY GAUGE CONDUIT WITH BOTH END CHECK NUTS LENGTH TO SUIT MOUNTING HEIGHT (MAXIMUM LENGTH 2 Mtrs.)	2 NOS.	
4	G.I. SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREW TO SUIT FOR CIRCUIT CABLE/CONDUIT.	AS REQUIRED	
5	25 x 6 THK. M.S. FLAT 200mm LONG FOR JUNCTION BOX MOUNTING ON SLAB/STEEL STRUCTURE.	2 NOS.	
6	COUNTER SUNK SCREW WITH RAWAL PLUG FOR RCC SLAB OR SELF TAPPING COUNTER SUNK SCREW FOR STEEL STRUCTURE.	4 NOS.	
7	240 x 50 x 6 THK. M.S. BRACKET FOR MOUNTING OF LIGHTING FITTING	2 NOS.	
8	M10-40mm LONG SCREW WITH RAWAL PLUG FOR MOUNTING OF M.S. BRACKET TO CEILING	4 NOS.	
9	M6-40mm LONG BOLT WITH NUT & WASHER	2 NOS.	
10	M10-68mm ANCHOR BOLT FOR MOUNTING OF JUNCTION BOX TO CEILING	2 NOS.	
11	M8-25mm G.I. BOLT WITH 2 Nos. PLAIN AND 1 No. SPRING WASHER TO ANGLE	2 NOS.	

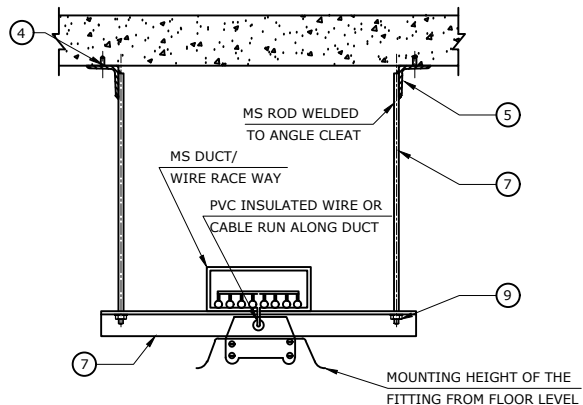
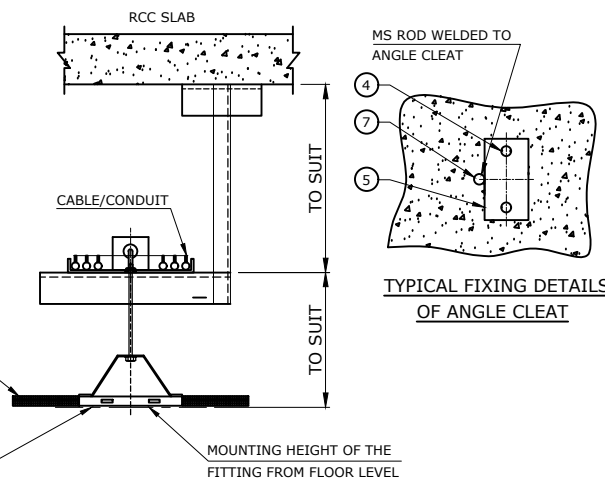
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



**INDUSTRIAL SUSPENSION MOUNTING FIXTURE
MOUNTING TYPE : SM4**



**DECORATIVE RECESS MOUNTING FIXTURE
MOUNTING TYPE : RM4**



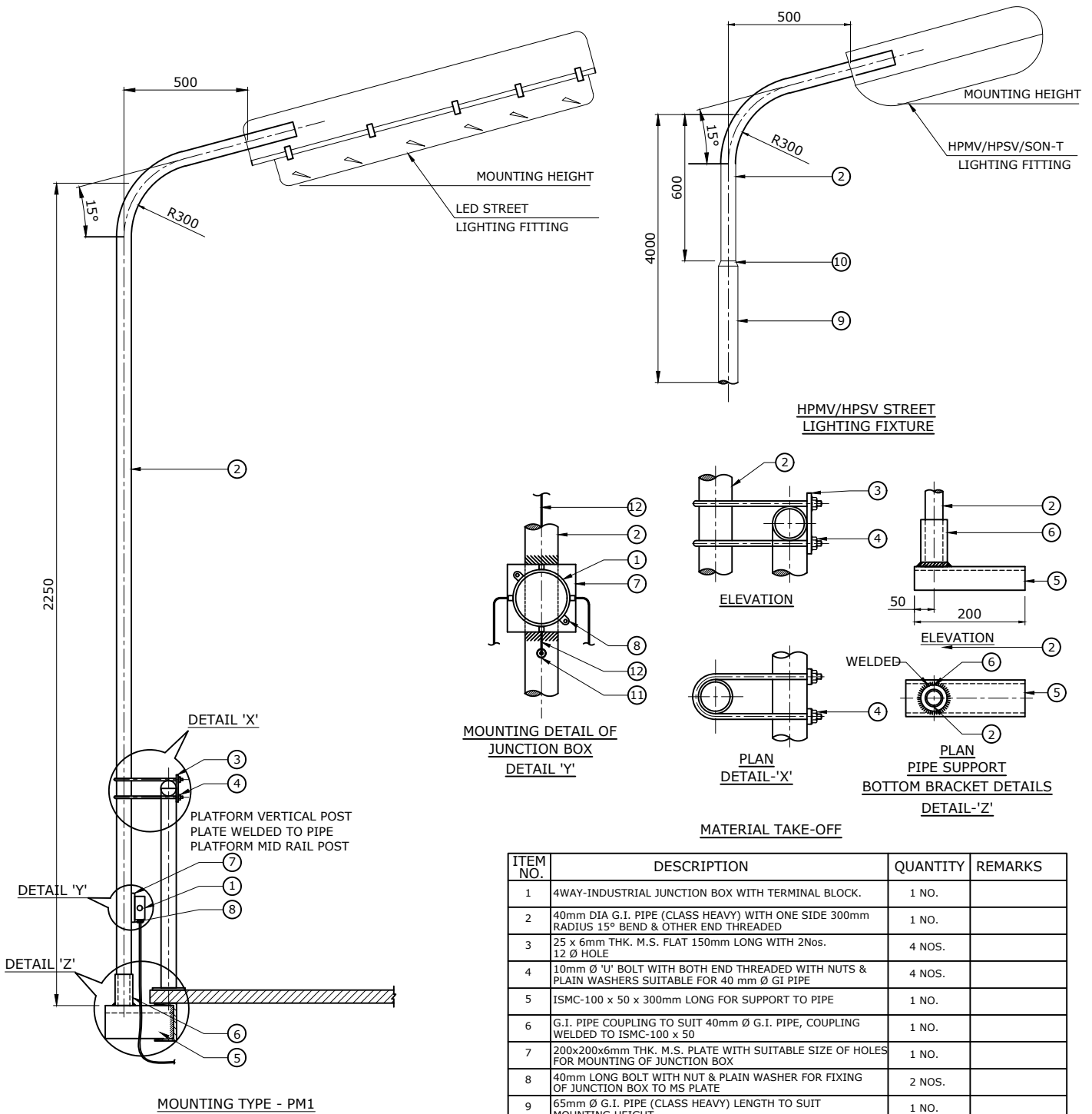
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY-100mm DIA ROUND JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	
2	19mm DIA CHECK NUT	4 NOS.	
3	G.I. SADDLE ALONG WITH SUITABLE SIZE OF FIXING SCREW & NUT TO SUIT FOR CIRCUIT CABLE/CONDUIT.	AS REQUIRED	
4	M10x68mm LONG ANCHOR STUD WITH BOLT & PLAIN WASHER	AS REQUIRED	
5	ISA 50x6mm THK. 100mm LONG ANGLE CLEAT.	AS REQUIRED	
6	150mm OR 300mm WIDE PERFORATED CABLE TRAY OR DUCT/ WIRE RACE WAY CHANNEL.	AS REQUIRED	
7	ISA 25 x 25 x 6mm THK. ANGLE WELDED TO ANGLE OR 8mm DIA MS ROD WITH THREAD AT BOTTOM END	AS REQUIRED	
8	19mm DIA G.I. PIPE/CONDUIT	AS REQUIRED	
9	NUT SUITABLE FOR M8 BOLT WITH PLAIN WASHER	AS REQUIRED	

NOTES:

1. ALL FABRICATED STEEL STRUCTURE SHALL BE PAINTED WITH TWO COATS OF ANTI CORROSIVE PAINT AND TWO COATS OF EPOXY PAINT OF APPROVED SHED.
2. ALL HARDWARE SHALL BE STAINLESS STEEL.

02	29.01.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

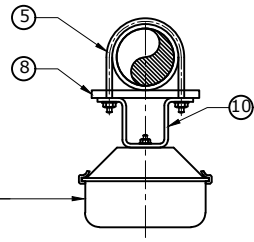
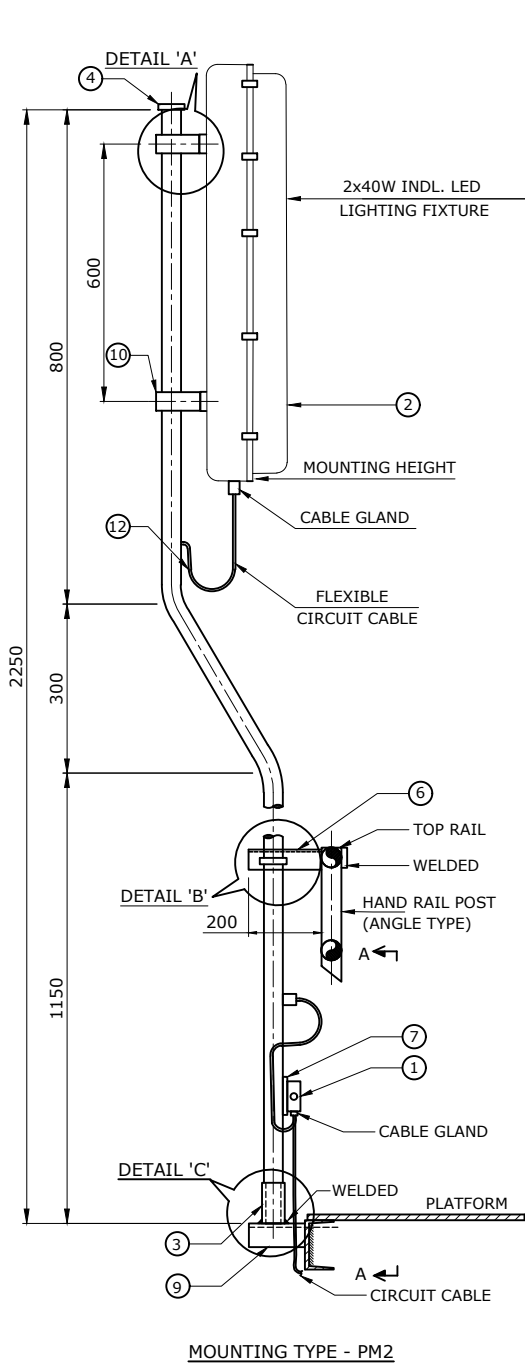


NOTES:

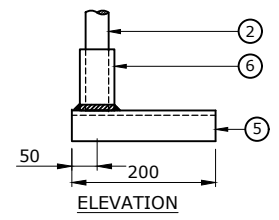
1. MOUNTING HEIGHT SHALL NOT EXCEED 4 METERS FROM THE TOP OF PLATFORM.
2. LIGHT FITTING SHALL BE WITH ONE EXTERNAL EARTH CONNECTION AND USE THIRD CORE OR PVC FLEXIBLE CABLE FOR INTERNAL EARTHING. EARTH JUNCTION BOX WITH TWO EXTERNAL EARTH CONDUCTORS.
3. CABLE GLANDS USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GRIP TYPE.
4. PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.
5. WHEN MOUNTING HEIGHT IS MORE THEN 2.25M THEN 65 Ø G.I. PIPE WITH REDUCER SHALL BE USED.

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY-INDUSTRIAL JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	
2	40mm DIA G.I. PIPE (CLASS HEAVY) WITH ONE SIDE 300mm RADIUS 15° BEND & OTHER END THREADED	1 NO.	
3	25 x 6mm THK. M.S. FLAT 150mm LONG WITH 2Nos. 12 Ø HOLE	4 NOS.	
4	10mm Ø 'U' BOLT WITH BOTH END THREADED WITH NUTS & PLAIN WASHERS SUITABLE FOR 40 mm Ø GI PIPE	4 NOS.	
5	ISMC-100 x 50 x 300mm LONG FOR SUPPORT TO PIPE	1 NO.	
6	G.I. PIPE COUPLING TO SUIT 40mm Ø G.I. PIPE, COUPLING WELDED TO ISMC-100 x 50	1 NO.	
7	200x200x6mm THK. M.S. PLATE WITH SUITABLE SIZE OF HOLES FOR MOUNTING OF JUNCTION BOX	1 NO.	
8	40mm LONG BOLT WITH NUT & PLAIN WASHER FOR FIXING OF JUNCTION BOX TO MS PLATE	2 NOS.	
9	65mm Ø G.I. PIPE (CLASS HEAVY) LENGTH TO SUIT MOUNTING HEIGHT	1 NO.	
10	65 x 10mm G.I. REDUCER	1 NO.	
11	RURDER GROMMET	1 NO.	
12	2.5 Sq. mm PVC COPPER CONDUCTOR FLEXIBLE CABLE	AS REQUIRED	

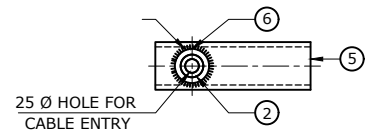
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
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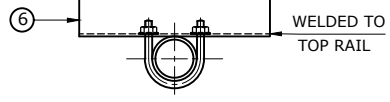
DETAIL 'A'



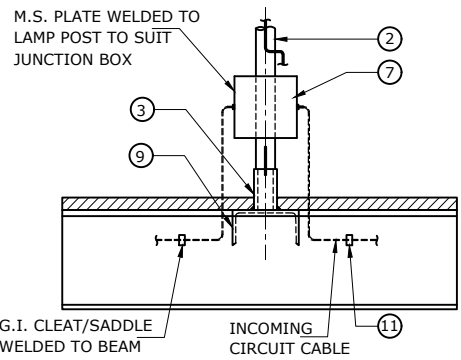
ELEVATION



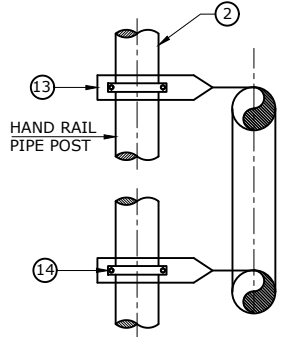
PIPE SUPPORT
BOTTOM BRACKET DETAILS
DETAIL 'C'



DETAIL 'B'



SECTION 'A-A'



ALTERNATIVE ARRANGEMENT
FOR PIPE RAILING

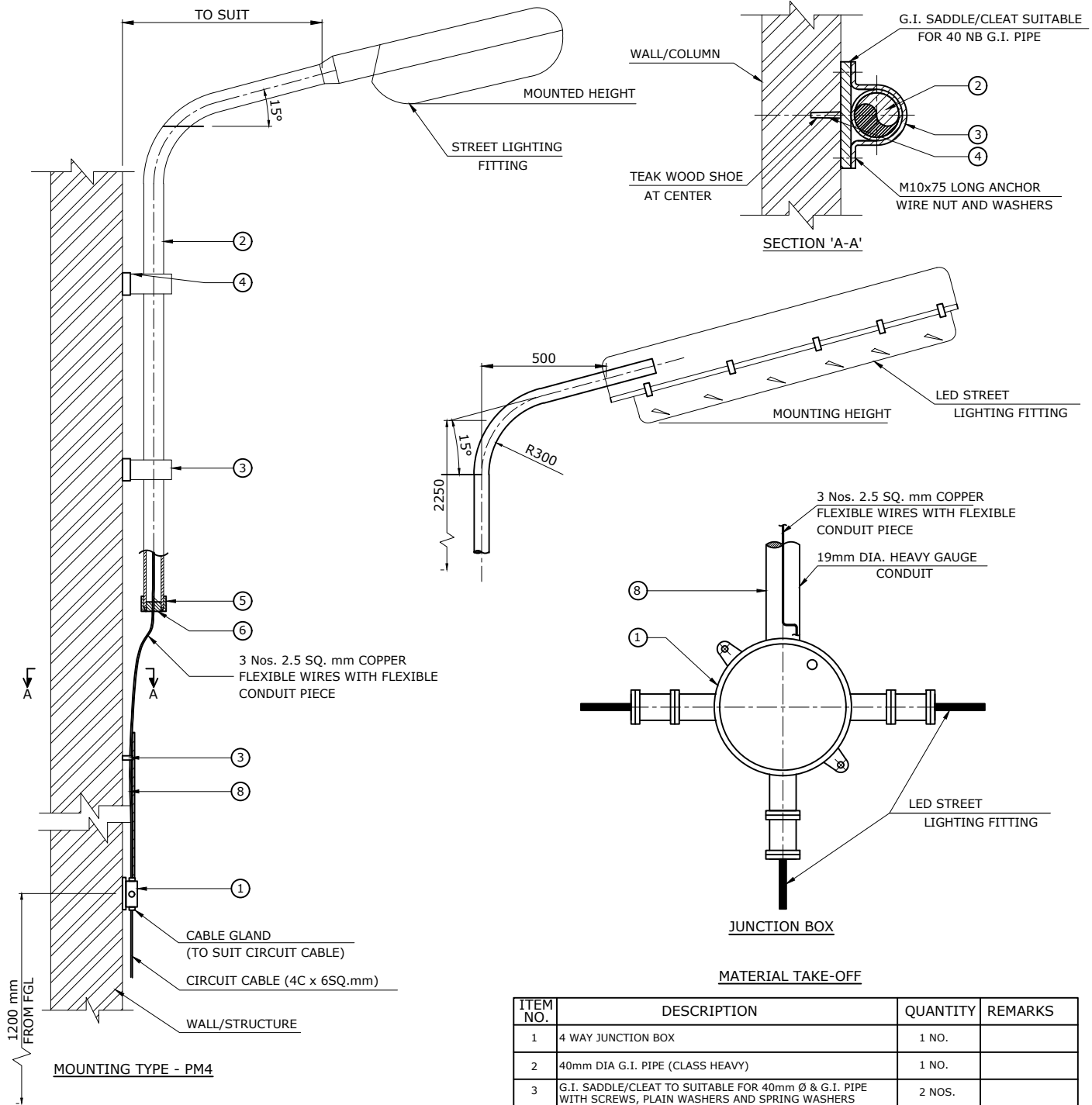
MATERIAL TAKE-OFF

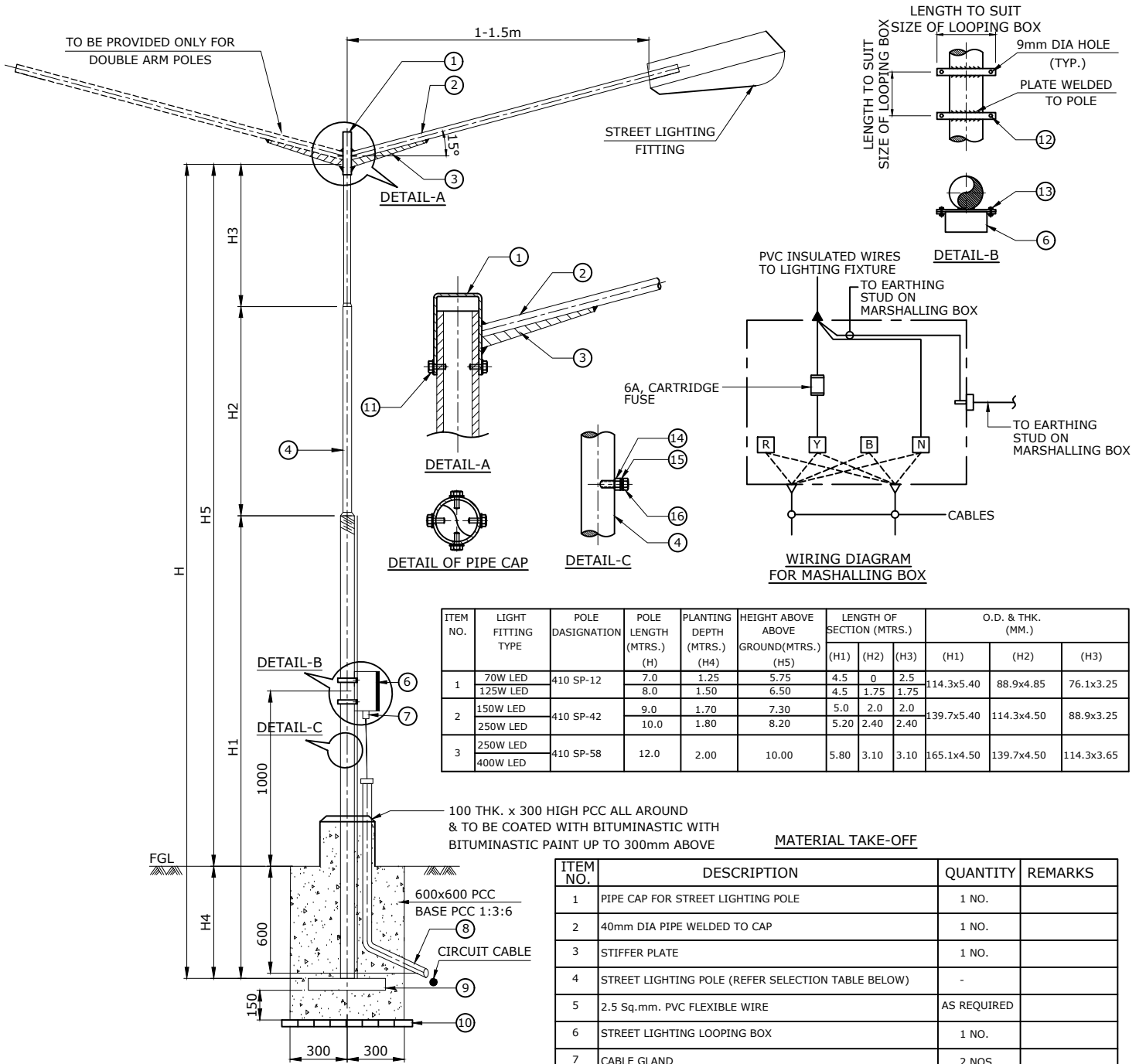
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX	1 NO.	
2	40mm DIA G.I. PIPE 2500mm LONG	1 NO.	
3	G.I. PIPE COUPLING TO SUIT 40mm Ø PIPE	1 NO.	
4	G.I. PIPE CAP TO SUIT 40mm Ø G.I. PIPE	1 NO.	
5	M10 'U' BOLT TO SUIT 40NB G.I. PIPE THREADED AT BOTH THE ENDS WITH NUTS AND WASHERS	2 EACH	
6	50 x 50 x 300mm GALVANIZED MILD STEEL ANGLE	1 NO.	
7	150 Sq. x 6mm THK. M.S. PLATE	1 EACH	
8	50 x 6mm M.S. FLAT - 100mm LONG	1 NO.	
9	ISMC-100 x 50 x 6mm THK. -200mm LONG	AS REQUIRED	
10	BRACKET TO BE MADE OUT OF 25 x 6mm M.S. FLAT	2 NOS.	
11	G.I. CLEAT, SADDLE WITH SUITABLE SIZE SCREW	AS REQUIRED	
12	RURDER GROMMET	2 NOS.	
13	75 x 10mm THK. G.I. FLAT - 300mm LONG	2 NOS.	
14	G.I. SADDLE/CLEAT TO SUIT 40mm Ø G.I. PIPE WITH G.I. SCREWS AND WASHERS	AS REQUIRED	

NOTES:

- ALL NUTS, BOLTS & WASHERS SHALL BE GALVANISED OR ZINC PASSIVATED.
- ALL SHARP EDGES AND BURR SHALL BE REMOVED.
- SITE FABRICATION STEEL SHALL BE PAINTED IN ACCORDANCE WITH THE CONTRACT SPECIFICATION.
- ALL DUMMIES TO GALVANISED FINISHED SHALL BE CLEANED AND APPLIED WITH 2 COATS OF ANTI-CORROSIVE PAINT AND ZINC RICH PAINT.
- WHERE POSSIBLE LOCATE LAMP POST ADJACENT TO HANDRAIL POST.

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02	29.01.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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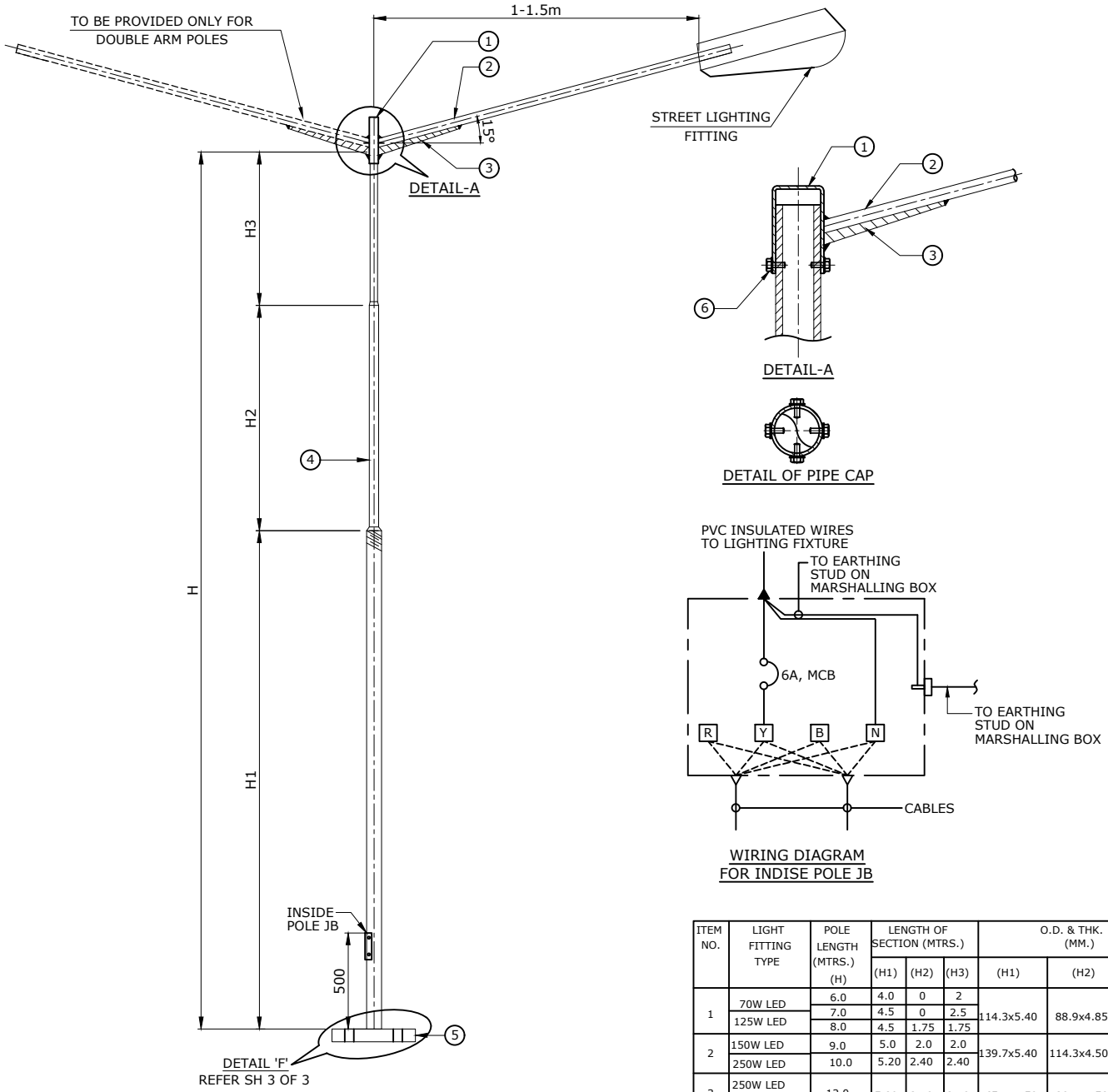




NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- POLE MATERIAL SHALL BE G.I. OR M.S AS PER PROJECT CONTRACT REQUIREMENTS .
- AFTER INSTALLATION THE ASSEMBLY IS TO BE PREPARED, PRIMED AND PAINTED IN ACCORDANCE WITH THE PROJECT PAINTING SPECIFICATION IF MATERIAL IS M.S.
- LIGHT FITTING FIXING DETAILS TO BE FURNISHED BY SITE.
- EARTHING TERMINAL ARE LOCATED DIAMETRICALLY OPPOSITE.
- ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANISED AND ZINC PASSIVATED.
- MOUNTING DETAILS OF CONTROL GEAR BOX AND LOOPING BOX REFER INSTALLATION DETAILS.
- ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
- POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION AS MENTIONED IN ABOVE TABLE- AS IS-2713 (PART III) - 1980.
- DOUBLE ARM SHALL BE EITHER AT 180° OR 30° AS PER THE LOCATION OF THE LIGHTING FITTING & SITE REQUIREMENT.

02	02.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



ITEM NO.	LIGHT FITTING TYPE	POLE LENGTH (MTRS.) (H)	LENGTH OF SECTION (MTRS.)			O.D. & THK. (MM.)		
			(H1)	(H2)	(H3)	(H1)	(H2)	(H3)
1	70W LED	6.0	4.0	0	2	114.3x5.40	88.9x4.85	76.1x3.25
	125W LED	7.0	4.5	0	2.5			
		8.0	4.5	1.75	1.75			
2	150W LED	9.0	5.0	2.0	2.0	139.7x5.40	114.3x4.50	88.9x3.25
	250W LED	10.0	5.20	2.40	2.40			
3	250W LED	12.0	5.80	3.10	3.10	165.1x4.50	139.7x4.50	114.3x3.65
	400W LED							

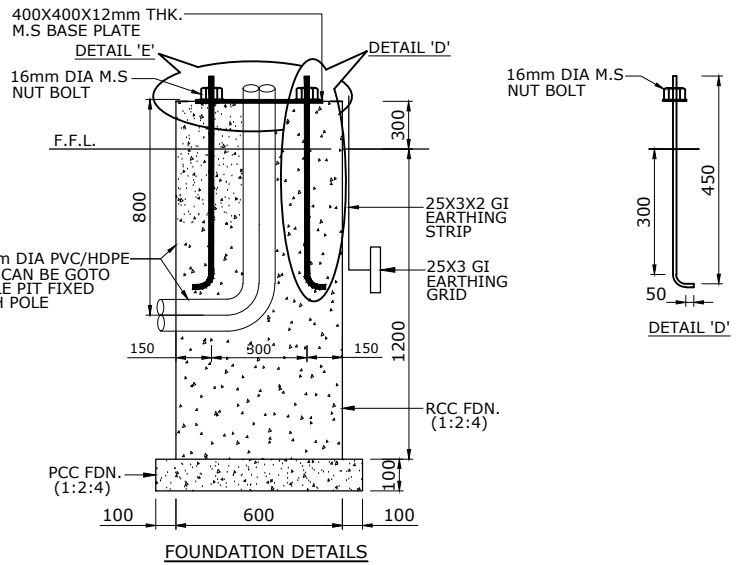
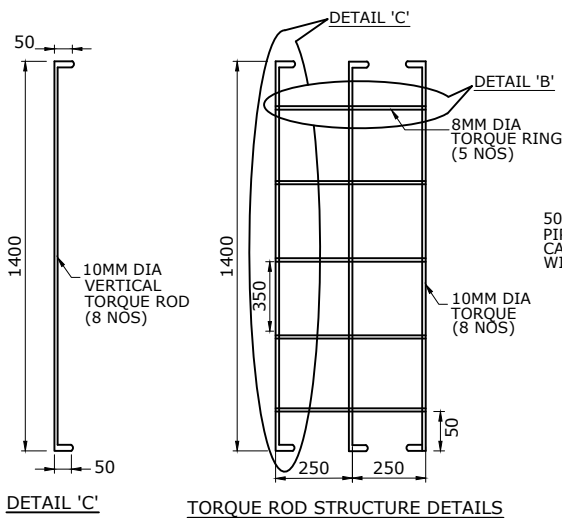
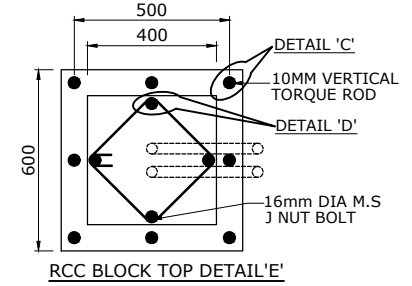
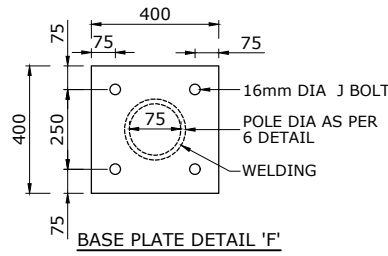
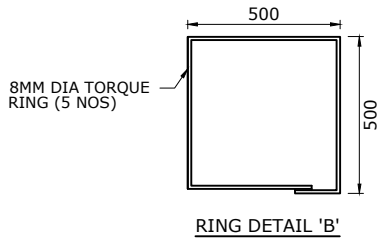
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	PIPE CAP FOR STREET LIGHTING POLE	1 NO.	
2	40mm DIA PIPE WELDED TO CAP	1 NO.	
3	STIFFER PLATE	1 NO.	
4	STREET LIGHTING POLE (REFER SELECTION TABLE BELOW)	-	
5	400x400x12mm THK. M.S. PLATE WITH 1 Nos. 20mm Ø HOLES	1 NO.	
6	M10 x 30mm LONG FULL THREADED BOLT	4 NOS.	

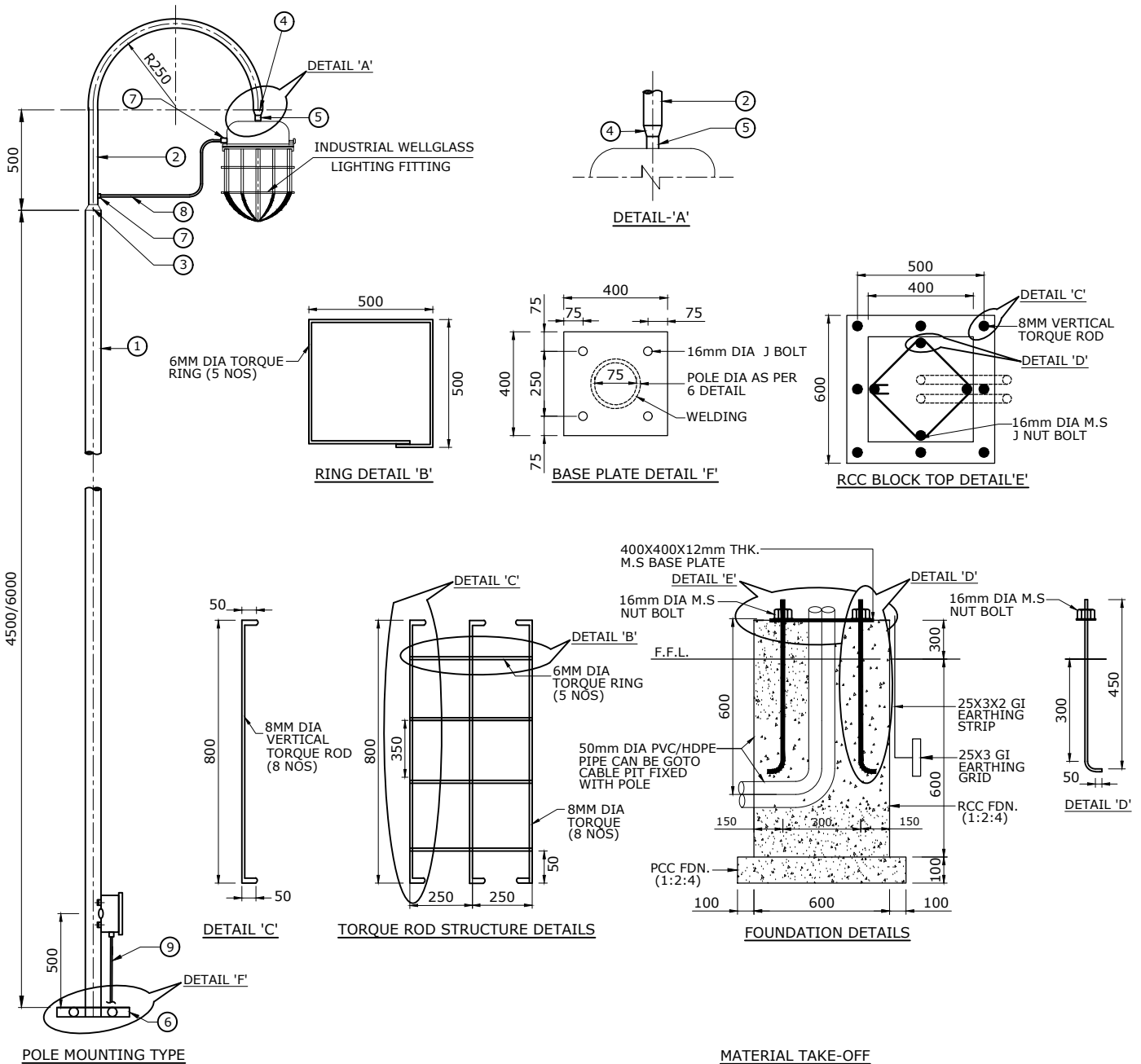
NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- AFTER INSTALLATION THE ASSEMBLY IS TO BE PREPARED, PRIMED AND PAINTED IN ACCORDANCE WITH THE PROJECT PAINTING SPECIFICATION.
- LIGHT FITTING FIXING DETAILS TO BE FURNISHED BY SITE.
- EARTHING TERMINAL ARE LOCATED DIAMETRICALLY OPPOSITE.
- ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANISED AND ZINC PASSIVATED.
- MOUNTING DETAILS OF CONTROL GEAR BOX AND LOOPING BOX REFER INSTALLATION DETAILS.
- ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
- POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION AS MENTIONED IN ABOVE TABLE- AS IS-2713 (PART III) - 1980.
- DOUBLE ARM SHALL BE EITHER AT 180° OR 30° AS PER THE LOCATION OF THE LIGHTING FITTING & SITE REQUIREMENT.

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02	02.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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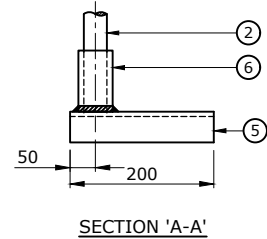
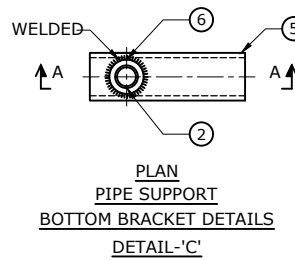
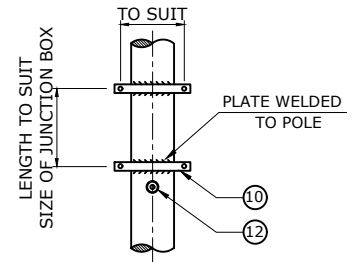
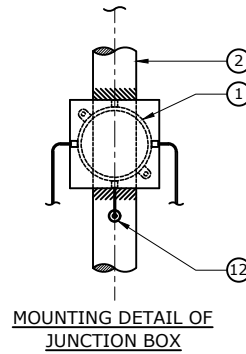
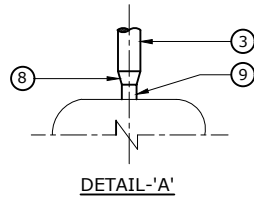
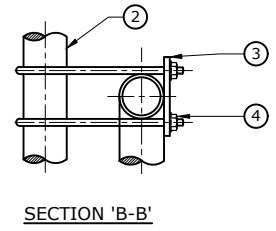
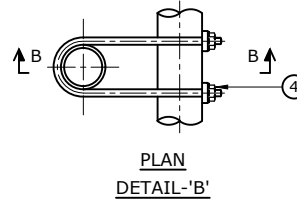
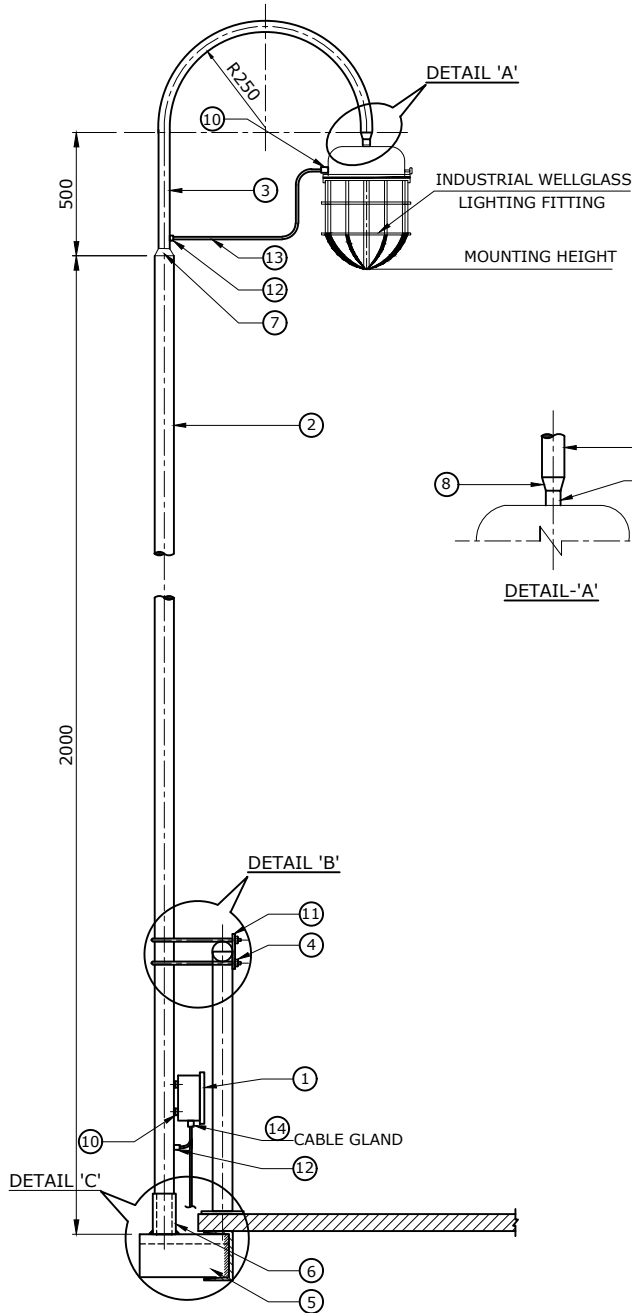
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. CABLE GLAND USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GRIP FOR BRADING.
3. PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.
4. ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANISED.
5. ALL SHARP EDGES AND BURRS SHALL BE REMOVED. SITE FABRICATED STEEL SHALL BE PAINTED WITH TWO COATS OF ANTI-CORROSIVE PAINT AND TWO COATS OF EPOXY PAINTS.
6. ALL DAMAGE TO GALVANISED FINISHED SHALL BE MADE GOOD WITH ZINC RICH PAINT.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	02.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK



MOUNTING TYPE - PM5

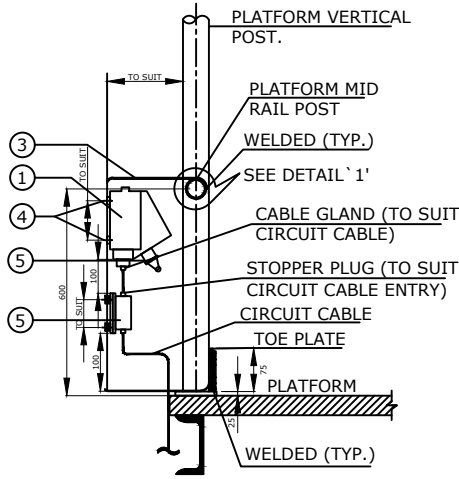
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX OR CONTROL GEAR BOX	1 NO.	
2	65mm Ø G.I. PIPE (CLASS HEAVY) WITH BOTH SIDE THREADING MAX. LENGTH 3.0 Mtrs.	1 NO.	
3	40mm Ø G.I. PIPE (CLASS HEAVY) WITH ONE END SWAN NECK 250mm RADIUS 180° BEND & BOTH END THREADED. MAX. 1Mtr.	1 NO.	
4	10mm Ø 'U' BOLT SUITABLE FOR 65mm Ø PIPE WITH BOTH END THREADED WITH NUTS 2Nos. PLAIN & 1NO. SPRING WASHER SUITABLE	4 NOS.	
5	ISMC-100 x 50 x 350mm LONG	1 NO.	
6	G.I. COUPLING SUITABLE FOR 65mm Ø G.I. PIPE	1 NO.	
7	G.I. REDUCER - 60 x 40	1 NO.	
8	G.I. REDUCER - 40 x 19	1 NO.	
9	G.I. NIPPLE THREADED AT BOTH END	1 NO.	
10	150x150x6mm THK. M.S. PLATE WITH 2 Nos. 12mm Ø HOLES OR 50x6x300 LONG G.I. FLATE WITH 2 Nos. 12mm Ø HOLES.	1 NO./2 Nos.	REFER VIEW -'A'
11	50 x 6 x 150mm LONG G.I. FLAT WITH 2 Nos. 12mm Ø HOLES.	4 NOS.	
12	RURDER GROMMET TO SUIT FLEXIBLE WIRE	2 NOS.	
13	2.5 Sq. mm SQ. FLEXIBLE CABLE	3.5Mtrs. MAX.	
14	CABLE GLAND SUITABLE FOR ITEM NO. 13	2 NOS.	

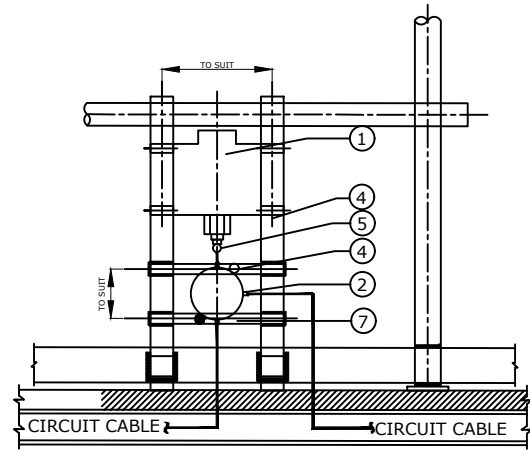
NOTES:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- MOUNTING HEIGHT SHALL NOT EXCEED 2.5M FROM THE PLATFORM.
- CABLE GLAND USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GRIP FOR BRADING.
- PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.
- ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANISED.
- ALL SHARP EDGES AND BURRS SHALL BE REMOVED. SITE FABRICATED STEEL SHALL BE PAINTED WITH TWO COATS OF ANTI-CORROSIVE PAINT AND TWO COATS OF EPOXY PAINTS.
- ALL DAMAGE TO GALVANISED FINISHED SHALL BE MADE GOOD WITH ZINC RICH PAINT.
- WHERE POSSIBLE LOCATE LAMP POST ADJACENT TO HANDRAIL POST.

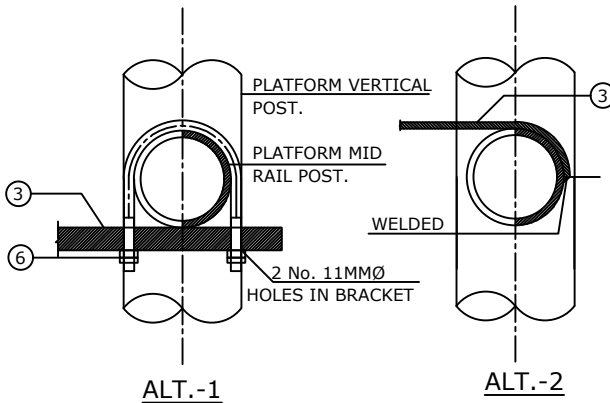
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



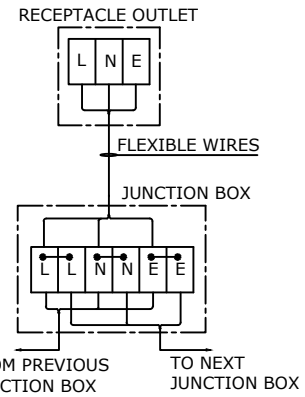
SIDE VIEW



FRONT VIEW



ALTERNATE ARRANGEMENT FOR FIXING
OF BRACKET TO MID RAIL POST
DETAIL - 1'



WIRING DIAGRAM FOR JUNCTION
BOX TO RECEPTACLE

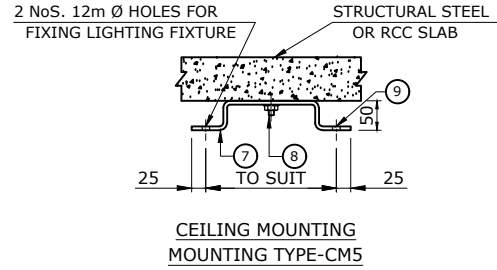
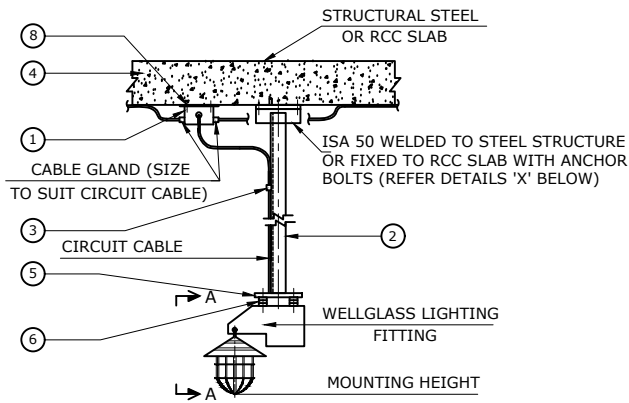
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	SMALL POWER SOCKET OUTLET	AS REQUIRED	
2.	JUNCTION BOX WITH TERMINAL BLOCK	AS REQUIRED	
3.	50 x 6mm THK. (LENGTH AS REQUIRED) MS FLAT FOR FIXING FOR POWER SOCKET OUTLET	3 MTRS.	
4.	M6 x 40mm LONG MS BOLT WITH NUT & WASHER FOR FIXING OF JUNCTION BOX ON BRACKET	8 NOS.	
5.	PLUG TO SUIT SMALL POWER SOCKET OUTLET	AS REQUIRED	
6.	M10 'U' BOLT OF SUITABLE TO MD HANDRAIL POST WITH THREADED BOTH THE SIDE WITH NUT, LOCK NUT & WASHER	2 NOS.	
7.	50 x 6mm THK. (LENGTH AS REQUIRED) MS FLAT FOR FIXING JUNCTION BOX	2 NOS.	

NOTES:

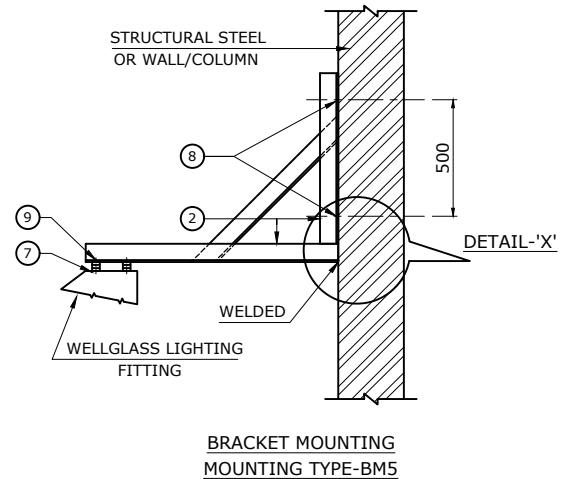
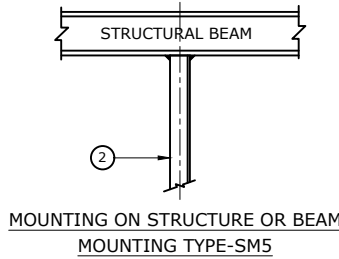
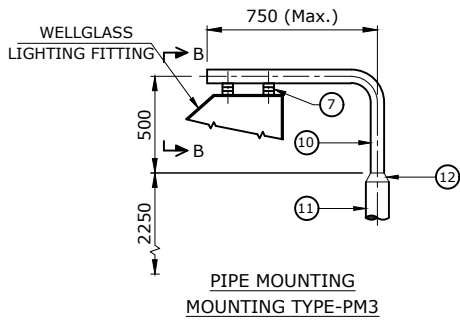
- ALL DIMENSION ARE IN MM.
- DRILLING OF ITEM 3 AND 7 TO BE DETERMINED BY FABRICATOR TO THE SOCKET OUTLET AND JUNCTION BOX.
- JUNCTION BOX, RECEPTACLES AND ACCESSORIES SHALL BE CALLED UP ON THE RELEVANT LAYOUT DRAWING MATERIAL LIST AS REQUIRED.
- ALL CABLE AND GLANDS SHALL CALLED UP ON DISTRIBUTION BOARD SCHEDULE.
- AFTER FABRICATION THE ASSEMBLY IS TO BE PAINTED WITH TWO COATS OF ANTI-CORROSIVE PAINT AND TWO COATS OF EPOXY PAINT.
- ALL NUTS, BOLTS, WASHERS SHALL BE GALVANISED OR ZINC PASSIVATED.
- RECEPTACLES AND JUNCTION BOX SHALL BE CERTIFIED FOR THE HAZARDOUS AREA IN WHICH THEY ARE TO BE LOCATED.

02	02.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

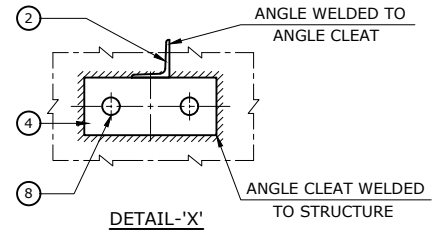
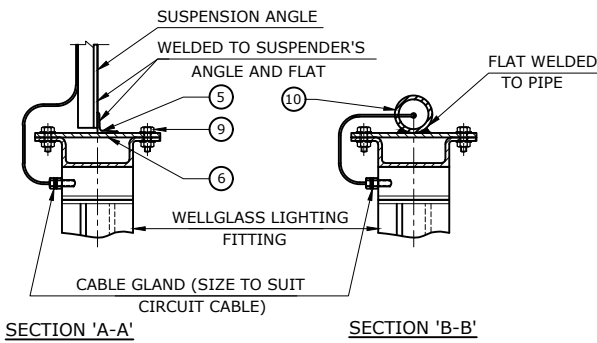


**SUSPENSION MOUNTING
MOUNTING TYPE-SM5**

**CEILING MOUNTING
MOUNTING TYPE-CM5**



**BRACKET MOUNTING
MOUNTING TYPE-BM5**



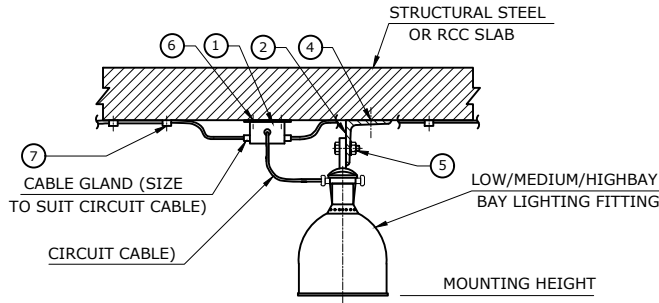
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY ROUND JUNCTION BOX	1 NO.	
2	ISA 50 x 50 x 6mm THK. -MAX. LENGTH 3500mm	1 NO.	
3	G.I. SADDLE/CLEAT LONG WITH SCREWS TO SUIT CIRCUIT CABLE	AS REQUIRED	
4	50 x 50 x 6 x 150 LONG ANGLE CLEAT WITH 2 Nos. 12 Ø HOLES (REFER DETAIL - 'X')	1 NO.	
5	25 x 25 x 6 x 300 LONG ANGLE CLEAT	1 NO.	
6	32 x 6 x 200 LONG G.I. FLAT WITH 3 Nos. 12 Ø HOLES	2 NOS.	
7	50 x 6 x 200 LONG G.I. FLAT WITH 2 Nos. 12 Ø HOLES	1 NO.	
8	M10 x 40mm LONG ANCHOR STUD WITH PLAIN AND SPRING WASHERS	1 NO.	
9	M10 x 30mm LONG G.I. BOLT WITH NUT, 2 PLAIN AND SPRING WASHERS	4 NOS.	
10	40mm Ø G.I. PIPE - CLASS HEAVY WITH MAX. LENGTH OF 1.5 Mtrs. WITH THREADED AT BOTH SIDES.	1 NO.	
11	65mm Ø G.I. PIPE - CLASS HEAVY WITH MAX. LENGTH OF 13.0 Mtrs. WITH THREADED AT BOTH SIDES.	1 NO.	

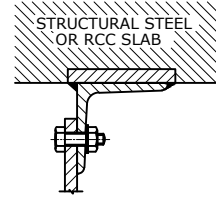
NOTES:

1. ALL WELDED POINT SHALL CLEANED AND APPLY TWO COAT OF ANTI-CORROSIVE PAINT AND TWO COATS OF ZINC RICH PAINT.

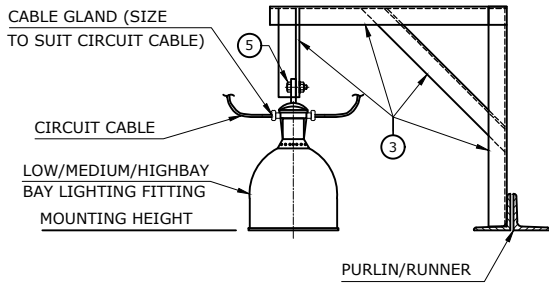
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



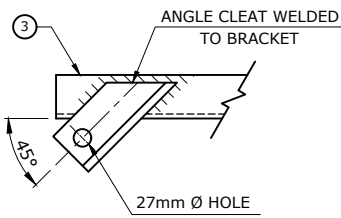
**CEILING MOUNTED
LIGHTING FITTING - CM6**



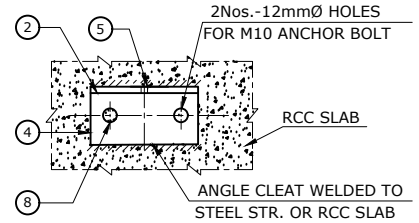
ELEVATION



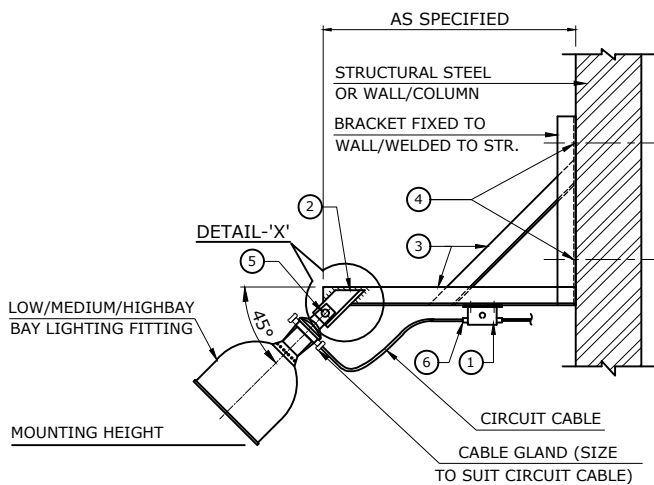
**BRACKET MOUNTED ON PURLIN
MOUNTING TYPE-BM6**



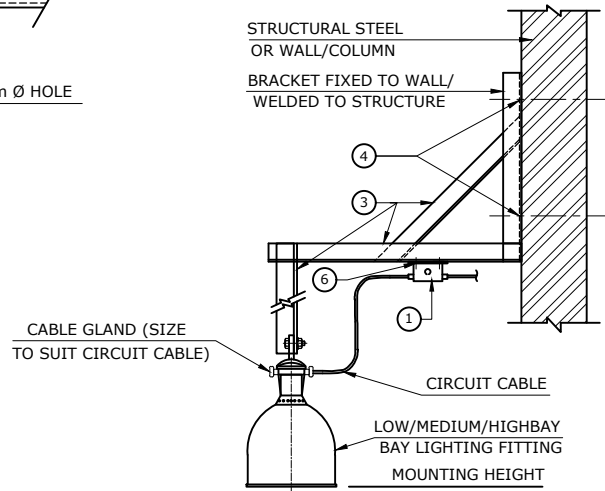
DETAIL-'X'



**PLAN
MOUNTING DETAIL ON
R.C.C. SLAB**



**BRACKET MOUNTED 30° OR 45°
MOUNTING TYPE-BM6**

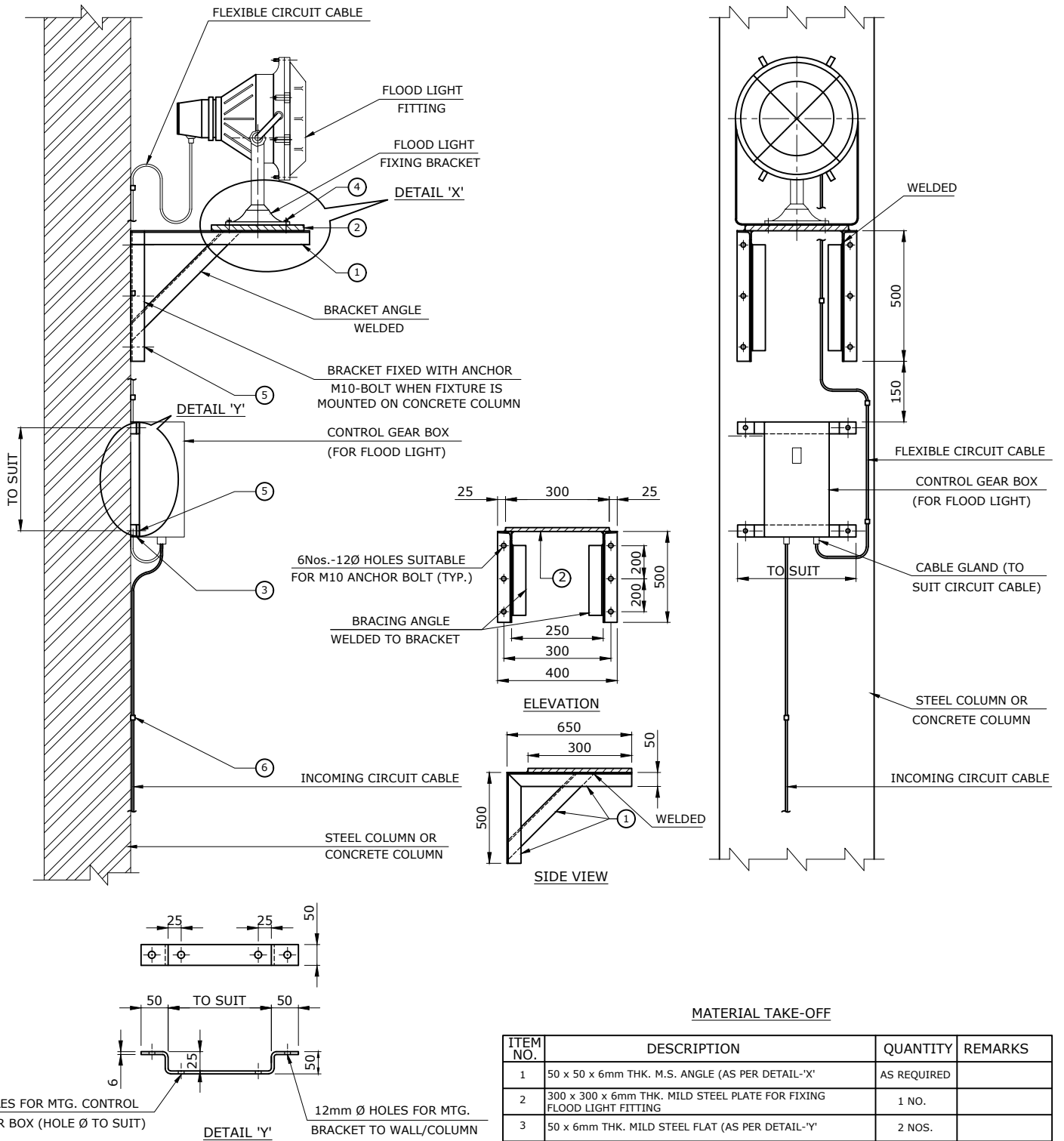


**BRACKET MOUNTING
MOUNTING TYPE-BM6**

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	4WAY ROUND JUNCTION BOX	1 NO.	
2	ISA 50 x 50 x 6mm THK. 160mm LONG ANGLE CLEAT WITH 2 Nos. 12mm Ø HOLES	1 NO.	
3	ISA 50 x 50 x 6mm THK. LENGTH TO SUIT MTG. HEIGHT OR BRACKET SUSPENSION MOUNTING TYPE TO SUIT HEIGHT	1 NO.	
4	M10-68mm LONG ANCHOR STUD WITH LOCK WASHERS AND NUTS FOR FIXING OF ISA IN RCC SLAB	2 NOS.	
5	M25-40mm LONG BOLT WITH NUT AND PLAIN WASHERS	1 NO.	
6	M10-40mm LONG BOLT WITH NUT AND PLAIN WASHERS FOR MOUNTING OF LIGHTING FITTING	2 NOS.	
7	SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF ANCHORING FIXING SCREWS TO SUIT FOR CIRCUIT CABLE SADDLE.	AS REQUIRED	

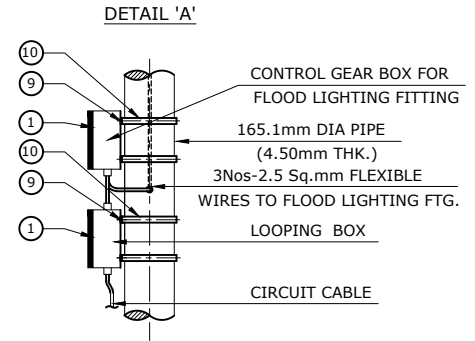
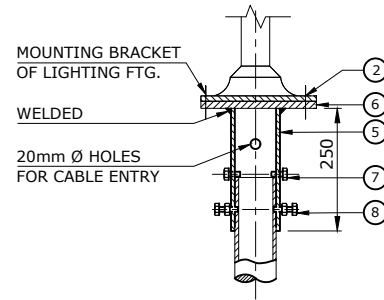
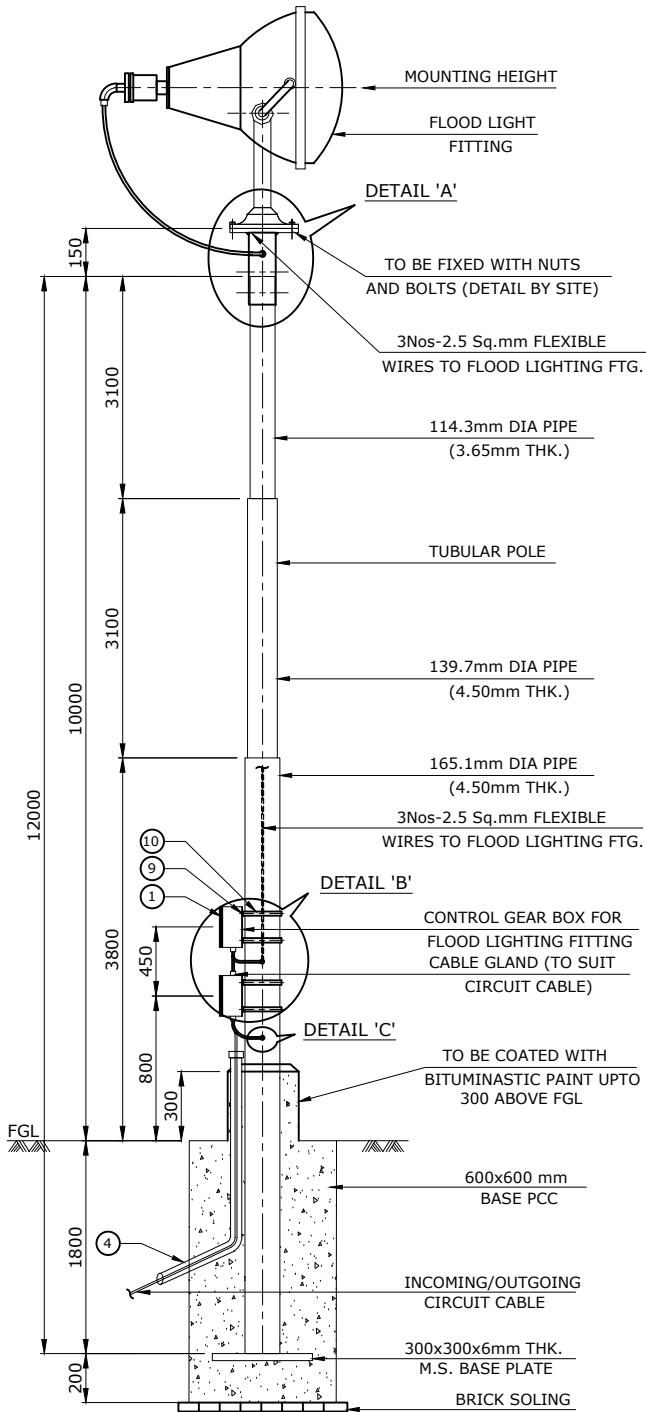
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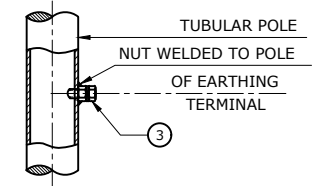
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. AFTER INSTALLATION THE ASSEMBLY IS TO BE PAINTED WITH TWO COATS OF ANTI-CORROSIVE PAINT AND TWO COATS OF EPOXY PAINTS.

02	03.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



DETAIL 'B'



DETAIL 'C'

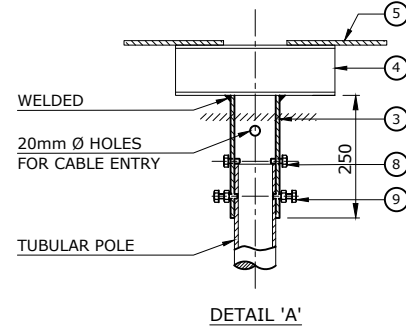
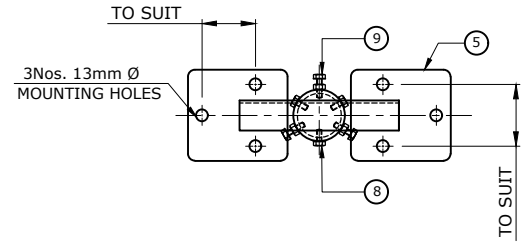
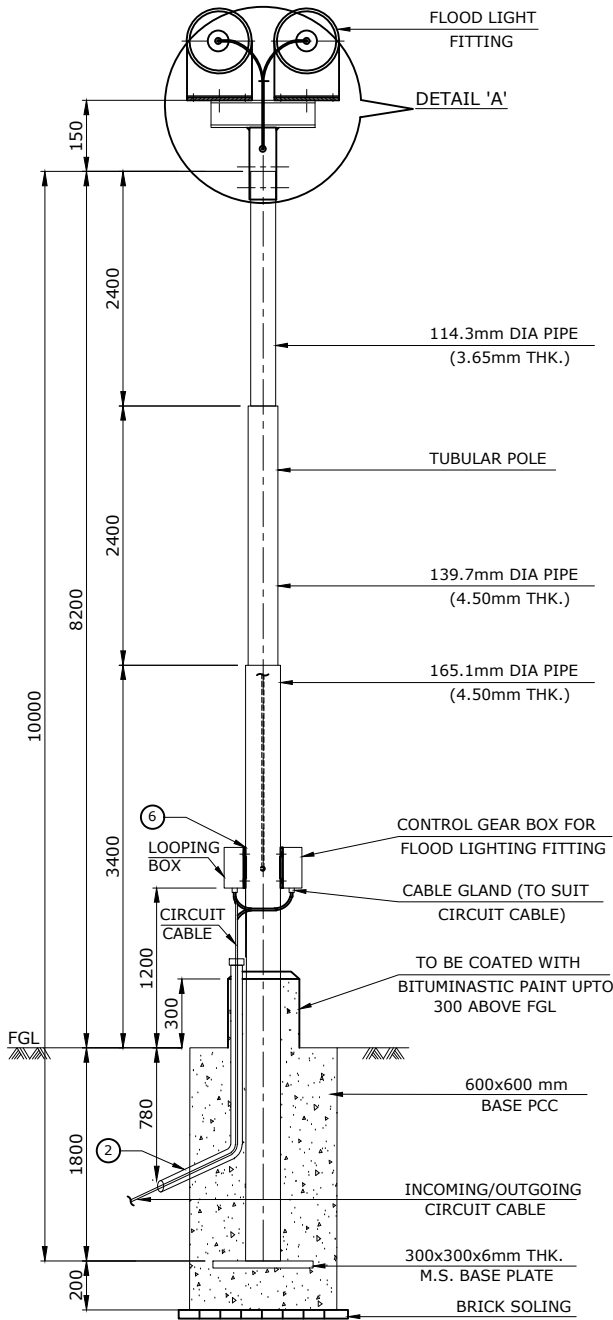
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	STREET LIGHTING LOOPING BOX	1 NO.	
2	M8 x 40mm LONG BOLT WITH NUTS & PLAIN WASHER FOR FIXING FLOOD LIGHT	AS REQUIRED	
3	EARTHING TERMINAL M10-40mm LONG BOLT WITH NUTS, 2Nos. SPRING WASHERS & 2Nos. PLAIN WASHERS	1 NO.	
4	75mm NB G.I. PIPE SLEAVE	2 NOS.	
5	M.S PIPE CAP TO SUIT 1114.30mm DIA PIPE	1 NO.	
6	300 x 300 x 10mm THICK M.S. PLATE	1 NO.	
7	M10-40mm LONG BOLT TO BE USED AS STOPPER	3 NOS.	
8	M10 x 40mm LONG BOLT WITH LOCK NUT TO BE USED AS HOLDER	3 NOS.	
9	M8-40mm LONG BOLT WITH NUTS & PLAIN WASHER FOR FIXING OF CONTROL GEAR BOX & LOOPING BOX	8 NOS.	
10	BRACKET/CLAMP MADE OUT FROM 25x6mm THK. M.S. FLAT FOR FIXING OF CONTROL GEAR BOX & LOOPING BOX	4 NOS.	

NOTES:

- LIGHTING FITTING FIXING DETAILS TO BE FURNISHED BY SITE.
- EARTHING TERMINALS ARE LOCATED DIAMETRICALLY OPPOSITE.
- ALL NUTS, BOLTS AND WASHER SHALL BE GALVANISED OR ZINC PASSIVATED.
- MOUNTING DETAILS OF CONTROL GEAR BOX & LOOPING BOX REFER INSTALLATION DETAILS.
- ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
- POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION 410TP-60 AS PER IS-2713 (PART II) - 1980.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	03.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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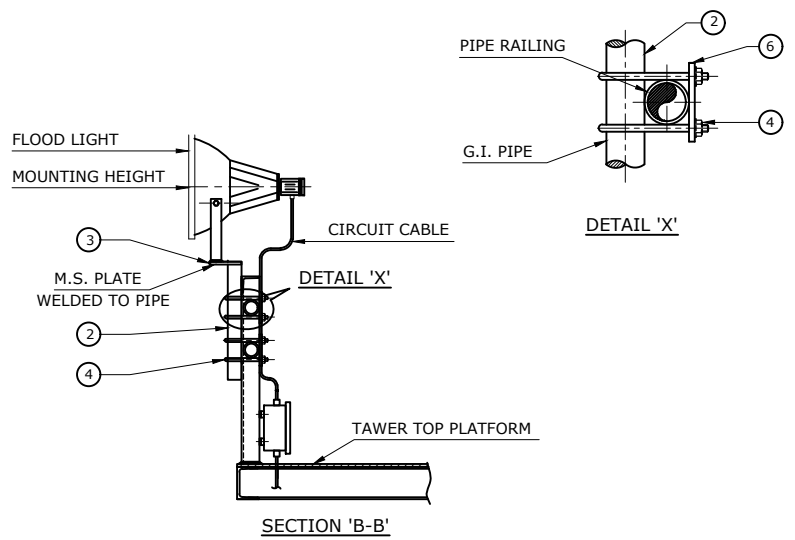
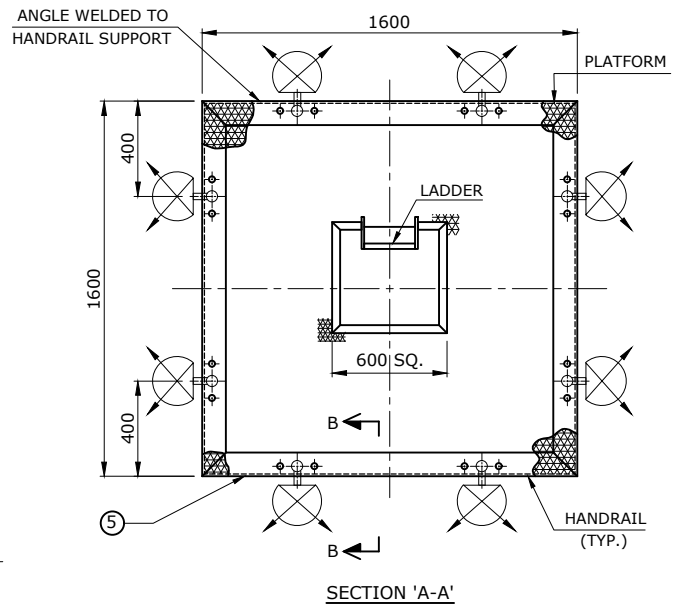
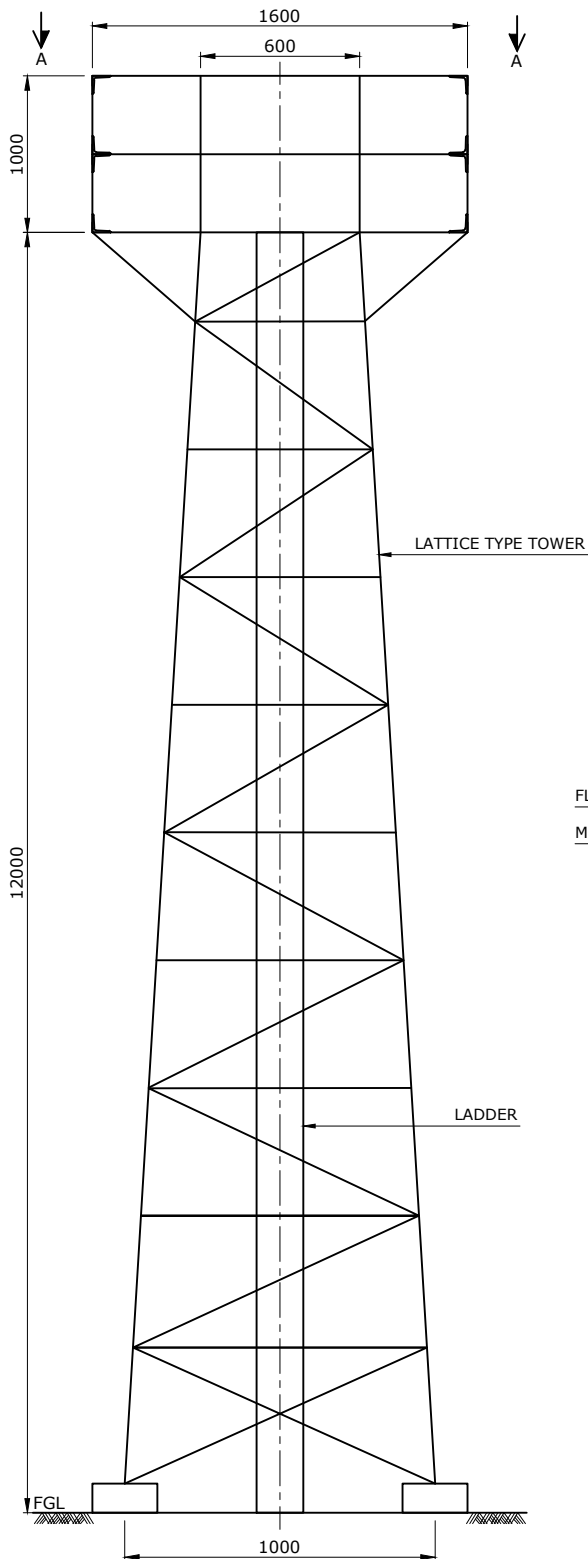
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	STREET LIGHTING LOOPING BOX	-	
2	75mm NB G.I. PIPE SLEEVE	2 NOS.	
3	M.S PIPE CAP (TO SUIT 1114.30mm DIA PIPE)	1 NO.	
4	100 x 50 x 6mm THK. M.S. CHANNEL (LENGTH TO SUIT)	AS REQUIRED	
5	300 x 300 x 6mm THICK M.S. PLATE	2 NOS.	
6	50 x 6mm THICK M.S. FLAT (LENGTH TO SUIT)	AS REQUIRED	
7	M10-30mm LONG BOLT WITH NUT, WASHER FOR FIXING FLOOD LIGHT	AS REQUIRED	
8	M10 BOLT (TO BE USED AS STOPPER)	3 NOS.	
9	M10 BOLT WITH LOCK NUT (TO BE USED AS HOLDER)	3 NOS.	

NOTES:

1. FIXING DETAILS TO BE FURNISHED BY SITE.
2. EARTHING TERMINALS ARE LOCATED DIAMETRICALLY OPPOSITE.
3. 2 Nos. 20mm Ø HOLES LOCATED DIAMETRICALLY OPPOSITE.
4. MOUNTING DETAILS OF CONTROL GEAR BOX & LOOPING BOX TO BE FIXED BY SITE.
5. FOR INCANDESCENT LAMP, FLEXIBLE CABLE TO GO DIRECTLY TO FITTING.
6. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
7. ALL NUTS, BOLTS AND WASHER SHALL BE GALVANISED OR ZINC PASSIVATED.
8. POLE SHALL BE MADE FROM TUBULAR STEEL PIPES SWAGED AND WELDED CONFORMING TO DESIGNATION 410TP-60 AS PER IS-2713 (PART II) - 1980.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	04.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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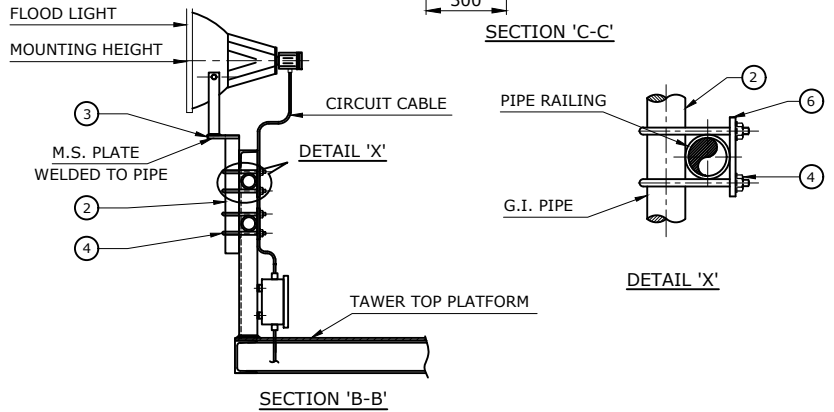
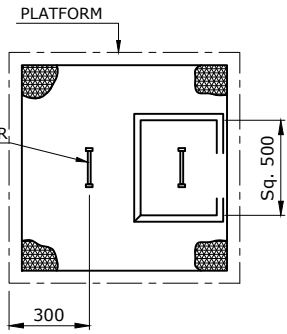
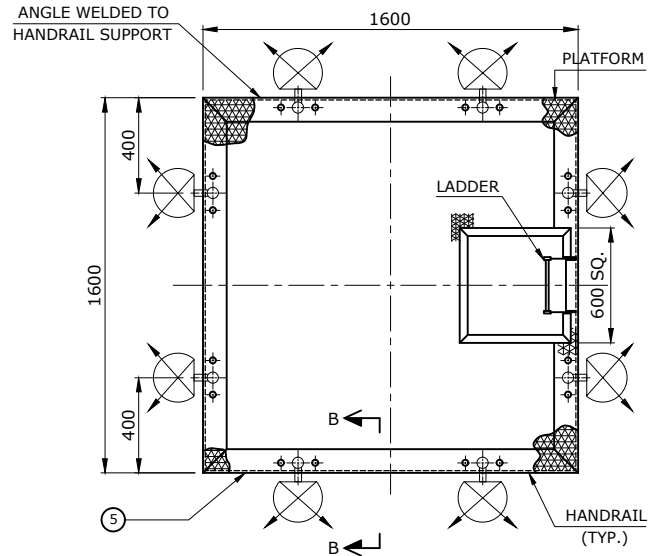
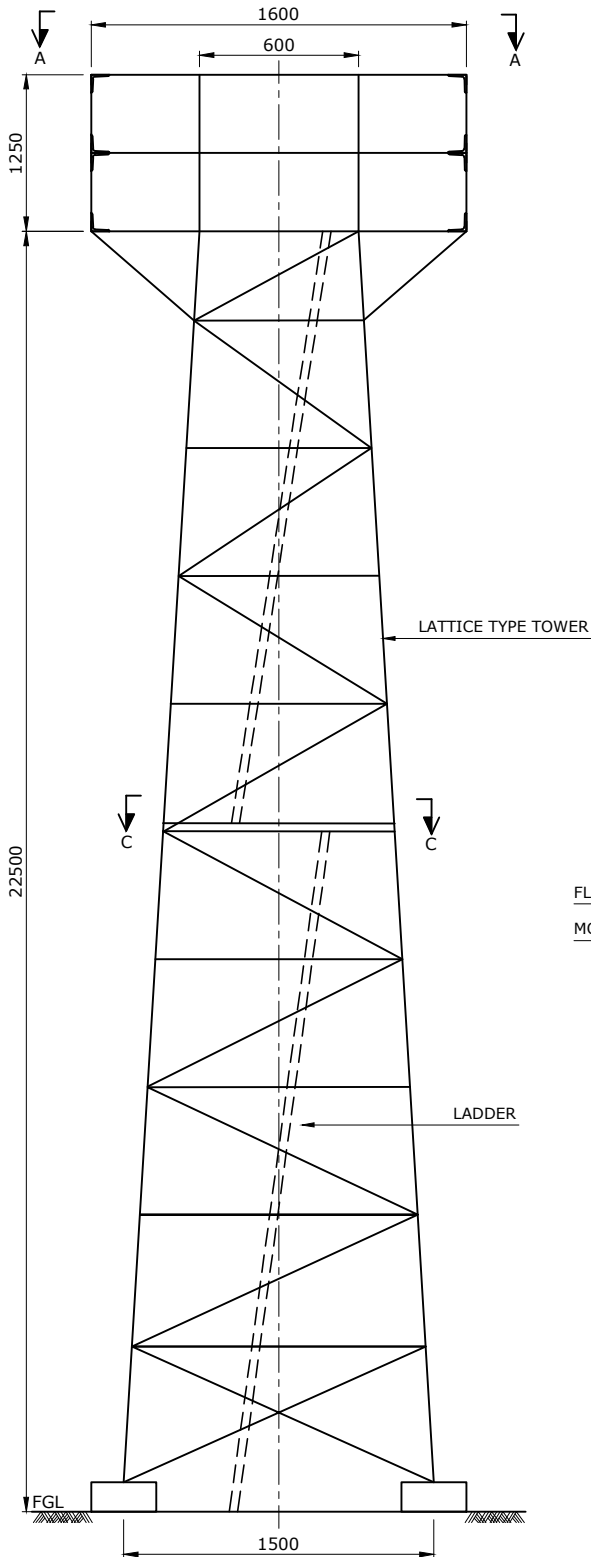


MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	CONTROL GEAR BOX	AS REQUIRED	
2	40mm Ø G.I. PIPE (CLASS HEAVY) LENGTH TO SUIT	AS REQUIRED	
3	150 x 250 x 6mm THK. M.S. PLATE	AS REQUIRED	
4	M10 'U' BOLT OF SUITABLE SIZE (THREADED AT BOTH ENDS) WITH NUT AND WASHER	4 NOS.	
5	75 x 75 x 6mm THK. M.S. ANGLE (LENGTH TO SUIT)	AS REQUIRED	
6	25 x 6mm THICK M.S. FLAT (LENGTH TO SUIT)	AS REQUIRED	

NOTES:

02	04.02.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

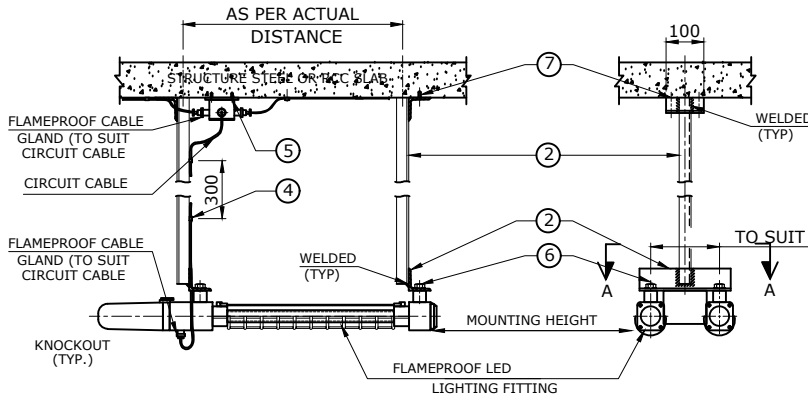


MATERIAL TAKE-OFF

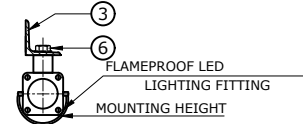
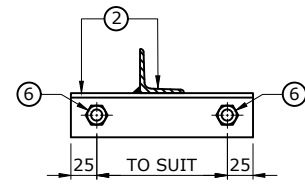
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	CONTROL GEAR BOX	AS REQUIRED	
2	40mm Ø G.I. PIPE (CLASS HEAVY) LENGTH TO SUIT	AS REQUIRED	
3	150 x 250 x 6mm THK. M.S. PLATE	AS REQUIRED	
4	M10 'U' BOLT OF SUITABLE SIZE (THREADED AT BOTH ENDS) WITH NUT AND WASHER	2 NOS.	
5	75 x 75 x 6mm THK. M.S. ANGLE (LENGTH TO SUIT)	AS REQUIRED	
6	25 x 6mm THICK M.S. FLAT (LENGTH TO SUIT)	AS REQUIRED	

NOTES:

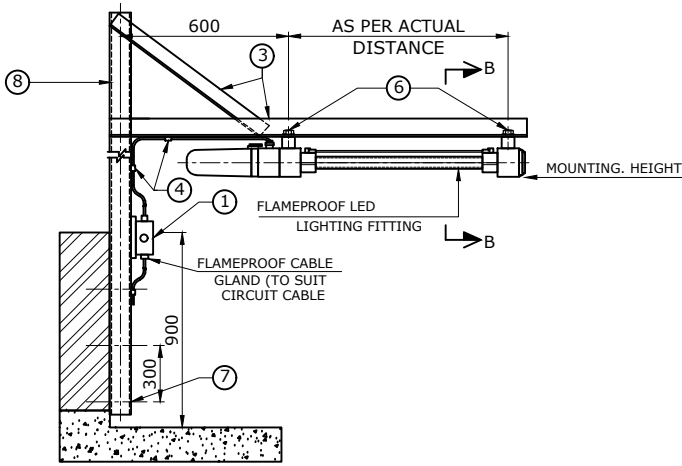
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



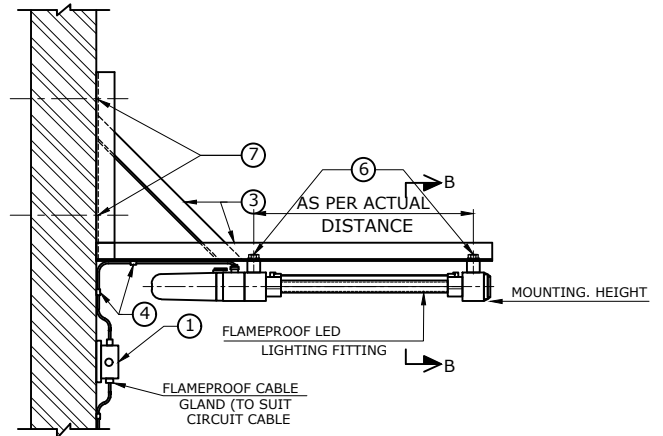
DETAIL FOR SUSPENSION MOUNTING
MOUNTING TYPE : SM9



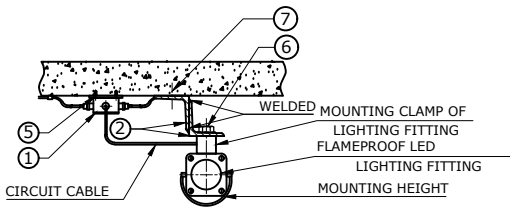
SECTION 'B-B'



DETAIL FOR ROOF/TERRACE MOUNTING
MOUNTING TYPE : BM9



DETAIL FOR BRACKET MOUNTING
MOUNTING TYPE : BM9



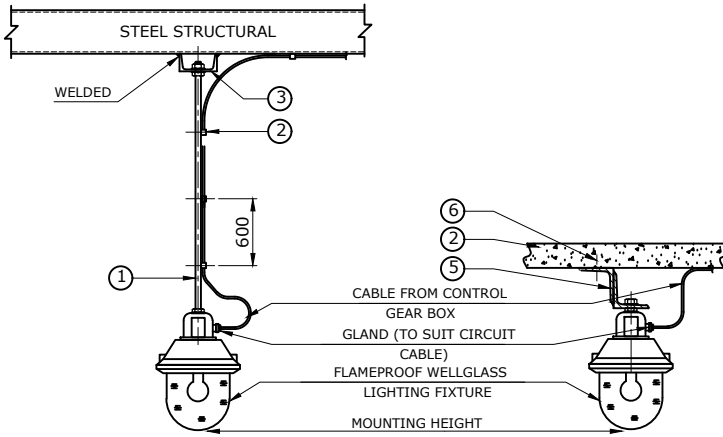
DETAIL FOR CEILING MOUNTING
MOUNTING TYPE : CM9

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY			REMARKS
		CM	SM	BM	
1	FLAMEPROOF JUNCTION BOX WITH TERMINAL BLOCK.	1 NO.	1 NO.	1 NO.	
2	ISA 50 x 50 x 6mm THK. (LENGTH TO SUIT)	AS REQD.	AS REQD.	-	
3	BRACKET MADE OUT FROM ISA 75 x 75 x 6mm THK. (LENGTH TO SUIT).	-	-	AS REQD.	
4	SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREWS TO SUIT FOR CIRCUIT CABLE.	AS REQD.	AS REQD.	AS REQD.	
5	M8-68mm LONG STUD ANCHOR WITH NUT & LOCK WASHER FOR JUNCTION BOX FIXING TO CEILING/WALL.	2 NOS.	2 NOS.	2 NOS.	
6	M10x40mm LONG BOLT NUT & PLAIN WASHER.	2 NOS.	4 NOS.	4 NOS.	
7	M10-68mm LONG STUD ANCHOR WITH NUT & LOCK WASHER FOR FIXING OF ISA TO CEILING/WALL.	2 NOS.	4 NOS.	4 NOS.	
8	ISMC -150 (LENGTH TO SUIT)	-	-	AS REQD.	

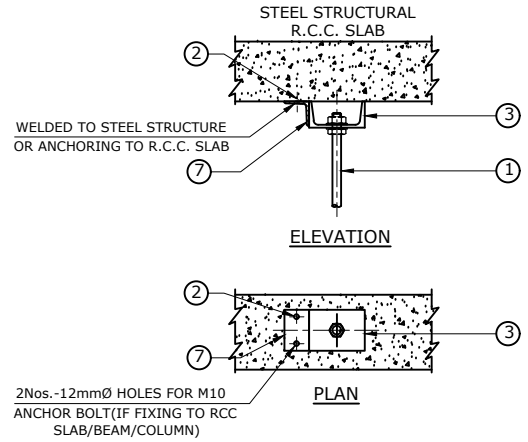
NOTES:

02	26.04.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

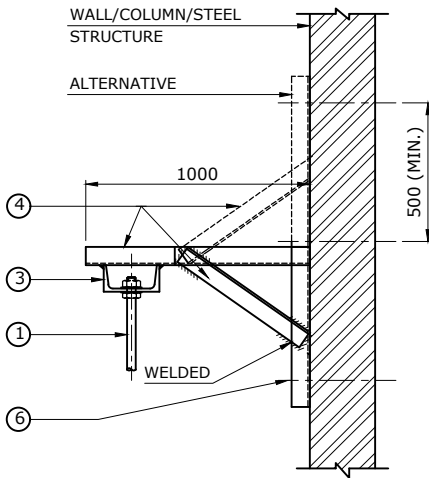


SUSPENSION MOUNTING
MOUNTING TYPE : SM8

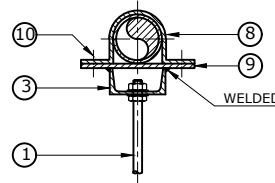
CEILING MOUNTING
MOUNTING TYPE : CM8



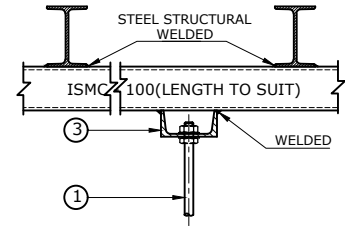
**MOUNTING DETAIL ON
R.C.C. SLAB**



WALL/COLUMN BRACKET
MOUNTING TYPE : BM8



TUBULAR TRUSS
MOUNTING TYPE : PM8



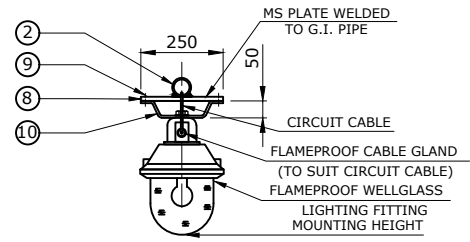
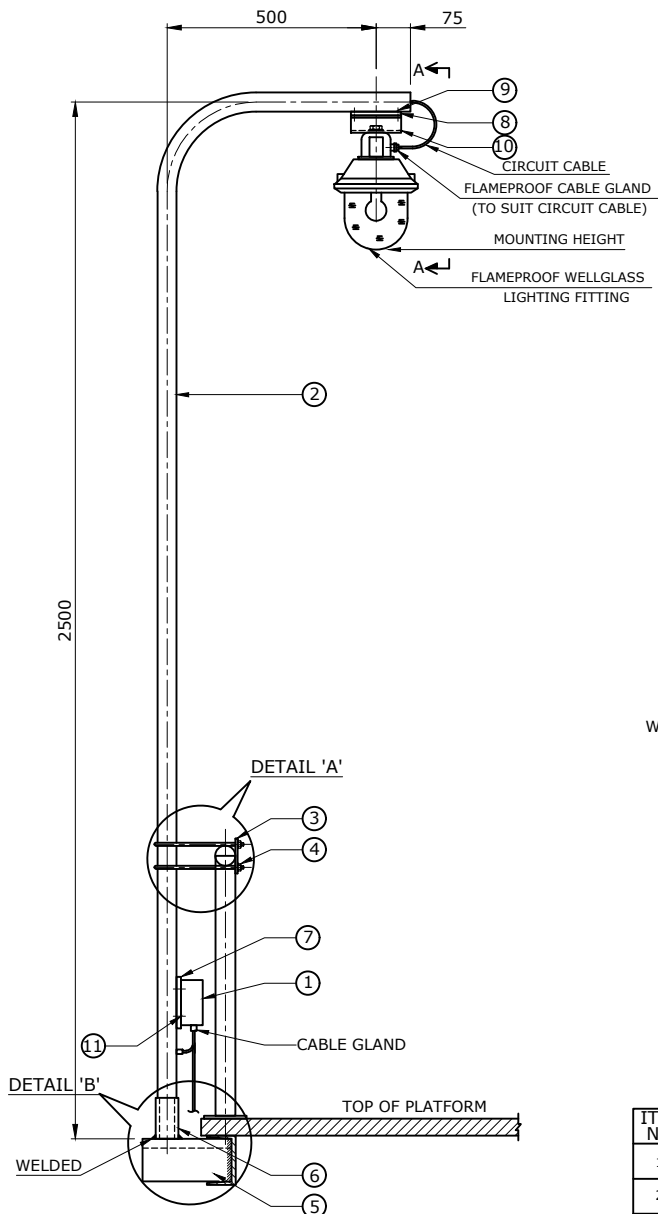
**SUSPENSION FROM STEEL
STRUCTURE**
MOUNTING TYPE-SM8

MATERIAL TAKE-OFF

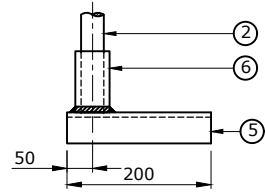
ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	19mm Ø M.S. ROD (LONG AS REQUIRED) THREADED WITH BOTH ENDS WITH 2 Nos. NUTS, 2Nos. PLAIN/SPRING WASHERS	2 NOS.	
2	SADDLE/CLEAT ALONG WITH SUITABLE SIZE OF FIXING SCREWS. TO SUIT FOR CIRCUIT CABLE.	AS REQUIRED	
3	ISMC 100 x 50 - 75mm LONG (OR MORE LONG AS REQUIRED)	1 NO.	
4	BRACKET MADE OUT FROM ISA 50 x 50 x 6mm THK.	AS REQUIRED	
5	ISMC 75 x 40 - 50mm LONG (OR MORE LONG AS REQUIRED)	1 NO.	
6	M10-40mm LONG ANCHOR BOLT FOR MOUNTING OF PLATE/ BRACKET/ISMC TO WALL/COLUMN/CEILING	AS REQUIRED	
7	ISA 50 x 50 x 6mm THK. WITH 2 Nos.-Ø12mm HOLES	AS REQUIRED	
8	CLAMP/SADDLE (TO BE MADE OUT OF 50 x 6mm M.S. FLAT) WITH FIXING SCREWS. (CLAMP TO SUIT SIZE OF TRUSS/PIPE)	1 NO.	
9	50 x 6mm THK. M.S. FLAT (FOR SADDLE/CLAMP FIXING) LENGTH TO SUIT SIZE OF TRUSS/PIPE	1 NO.	
10	M10-40mm LONG BOLT WITH NUT & WASHER FOR CLAMP/ SADDLE BOLTED	2 NOS.	

NOTES:

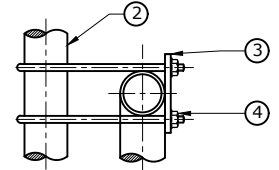
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK



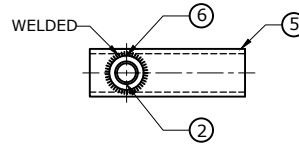
SECTION 'A-A'



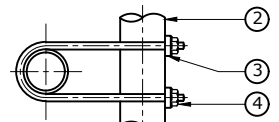
ELEVATION



ELEVATION



**PLAN
PIPE SUPPORT
BOTTOM BRACKET DETAILS
DETAIL-'B'**



**PLAN
DETAIL-'A'**

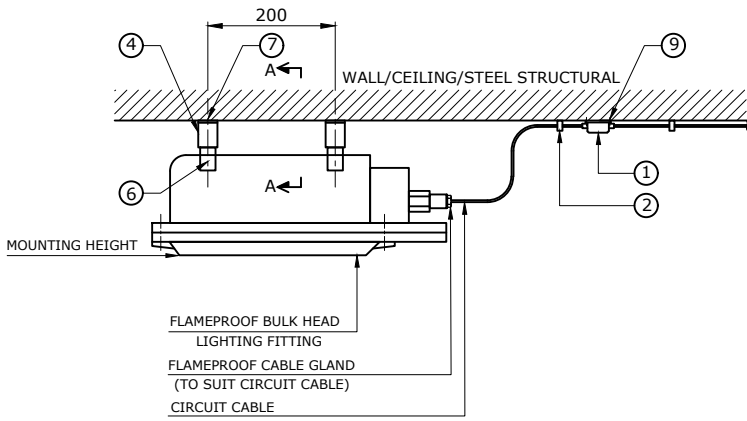
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	FLAMEPROOF CONTROL GEAR BOX	1 NO.	
2	40mm Ø G.I. PIPE (CLASS HEAVY) WITH ONE SIDE 300mm RADIUS 90° BEND & OTHER END THREADED	1 NO.	
3	CLAMP MADE OUT FROM 25x6mm THK. M.S. FLAT 150mm LONG FOR FIXING WITH 'U' BOLT	4 NOS.	
4	10mm Ø 'U' BOLT SUITABLE WITH BOTH END THREADED WITH NUTS & PLAIN WASHER SUITABLE FOR 40mm Ø G.I. PIPE	4 NOS.	
5	ISMC-100 x 50 x 200mm LONG FOR SUPPORT TO PIPE	1 NO.	
6	G.I. PIPE COUPLING TO SUIT 40mm Ø G.I. PIPE, COUPLING WELDED TO ISMC-100 x 50	1 NO.	
7	150 x 150 x 3mm THK. M.S. PLATE WITH SUITABLE SIZE OF HOLES FOR MOUNTING OF JUNCTION BOX	1 NO.	
8	25 x 6mm THK.-250 LONG M.S. FLAT WELDED TO G.I. PIPE	1 NO.	
9	M10-40mm LONG BOLT WITH NUT & PLAIN WASHER FOR FIXING OF BRACKET TO FLAT	2 NOS.	
10	BRACKET/CLAMP MADE OUT FROM 25 x 6mm THK. M.S. FLAT 325mm LONG FOR LIGHTING FITTING FIXING	1 NO.	
11	M6-40mm LONG BOLT WITH NUT & PLAIN WASHER FOR FIXING OF JUNCTION BOX TO MS PLATE.	2 NOS.	

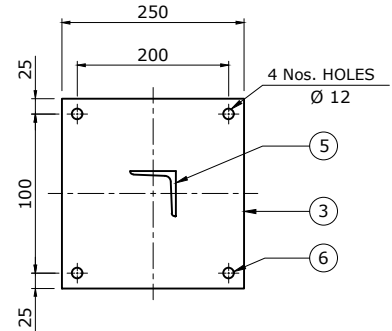
NOTES:

1. MOUNTING HEIGHT SHALL NOT BE EXCEED 4M FROM THE PLATFORM.
2. CABLE GLAND USED FOR TERMINATION OF FLEXIBLE CABLE SHALL BE DOUBLE SEAL WITH CONE GRIP FOR BRADING.
3. PLUG ALL UNUSED ENTRIES OF LIGHTING FITTING AND JUNCTION BOX WITH THREADED STOPPING PLUGS.

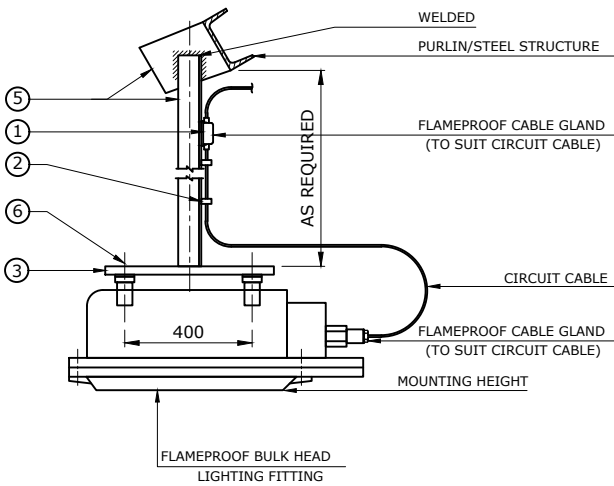
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01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



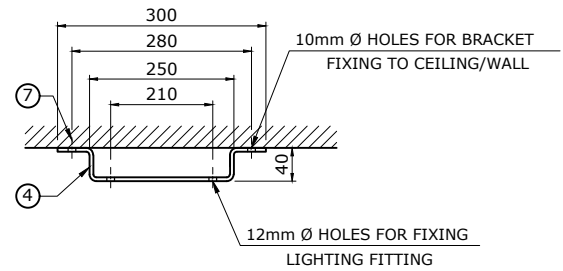
**CEILING/WALL MOUNTED BULK HEAD
FITTING MOUNTING TYPE : CM7**



MOUNTING DETAILS OF PLATE



**PENDENT (SUSPENSION) MOUNTING BULK HEAD
LIGHTING FITTING (ON PURLIN)
MOUNTING TYPE : SM7**



SECTION 'A-A'

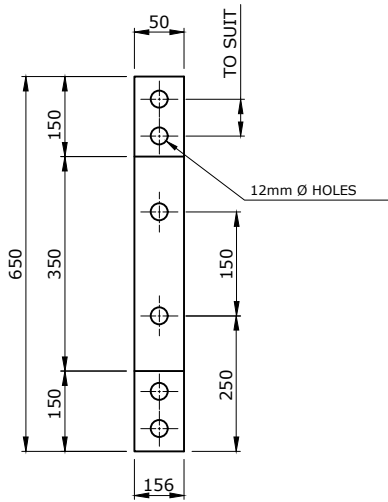
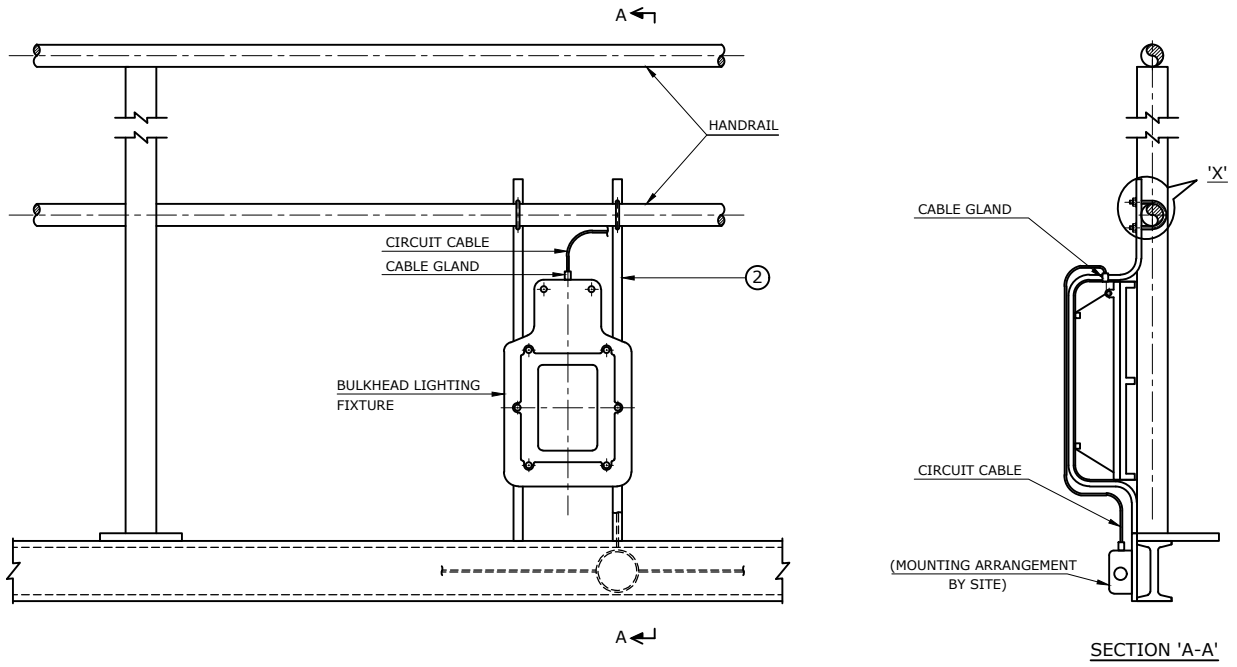
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY		REMARKS
		CM7	SM7	
1	FLAMEPROOF CONTROL GEAR BOX	1 NO.	1 NO.	
2	SADDLE/CLEAT WITH FIXING SCREWS/ANCHOR STUD, NUTS & LOCK WASHERS FOR CIRCUIT CABLE.	AS REQD.	AS REQD.	
3	250 x 250 x 8mm THK. M.S. PLATE	-	1 NO.	
4	MOUNTING BRACKET/CLAMP (TO MADE OUT FROM 25 x 6mm THK. FLAT) FOR LIGHTING FITTING.	2 NOS.	-	
5	ISA 50 x 50 x 6mm THK. (LENGTH TO SUIT)	-	AS REQD.	
6	M10-40mm LONG BOLT WITH NUT & WASHER FOR BOLTING FITTING TO BRACKET	4 NOS.	4 NOS.	
7	M10-68mm LONG STUD WITH NUT & LOCK WASHER FOR BRACKET MOUNTING TO CEILING	4 NOS.	-	
8	M8-40mm LONG BOLT WITH NUT & WASHER FOR BOLTING JUNCTION BOX TO ANGLE	-	2 NOS.	
9	M8-68mm LONG ANCHOR STUD WITH NUT & LOCK WASHER FOR JUNCTION BOX MOUNTING TO CEILING	2 NOS.	-	

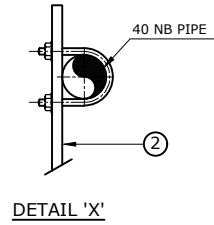
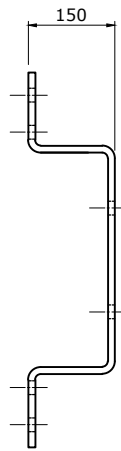
NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. ALL SHARP EDGES AND BURRS SHALL BE REMOVED.
3. ALL NUTS, BOLTS AND WASHERS SHALL BE GALVANISED OR ZINC PASSIVATED.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	26.04.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK



DETAIL OF FIXING BRACKET



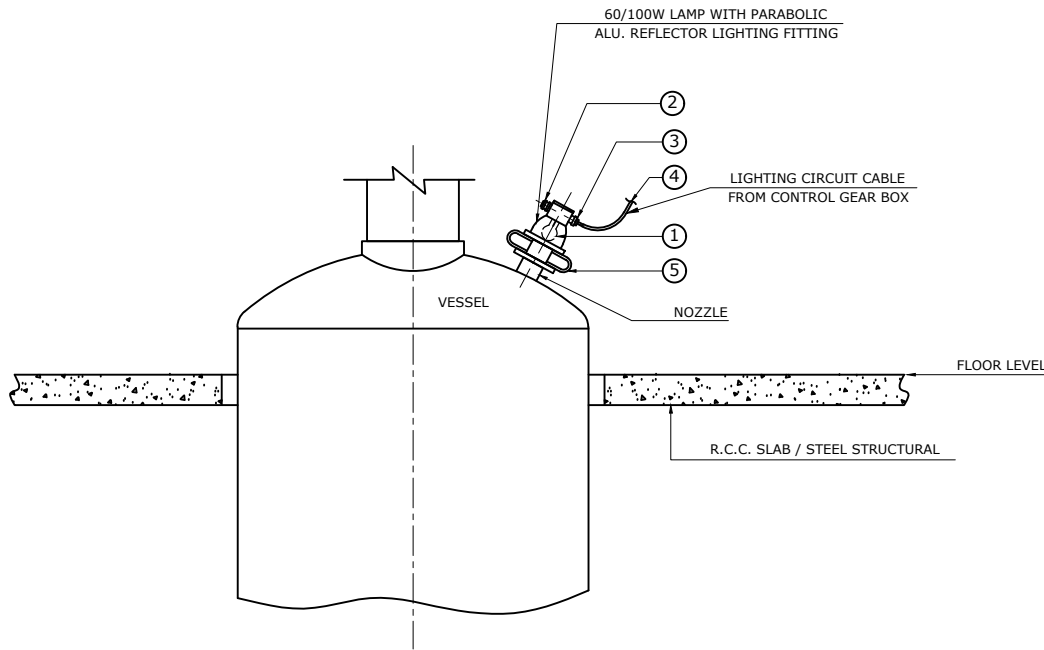
DETAIL 'X'

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	JUNCTION BOX	1 NO.	
2	FIXING BRACKET MADE OUT OF 32 x 6mm M.S. FLAT	2 NOS.	
3	10mm 'U' BOLT SUITABLE SIZE (BOTH END THREADED) WITH NUTS WASHERS.	AS REQUIRED	

NOTES:

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	26.04.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK



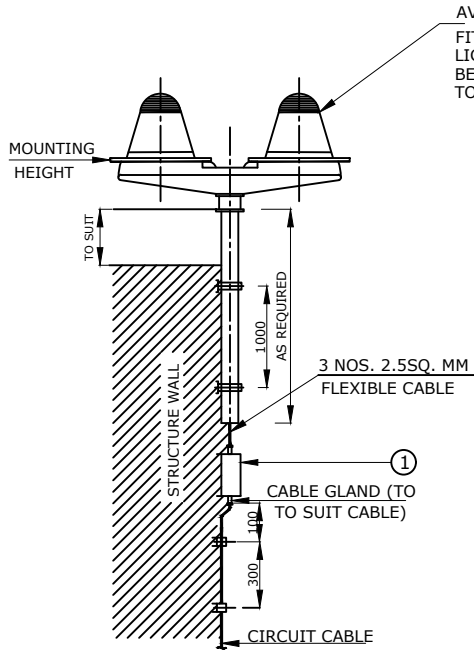
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1	60/100 W LAMP & PARABOLIC ALUMINUM REFLECTOR	1 NO.	BY PURCHASER
2	PLUG	1 NO.	BY PURCHASER
3	CABLE GLAND (TO SUIT CIRCUIT CABLE)	AS REQUIRED	BY PURCHASER
4	CIRCUIT CABLE	AS REQUIRED	BY PURCHASER
5	6mm THK. M.S. MOUNTING BRACKET (SIZE TO SUIT)	1 NO.	BY PURCHASER

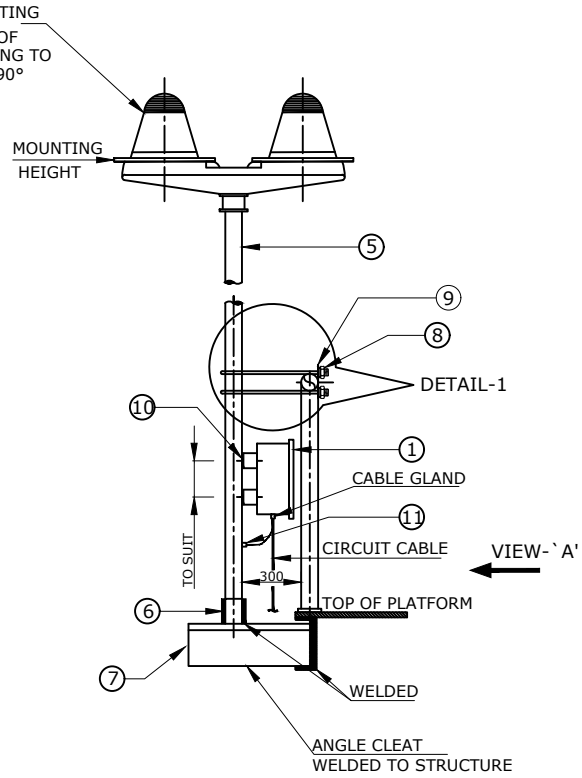
NOTES:

1. LONGER CABLE ROUTE SHALL BE SELECTED TO KEEP EXTRA LENGTH OF CABLE FOR REGLANDING IF NECESSARY.

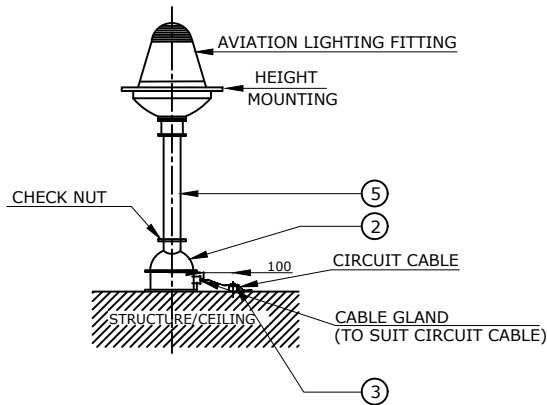
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



FITTING MOUNTED ON SIDE
SUPPORT TO STRUCTURE/ WALL
MOUNTING TYPE-PM11



FITTING MOUNTED ON PLATFORM
MOUNTING TYPE-PM11



FITTING DIRECTLY MOUNTED
ON STRUCTURE/ CEILING MOUNTING TYPE PM-11

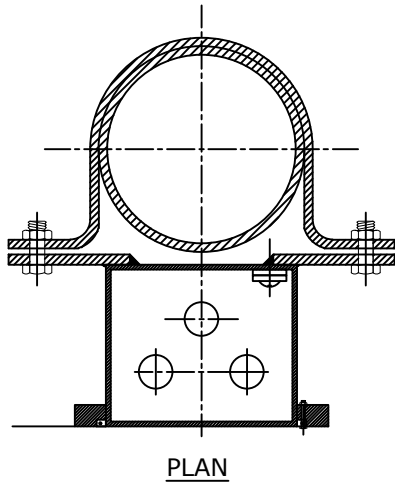
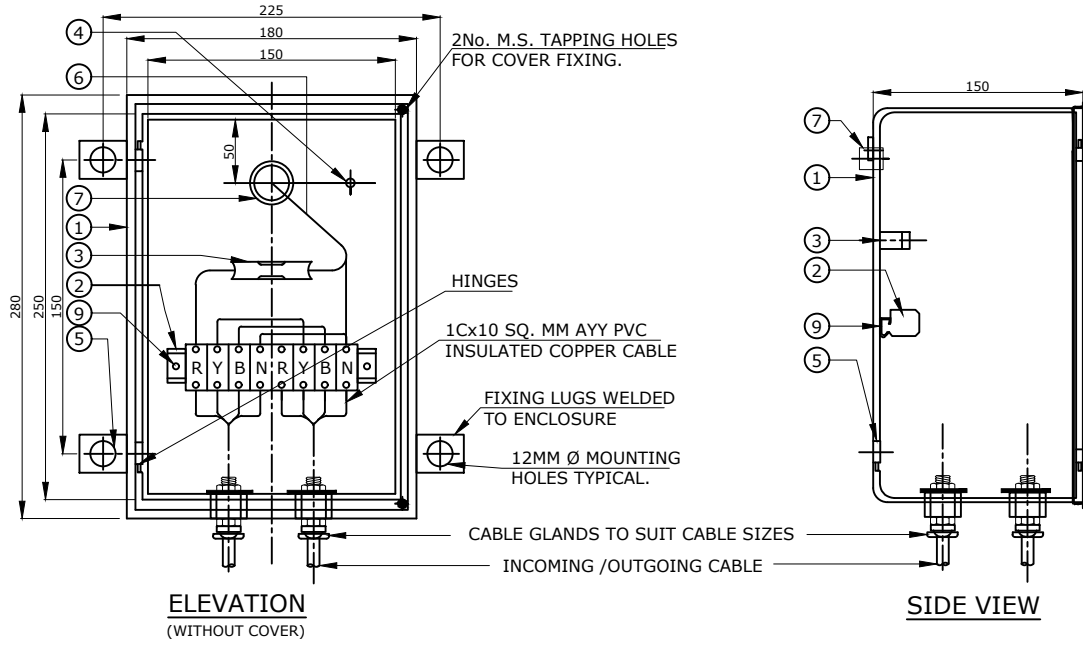
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	JUNCTION BOX WEATHER PROOF TYPE	1 No.	
2.	JUNCTION BOX WEATHER PROOF WITH DOME COVER TO SUIT 40 MM DIA G.I. PIPE.	1 No.	
3.	SADDLE/CLEAT WITH FIXING M.S. 66MM LONG SCREWS/ STUCS, NUTS & LOCK WASHER FOR CIRCUIT CABLE.	AS REQUIRED	
4.	SADDLE/CLEAT WITH FIXING M.S. 66MM LONG SCREWS/ STUCS, NUTS & LOCK WASHER FOR 40 MM DIA PIPE.	AS REQUIRED	
5.	40 MM DIA G.I. PIPE (LENGTH AS REQUIRED) WITH BOTH ENDS THREADED & CHECK NUTS.	1 No.	
6.	G.I. COUPLING SUITABLE FOR 40 MM DIA G.I. PIPE.	1 No.	
7.	ISMC-100x50x350 MM LONG.	1 No.	
8.	10 MM DIA "U" BOLT SUITABLE FOR 40 MM PIPE WITH BOTH ENDS THREADED WITH NUTS 2NO. PLAIN AND 1NO. SPRING WASHERS WITH SUITABLE LENGTH.	4 No.	
9.	50x6x150MM LONG G.I. FLAT WITH 2NO. 12 MM DIA HOLES	4 No.	
10.	150X150X6 THICK M.S. PLATE WITH 2NO. 12MM DIA HOLES OR 50x6x300 LONG G.I. FLAT WITH 2NO. 12MM DIA HOLES	1 No.	
11.	RURDER GROUMENT TO SUIT FLEXIBLE WIRE.	2 No.	

NOTES:

1. WEIGHT OF FITTING 5.5 KG.
2. USE FLEXIBLE WIRE FOR CONNECTION TO LIGHTING FROM JUNCTION BOX.
3. MOUNTING HEIGHT OF THE AVIATION LIGHTING FITTING SHALL BE AT HIGHER ELEVATION THAN THE STRUCTURE ON WHICH FITTING IS TO BE MOUNTED.

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02	26.04.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
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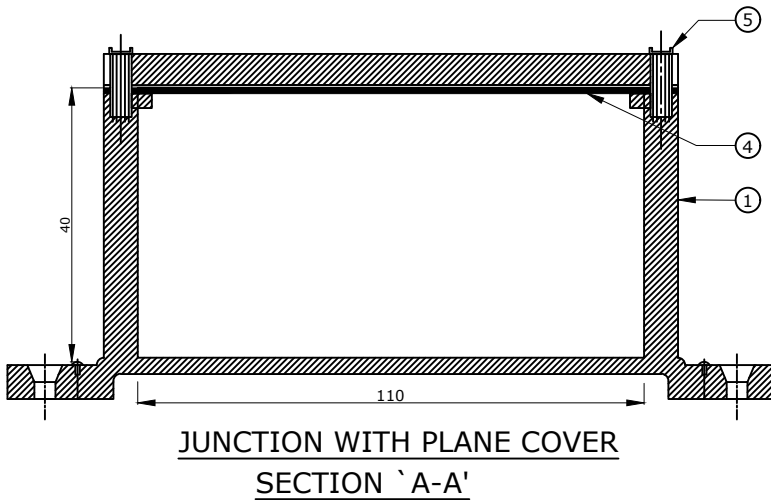
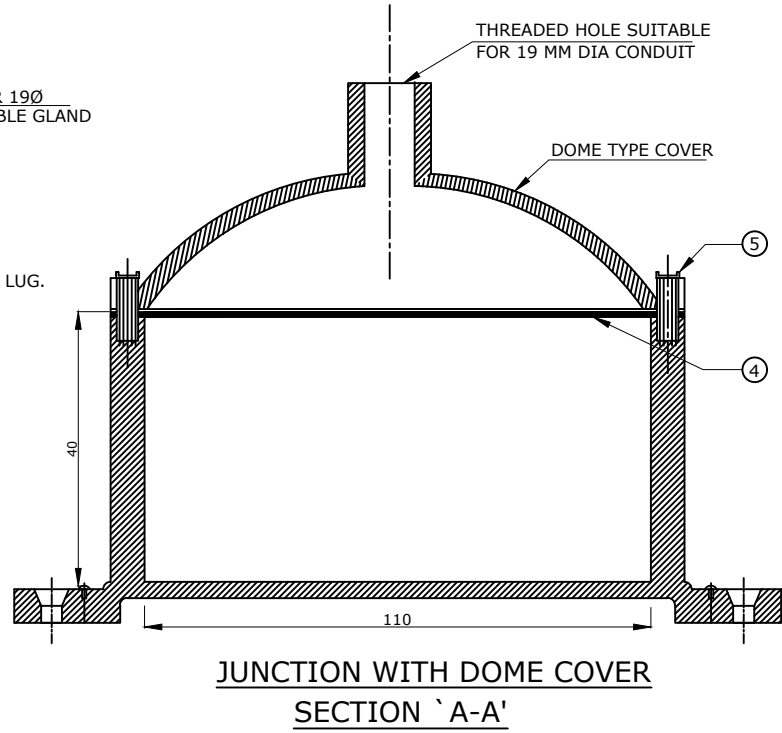
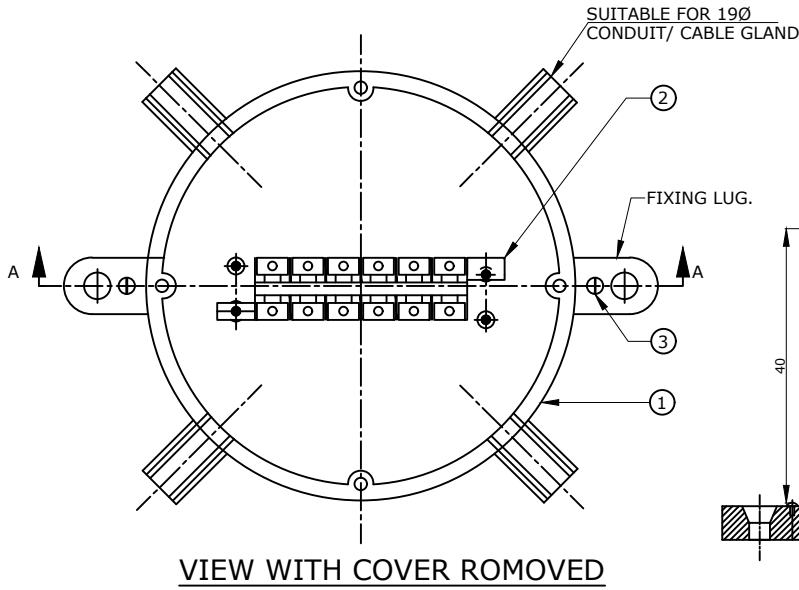


MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	2 MM THICK SHEET STEEL ENCLOSURE WITH COVER	1 No.	
2.	6 No. 30A, TERMINAL CONNECTOR SUITABLE FOR TERMINATING OF 4Cx16 SQ. MM CABLE (CHANNEL MFG.)	1 No.	
3.	4A, HRC FUSE	1 No.	
4.	M4x20 MM LONG ROUND HEAD EARTHING SCREW WITH 2 No. PLAIN WASHER & 1 No. SPRING WASHER.	2 No.	
5.	25x3 MMx70 MM LONG MS FLAT WITH 12 MM Ø HOLE WELDED TO ENCLOSURE LOGS FOR MOUNTING	4 No.	
6.	3Cx2.5 SQ. MM PVC FLEXIBLE WIRES.	AS REQUIRED	
7.	20 MM Ø -25 MM LONG G.I. PIPE WELDED TO ENCLOSURE	1 No.	
8.	M10x40 MM LONG BOLTS WITH NUT , LOCK NUT & PLAIN WASHERS FOR ENCLOSURE FIXING.	4 No.	
	MOUNTING CHANNEL SUITABLE FOR 6 No. 30A, TERMINAL CONNECTOR (LENGTH AS REQUIRED)	1 No.	

NOTES:

02	26.04.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	02.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

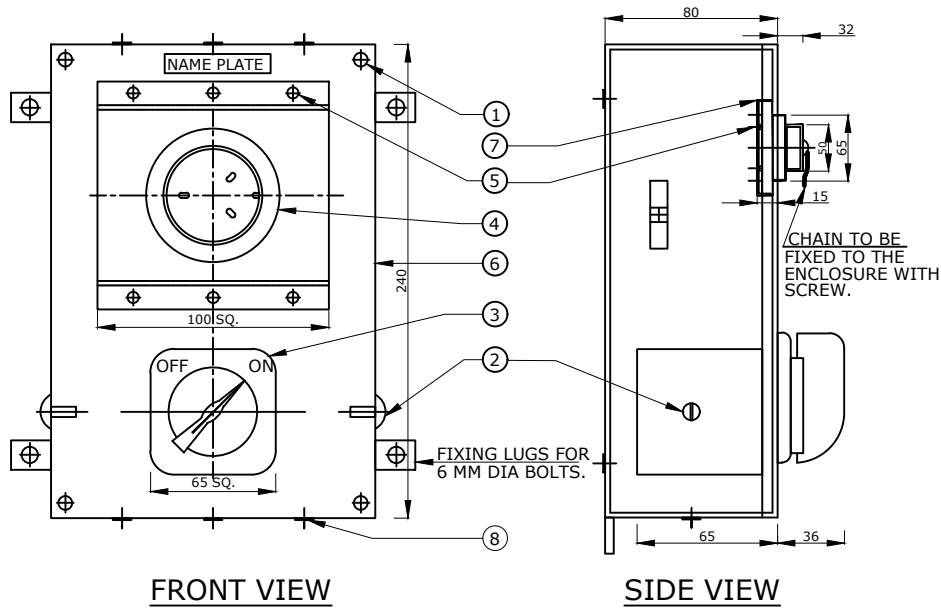


MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	JUNCTION BOX (CAST ALUMINIUM)	AS REQUIRED	
2.	30A, 4 WAY, TERMINAL BLOCK	1 No.	
3.	8 MM LONG BRASS SCREW WITH 2 No. PLAIN AND SPRING WASHER FOR INTERNAL AND EXTERNAL EARTHING TERMINAL.	2 No.	
4.	DISC TYPE NEOPRENE GASKET.	1 No.	
5.	COVER FIXING G.I. SCREWS WITH WASHER	4 No.	

NOTES:

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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



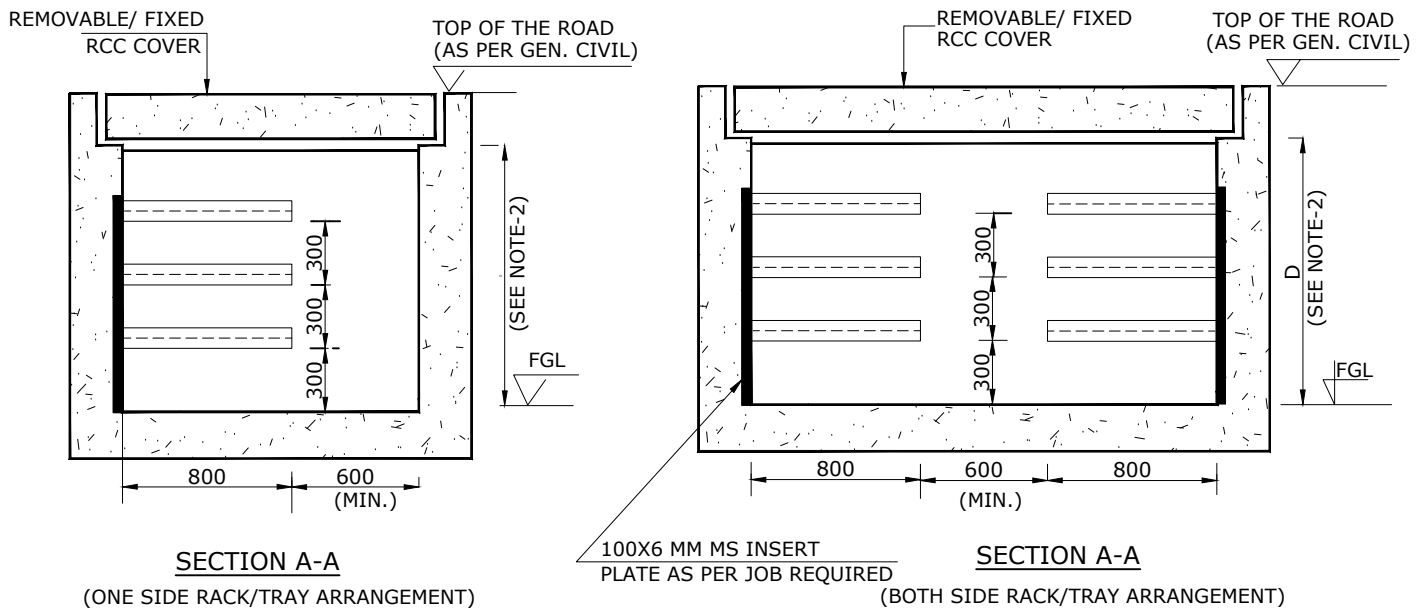
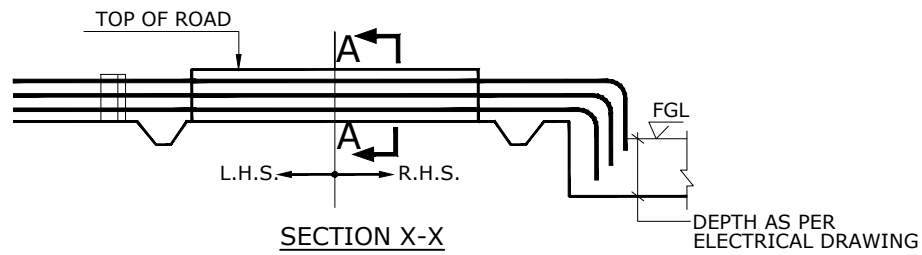
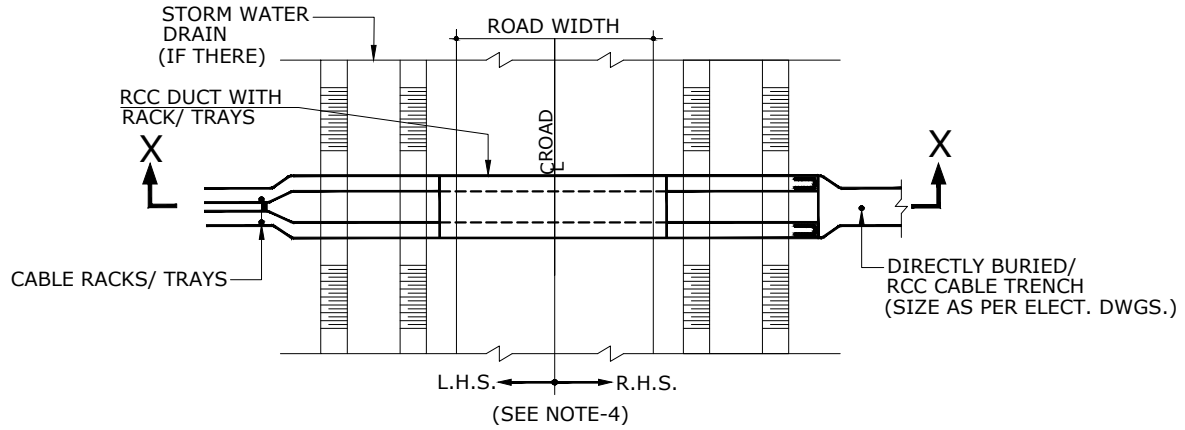
MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QUANTITY	REMARKS
1.	5 MM DIA M/C SCREWS.	4 No.	
2.	5 MM DIA EARTHING SCREW WITH 2 No. PLAIN 1 No. SPRING WASHER.	2 No.	
3.	16A, 2 POLE, ON-OFF ROTARY SWITCH.	1 No.	
4.	10A, 1Ø AND EARTH METAL CLAD SOCKET OUTLET	1 No.	
5.	3 MM ,DIA M/C SCREWS	6 No.	
6.	14 SWG M.S. BOX WITH COVER FOR MOUNTING OF SWITCH AND SOCKET OUTLET	1 No.	
7.	14 SWG M.S. SHEET FIXED TO COVER PLATE FROM INSIDE FOR MOUNTING OF SOCKET	1 No.	
8.	19 MM DIA KNOCKOUT	6 No.	

NOTES:

- SIMILAR ARRANGEMENT CAN BE EMPLOYED FOR 20A, SP & E, 30A, TP & E, SD WITH 30A, DP & 63A, TP SWITCH RESPECTIVELY.
- EPOXY BASED PAINT OF SPECIFIED SHADE SHALL BE APPLIED.
- REAR ENGRAVED PERSPEX OF LAMINATED PLASTIC NAME PALTE WITH APPROPRIATE INSCRIPTION SHALL BE FIXED ON COVER WITH OR SUITABLE ADHESIVE.

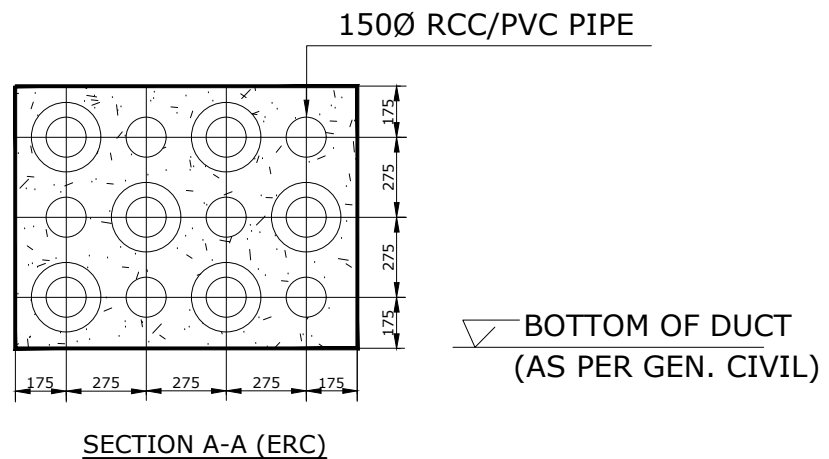
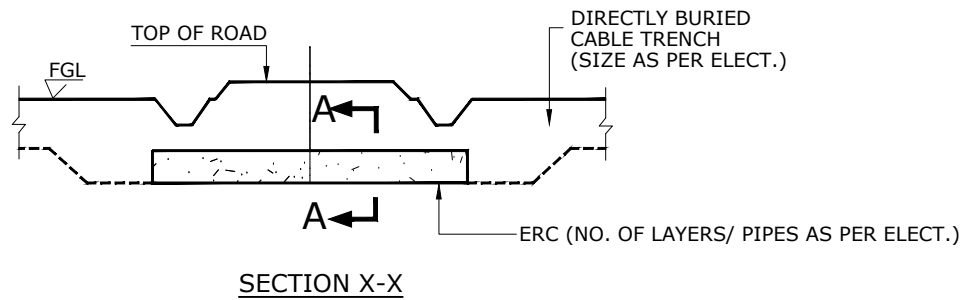
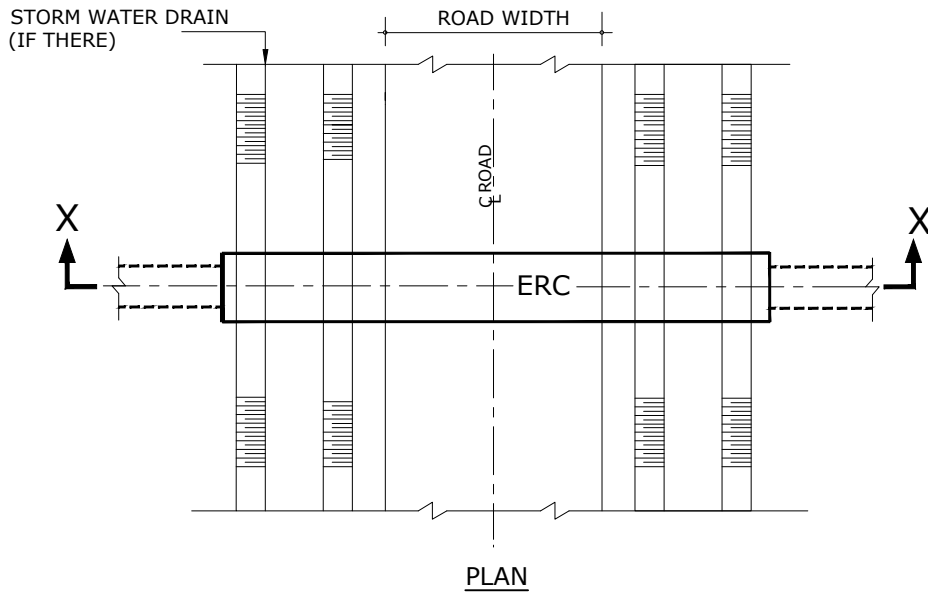
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



NOTES:

1. WIDTH OF DUCT & NO. OF RACKS AND TRAY IN EACH ROAD CROSSING SHALL BE DECIDED BY ELECTRICAL AS PER THE REQUIREMENT OF ELECT. CABLES AND MAXIMUM AVAILABLE DEPTH OF DUCT w.r.t. F.G.L. AND ROAD LEVEL.
2. IN CASE, SUFFICIENT DEPTH OF DUCT IS AVAILABLE (> 1500MM), THE DUCT CAN BE COVERED WITH FIXED SLAB.
3. CO-ORDINATES OF TRENCHES & RCC DUCT ETC. SHALL BE DECIDED BY CIVIL & SHOWN IN RESPECTIVE AREA DRAWING.
4. IN CASE OF COMPLETE CABLE TRAY SYSTEM ON BOTH SIDES OF ROAD, ARRANGEMENT SHALL BE AS PER LHS ON BOTH SIDES AND IN CASE OF TRENCH SYSTEM IT SHALL BE AS PER RHS ON BOTH SIDES.

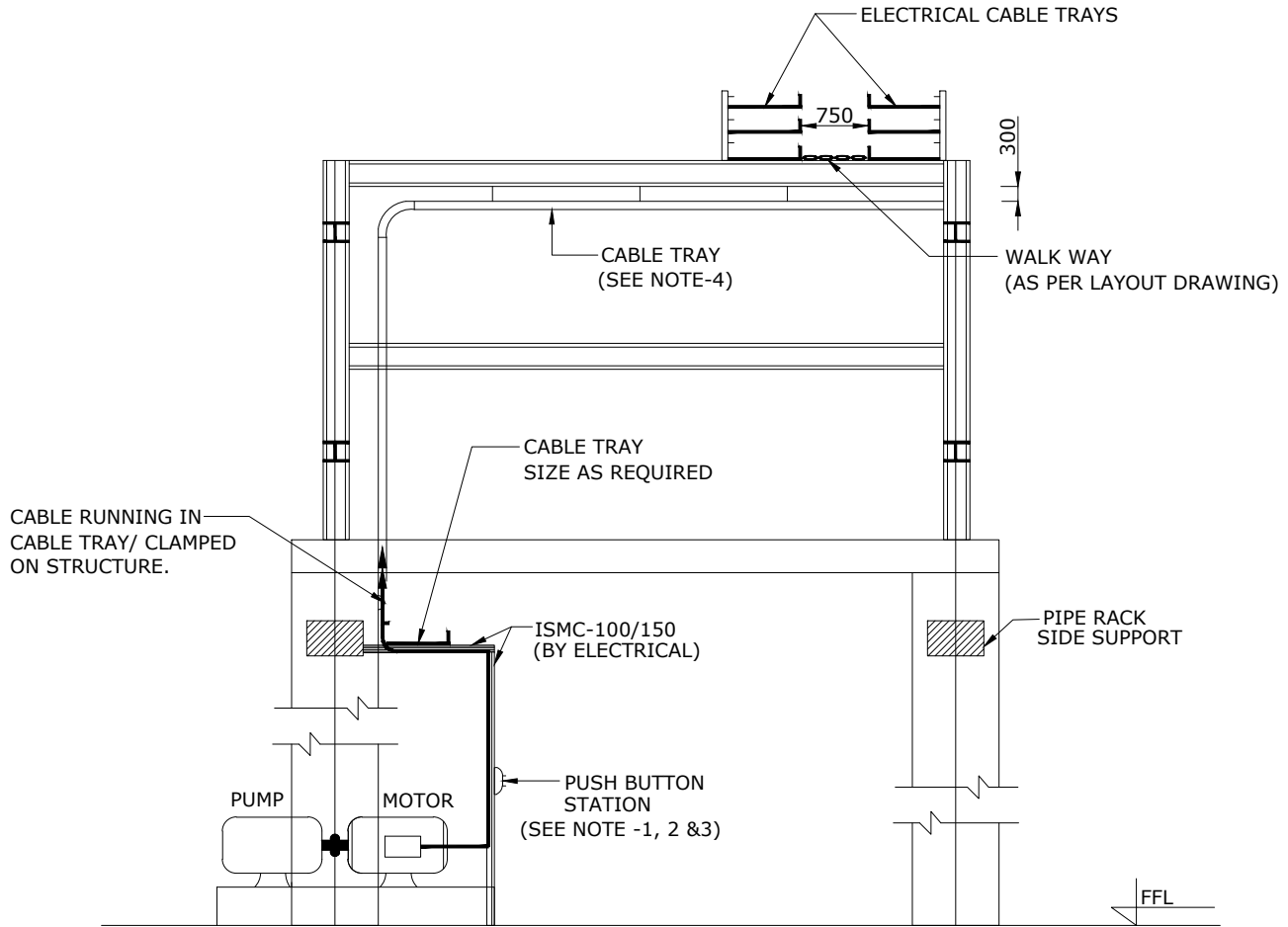
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



NOTES:

1. CO-ORDINATES OF TRENCH, LENGTH & LEVEL OF EACH ERC SHALL BE DECIDED BY GEN. CIVIL & SHOWN IN RESPECTIVE AREA DRAWING.
2. NO. OF PIPES e.g. LAYERS & PIPES IN EACH LAYER SHALL BE AS PER THE REQUIREMENT OF ELECTRICAL.

02	22.03.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	11.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

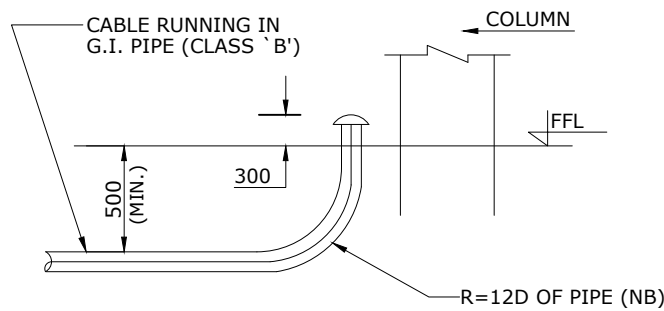
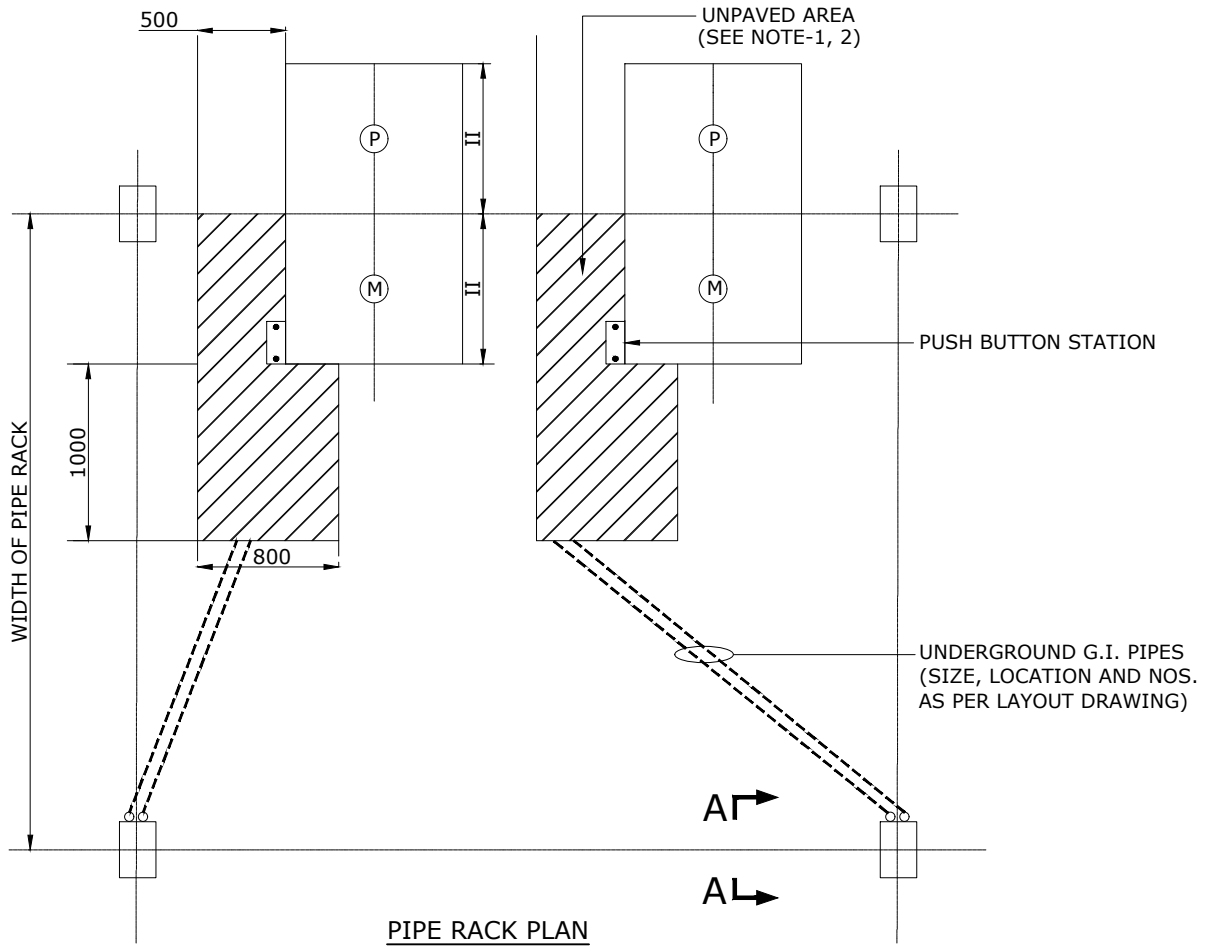


TYPICAL CROSS-SECTION OF PIPE RACK

NOTES:

1. LOCATION OF SUPPORT FOR P.B. STATION SHALL BE SUITABLY DECIDED AT SITE DEPENDING UPON THE BENDING RADIUS OF CABLE.
2. THE HEIGHT OF P.B. SUPPORT SHALL BE AS PER BOTTOM LEVEL OF PIPE RACK SIDE SUPPORT.
3. FOR DETAIL OF INSTALLATION OF P.B. STATION.
4. FOR A GROUP OF 2-3 MOTORS IN ONE BAY OF PIPE RACK, COMMON CABLE TRAY OF REQUIRED SIZE SHALL BE PROVIDED.

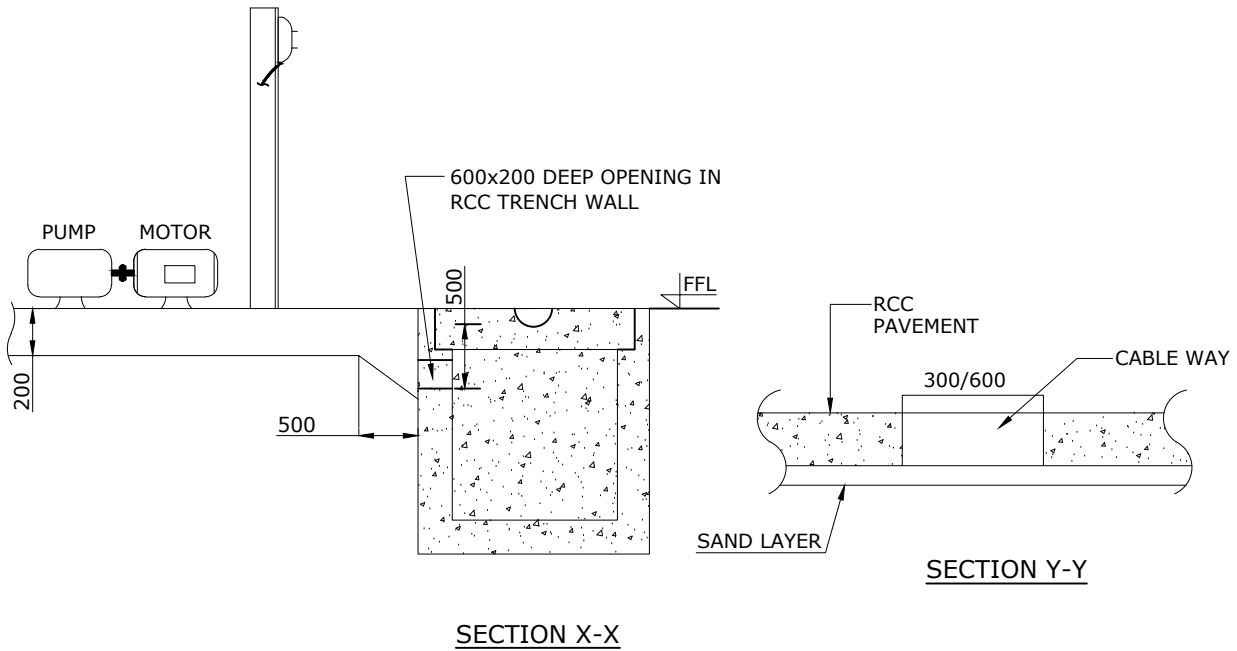
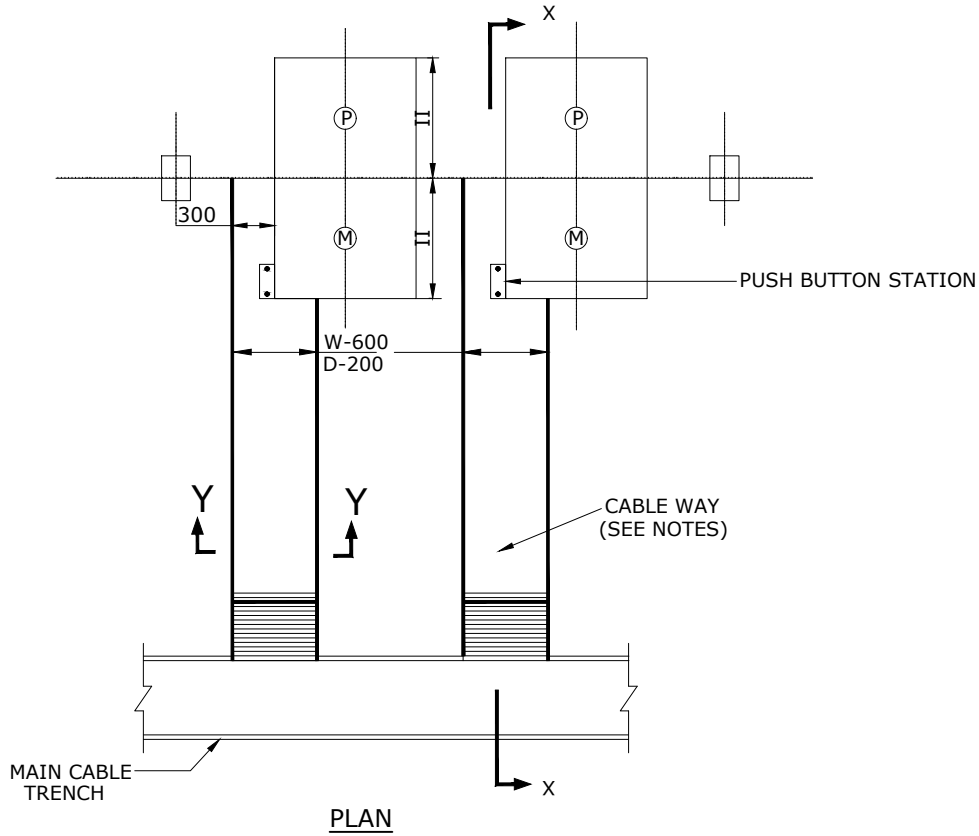
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



NOTES:

1. AREA AS SHOWN HATCHED NEAR EACH PUMP FOUNDATION SHALL BE LEFT UNPAVED BY PAVEMENT CONTACTOR.
2. CABLES LAYING & SAND / LEAN CONCRETE FILLING ON TOP OF CABLES SHALL BE DONE BY THE ELECTRICAL CONTRACTOR.
3. CIVIL CONTRACTOR SHALL PROVIDE G.I PIPES AND PLUG BOTH ENDS OF THE PIPES WITH PVC BUSHINGS.

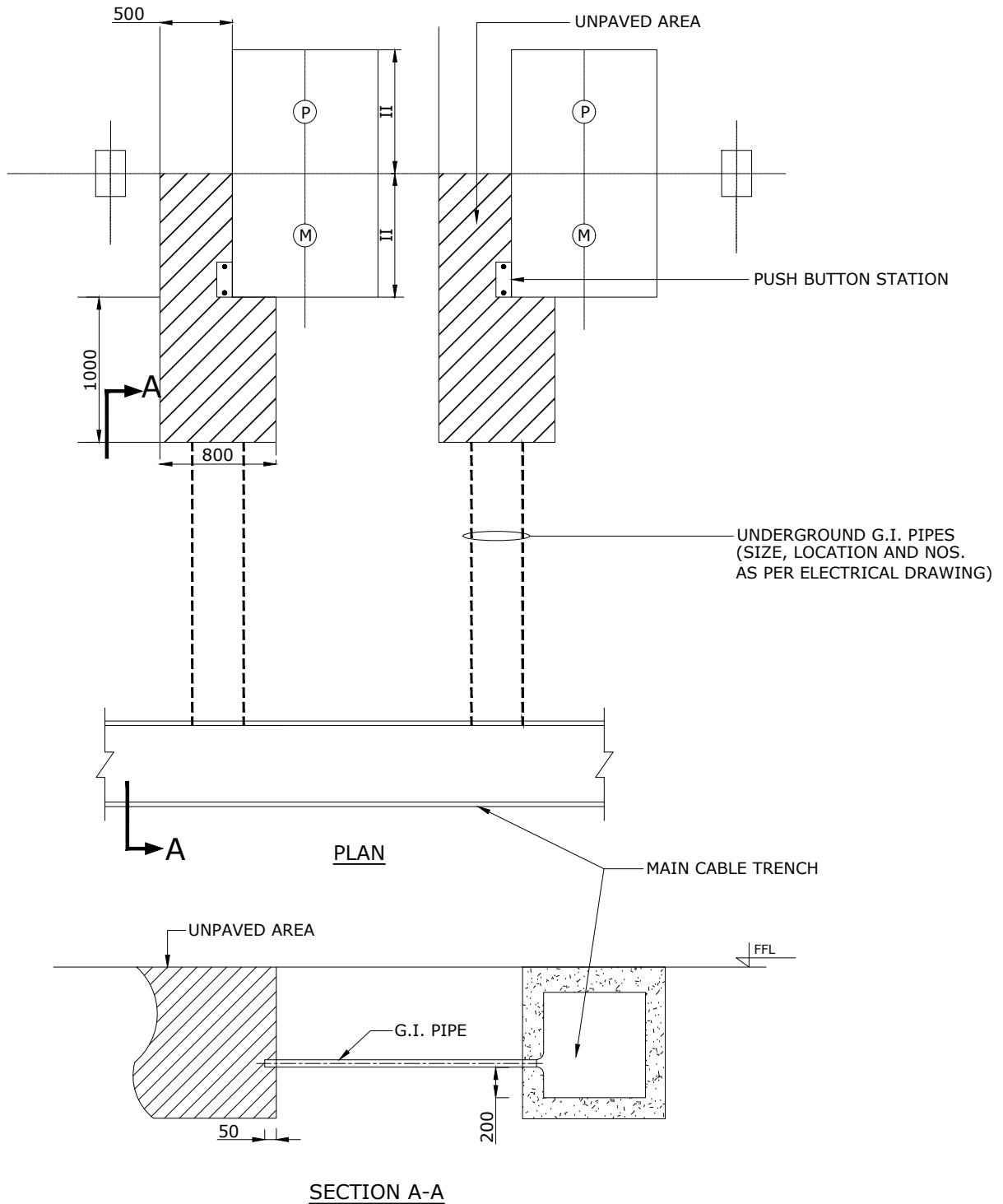
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



NOTES:

1. IF REQUIRED CABLES SHALL BE LAID IN SUITABLE SIZE OF G.I. PIPES IN CABLE WAY.
2. CABLE WAY SHALL BE FILLED WITH SAND AND LEAN CONCRETE AFTER LAYING OF CABLES BY THE ELECTRICAL CONTACTOR.
3. AREA SHOWN FOR EACH CABLE WAY SHALL BE LEFT UNPAVED BY PAVEMENT CONTRACTOR.

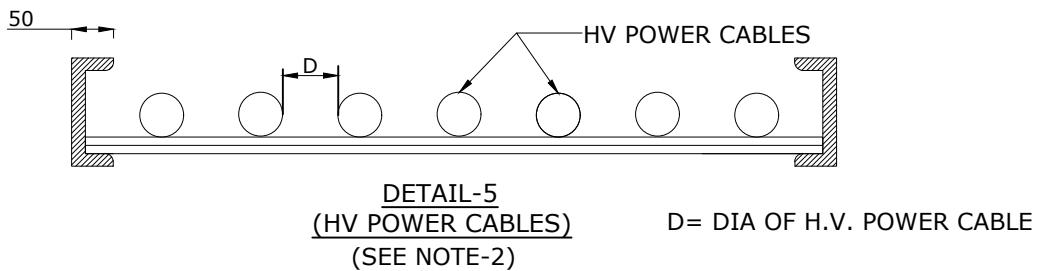
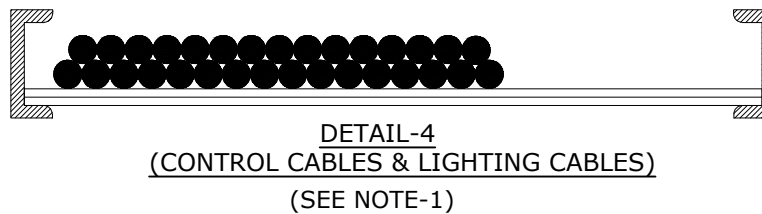
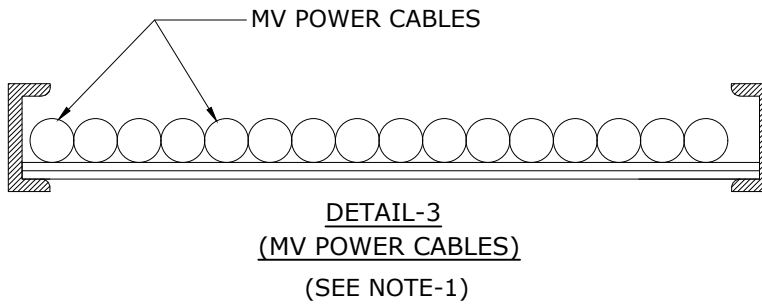
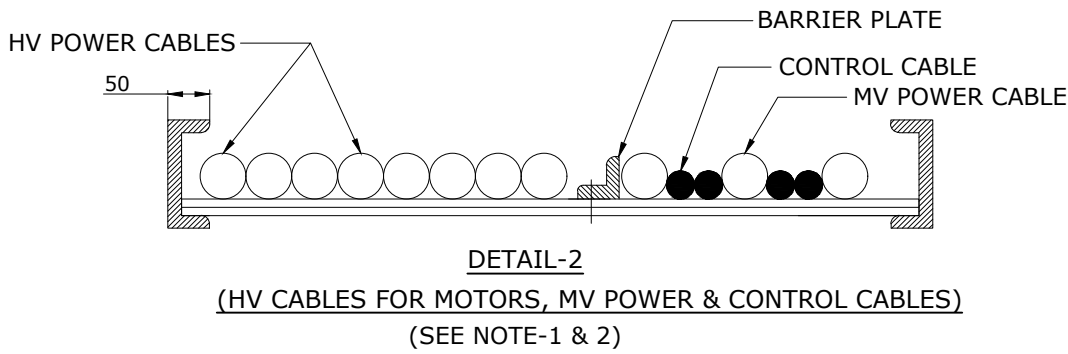
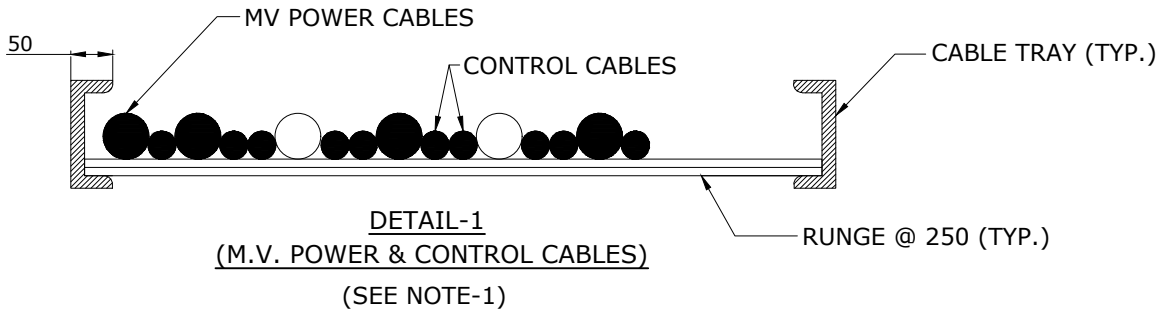
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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



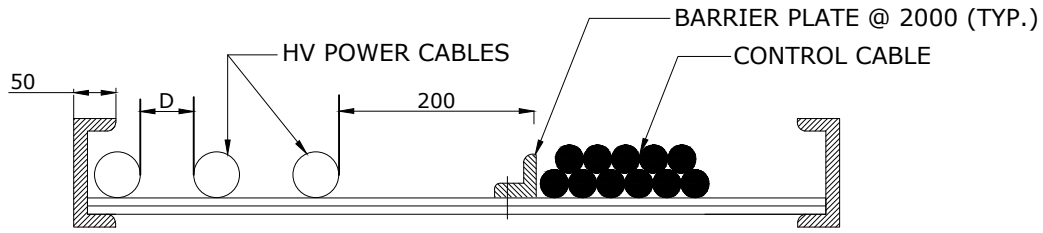
NOTES:

1. AREA AS SHOWN HATCHED NEAR EACH PUMP FOUNDATION SHALL BE LEFT UNPAVED BY PAVEMENT CONTRACTOR.
2. CABLES LAYING & SAND / LEAN CONCRETE FILLING ON TOP OF CABLES SHALL BE DONE BY ELECTRICAL CONTRACTOR.
3. CIVIL CONTRACTOR SHALL PROVIDE G.I. PIPES AND PLUG BOTH ENDS OF THE PIPES WITH PVC BUSHINGS.

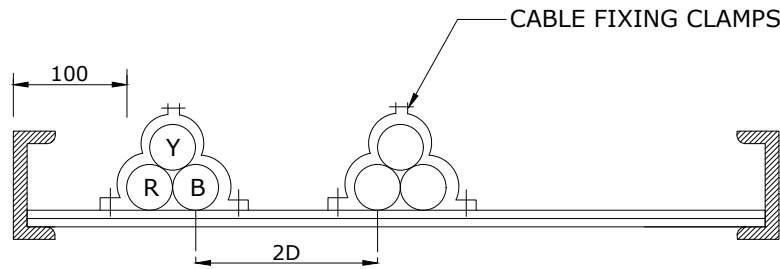
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



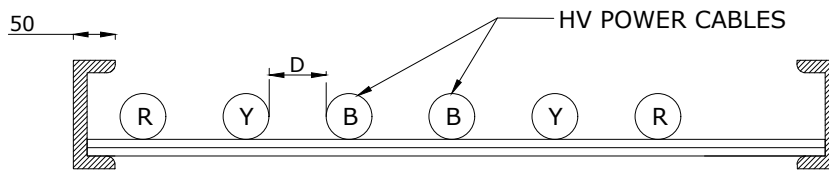
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



DETAIL-6
(H.V. POWER & CONTROL CABLES)
(SEE NOTE-2 & 3)



DETAIL-7
(SINGLE CORE HV CABLES IN TREFOIL CONFIGURATION)



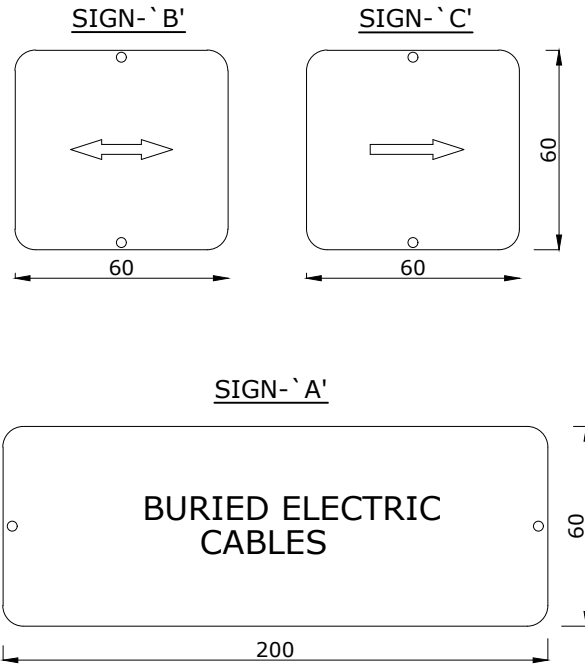
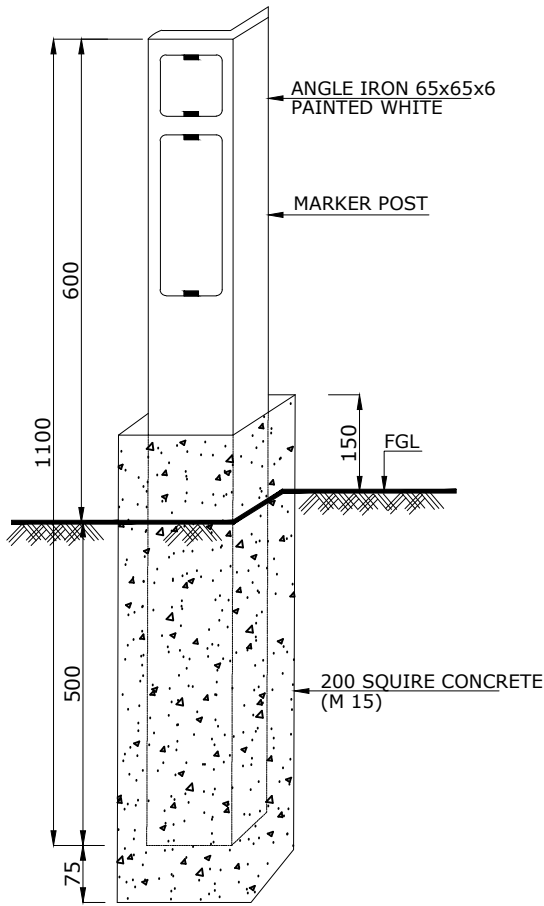
D= DIA OF H.V. POWER CABLE

DETAIL-8
(SINGLE CORE HV CABLES IN FLAT CONFIGURATION)

NOTES:

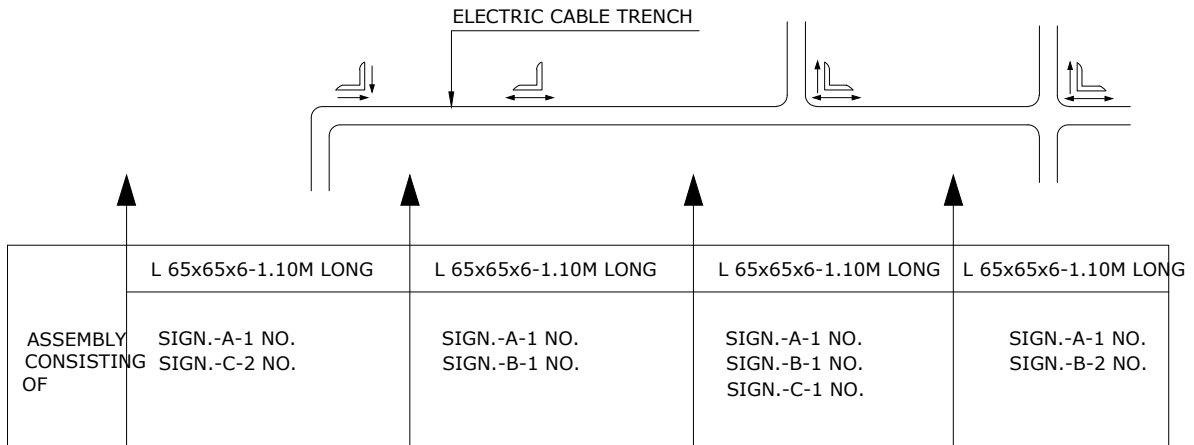
1. IN CASE OF SINGLE TRAY ARRANGEMENT, DETAILS-1 OR DETAIL-2 SHALL BE FOLLOWED WHEREAS IN CASE OF LOCATIONS WHERE TWO OR MORE TRAYS ARE INSTALLED, DETAIL 3 & 4 SHALL BE USED.
2. UNLESS OTHERWISE SPECIFIED, H.V. POWER CABLES FOR H.V. MOTORS SHALL BE KEPT TOUCHING.
3. WHEREVER A FEW H.V. POWER CABLES ARE TO BE LAID ALONG WITH CONTROL CABLES IN THE SAME TRAY, H.V. CABLES SHALL BE SEPERATED BY PROVIDING BARRIER PLATE AT AN INTERVAL OF 2M.
4. CABLE LAID IN TRAYS SHALL BE SUITABLY CLAMPED BY MEANS OF G.I. SADDLES/CLAMPS FOR HORIZONTAL RUN AND VERTICAL RUN OF CABLES FOR SINGLE CORE CABLES LAID IN FLAT CONFIGURATION, NON-MAGNETIC, NON-CORROSIVE CLAMPS AT AN INTERVAL OF 0.5M TO 0.8M SHALL BE USED.
5. ALL COMMUNICATION CABLES (TELEPHONE, PAGING / FA SYSTEM) & RTD SIGNAL CABLES SHALL RUN IN INSTRUMENT DUCT/ TRAY/TRENCHES IN THE UNITS WHEREVER THESE ARE NOT AVAILABLE. CABLE SHALL BE DIRECTLY CLEATED ON A SEPERATE ROUTE WAY FROM POWER CABLES OR TAKEN IN A SEPERATE TRAY IN LINE WITH DETAIL-4.
6. ALL DIMENSIONS ARE IN MM.

02	22.03.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	11.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



TYPICAL ARRANGEMENT OF MARKER

(SEE NOTE-1)

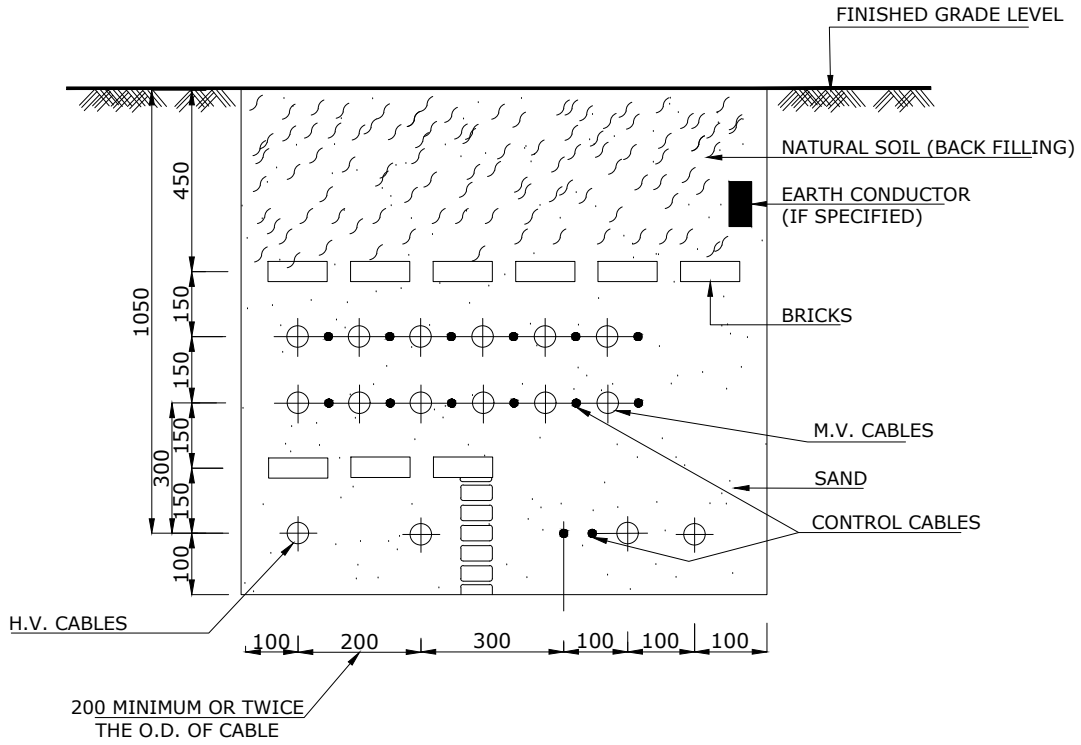


NOTES:

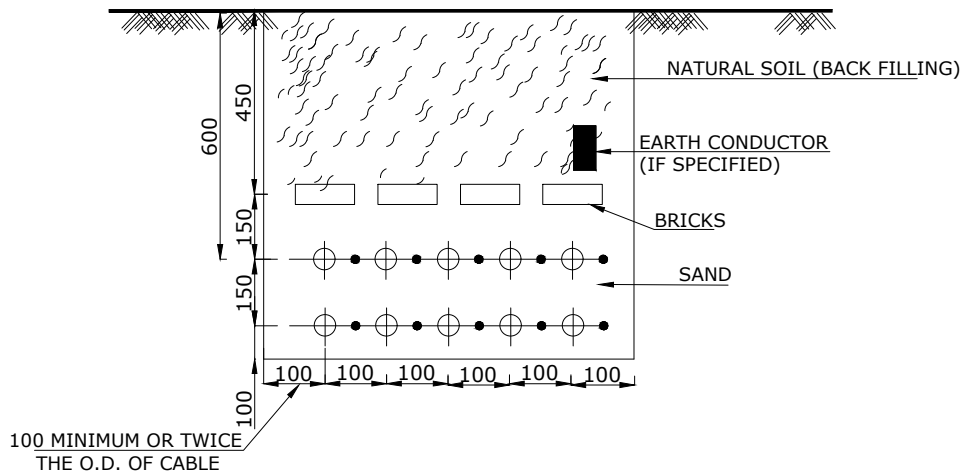
- TRENCHES SHALL BE MARKED AT ALL DIRECTION CHANGES, INTERSECTIONS AND STRAIGHT RUNS.
- SIGN BOARDS SHALL BE MADE OF 14G ENAMELLED STEEL PLATE WHITE LETTERING SHALL BE ON JADE GREEN BACKGROUND

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01	11.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

TYPICAL SECTION WITH H.V. AND M.V. CABLES



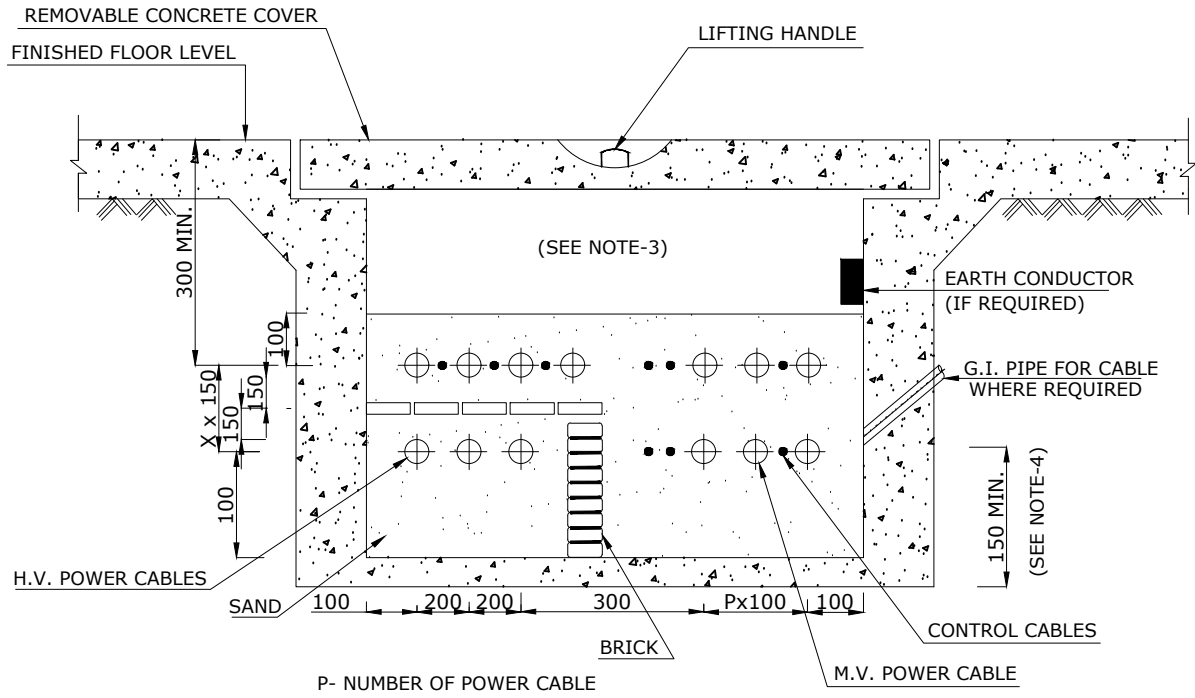
TYPICAL SECTION WITH M.V. CABLES ONLY



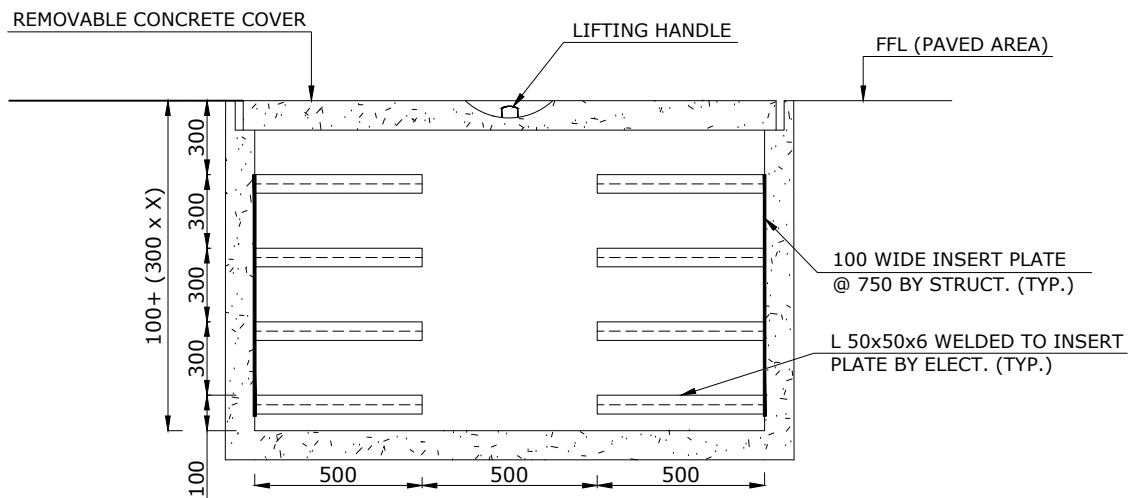
NOTES:

1. LEAVE SPACE FOR LATER ADDITION OF AT LEAST 2 CABLES OR 15% AVERAGE SPARE SPACE REGARDLESS OF FUTURE EXPANSION.
2. IF FIRE ALARM AND COMMUNICATION CABLES ARE LAID IN THE SAME TRENCH A CLEARANCE OF 300mm (MINIMUM) AWAY FROM

02	22.03.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	11.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



ALT. -1

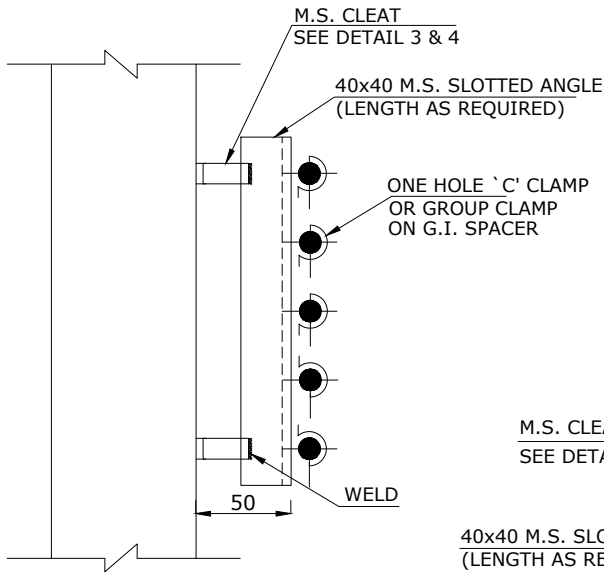


ALT. -2

NOTES:

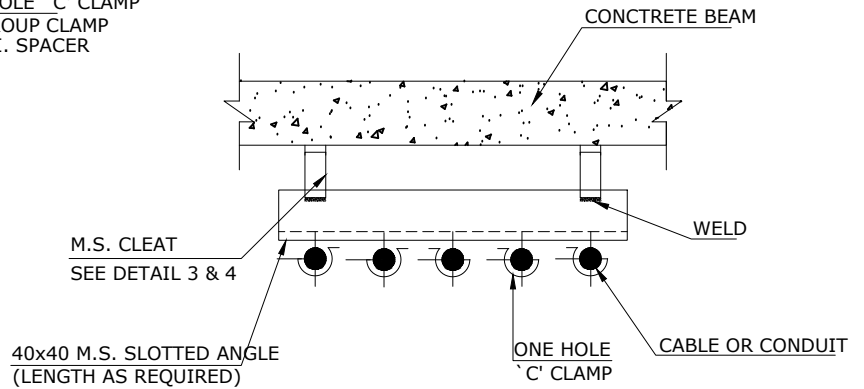
1. LEAVE SPACE FOR LATER ADDITION OF 15% AVERAGE SPARE SPACE FOR FUTURE EXPANSION.
2. REQUIREMENT OF RACKS ON ONE SIDE OR BOTH SIDES SHALL BE DECIDED AS PER JOB REQUIREMENT AND AVAILABILITY OF SPACE FOR TRENCH.
3. TRENCHES IN HAZARDOUS AREAS SHALL BE COMPLETELY FILLED WITH SAND.
4. THE EXACT HEIGHT OF OPENING IN TRENCH WALL FOR G.I. PIPE FOR TAKING CABLE SHALL BE SUITABLY DECIDED AT SITE.

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01	11.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



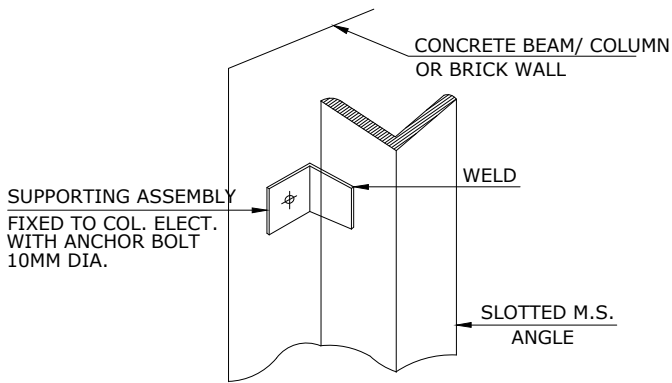
DETAIL-1

SUPPORT FOR VERTICAL RUN ON WALL

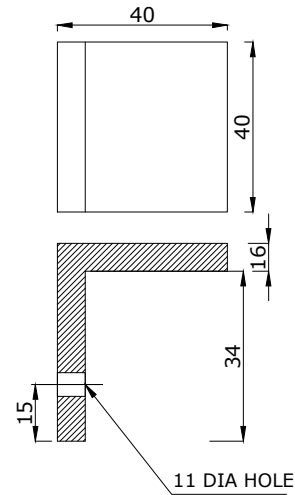


DETAIL-2

SUPPORT FOR HORIZONTAL RUN ON BEAM

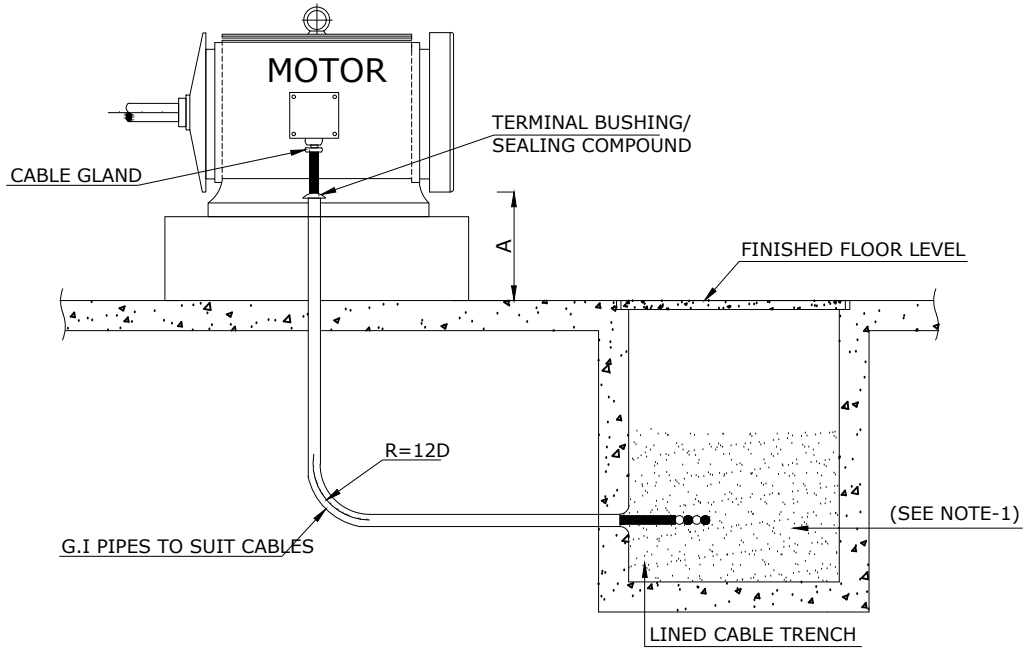


DETAIL-3

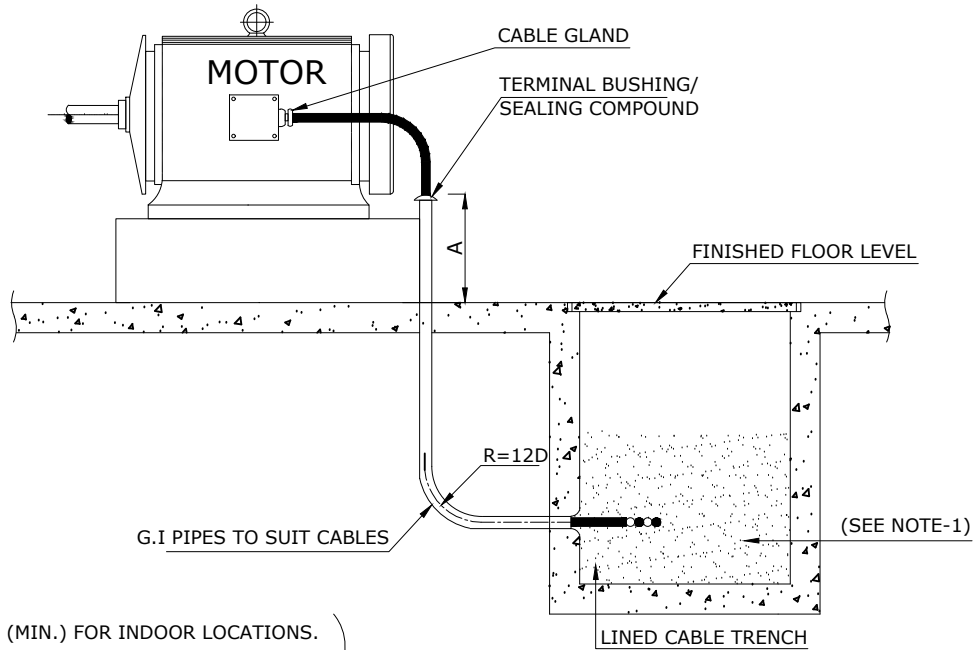


DETAIL-4 (M.S. CLEAT)

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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



ALT.-I (BOTTOM ENTRY)



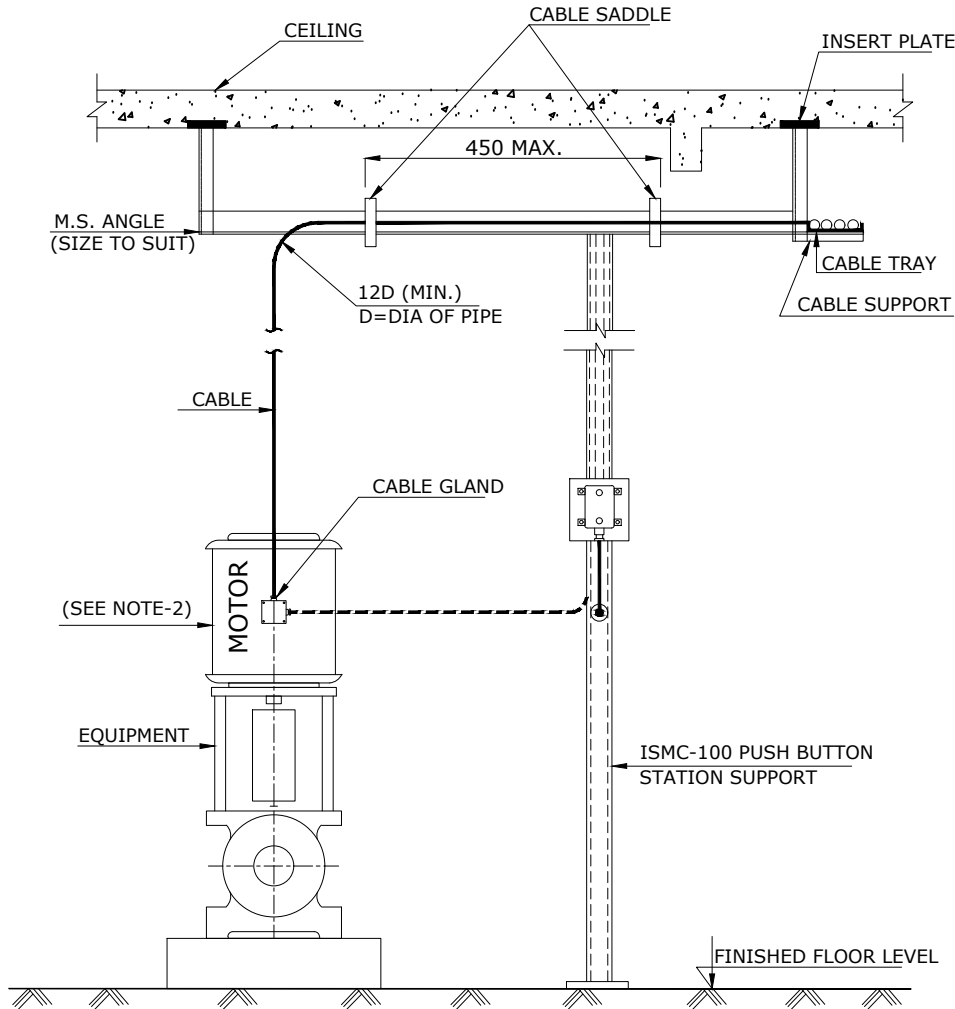
(A= 150 MM (MIN.) FOR INDOOR LOCATIONS.
A= 300 MM (MIN.) FOR OUTDOOR LOCATIONS.)

ALT.-II (SIDE ENTRY)

NOTES:

1. CABLE TRENCH IN HAZARDOUS AREA SHALL BE COMPLETELY FILLED WITH SAND.

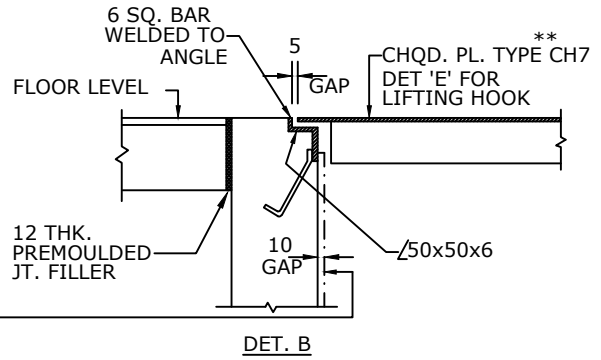
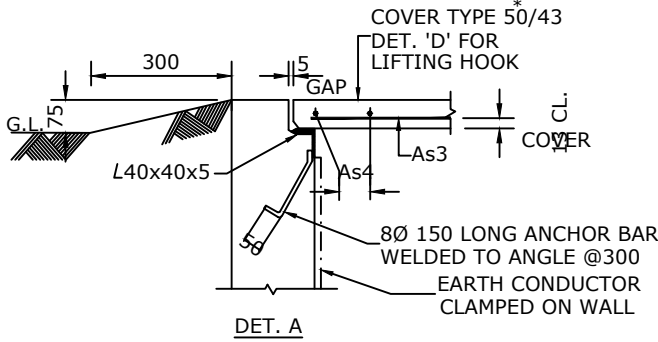
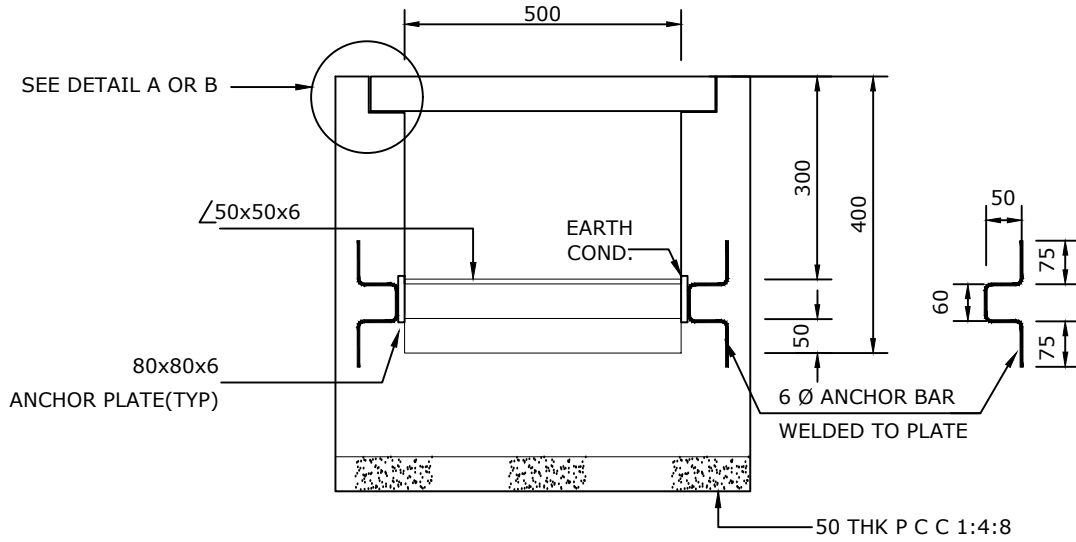
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01	12.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



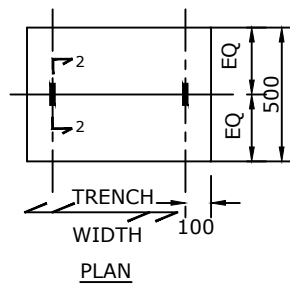
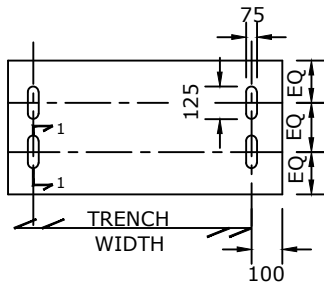
NOTES:

1. WHERE FEASIBLE MAIN CABLE TRAY CAN BE ROUTED IN SUCH A WAY THAT ISMC CAN BE DIRECTLY WELDED TO TRAY SUPPORT.
2. THE ARRANGEMENT SHOWN IS FOR THE INDOOR CABLE ENTRY INSTALLATION. FOR OUTDOOR AREAS, THE SAME SHALL BE EITHER FROM BOTTOM OR SIDE.

02	23.03.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	12.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

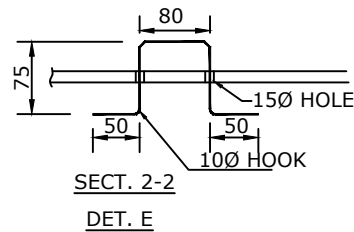
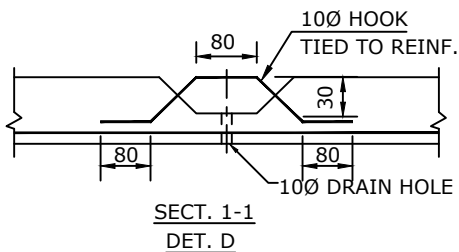


**CH7 = 7 THK. CHQD. PL



R C COVER TYPE	THICKNESS mm.	As3	As4
50/72	50	7-6Ø	7-6Ø
50/36	50	7-6Ø	4-6Ø

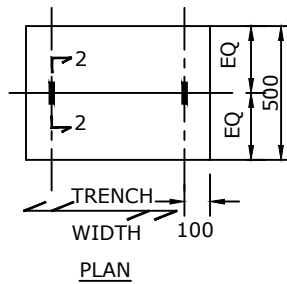
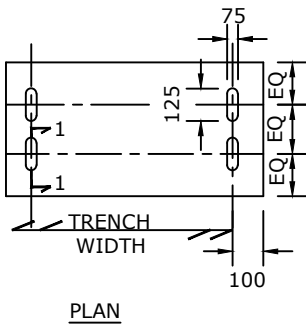
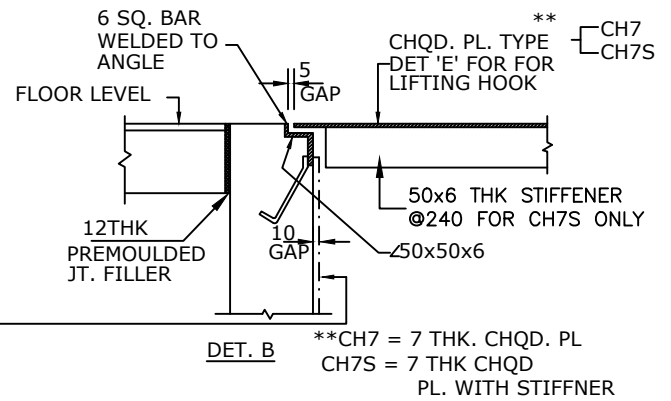
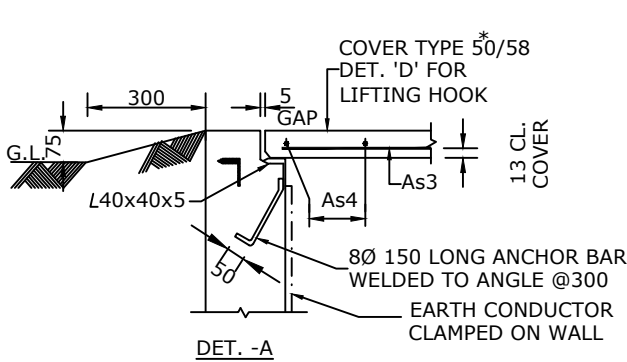
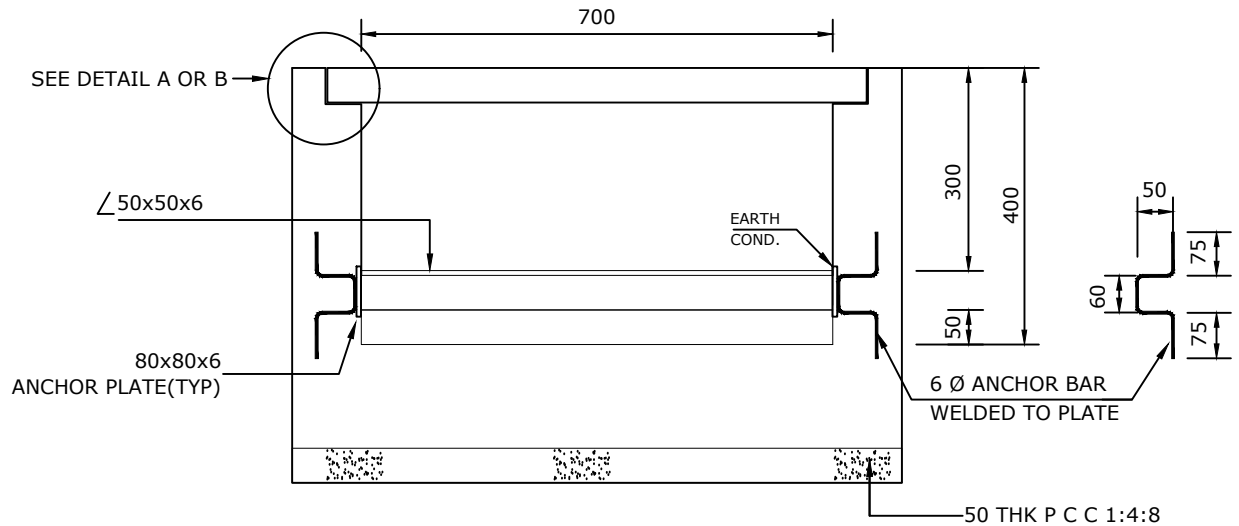
50/36 MEANS 50mm. THK.x36 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



NOTES:

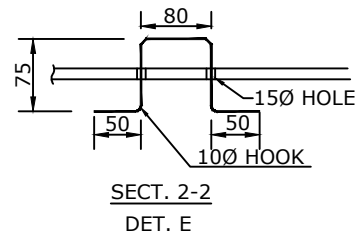
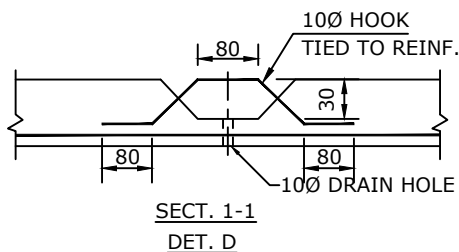
1. ALL DIMENSIONS ARE IN MM
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



R C COVER TYPE	THICKNESS mm.	As3	As4
50/58	50	7-6Ø	7-6Ø

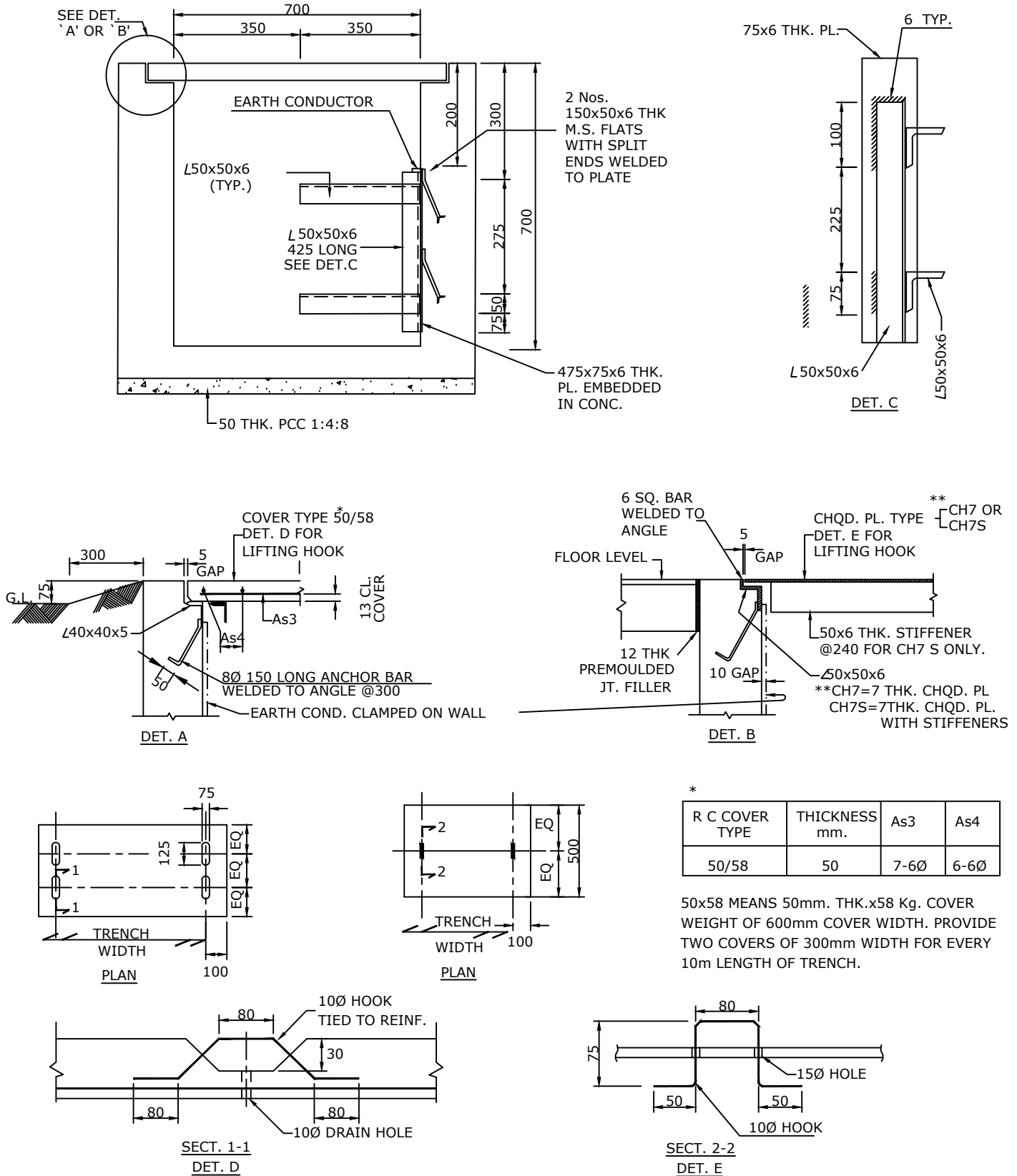
* 50/58 MEANS 50mm. THK.x58 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



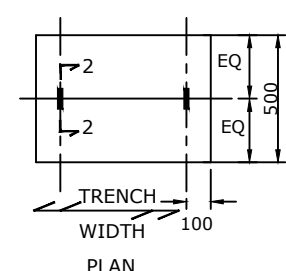
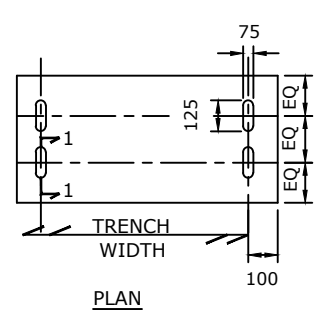
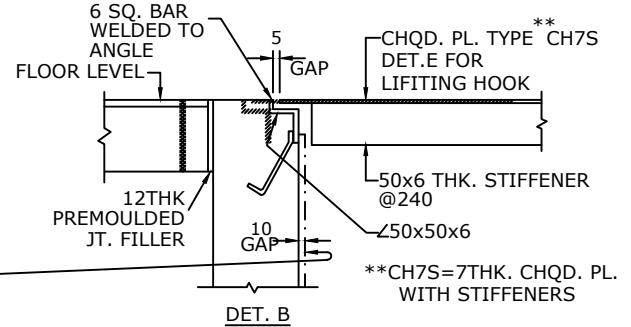
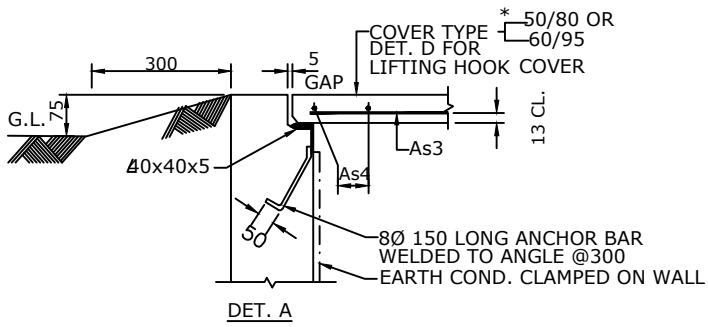
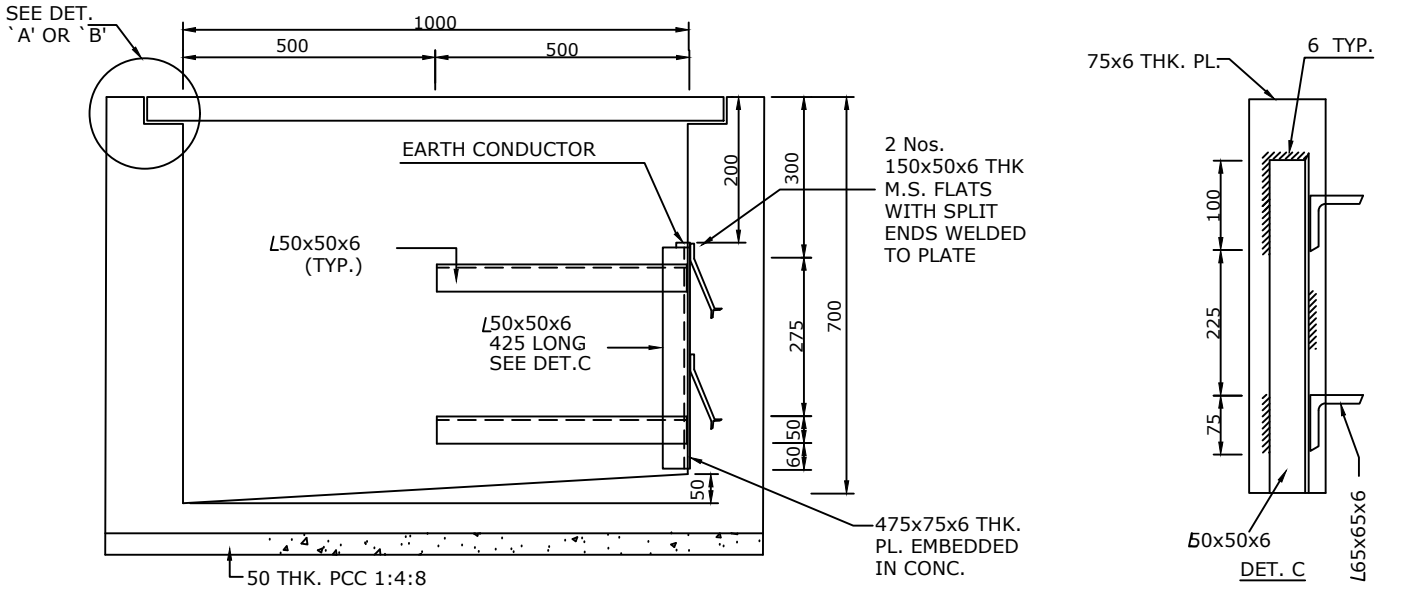
NOTES:

- ALL DIMENSIONS ARE IN MM
- STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

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REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

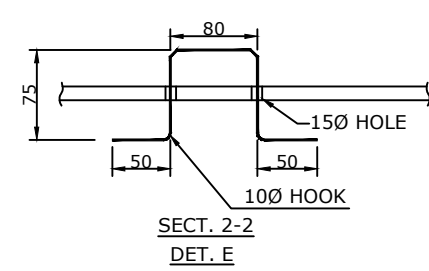
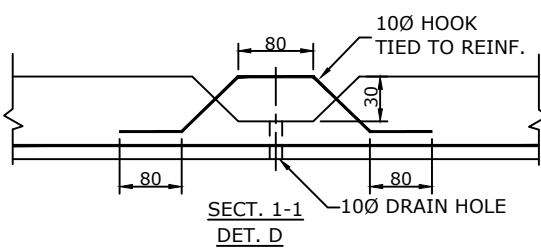


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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK



R C COVER TYPE	THICKNESS mm.	As3	As4
50/80	50	7-6Ø	6-6Ø
60/95	60	7-8Ø	6-8Ø

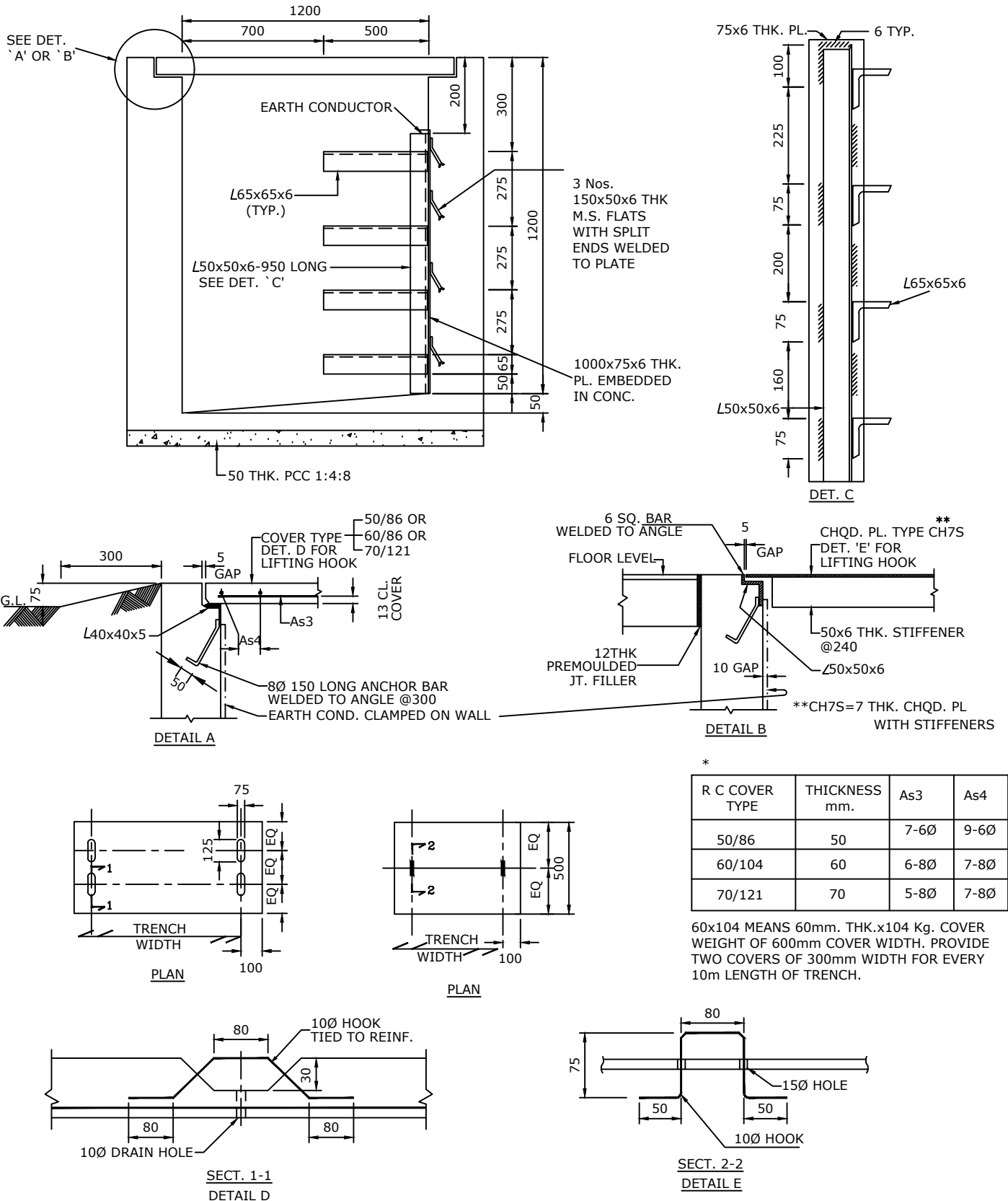
* 60x95 MEANS 60mm. THK.x95 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



NOTES:

- ALL DIMENSIONS ARE IN MM.
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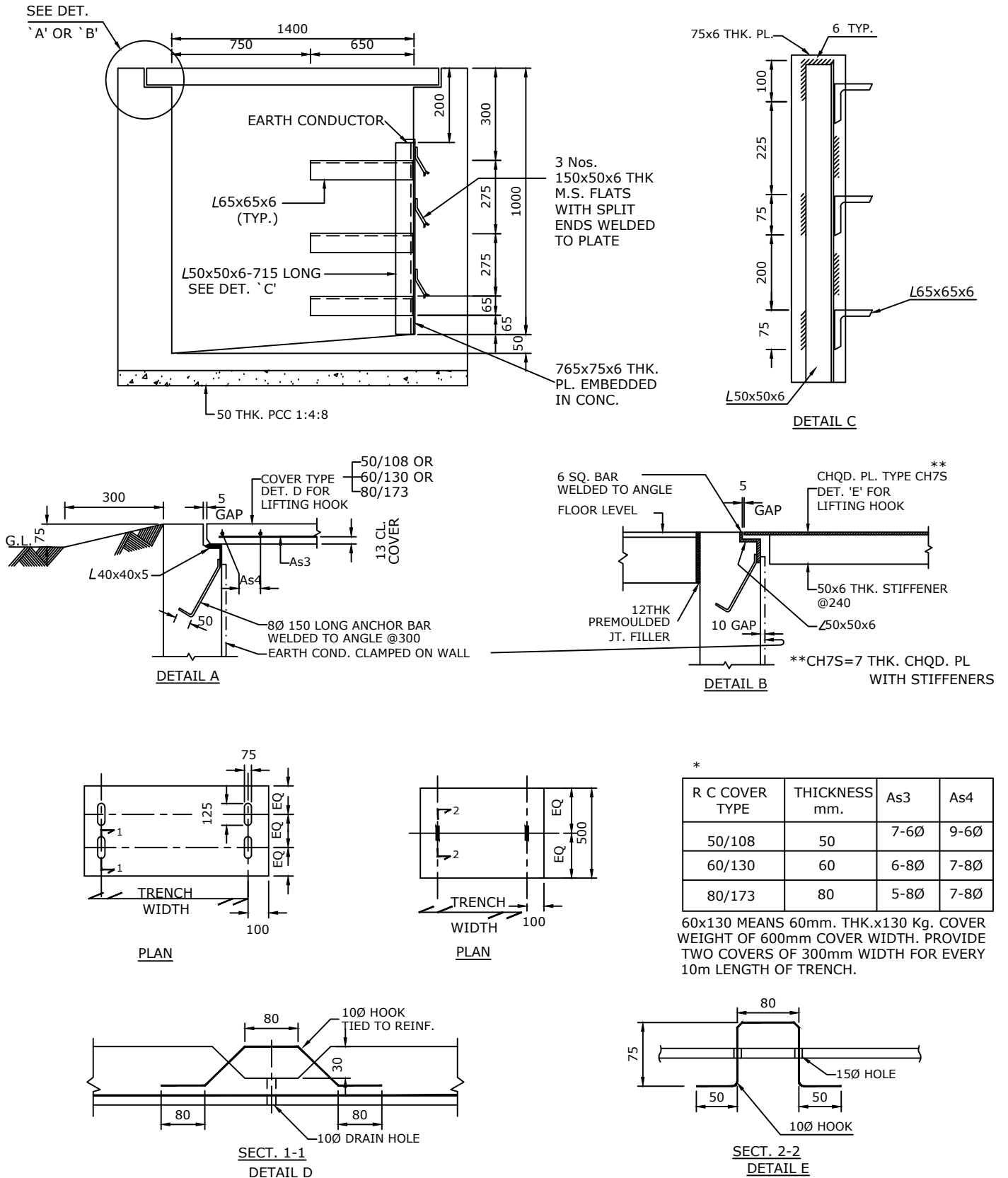
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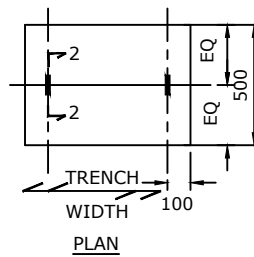
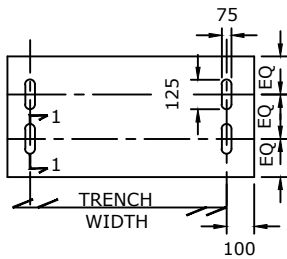
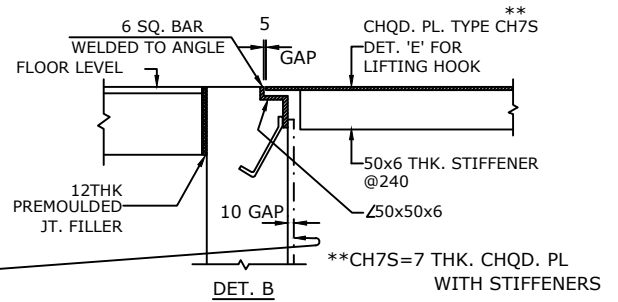
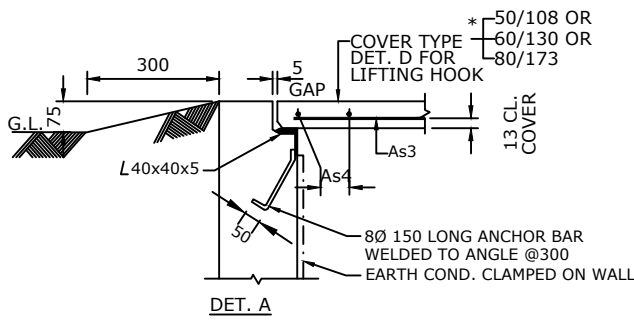
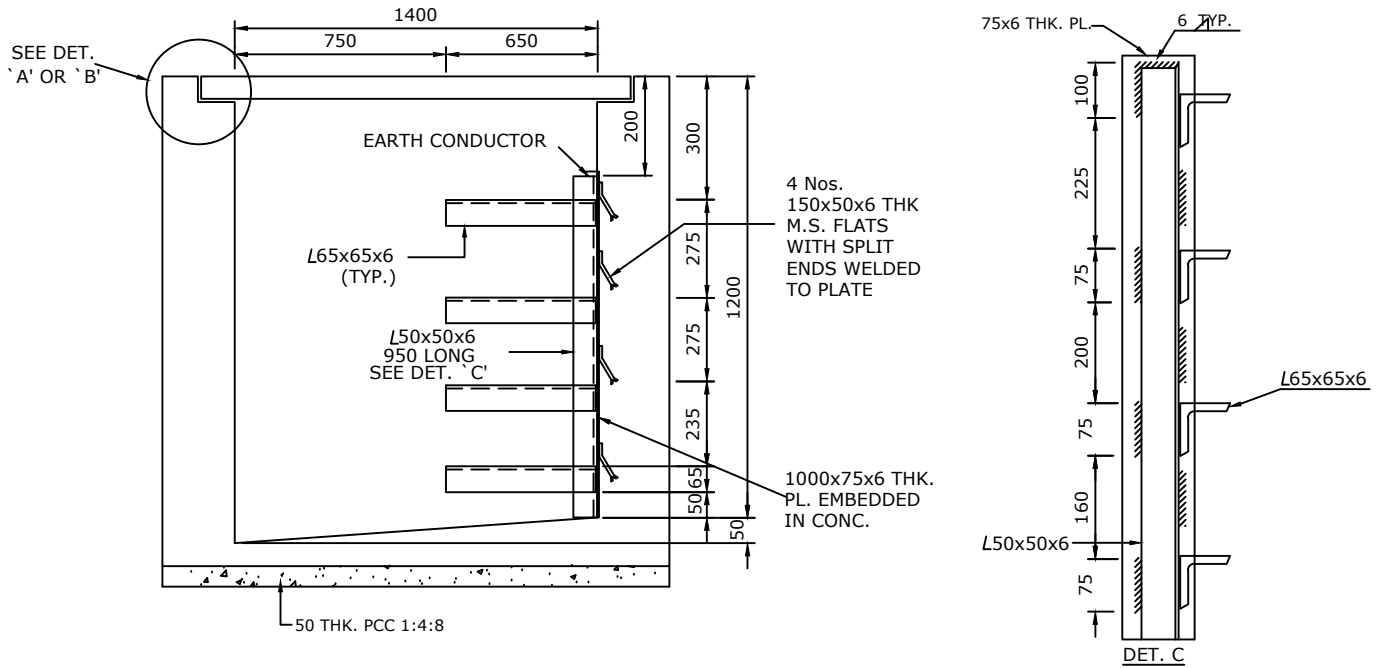
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NOTES:

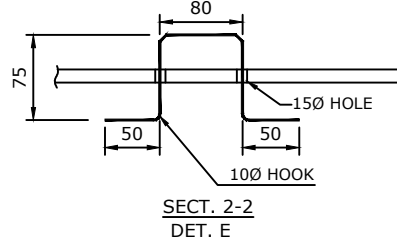
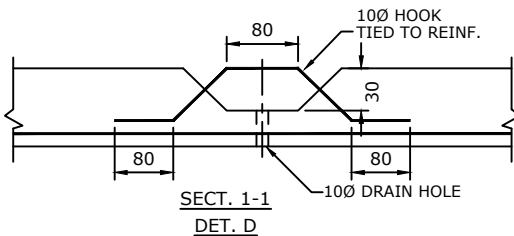
1. ALL DIMENSIONS ARE IN MM.
2. STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

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R C COVER TYPE	THICKNESS mm.	As3	As4
50/108	50	7-6Ø	9-6Ø
60/130	60	6-8Ø	8-8Ø
80/173	80	5-8Ø	8-8Ø

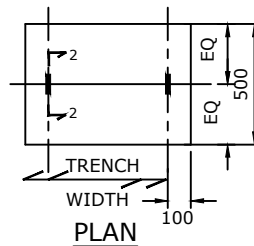
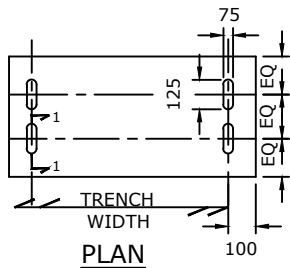
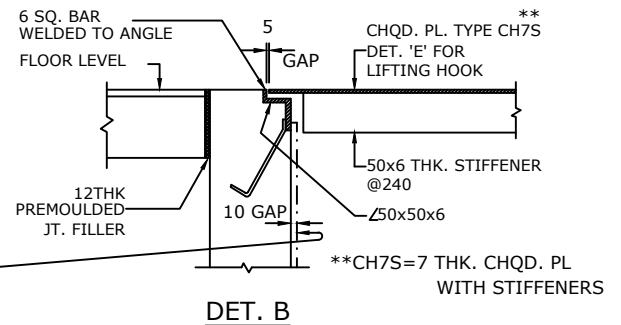
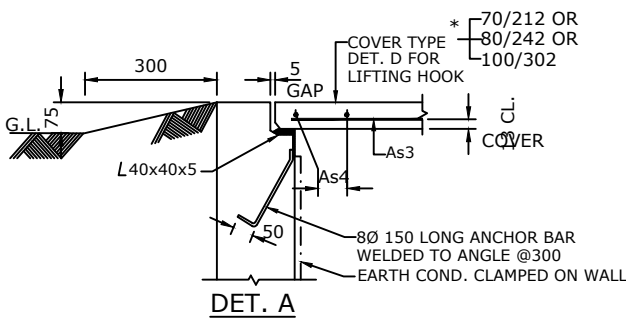
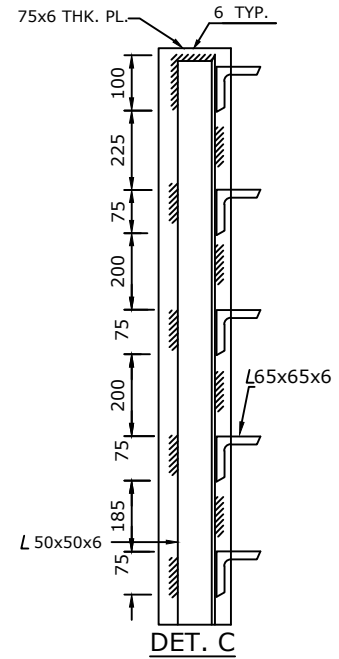
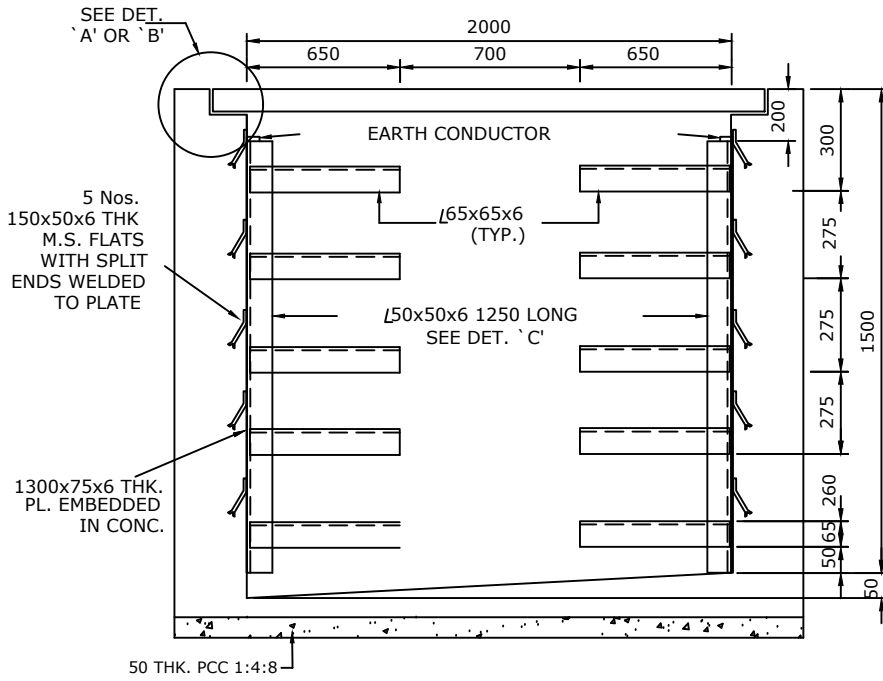
* 60x130 MEANS 60mm. THK.x130 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



NOTES:

- ALL DIMENSIONS ARE IN MM.
- STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

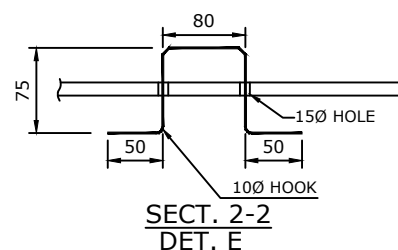
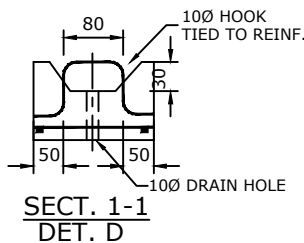
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



*

R C COVER TYPE	THICKNESS mm.	As3	As4
70/212	70	5-8Ø	11-8Ø
80/242	80	5-8Ø	11-8Ø
100/302	100	6-8Ø	11-8Ø

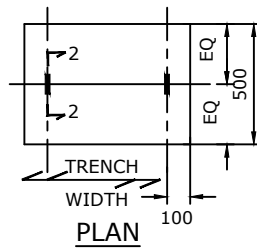
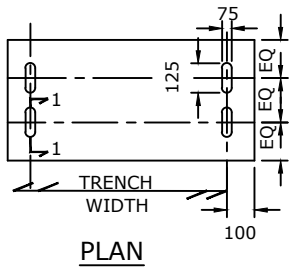
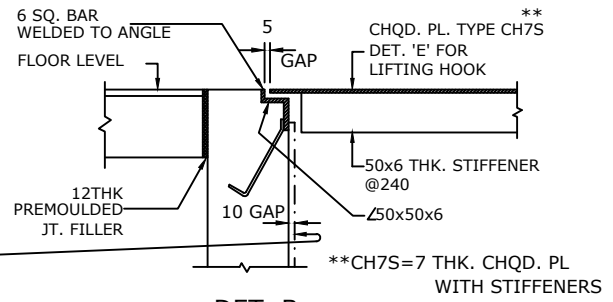
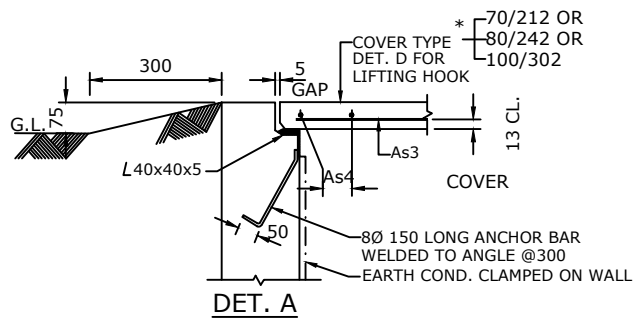
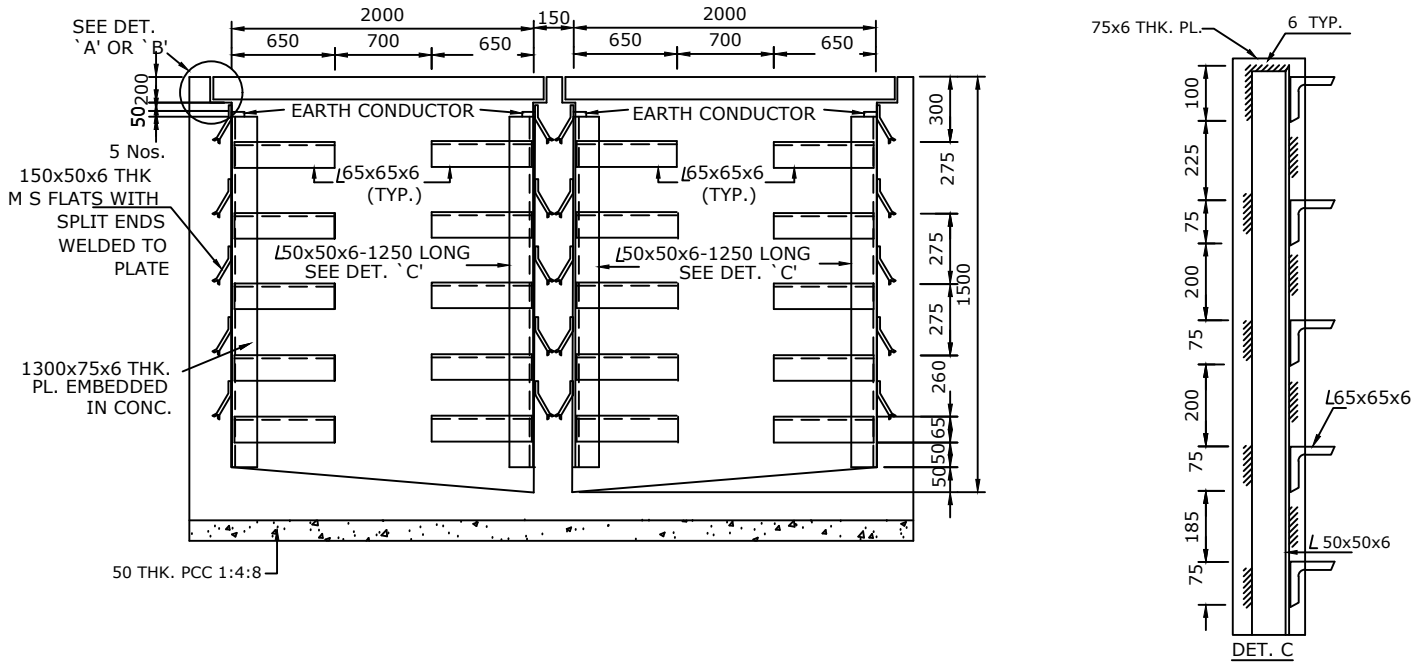
70x130 MEANS 70mm. THK.x212 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10.0m LENGTH OF TRENCH.



NOTES:

- ALL DIMENSIONS ARE IN MM.
- STRUCTURAL STEEL SHALL BE AS PER IS 2062:1992

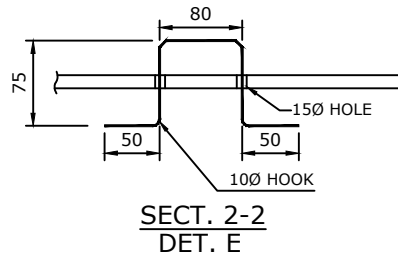
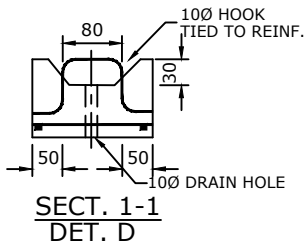
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY



*

R C COVER TYPE	THICKNESS mm.	As3	As4
70/212	70	5-8Ø	11-8Ø
80/242	80	5-8Ø	11-8Ø
100/302	100	6-8Ø	11-8Ø

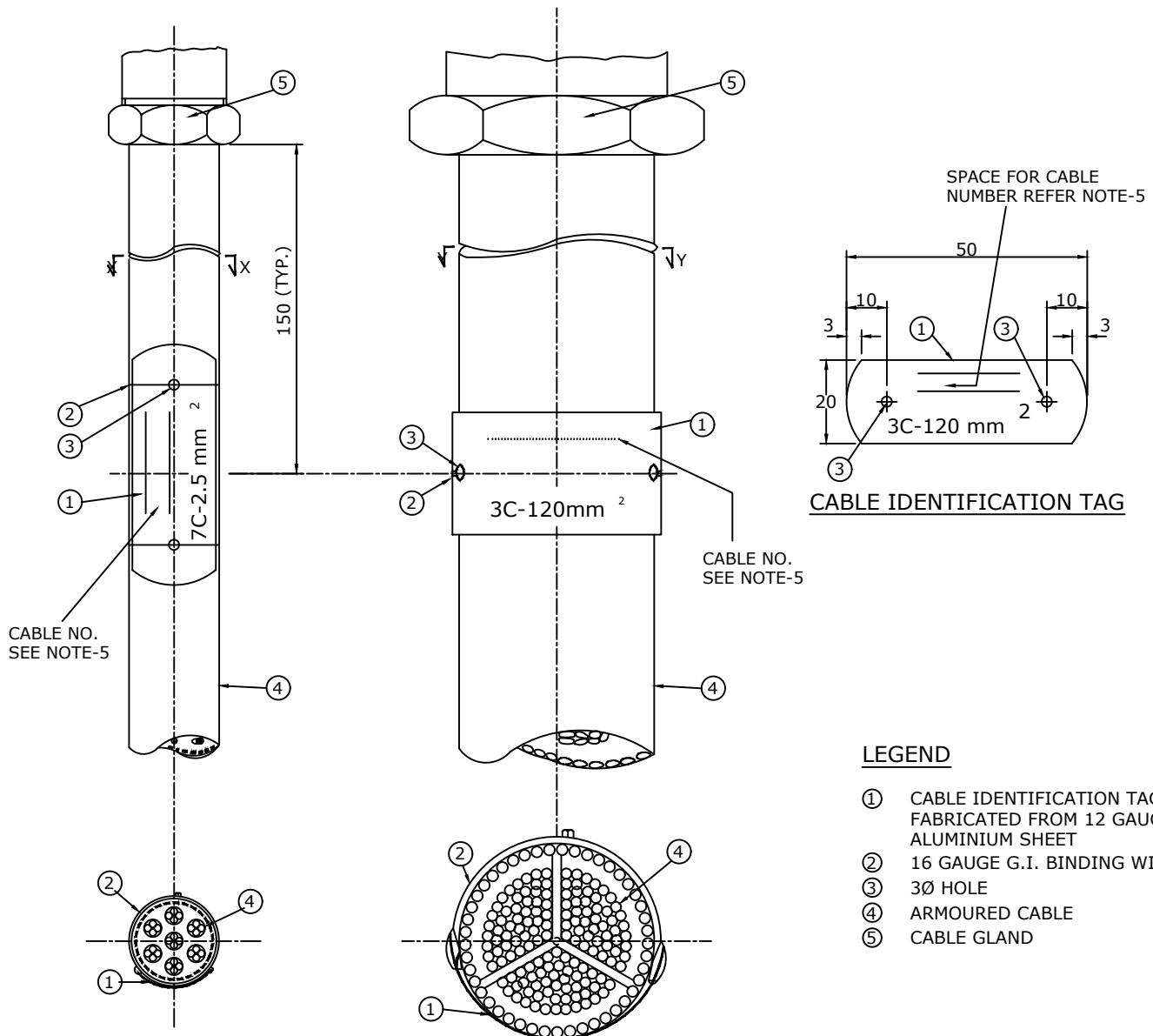
70x212 MEANS 70mm. THK.x212 Kg. COVER WEIGHT OF 600mm COVER WIDTH. PROVIDE TWO COVERS OF 300mm WIDTH FOR EVERY 10m LENGTH OF TRENCH.



NOTES:

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TYPE-A (SECTION X-X)

TYPICAL METHOD OF TYING THE TAG FOR CABLES WITH OVERALL DIA. <25 (ONLY FOR MULTICORE CABLES)

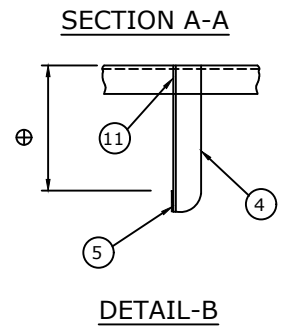
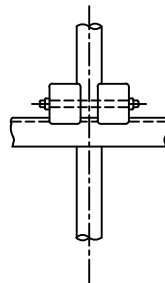
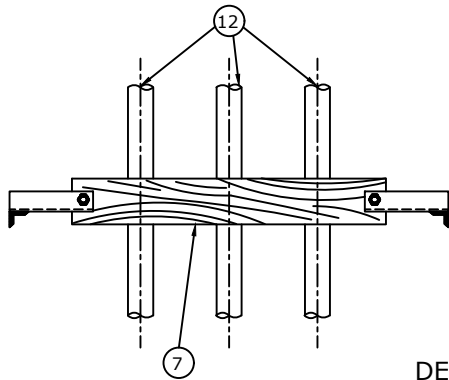
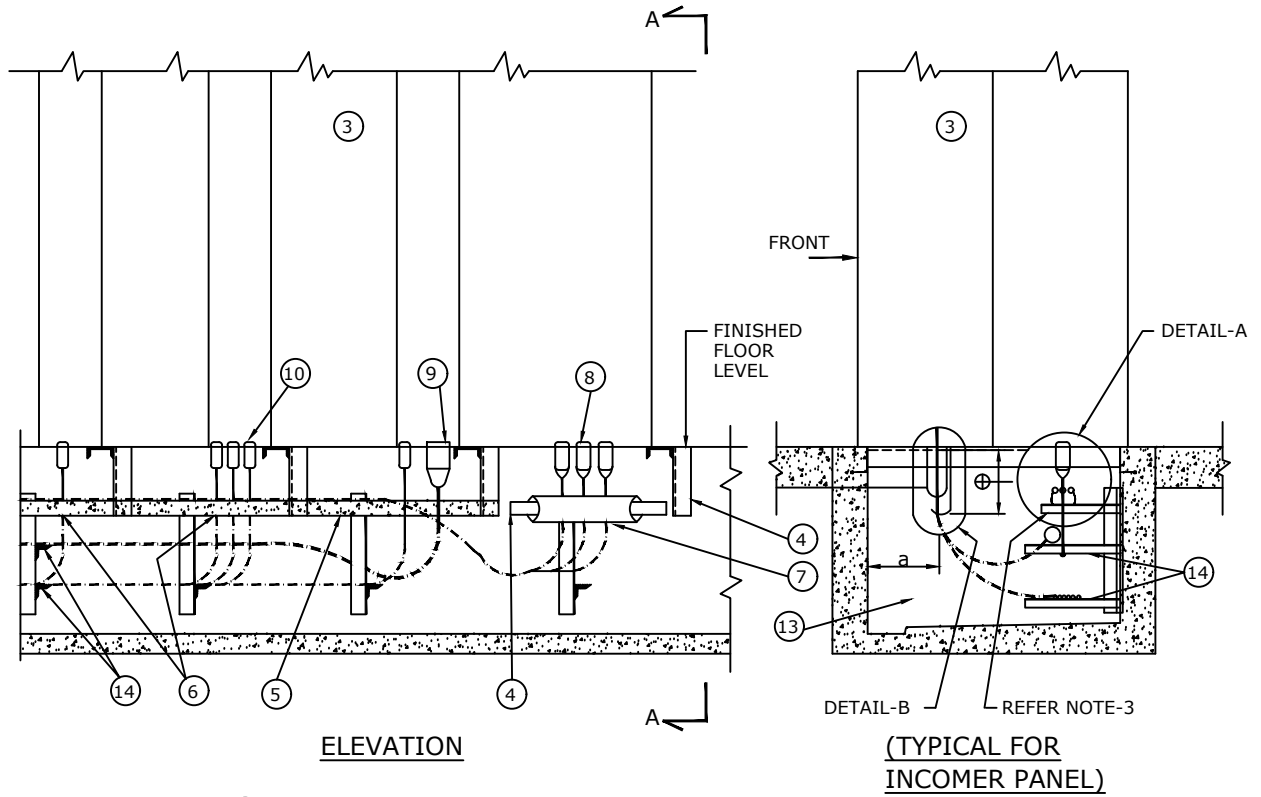
TYPE-B (SECTION Y-Y)

TYPICAL METHOD OF TYING THE TAG FOR CABLES WITH OVERALL DIA. >25

NOTES:

1. ALL DIMENSIONS ARE IN MM.
2. THE CABLE IDENTIFICATION NUMBER, NUMBER OF CORES AND SIZE SHALL BE EMBOSSED ON THE TAG.
3. THE TAG SHALL BE SUITABLY TIED APPROXIMATELY 150mm AWAY FROM THE CABLE GLAND AT BOTH ENDS OF THE CABLE.
4. THE TAG SHALL BE FREE FROM SHARP EDGES.
5. CABLE NUMBER SHALL BE EMBOSSED AS PER CABLE SCHEDULE.

02	24.03.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
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0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
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LEGEND

- ① TO ⑫ REFER SH. 1 OF 2
- ⑬ CABLE TRENCH
- ⑭ CABLE SUPPORTING ARM

NOTES:

1. FOR NOTES REFER SHEET 1 OF 2.
2. CONTROL AND POWER CABLES IN TRENCH SHALL BE TIED TO THE SUPPORTING ARM WITH 3Ø NYLON CORD, IF CABLE TRAY IS NOT USED.
3. 50x50x6 FOR CLAMPING 1/C CABLES TO BE SUITABLY GROUTED AT SITE.

02	24.03.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	16.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK
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Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR MV SWITCHBOARD

VCS – SS – EL - 4005

02	25.02.2022	SP	RD	AA	HK
01	16.10.2019	MG	VV	AD	SK
00	05.07.2017	MG	RD	AD	SK
Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed



REVISION RECORD

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description
00	05.07.2017	MG	RD	AD	SK	Issued for use as Standard
01	16.10.2019	MG	VV	AD	SK	New revision system updated
02	25.02.2022	SP	RD	AA	HK	New revision system updated



ABBREVIATION

BIS/IS:	Bureau of Indian standards
IEC:	International Electro-Technical Commission
BS:	British Standards
IEEE:	Institute of Electrical and Electronics Engineers
NEMA:	National Electrical Manufacturers Association
OISD:	Oil Industries Safety Directorate
CCE:	Chief Controller of Explosive
DGMS:	Director General Mines Safety
IE Rules:	Indian Electricity Rules
CPRI:	Central Power Research Institute
SWG:	Switchgear
CRCA:	Cold Rolled Cold Annealed
PCC:	Power Control Centre
PMCC:	Power and Motor Control Centre
MCCB:	Molded Case Circuit Breaker
MCB:	Miniature Circuit Breaker
MCC:	Motor Control Centre
CT:	Current Transformer
PT:	Potential Transformer
PVC:	Polyvinyl chloride



CONTENTS

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8.0	MARKING, PACKING AND SHIPMENT.....	22

1.0 SCOPE

This specification covers the requirements of design, manufacture, testing, packing and supply of Fixed / draw out type Medium Voltage Switchboards.

2.0 REFERENCE DOCUMENTS

2.1 The equipment shall comply with the requirements of latest revision of following standards issued by BIS unless otherwise specified.

- IS 5: Colors for ready mixed paints and enamels
- IS 772: AC Electricity Meters
- IS 1248: Direct acting electrical indicating instruments
- IS 2705: Current transformers
- IS: 2824: Method for determining the comparative tracking index of solid insulating materials under moist conditions
- IS: 3156: Voltage transformers
- IS: 3231: Electrical relays for power systems protection.
- IS: 3618: Phosphate treatment of iron and steel for protection against corrosion,
- IS: 5082: Material data for aluminum bus bars.
- IS: 5578: Guide for marking of insulated conductor.
- IS: 6005: Code of practice of Phosphating of iron and steel.
- IS: 8623: Factory built assemblies of switchgear and control gear for voltages up to and including 1000V AC and 1200V DC. Part -II particular requirements for busbar trucking systems (bus ways).
- IS: 11353: Guide for uniform system marking and identification of conductors and apparatus terminals.
- IS: 13703: Medium voltage fuses.
- IS: 13947: LV Switchgear and control gear

2.2 In case of imported equipment's, standards of the country of origin shall be applicable if these standards are equivalent or stringent than the applicable Indian standards.

2.3 The equipment shall also conform to the provisions of Indian Electricity Rules and other statutory regulations currently in force in the country.

2.4 In case Indian Standards are not available for any equipment, standards issued by IEC/BS / VDE/ IEEE/ NEMA or equivalent agency shall be applicable.

- 2.5 In case of any contradiction between various referred Standards / Specifications / Data Sheet and statutory regulations the following order of priority shall govern:
- a. Local Statutory regulations
 - b. Data Sheets
 - c. Job Specifications
 - d. Standards Specification
 - e. Codes and Standards

3.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

- 4.1 The frame, of individual vertical panels shall be fabricated using pressed and cold rolled sheet steel. The sheet steel used for panel shall be of minimum 2mm (14SWG) CRCA except that the doors and covers may be made of 1.6mm (16SWG) CRCA. Wherever required, stiffeners shall be provided to increase stiffness of large size doors and covers.
- 4.2 Bus bars shall be of high conductivity electrolytic aluminum /copper supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in Indian standards.
- 4.3 All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made by zinc passivated cadmium plated high quality steel bolts, nuts and washers.

5.0 DESIGN

5.1 GENERAL REQUIREMENTS

- 5.1.1 The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
- 5.1.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment at least for 15 years from the date of supply.
- 5.1.3 Vendor shall give a notice of at least one year to the end user of equipment and consulted before phasing out the product/spares to enable the end user for placement of order for spares and services.

5.2 TECHNICAL REQUIREMENTS

- 5.2.1 Medium & Low voltage switchboard shall be metal enclosed fully draw out, free standing, floor mounting, compartmentalized, modular type suitable for indoor installation only, otherwise specified in datasheet or project specification.
- 5.2.2 The switchboard enclosure shall be dust and vermin proof and shall provide a degree of protection not less than IP-42.
- 5.2.3 The switchboard shall be assembled out of vertical panels of uniform height in single line up.
- 5.2.4 It shall be possible to extend the switchboards, in either direction at a later date. Ends of bus bars shall be suitably drilled for this purpose. Panels at extreme ends shall have openings, which shall be covered with plates screwed to the panel. Details of drilled holes in bus bar and openings in the panels, provided for future extension shall be clearly shown in the vendor drawings.
- 5.2.5 The switchboard shall be designed to ensure maximum safety during operation, inspection, connection of cables, relocation of outgoing circuits and maintenance, with the bus bar system energized and without taking any special precautions.
- 5.2.6 Adequate means shall be provided to prevent shorting of power and / or control terminals due to accidental dropping of maintenance tools etc. inside the switchboard. Checking and removal of components shall be possible without disturbing adjacent equipment.

5.3 SPECIFIC REQUIREMENTS OF AIR CIRCUIT BREAKER PANELS

- 5.3.1 The breaker panels shall have distinct bus bar, breaker and cable compartments.
- 5.3.2 The design of each compartment shall be such as to prevent movement of vermin from a particular compartment to any other compartment of the panel when the breaker is withdrawn and compartment door is closed.

- 5.3.3 Blanking plates shall be provided for each circuit breaker compartments, which would be used after installation, to cover the openings in the event of taking out the breaker outside the compartment.
- 5.3.4 In order to minimize accidental access and avoid accidents due to falling tools, all the outgoing links shall be shrouded.
- 5.3.5 Outgoing Air circuit breaker can be mounted in a maximum of two-tier execution while the incoming/bus coupler Air circuit breaker shall be in single tier execution only.

5.4 CABLE COMPARTMENT

- 5.4.1 Separate compartment totally enclosed from all sides shall be provided for cable termination, on the rear side. Access to cables shall be from the rear side after opening the cabling compartment door.
- 5.4.2 The incoming / outgoing cable termination shall be staggered for each circuit and barriers of sheet steel or insulating material shall be provided between termination of two circuits such that maintenance on one circuit could be carried out while the other circuit is live. Suitable clamping arrangements shall be provided for cables and cable termination. Terminal blocks shall not be used for supporting the cables.
- 5.4.3 The incoming supply for PCC/ PMCC panels shall be through top entry bus ducts or through bottom entry cables unless specified otherwise. The outgoing cables shall have bottom entry unless specified otherwise.
- 5.4.4 The cable terminations shall be suitably sized for receiving specified number of cables per termination and provision shall be made for terminating each outgoing cable with a separate bolted connection. In case the total number of cables entering a particular panel cannot be accommodated in the cabling compartment of the panels an extension panel of full height shall be added to the cabling compartment for accommodating extra cables.

5.5 CIRCUIT BREAKER COMPARTMENT

- 5.5.1 The circuit breaker compartment shall be fully draw out. Suitable guides shall be provided to facilitate easy withdrawal of the circuit breaker.
- 5.5.2 The current transformers for the ammeter/protection circuits shall be mounted on the fixed portion of the compartment. However, current transformers associated with built-in releases may be mounted on the breaker trolley.
- 5.5.3 All terminals except wiping/sliding type control terminals shall be shrouded with plastic covers to prevent accidental contact. For direct termination - clip on shrouded type terminals shall be provided.
- 5.5.4 There shall be three positions for the draw out trolley viz:
 - a. "Service" position - In this position both power and control circuits shall be connected. This shall be the normal operating position of the circuit breaker.

- b. "Test" position - The power contacts shall be disconnected in this position but the control connections shall not be disturbed, it shall be possible to close and trip the breakers in this position.
- c. "Draw out" Position - both power and control circuits shall be disconnected in this position and breaker removed from the cubicle.

5.5.5 The circuit breaker shall be lockable in "service" and "test" positions. Safety shutters shall be provided when the breaker is in withdrawn/draw out position.

5.5.6 The earth connection must remain connected in "Test" position; Earthing of the unit shall be done with a "pin" or with scrapping earth connections.

5.5.7 The earth connection shall make before the main power / control contacts make and break after the power /control contacts are disconnected. Earthing connection through a plug and socket connection shall not be acceptable.

5.6 INTERLOCKS

Following interlocks shall be provided:

5.6.1 Compartment doors shall be interlocked against opening when breaker is in closed condition. However, it shall be possible to defeat this interlock for inspection purposes.

5.6.2 It shall not be possible to push "in" a drawn-out circuit breaker in closed condition or withdraw a circuit breaker in closed condition.

5.6.3 It shall be possible to operate a circuit breaker only in the defined "Full in" or "service" and "test" position inside the panel. It shall not be possible to operate the breaker in intermediate positions while inserting or withdrawing circuit breaker.

5.6.4 Any unused circuit breaker compartment shall be fully equipped and provided with compartment door, vertical busbars and control terminals/wiring etc., such that the same could be used for housing outgoing breakers in future without any modifications to the panel.

5.7 SPECIFIC REQUIREMENTS OF NON-AIR CIRCUIT BREAKER FEEDERS

5.7.1 The design of draw out feeder modules shall not change for single front or double front execution. Separate vertical bus bars shall be provided for each front side modules.

5.7.2 All identical feeder modules shall be interchangeable.

5.7.3 Each vertical panel shall have a separate cable alley. The width of this cable alley shall be sufficient to accommodate all the cables and shall have free access for cable terminations and in any case shall not be less than 200mm minimum. Cable alleys shall be provided with suitable doors.

5.7.4 Sheet steel barriers shall be provided between individual compartments and cable alley. This barrier shall be provided with opening for power and control connections and it shall be possible to safely carryout maintenance work on cable connections to any one circuit in the cable alley with the busbars and the adjacent circuits live.

- 5.7.5 Maintenance and connection of cables to any modules shall be possible without having to take out the modules from its position from the panel.
- 5.7.6 The outgoing feeder trolleys for draw out type switchboard shall be fully draw out and shall have the following features.
- a. It shall be possible to withdraw the trolley without having to unbolt or unscrew any power and control connections to the equipment mounted on the withdrawable trolley.
 - b. Both power and control connections shall be draw out type. All line and bus PTs shall be in draw out execution only. However, outgoing modules having size more than half of the useful vertical height of the panel may be in mixed combination of draw out/fixed type.
 - c. Control supply transformer modules with burden higher than 2.5KVA may be in fixed execution.
 - d. The trolley withdrawal shall be by means of crank and screw arrangement. Alternatively movement on guided rollers may also be acceptable. Plug in operation shall be independent of manual force.
 - e. For draw out type feeders of size equal to or greater than half the useful vertical height of panel, positive clamping arrangement shall be provided on the top portion of the trolley in addition to clamping arrangement at the bottom, to ensure all round positive pressure on the power draw out contacts once the trolley is plugged in.
 - f. Power draws out contacts shall preferably be located towards the bottom portion of each trolley. The trolley shall be lockable in fully plugged in position and devices shall be provided to ensure positive plugging in. In test position, power contacts shall be totally isolated and a device shall be provided for indication of test position.
 - g. The incomer and bus tie feeders with load break switches rated 800A and above may be in fixed execution.
- 5.7.7 Various compartment sizes in a vertical panel shall be multiples of a basic dimension. However the minimum module size for switch fuse feeder and motor starter/contactors feeder shall not be less than that defined in Data Sheet/Job Specification. Vertical bus bars shall be pre-drilled at regular intervals for complete flexibility for changes in size of modules.
- 5.7.8 All switch drives other than rotary control switches, shall be lockable in both 'ON' and 'OFF' positions.
- 5.7.9 The Switches / Molded case circuit breakers / MCB shall be interlocked with the compartment door to prevent opening of the door when the Switch/ Molded case circuit breaker is in 'ON' position and to prevent switching on when the door is open. A defeat mechanism for this interlock shall also be provided.
- 5.7.10 The maximum height of the operating handle and switches shall not exceed 1900 mm and the minimum height not below 300 mm.

5.7.11 Unused modules in the panel shall be fully equipped with hinged door, power and control terminals for starter modules and cradle for future use.

5.8 SWITCHGEAR MODULES

5.8.1 Switchboard shall be completely lined up in one straight row with the type and quantities of feeders as defined in switchboard Data Sheet. Generally the feeders of three main categories are identified as circuit breaker, motor starters and switch-fuse,

5.8.2 Starter modules required for motor control shall be of following types and internal control wiring of all starter modules of each type shall be identical for all ratings.

FVNR Full voltage non -reversing starter with minimum 18 control terminals.

FVR Full voltage reversing starter with minimum 24 control terminals.

FVNR HD Full voltage non -reversing heavy duty starter with long starting time such as for compressors and fans etc., with minimum 18 control terminals.

5.8.3 Switchgear /contactor feeder modules shall be of following types and internal control wiring of all modules of each type shall be identical for all ratings.

MCCB Molded case circuit breaker.

MPCB Motor Protection circuit breaker

MCB Miniature circuit breaker

ELCB Earth leakage circuit breaker

RCCB Residual current circuit breaker

5.8.4 Type of modules for fixed type switchboard shall be similar to above specified draw out modules except that the modules shall be of fixed type.

5.8.5 Minimum 2000 VA control transformer shall be provided for each bus section of the PMCC/MCC switchboard having contactor control feeders and each transformer shall be sized for the entire switchboard. For switchboard having two bus sections and coupled by bus tie shall have manual changeover switch for the control transformers.

5.8.6 To facilitate site modification due to changes in motor KW ratings and to minimize spares inventory, overload relays and power fuse links shall meet the following requirements.

a. All bimetal overload relays shall be separately mounted type with connecting links rated for the maximum rating of the contactor in a starter module.

b. Bimetal overload relays of various current ranges required for motors likely to be connected to a contactor must be identical in dimension for inter-changeability. In case offered relays are with different dimension for any particular starter module, special mounting plate suitable for mounting different relays shall be provided in all the modules of that size.

c. Heavy duty starters shall be provided with saturable type current transformer

operated overload relays only, which shall be suitable for motor starting time of 15-60 seconds.

- d. All contactor-controlled starter feeders shall meet the requirements of type-2 co-ordination as per IS: 13947.

5.9 SWITCHGEAR COMPONENTS

5.9.1 CIRCUIT BREAKER

- a. Circuit breakers shall be air brake, 3 pole and draw out type. However Circuit breaker for generator incomer shall be with four poles unless specified otherwise.
- b. The circuit breakers shall be provided with mechanically operated emergency tripping device. This device shall be available on the front of the panel. Mechanically operated 'closing' device shall be provided for all breakers. However mechanical closing shall be inhibited for all breakers in service position.
- c. The circuit breakers shall be provided with minimum 4 NO + 4 NC contacts, wired and available for Purchaser's use.
- d. Circuit breakers Open and closed positions; Service and test locations and spring charged condition shall also be indicated mechanically in addition to electrical indications.
- e. Unless otherwise specified, all circuit breakers in the switchboard shall be provided with electrical power operating mechanism. Wherever circuit breakers are provided in place of Isolators, Breaker can be manually operated type.

5.9.2 OPERATING MECHANISM

- a. Electric power operating mechanism shall be motor wound spring charged stored energy type. However, manual-operating mechanism may be of the spring charging stored energy type or the spring assisted type. For circuit breakers with electrical power operating mechanism, provision shall also be made for manual spring charging. Closing time of circuit breakers with manual operating mechanism shall be independent of the speed of the operating handle.
- b. All stored energy operating mechanism shall be equipped with following features.
 - i. Failure of springs, vibrations or shocks shall not cause unintended operation of breaker or prevent intended tripping operation.
 - ii. Closing of circuit breakers shall be prevented unless the spring is fully charged.
- c. All electrical power operating mechanisms shall be suitable for remote operation and shall be equipped with following features.
 - i. Provided with universal motor operable on AC or DC control supplies.
 - ii. Provided with emergency manual charging facility. The motor shall be automatically, decoupled (mechanically) once the manual-charging handle is inserted.
 - iii. Closing operation of circuit breaker shall automatically initiate charging of the spring for the next closing operation without waiting for tripping of circuit breaker.
 - iv. Closing operation shall be completed once the closing impulse is given and the

first device in the control scheme has responded even though the control switch / Push Button is released provided no counter trip impulse is present.

- v. Circuit breaker trip and closing coils in case of electrically operated breakers and trip coil in case of mechanically operated breakers and circuit breaker indication shall be suitable for satisfactory operation on a control supply system indicated in data sheets/job specification.
- vi. Circuit breakers shall be provided with anti-pumping and trip free feature.
- vii. Circuit breakers shall be provided with operation counters.
- viii. Releases are not required to be provided with breakers where relays are used. However, breaker having AC control supply voltage shall be provided with under voltage release unless specified otherwise.

5.9.3 SWITCHES

- a. All switches or fuse switches shall be air break type provided with quick make/break manual operating mechanism. The operating handle shall be mounted on the door of the compartment having the switch.
- b. Rating of switches for starter module shall meet the requirements of AC-23 duty as per IS: 513947 and minimum rating shall be as specified in job specification/data sheets.

5.9.4 FUSES (shall be used as per client requirements only)

- a. Fuses shall be non-deteriorating HRC cartridge link type.
- b. Power fuses shall be pressure fitted type and shall preferably have ribs on the, contact blades to ensure good line contact.
- c. It shall be possible to handle fuses during off load conditions with full voltage available on the terminals. Wherever required, fuse pullers shall be provided. The fuse base shall be so located in the modules to permit insertion of fuse pullers and removal of fuse links without any problem.

5.9.5 CONTACTORS

- a. The contactors shall be air break type, equipped with three main contacts and minimum 1NO+1NC auxiliary contacts: The main contacts of a particular contactor for motor starter module shall have AC-3 or AC-4 ratings as specified in Data Sheet.
- b. Unless specified otherwise, the coil of the contactor shall be suitable for operation on 240 V, I Phase, AC supply and shall work satisfactorily between 65 to 110% of the rated value.

5.9.6 THERMAL OVERLOAD RELAY

- a. Bimetal relays shall be provided for protecting the motor from thermal overload.
- b. Bimetal relays shall be manually reset type with the reset push button brought out on the front of the panel. The reset push button shall be capable of being operated without opening the compartment door.
- c. Bimetal relays shall be positive acting ambient temperature compensated type with

adjustable setting range.

- d. Bimetal relays shall have built-in single phasing prevention feature, which operate even with 50% rated current at the time of single phasing.

5.9.7 MOULDED CASE CIRCUIT BREAKERS

- a. MCCBs shall be provided with spring assisted quick make/ break manually operated trip free mechanism. Wherever specified, MCCB shall be suitable for remote tripping operation and the tripping device shall be suitable for the specified control supply voltage.
- b. MCCBs shall be provided tripping device with inverse time characteristic for over load protection and instantaneous characteristics for short circuit protection and MCCB rated above 125A shall preferably have adjustable settings.
- c. 'ON' and 'OFF' position of the operating handle of MCCB shall be displayed and the operating handle shall be mounted on the door of the compartment housing MCCB.
- d. Each MCCB shall be provided with minimum 1 NO + 1 NC auxiliary contact and 1NO contact for tripping indication/alarm for Purchaser's use.
- e. MCCBs shall be provided with solenoid/ Motorized closing mechanism to make them suitable for remote closing operation if specified. The closing solenoid/motor shall be suitable for specified (control supply voltage).
- f. MCCB's as part of motor starter module shall be current limiting type and type tested for type-2 coordination as per IS: 13947.

5.9.8 RELAYS

- a. All the protective relay shall be provided as per OISD/Engineering standard guideline as per utilization of Electrical panels requirements.
- b. All the type of relay shall be numerical only otherwise static or electromagnetic type if specified in the Data Sheet/Job Specification.
- c. All electromagnetic protective relays shall be back connected, of draw out type, suitable for flush mounting, and fitted with dust-tight covers. Alternatively, "plug-in" type relays will also be acceptable. Auxiliary relays are acceptable in fixed execution.
- d. The protective relay cases shall have provision at the front for "testing and calibration" purposes. It shall be possible to test the relays without disconnecting the wiring and without withdrawing the relays. The insertion of the test plug shall automatically short circuit the CTs and permit extension of external power supply to the relay.
- e. Each protective relay shall be provided with minimum 2 nos. potential free contacts of required configuration.
- f. Each tripping relay shall be lockout type with hand reset coil cut-off contact. The tripping relay shall be suitable for satisfactory operation from 50 % to 110 % of the specified control supply voltage.
- g. Protective relays shall be preferably mounted on the front side and upper part of the panel and mounting of relays on the lower portion shall be avoided.

5.9.9 INSTRUMENT TRANSFORMERS (CTS/PTS)

- a. Current transformers shall generally conform to IS: 2705 and any special requirement with respect to Numerical relay shall be taken care by the Vendor.
- b. For general guidance the Vendor shall note that the protective current transformers shall have an accuracy class "5 P" and an accuracy limit factor greater than "10 ". However CTs for restricted earth fault shall be of class "PS". Vendor shall co-ordinate the knee point voltage, magnetizing current for PS class CTs to avoid saturation and mismatching of CTs provided at another end by other Vendor.
- c. Current transformers for instruments shall have an accuracy class 1.0 and accuracy limit factor less than 5.0. However accuracy class of 3.0 is acceptable for CT's meant for remote ammeters.
- d. The current transformers in breaker feeders shall be capable of withstanding the applicable peak momentary short circuit and the symmetrical short circuit current for 1.0 second.
- e. The voltage transformers shall be cast resin type transformers and PT shall generally conform to IS: 3156. PT shall be provided with HRC fuses on primary side and Miniature circuit breakers with auxiliary contact on the secondary side.

5.9.10 MEASURING INSTRUMENTS

- a. Multifunction meter shall be used for all incomer & specified outgoing feeders.
- b. All measuring instruments shall be of 96 x 96, mm and 72 x 72 mm square pattern, flush mounting type for incomer and outgoing feeders respectively in the switchboard.
- c. All auxiliary equipment such as shunts transducers, CT's PT's etc. as required shall be included in the supply of the switchboard.
- d. All AC ammeters and voltmeters shall be of moving iron type with accuracy class of 1.5 as per IS: 1248. Ammeters for motor feeders shall have a non-linear compressed scale at the end to indicate motor starting current and red mark for the full load current.
- e. The KW/KWH meters shall be suitable to measure unbalanced loads on 3 phases 4-wire system. Test terminal block shall be provided for KWH meters. The accuracy class of KW/KWH meters shall be a minimum of 2.5.
- f. Digital meters shall be provided if specified in Job Specification/Data Sheets. All digital meter shall be high reliable, accurate, compact and self-powered. Digital meter data shall be saved in case of power failure. Field programming from front of the meter shall be possible and shall be RS232/485 port in case specified in the Job Specification/Data Sheet.

5.9.11 CONTROL SWITCHES

- a. All control switches shall be rotary type, having a cam operated contact mechanism. Switch shall have pistol grip handles for circuit breaker control and knob type handle for other applications.
- b. Ammeter selector switches shall have make before break feature on its contacts. The selector switch shall generally have 4 positions for reading 3 phase currents and fourth position for off. The voltmeter selector switch shall also have 4 positions, three positions shall be used to measure phase to phase voltage and fourth shall be OFF position.

5.9.12 PUSH BUTTONS:

Push button colors shall be as follows:

- a. Stop /open/emergency : Red
- b. Start/close : Green
- c. Reset/test : Yellow / Black /white

5.9.13 INDICATIONS

- a. Clustered LED type indicating light with minimum 8mm diameter size shall be provided for indications.
- b. Breaker positions (Close, Open, spring-charged, test position, service position) electrical indications, with colors as given below, shall also be provided:

Breaker `Close'	:	Red lamp
Breaker 'Open'	:	Green lamp
Breaker auto-trip	:	Amber lamp
Trip circuit healthy	:	White lamp
Spring charging	:	Blue lamp

- c. Outgoing feeder (Close, Open, trip) electrical indications, with colors as given below, shall also be provided:

'Close'	:	Red lamp
'Open'	:	Green lamp
`Trip'	:	Amber lamp

5.9.14 AUXILIARY RELAYS/CONTACTORS

Auxiliary relays/contactors shall generally be used for interlocking and multiplying contacts. Auxiliary contacts shall be capable of carrying the maximum anticipated current.

5.9.15 TIMERS

For re-acceleration duty, timers unless otherwise stated, shall be pneumatic type and shall have adjustable time setting of 0-60 seconds, alternatively static timer may be considered. The time settings, where specified, shall be accurately set before dispatch of the switchboard. Timer provided for control of capacitor feeder shall have minimum setting of 0-5 minutes.

5.9.16 MINIATURE CIRCUIT BREAKER

- a. MCB shall provide high mechanical and electrical life, reliable protection of circuits

against overload and short circuit and shall have minimum breaking capacity of 9KA unless otherwise specified. Positive ON/OFF indication shall be provided.

- b. Earth leakage circuit breaker shall have earth sensitivities range 30mA to 300mA unless otherwise specified.
- c. Residual current circuit breaker shall have sensitivities range 30mA to 300mA unless otherwise specified

6.0 FABRICATION

- 6.1 All identical equipment and corresponding part shall be fully interchangeable.
- 6.2 The frame, of individual vertical panels shall be fabricated using pressed and cold rolled sheet steel. The sheet steel used for panel shall be of minimum 2mm (14SWG) CRCA except that the doors and covers may be made of 1.6mm (16SWG) CRCA. Wherever required, stiffeners shall be provided to increase stiffness of large size doors and covers.
- 6.3 The switchboard shall be provided with integral base frame for each vertical panel. The switchboard integral base frame shall be suitable for tack welding.
- 6.4 All openings, covers and doors shall be provided with neoprene Gaskets. Removable blanking plates shall be provided to cover the openings in the event of withdrawing the feeder modules. Number of blanking plates shall be 10% of each module size with a minimum of one number.
- 6.5 All hardware shall be corrosion resistant. All joints and connections of the panel members shall be made by zinc passivated cadmium plated high quality steel bolts, nuts and washers.
- 6.6 Suitable removable type eyebolts shall be provided for the lifting of the panel/shipping section. These bolts, when removed shall not leave any opening in the panels.
- 6.7 Non-magnetic cable gland plates shall be provided for termination of single core cables.
- 6.8 The switchboard shall be formed using distinct vertical panels each comprising of following compartments.
 - 6.8.1 A metal enclosed horizontal bus bar compartment running at top unless otherwise specified. Individual feeder modules in multitier mode.
 - 6.8.2 Vertical bus bars serving all feeder modules in the vertical panel.
- 6.9 CABLE TERMINATION COMPARTMENT
 - 6.9.1 Perforated sheet steel/insulating material enclosed horizontal auxiliary bus bars for control, interlock, indication and metering wiring running horizontally.
 - 6.9.2 Metal sheets shall be provided between two adjacent vertical panels running up to full useful height of the switchboard.
 - 6.9.3 MCC shall be of single/double front execution as specified in Data Sheet/Job Specification. However Circuit breaker panels and fixed type switchboard shall be in

single front execution only.

6.9.4 Motor starter and switch fuse modules shall not be accommodated at front and rear of ACB Incomer and bus coupler panel.

6.9.5 All metering and protection equipment associated with a particular circuit as specified in Data Sheet shall be housed in separate and independent compartment earmarked for that particular circuit and in the fixed portion of the vertical panel in case of breaker panels.

6.9.6 All auxiliary devices for control, reset, indication, measurement and protection such as push buttons, control and selector switches, indicating lamps, measuring instruments and protective relays shall be mounted on the front side of the respective compartment. The design shall be such that all power on/off or start / stop and relay reset operations shall be performed without opening the panel door.

6.10 SPACE HEATERS

6.10.1 The switchboard panels shall be provided with space heaters to prevent moisture condensation. The space heater shall be located in the bottom part of each panel and shall be supplied from 240 V AC auxiliary bus for space heater. The space heater shall be provided with a thermostat having adjustable setting and double pole miniature circuit breaker.

6.11 AUXILIARY BUS BARS

6.11.1 Auxiliary bus bars each of minimum size 18-mm² copper shall be provided for following applications. Exact number of bus bars shall depend on various control, metering and auxiliary power distribution requirement.

6.11.2 Panel space heater supply and motor space heater supply.

6.11.3 Control supply for breaker tripping, closing and indication circuits.

6.11.4 Control supply for breaker spring charging motors, motor starter control and indication circuit. AC potential supply for energy meters, voltage operated relays etc.

6.11.5 Tee-off connectors shall be used for distributing auxiliary supply to each vertical panel. Rubber grommets shall be used for all wire entries to make the entries dust and vermin proof.

6.11.6 Provision to hook up of external DC control supply to be provided either in bus PT panel or bus coupler panel.

6.12 BUS BAR

6.12.1 Bus bars shall be of high conductivity electrolytic aluminum /copper supported on insulators made of non-hygroscopic, non-inflammable material with tracking index equal to or more than that defined in Indian standards.

6.12.2 The main bus bars shall have uniform current ratings throughout their length as specified in Data Sheet/Job Specification. The current rating of the neutral shall be half that of the phase bus bars, Removable neutral links shall be provided on feeders to permit isolation

of the neutral bus bar.

- 6.12.3 Both horizontal and vertical bus bars, bus joints and supports shall be capable of withstanding dynamic and thermal stresses of the specified short circuit currents for 1 second, The short circuit capacity of the neutral bus bars shall be in line with IS:13947.
- 6.12.4 Only zinc passivated or cadmium plated high tensile strength steel bolts, nuts and washers shall be used for all bus bar joints and supports. The hot spot temperature of bus bars including joints at design ambient temperature shall not exceed 95° C for normal operating conditions.
- 6.12.5 The current rating as defined for switchboard and components in Data Sheet/Job Specification are for design ambient temperature at site conditions and for being inside the cubicle at fully loaded condition. The Vendor shall suitably derate the nominal rating to suit the above condition.
- 6.12.6 All bus bars shall be insulated with heat shrunk PVC sleeves of 1100 V grade. Red, yellow and blue color shall be used for phase bus bars and black color shall be used for neutral bus bars; Removable type shrouds shall be provided for joints.
- 6.12.7 Minimum clearance between live parts, between live parts/neutral to earth shall be 19 mm, however clearances between terminals at components shall be as per applicable individual standards for components.
- 6.12.8 Interconnections between the main bus bars and individual units shall be made by using aluminum bus bars of adequate rating. These interconnections of the vertical bus bars shall be in separate compartment and fully shrouded.
- 6.12.9 Vertical bus bars for circuit breaker panels shall be sized depending upon the rating and number of breakers per vertical panel. However Vertical bus bars of all other panels shall be of uniform cross section, Size of vertical bus bars shall not be less than 500 mm² aluminum per phase or equivalent copper for panels rated above 25kA.

6.13 WIRING AND TERMINALS

- 6.13.1 Inside the cubicles, the wiring for control, signaling, protection and instrument circuits shall be done with BIS approved, PVC insulated, flame retardant type, copper conductor wire. The insulation grade shall be 660 V. The wiring shall preferably be enclosed in plastic channels or neatly bunched, together.
- 6.13.2 PVC insulated copper conductor of cross section 1.5 mm² may normally be used provided the control fuse rating is 10 amps or less. For 16 amps control fuse circuit 2.5mm² copper conductor shall be used. Each wire shall be terminated at a separate terminal. C.T. Circuit wiring shall be done with 2.5mm² Copper conductor.
- 6.13.3 Shorting links/suitable-shortening arrangement for shorting CT. secondary shall be provided. Each wire shall be identified at both ends by PVC ferrules.
- 6.13.4 Inter panels wiring within each shipping section shall be switchboard Vendor's responsibility. For wiring between shipping sections, Vendor shall provide terminal blocks on adjoining shipping sections and supply suitable umpiring wires. Interpanel wiring shall be taken thorough PVC sleeves or rubber grommets.

- 6.13.5 A minimum of 10% spare terminals shall be provided on each terminal block.
- 6.13.6 Conductors shall be terminated with adequately sized compression-type lugs for connection to equipment terminals and strips. Stranded conductors shall be soldered at the ends before connections are made to the terminals. Sufficient terminals shall be provided on each terminal block to ensure that not more than one outgoing wire is connected per terminal.
- 6.13.7 Terminal strips shall preferably be separated from power circuits by metal barriers or enclosures. All spare contacts of auxiliary relays, timers, etc. shall be wired up to the terminals.
- 6.14 EARTHING
- 6.14.1 All panels shall be connected to a tinned copper / GI earth bus bar running throughout the length of the switchboard.
- 6.14.2 The minimum earth bus size shall be 30x6 mm² copper for fault level up to 31.5kA and 50x6 mm² copper for fault level above 31.5kA,
- 6.14.3 All doors and movable parts shall be earthed using flexible copper connections to the fixed frame of the switchboard. Provision shall be made to connect the earthing bus bar to the plant earthing grid at two ends.
- 6.14.4 All non-current carrying metallic parts of the mounted equipment shall be earthed. Minimum 4 no's, 10 mm diameter bolts with nuts shall be provided on the earth bus for termination of fourth core of cable per vertical panel.
- 6.15 NAME PLATE
- 6.15.1 A nameplate with the switchboard designation shall be fixed at the top of the central panel. A separate nameplate giving details for each feeder compartment of all panels shall be provided.
- 6.15.2 The nameplates for feeder compartments shall be in two parts. One part shall have necessary details pertaining to the compartments number of vertical panel of the switchboards, The other parts shall be removable and shall contain all details regarding the feeder number for drives/equipment controlled by the particular module as per approved single line diagram.
- 6.15.3 Blank nameplates shall be provided for all spare and vacant modules.
- 6.15.4 Nameplate or polyester adhesive stickers shall be provided for each equipment mounted inside the switchboard, Special warning plates shall be provided on removable covers or doors giving access to cable terminals and bus bars.
- 6.15.5 Special warning labels shall be provided inside the switchboards also, wherever considered necessary. Identification tags shall be provided inside the panels matching with those shown on the circuit diagram.
- 6.15.6 Engraved nameplates shall preferably be of 3 ply (Black-White Black) lamicoide sheets or anodized aluminum. However back engraved Perspex sheet nameplates may also be acceptable. Nameplates shall be fastened by screws and not by adhesives.

6.16 PAINTING

- 6.16.1 All metal surfaces shall be thoroughly cleaned and degreased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid, The under surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer, The under surface shall be made free from all imperfections before undertaking the finishing coat.
- 6.16.2 After preparation of the under surface, the switchboard shall be spray painted with two coats of epoxy based final paint or shall be powder coated.
- 6.16.3 Color shade of final paint shall be 631 as per IS:5 unless otherwise specified.
- 6.16.4 The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc. Vendor shall supply final paint (1 liter per switchboard) in non-returnable container for final touch up at site.
- 6.16.5 All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements, then they shall be greased.

7.0 INSPECTION AND TESTING

- 7.1 During fabrication, switchgear shall be subject to inspection by Consultant / Owner or by an agency authorized by the Owner. Manufacturer shall furnish all necessary information concerning the supply to Consultant / Owners inspectors.
- 7.2 All routine and acceptance tests shall be carried out at Manufacturer's work under his care and expense.
- 7.3 Type tests, if specified shall be performed. Short circuit test shall be performed at CPRI or equivalent approved testing agency and heat run test may be performed at manufacturer's works. Heat run test shall be performed at least on one incomer and two outgoing vertical panels of the ordered switchboard.
- 7.4 Type and shop tests shall be witnessed by an inspector of Consultants / Owner or of an agency authorized by the Owner. Prior notice of minimum 4 weeks shall be given to the Inspector for witnessing the tests.

7.5 ACCEPTANCE TESTS

Acceptance tests shall be as follows:

- 7.5.1 A general visual check shall be carried out. This shall cover measurement of overall dimension, location, number and type of devices, location and connection of terminals etc.,
- 7.5.2 Manual and electrical operation of Circuit Breakers. / Relays shall be checked under the worst conditions of auxiliary supply voltage.
- 7.5.3 Dry insulation test with power frequency voltage shall be conducted for the main and auxiliary circuits.



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- 7.5.4 Insulation resistance of the main and auxiliary circuits shall be checked before and after power frequency voltage withstand test.
 - 7.5.5 Operation check shall be carried out for every control function /interlocks as per the schematic diagrams by manually simulating fault conditions and operation of control switches/relays etc.
 - 7.5.6 For equipment bought from other sub-suppliers, certified test reports of tests carried out at the manufacturers works shall be submitted. Normally all routine tests as specified in the relevant standards shall be conducted by the sub-supplier at his works.
 - 7.5.7 Interchangeability of similar modules shall be checked on a random basis. This may be done on one module of each size.

8.0 MARKING, PACKING AND SHIPMENT

- 8.1 All the equipment shall be divided into several shipping sections for protection and ease of handling during transportation. The equipment shall be properly packed for selected mode of transportation i.e., by ship/rail or trailer.
- 8.2 The panels shall be wrapped in air bubble polyethylene sheets before being placed in wooden crates /cases to prevent damage to the finish. Crates /cases shall have skid bottoms for handling. Special precaution notations such as Fragile, this side up, center of gravity, weight, Owner's particulars, Purchase number etc. shall be clearly marked on the package together with other details as per purchase order.
- 8.3 The equipment may be stored outdoors for long periods before installation. The packing should be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agree.



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR MEDIUM AND HIGH VOLTAGE CABLES

VCS – SS – EL - 4007

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ABBREVIATION

BIS/IS:	Bureau of Indian standards
IEC:	International Electro-Technical Commission
BS:	British Standards
IEEE:	Institute of Electrical and Electronics Engineers
NEMA:	National Electrical Manufacturers Association
OISD:	Oil Industries Safety Directorate
CCE:	Chief Controller of Explosive
DGMS:	Director General Mines Safety
IE Rules:	Indian Electricity Rules
CPRI	Central Power Research Institute
PVC	Polyvinyl chloride
XLPE	Cross Linked Poly Ethylene



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1.0 SCOPE

This Specification along with Data Sheets covers requirements for design, manufacture, testing at works and supply of Flame Retardant PVC/XLPE cables and cable jointing / terminating accessories for medium and high voltage systems.

2.0 REFERENCE DOCUMENTS

2.1 The cables and cables jointing & terminating accessories shall comply with the latest edition of the following standards as applicable:

IS: 1554:	PVC insulated (heavy duty) electric cables.
IS: 7098:	cross linked polyethylene insulated PVC sheath
IS: 8130:	Conductors for insulated electric cables and flexible cords
IS: 5831:	PVC insulation and sheath of electric cables
IS: 3975: 10810 (Part 41)	Mild steel wires, strips and tapes for armoring of cables Methods of testing cables: Mass of zinc coating on steel armor.
IS: 209:	Specification of zinc
IS: 3961:	Recommended current ratings for cables: part-2 PVC Insulated and PVC sheathed heavy duty cables.
IS: 10418:	Drums for electric cables
IS: 10462(Pt-1):	Fictitious calculation method for determination of dimension of protective coverings of cables: part – I electrometric and thermoplastic insulated cables.
IS: 10810(Pt-58):	Oxygen index test
IS: 10810(Pt-61):	Flame retardant test
IS: 10810(Pt-62):	fire resistance test bunched cables.
IS: 13573:	Joints and termination for polymeric cables for working voltages from 6.6 KV up to and including 33 KV.
IEC: 60332-3:	Test on electric cables under fire conditions
IEC: 60502:	Extruded solid dielectric insulated power cables for rated Voltages from 1 KV up to 30 KV.
IEC: 60540&60540A:	Test methods for insulation and sheaths of electric Cables.
ASTM: D2863:	Standard method of test for flammability of plastics using oxygen index method.

ICEA S-61-402:	Thermoplastic insulated wire and cable for transmission and Distribution of electrical energy
NEMA-WCS:	Distribution of electrical energy
ICEA. S-66-S24:	Cross-linked thermosetting polyethylene insulated wire
NEMA-WC7:	Cable for transmission of electrical energy.

2.2 The cables and accessories shall also conform to the provisions of Indian electricity rules and other statutory regulations as applicable.

2.3 In case of any contradiction between various referred Standard/Specification/Data sheet and statutory regulations, the following order of priority shall govern:

- a. Statutory regulations
- b. Data Sheets
- c. Job specifications
- d. Standard specification
- e. Codes and standards

3.0 DEFINITIONS

3.1 For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

4.1 PVC CABLES

4.1.1 The core insulation shall be with PVC compound applied over the conductor by Extrusion and shall conform to the requirements of type 'A' compound as per IS: 5831.

4.2 XLPE CABLES

4.2.1 The core insulation shall be with cross linked polyethylene insulating compound dry cured, applied by extrusion it shall be free from voids and shall withstand all mechanical and thermal stresses under steady state and transient operating conditions.

5.0 DESIGN

5.1 PVC CABLES

- 5.1.1 All power/control cables for use on medium voltage systems shall be heavy-duty type, 650/1100 V grade with aluminum / copper conductor, PVC insulated, inner-sheathed, armored and overall PVC sheathed unless specified otherwise in Data Sheet.
- 5.1.2 The conductors shall be solid for conductor of nominal area up to and including 6mm² and stranded beyond 6mm². Conductors of nominal area less than 16 mm² shall be circular only. Conductors of nominal area 16 mm² and above may be circular or shaped as per IS 8130. Cables with reduced neutral conductor shall have sizes as per Table 1 of IS 1554 (Part-1).
- 5.1.3 The core insulation shall be with PVC compound applied over the conductor by extrusion and shall conform to the requirements of type 'A' compound as per IS: 5831. The thickness of insulation and the tolerance on thickness of insulation shall be as per Table 2 of IS: 1554 (Part-1). Control cables having 6 cores and above shall be identified with prominent and indelible numerals on the outer surface of the insulation. Color of the numbers shall contrast with the color of insulation with a spacing of maximum 50 mm between two consecutive numbers. Color coding for cables up to 5 cores shall be as per Indian Standards.
- 5.1.4 The inner sheath shall be applied over the laid-up cores by extrusion and shall be of PVC conforming to the requirements of Type ST-1 PVC compound as per IS: 5831. The minimum thickness of inner sheath shall be as per IS: 1554 (Part-1). Single core cables shall have no inner sheath.
- 5.1.5 If armoring is specified for multicore cables in the Data Sheet, the same shall be by single round galvanized steel wires where the calculated diameter below armoring does not exceed 13 mm and by galvanized steel strips. where this dimension is greater than 13 mm. Requirement and methods of tests for armor material and uniformity of galvanization shall be as per IS - 3975 and IS -10810 (Part 41). The dimensions of Armor shall be as per method (b) of IS - 1554 (Part -1). If armoring is specified for single core cables in the Data Sheet, the same shall be with H4 grade hard drawn aluminum round wire of 2.5 mm diameter.
- 5.1.6 For mining cables, the size and type of armor shall be such that the combined conductance of armor shall be equivalent to 75 percent of the conductance of the largest conductor of the cable.
- 5.1.7 The outer sheath for the cables shall be applied by extrusion and shall be of PVC compound conforming to the requirements of type ST-I compound as per IS 5831. The minimum and average thickness of outer sheath for unarmored cables and minimum thickness of outer sheath for armored cables shall be as per IS:1554 (Part-I).
- 5.1.8 If Heat Resisting PVC cables are specified in the Data Sheet, the following shall be the requirements:
- a. It shall be possible to continuously operate the cable at a maximum conductor temperature of 85°C. PVC compounds used for HR PVC cables shall be as follows:

- i. Conductor insulation Type C
- ii. Inner sheath Type ST 2
- iii. Outer sheath Type ST 2

5.2 XLPE CABLES

- 5.2.1 Power cables for 3.3kV up to and including 33kV systems shall be aluminum/copper conductor, XLPE insulated, sheathed, armored and overall PVC sheathed.
- 5.2.2 The conductors shall be stranded and compacted circular for all cables.
- 5.2.3 All cables rated 3.8/6.6kv and above shall be provided with both conductor screening and insulation screening. The conductor shall be provided with non-metallic extruded semi conducting screen.
- 5.2.4 The core insulation shall be with cross linked polyethylene insulating compound dry cured, applied by extrusion it shall be free from voids and shall withstand all mechanical and thermal stresses under steady state and transient operating conditions. It shall conform to the properties given in Table-I of IS 7098-(Part 2).
- 5.2.5 The insulation screen shall consist of non metallic extruded semi conducting compound in combination with a non magnetic metallic copper screen. Unless specified otherwise, the copper screen for all the three cores together shall be capable of carrying the single line to ground fault current value and the duration specified in the Data Sheet.
- 5.2.6 The conductor screen, XLPE insulation and insulation screen shall all be extruded in one operation by 'Triple Extrusion' process to ensure perfect bonding between the layers. The core identification shall be by colored strips or by printed numerals.
- 5.2.7 The inner sheath shall be applied over the laid up cores by extrusion and shall conform to the requirements of type ST 2 compound of IS: 5831. The extruded inner sheath shall be of uniform thickness. In case of single core cables, there shall be extruded inner sheath between insulation metallic screen and armoring.
- 5.2.8 For multicore cables, the armoring shall be by galvanized steel strips as per method (b) of IS7098 (Part-2). If armoring is specified for single core cables in the Data Sheet, the same shall be with H4 grade hard drawn aluminum round wire of 2.5 mm diameter.
- 5.2.9 The outer sheath of the cables shall be applied by extrusion over the armoring and shall be of PVC compound conforming to the requirements of Type ST 2 compound of IS: 5831. The minimum and average thickness of outer sheath for unarmored cables and minimum thickness of outer sheath for armored cables shall be as per IS: 7098 (Part-2)
- 5.2.10 The thickness of the insulation, inner sheath shall be governed by values given in IS: 7098 (Part -2).
- 5.2.11 Where specified, 1100V grade power cables shall also be XLPE insulated and shall meet the requirement specified in IS-7098 (Part-1).

6.0 FABRICATION

- 6.1** The cables shall be suitable for laying in trays, trenches, ducts, and conduits and for underground-buried installation with uncontrolled backfill and possibility of flooding by water and chemicals.
- 6.2** Outer sheath of all PVC and XLPE cables shall be black in color and the minimum value of oxygen index shall be 29 at 27 + 2 ° C. In addition suitable chemicals shall be added into the PVC compound of the outer sheath to protect the cable against rodent and termite attack.
- 6.3** All cables covered in this Specification shall be flame retardant (FR) unless specified otherwise in the Data Sheet. The outer sheath of PVC and XLPE cables shall possess flame propagation properties meeting requirements as per IS-10810 (Part-62) category AF.
- 6.4** Sequential marking of the length of the cable in meters shall be provided on the outer sheath at every one meter. The embossing /engraving shall be legible and indelible.
- 6.5** The overall diameter of the cables shall be strictly as per the values declared by the manufacturer in the technical information subject to a maximum tolerance of ± 2 mm, up to overall diameter of 60mm and ± 3 mm for beyond 60mm.
- 6.6** PVC / Rubber end caps shall be supplied free of cost for-each drum with a minimum of eight per thousand meter length. In addition, ends of the cables shall be properly sealed with caps to avoid ingress of water during transportation and storage.
- 6.7** The cables used in installations under, the jurisdiction of Director General of. Mines and Safety (DGMS) shall be of copper conductor only, and. shall have valid DGMS approvals. for the specified locations. The word "Mining Cable" shall be embossed /engraved on the cable outer sheath as per the applicable Indian Standards.

7.0 INSPECTION AND TESTING

- 7.1** The cables shall be tested and inspected at the manufacturer's works. All the materials employed in the manufacture of the cable shall be subjected, both before and after manufacture, to examination, testing and approval by Consultant /Owner Manufacturer shall furnish all necessary information concerning supply to Consultant/ Owner's inspectors. The inspector shall have free access to the manufacturer's works for the purpose of inspecting the process of manufacture in all its stages and he will have the power to reject any material, which appears to him to be of unsuitable description or of unsatisfactory quality. The Vendor shall give at least 2 weeks advance notice to the Purchaser, regarding the date of testing to enable him or his representative to witness the tests.

7.2 CABLES

- 7.2.1** After completion of manufacture of cables and prior to dispatch, the cables shall be subjected to type, routine, acceptance and special tests as detailed below. Consultant/Owner reserves the right to witness all tests with sufficient advance notice from Vendor. The test reports for all cables shall be got approved from the Engineer before dispatch of the cables.

- 7.2.2 All routine tests, acceptance tests, type tests and additional type tests for improved fire performance shall be carried out as listed in IS:1554 (Part 1), and IS:1098 (Part 2) on PVC and XLPE insulated cables respectively.
- 7.2.3 The test requirements for PVC insulation and sheath of cables shall be as per latest revision of IS: 5831.
- 7.2.4 Test for Resistance to Ultra Violet Radiation: This test shall be carried out as per DIN 53387 or ATM-G-53 on outer sheath. The retention value of tensile strength and ultimate elongation after the test shall be minimum 60% of tensile strength and ultimate elongation before the test. Test certificates with respect to this test (not older than one year) from recognised testing laboratory to be furnished for review by Consultant before dispatch clearance of cables. In case test certificates are not available, test is to be conducted by Vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is to be done randomly once for each order, provided outer sheath remains same.
- 7.2.5 Acceptance tests as per IS-1554 (Part-I) and IS-7098 (Part-2) and the following special tests to be performed on the cables as per sampling plan. These tests are required to be witnessed by Consultant/owner before dispatch of cables.
- a. Accelerated water absorption test for insulation as per NEMA - WC - 5. (For PVC insulated cables) and as per NEMA WC - 7 (for XLPE insulated cables). Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by Consultant before dispatch clearance of cables. In case test certificates are not available, test is to be conducted by Vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is to be done randomly once for each order, provided type of insulation remains same.
 - b. Dielectric Retention Test: The dielectric strength of the cable insulation tested in accordance with NEMA WC - 5 at $75 \pm 1^\circ \text{C}$ shall not be less than 50 % of the original dielectric strength. (For PVC insulated cables). Test certificates with respect to this test (not older than one year) from recognized testing laboratory to be furnished for review by Consultant before dispatch clearance of cables. In case test certificates are not available, test is to be conducted by Vendor at his own cost in any recognized test laboratory or in house testing laboratory, before dispatch clearance of cables. Sampling for this test is to be done randomly and once for each order.
 - c. Oxygen Index Test: The test shall be carried out as per ASTM D2863 or applicable Indian Standard specifications. Sampling to be done for every offered lot/size as per sampling plan.
 - d. Flammability Test: The test shall be carried out on finished cable as per IS - 10810 (part 61 & 62). Sampling for these tests is to be done randomly once for each order, provided outer sheath remains same. The acceptance criteria for tests conducted shall be as under.
 - i. Part-61-The cable meets the requirement if there is no visible damage on the test specimen within 300 mm from its upper end.

- ii. Part-62-The maximum extent of the charred portion measured on the test sample should not have reached a height exceeding 2.5 m above the bottom edge of the burner at the front of the ladder.
- e. Test for rodent and termite repulsion property: The Vendors shall furnish the test details to analyses the property by chemical method. Sampling to be done for every offered lot / size as per sampling plan.

7.3 CABLE ACCESSORIES

Type tests should have been carried out to prove the general qualities and design of a given type of termination / jointing system as, per IS-13573. The type test certificates from independent testing laboratory shall be submitted before dispatch.

8.0 MARKING, PACKING AND SHIPMENT

8.1 Cables shall be dispatched in non-returnable wooden or steel drums of suitable barrel diameter, securely battened, with the takeoff end fully protected against mechanical damage. The wood used for construction of the drum shall be properly seasoned, sound and free from defects. Wood preservatives shall be applied to the entire drum. Ferrous parts used shall be treated with a suitable rust preventive finish or coating to avoid rusting during transit or storage.

8.2 On the flange of the drum, necessary information such as project title, manufacturer's name, type size, voltage grade of cable, length of cable in meters, drum no, cable code, BIS certification mark, gross weight etc. shall be printed. An arrow shall be printed on the drum with suitable instructions to show the direction of rotation of the drum.

Unless otherwise specified, Cables shall be supplied in drum lengths as follows:

8.2.1 MV CABLES

- a. Multicore power cables up to 6mm² : 1000m
- b. Multicore power cables from 10mm² up to 300mm² : 500m
- c. Single core power cables up to 630 mm² : 1000m
- d. Control cables up to 61 cores : 1000m

8.2.2 HV POWER CABLES – UPTO 11KV (E) GRADE

- a. Three core cables up to 400 mm² : 500m
- b. Single core cables up to 400 mm² : 1000m
- c. Single core cables above 400 mm² and up to 630 mm² : 750m

8.2.3 HV POWER CABLES – ABOVE 11KV(E) GRADE AND UPTO 33KV(E)

- a. Three core cables up to 300 mm² grade : 350 m
- b. Single core cables up to 400 mm² : 1000m
- c. Single core cables above 400 mm² and up to 1000 mm² : 500m

8.2.4 A tolerance of plus or minus 3 % shall be permissible for each drum. However overall tolerance on each size of cable shall be limited to $\pm 2\%$. Offers with short/non-standard

lengths are liable for rejection. If non-standard drum lengths are specified in the Data Sheet, the same shall be supplied.

9.0 SPARES & ACCESSORIES

9.1 The termination and straight through jointing kits for use on the systems shall be suitable for the type of cables offered as per this Specification.

9.2 The accessories shall be supplied in kit form. Each component of the kit shall carry The manufacturer's mark of origin.

9.3 The kit shall include all stress grading, insulating and sealing materials apart from conductor fittings and consumable items. An installation instruction sheet shall also be included in each kit.

9.4 The contents of the accessories kit including all consumable shall be suitable for storage without deterioration at a temperature of 45° C, with shelf life extending to more than 5 years.

9.5 TERMINATING KITS

9.5.1 The terminating kits shall be suitable for termination of the cables to an indoor switchgear or to a weatherproof cable box of an outdoor mounted transformer / motor. For outdoor terminations, weather shields/sealing ends any other accessories required shall also form part of the kit. The terminating kits shall be from one of the makes / types mentioned in the Data Sheet.

9.6 JOINTING KITS

The straight through jointing kits shall be suitable for installation on overhead trays, concrete lined trenches, and ducts and for underground burial with uncontrolled backfill and possibility of flooding by water and chemicals. These shall have protection against any mechanical damage and suitably designed to be protected against rodent and termite attack. The inner sheath similar to that provided for cables shall be provided as part of straight through joint. The jointing kits shall be from one of the makes / types mentioned in the Data Sheet.



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR UNINTERRUPTED POWER SUPPLY VCS – SS – EL - 4011

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ABBREVIATION

BIS/IS	Bureau of Indian Standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
CRCA	Cold rolled cold annealed
UPS	Uninterrupted Power Supply
DCS	Distributed Control System
IGBT:	Insulated Gate Bipolar Transistor
SMPS	Single Mode Power Supply
RMS	Root Mean Square
LCD	Liquid Crystal Display



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1.0 SCOPE

- 1.1 The scope of this Specification is to define the requirements of design, manufacture, testing, packing and dispatch of static Uninterrupted Power Supply (UPS) system.
- 1.2 Deviation from this specification shall be acceptable only when the manufacturer shall inform the deviation in quotation before placing the order & shall take the necessary written approval for deviation from the Consultant / Owner. In absence of a list of deviation, it will be assumed that the Manufacturer complies fully with this specification.

2.0 REFERENCE DOCUMENTS

- 2.1 The equipment shall comply with the requirements of latest revision of following Standards issued by BIS (Bureau of Indian Standards) unless otherwise specified:

IS: 5:	Colours for ready mixed paints and enamels
IS: 1248:	Direct acting indicating analogue electrical measuring (Part 1, 2, 4 and 9) instruments and their accessories
IS: 2147:	Degree of protection provided by enclosures for low voltage Switchgear and control gear.
IS: 3700:	Essential ratings and characteristics of semi-conductor (Part I to 11) devices.
IS: 3715:	Letter symbols for semi-conducting devices. (Part 1 to 4)
IS: 4411:	Code for designation of semi-conductor devices.
IS: 5001:	Guide for preparation of drawings of semi-conductor devices (Part I & 2) and integrated circuits.
IS: 5469:	Code of practice for the use of semi-conductor junction (Part 1 to 3) devices
IS: 7204:	Stabilized power supplies D.C. output (Part 1 to 4)
IS: 12021:	Control transformers for switchgear and control gear for voltages not exceeding 1000V AC
IS: 13314:	Solid state inverters run from storage batteries
IS: 13703:	Low voltage fuses for voltage not exceeding 1000V AC or (Part 1 to 4) 1500V DC
IS: 13947:	Specification for low voltage switchgear and control gear (Part-4 / Sec-1)

- 2.2 In case of imported equipment's Standards of the country of origin shall be applicable Standards are equivalent or stringent than the applicable Indian Standards.
- 2.3 The equipment shall also conform to the provisions of Indian electricity rules and other statutory regulations currently in force in the country.
- 2.4 In case Indian Standards are not available for any equipment, Standards issued by IEC/BS/VDE/IEEE/NEMA or equivalent agency shall be applicable.
- 2.5 In case of any contradiction between various referred Standards/Specifications/ Data Sheet and statutory regulations, the following order of priority shall govern:

- a. Local Statutory Regulations
- b. Data Sheets
- c. Job Specification
- d. This Specification
- e. Codes and Standards

3.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
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BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

- 4.1 UPS panels, ACDB and cell booster enclosures shall be fabricated from Structural/CRCA sheet steel. The frames shall be fabricated by using minimum 2mm thick CRCA sheet steel while the doors and covers shall be made from 1.6mm thick CRCA sheet steel. Wherever required suitable stiffeners shall be provided.
- 4.2 The panels shall be free standing, fitted with suitable louvers for ventilation and cooling fans as required. Hinged doors shall be provided at the front and back with dust tight gaskets. Inter panel sheet steel barriers shall be provided. The enclosure shall provide minimum IP-42 degree of protection, if not specified otherwise in the Data Sheet. The maximum and minimum operating height of the switches shall be 1800 mm and 300 mm respectively.

5.0 DESIGN

5.1 GENERAL REQUIREMENTS

- 5.1.1 The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.
- 5.1.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 15 years from the date of supply.
- 5.1.3 Vendor shall give a notice of at least one year to the end user of equipment before phasing out the product/spares to enable the end/user for placement of order for spares and services.

- 5.1.4 The UPS system shall be an integrated system comprising static rectifiers, battery, static inverters, static switches, auto / manual by pass switch, AC distribution board, voltage stabilizer in bypass, isolating and protection devices and all other equipment/ accessories required for completeness of the system whether specifically mentioned herein or not, but necessary for completeness and satisfactory performance of the system.
- 5.1.5 The UPS system shall be suitable to feed all loads connected to the output which are primarily instruments, (DCS), computers, disc drives and other SMPS equipment leading to high crest factor of the load.
- 5.1.6 The inverter shall be thyristor / transistorised (IGBT) type or with the latest proven technology. All components shall be of a high quality and reliability that satisfy with the requirements of a secure AC power to vital equipment with respect to performance, controlling, monitoring and safeguarding function in continuously operating petrochemical process units, petroleum refineries, gas processing facilities, utility and other miscellaneous industrial plants. Components shall be capable of withstanding the thermal and dynamic stresses resulting from internal and external short circuits and switching surges etc.
- 5.1.7 The design of the UPS shall be such as to minimize the risk of short circuits and shall ensure human and operational safety.
- 5.1.8 The vendor shall be responsible for design, engineering and manufacturing of the complete system to fully meet the intent and requirements of this specification and enclosed data sheets. Selection, sizing and suitability of all equipment and components used for UPS system shall be Vendor's responsibility.
- 5.1.9 The UPS shall be single phase or three phase system as indicated in the Data Sheets.
- 5.1.10 For the Batteries detail see technical requirement.

6.0 TECHNICAL REQUIREMENTS

6.1.1 INPUT POWER SUPPLY

- a. The UPS shall be suitable for input power supply as defined in the Data Sheet. If not specified therein the UPS shall be suitable for the following input power supply.
- Voltage 415V \pm 10%
- Frequency 50 Hz \pm 3%
- b. In addition to above variations, the input voltage may be subjected to transient variations comprising voltage dip to 20% of normal voltage during motor start-up as well as voltage variations due to fault condition. UPS system shall be designed to operate satisfactorily while deriving the input power from an emergency diesel generator set.
- c. UPS system shall also operate satisfactorily on input power supply having:
- the ratio of negative to the positive sequence components not exceeding 5% and
 - Total harmonic distortion of not more than 5%.

- d. Total Harmonic Distortion is the ratio in percentage of r.m.s. value of the harmonic content to the r.m.s. value of the fundamental component of alternating quantity.
- e. The incoming power supply to UPS will be provided by 2 Nos. feeders. one feeder shall feed the rectifier(s) while other shall supply power to stabilized bypass supply.

6.1.2 UPS CONFIGURATION AND OPERATIONAL REQUIREMENTS

The UPS system shall have one of the following basic configurations as specified in Data Sheet and drawings:

- a. Single UPS with Bypass
 - i. In UPS system having this configuration a single rectifier and inverter shall be provided. Under normal conditions when AC mains power is available, the rectifier shall simultaneously feed DC power to inverter as well as for float/rapid charging of the battery. The AC supply to loads shall be fed from inverter output. In case of any fault in the inverter, the load shall be automatically transferred to stabilized bypass supply and retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.
 - ii. In case of AC input power failure or battery charger failure, the battery shall supply power to inverter without any interruption. The charger shall be designed for simultaneously feeding complete inverter load and for float/rapid charging the battery to its rated capacity. Charger shall be equipped with 'On Line' automatic as well as manual charging facility.
- b. Parallel Redundant UPS with bypass
 - i. In UPS system having this configuration two sets of rectifiers and inverters shall be provided. Under normal conditions, when AC mains power is available, both the rectifiers shall operate in parallel and supply DC power for float/rapid charging the battery and simultaneously to inverters. In case of failure in one rectifier, the other rectifier shall feed the complete load and the battery without any interruption. In case of incoming supply failure or failure of both rectifiers the battery shall feed the inverters without any interruption. Each rectifier shall be designed for simultaneously feeding complete inverter load and float/rapid charging of the battery to its rated capacity. Each rectifier shall be equipped with 'On Line' automatic as well as manual charging facility.
 - ii. Normally both inverters will be synchronized with each other and with stabilized bypass supply. Both inverters shall operate in parallel and share the load equally. When a disturbance/fault occurs in any one of the inverters, the faulty unit shall automatically get disconnected and the entire load shall be fed from the other inverter. In case both the inverters develop a fault, the complete load shall be transferred to stabilized bypass supply through the static switches and retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.
- c. Parallel Redundant UPS
 - i) In UPS system having this configuration two sets of rectifiers and inverters shall be provided. Under normal conditions, when AC mains power is available, both the rectifiers shall operate in parallel and supply DC power for float/rapid charging the battery and simultaneously to inverters. In case of failure in one rectifier, the other

rectifier shall feed the complete load and the battery without any interruption. In case of incoming supply failure or failure of both rectifiers the battery shall feed the inverters without any interruption. Each rectifier shall be designed for simultaneously feeding complete inverter load and float/rapid charging of the battery to its rated capacity. Each rectifier shall be equipped with 'On Line' automatic as well as manual charging facility.

- ii) Normally both inverters will be synchronized with each other. Both inverters shall operate in parallel and share the load equally. When a disturbance/fault occurs in any one of the inverters, the faulty unit shall automatically get disconnected and the entire load shall be fed from the other inverter.
- d. Hot stand-by Redundant UPS with bypass
- i. In UPS system having this configuration, the arrangement of rectifiers/inverters and the operating philosophy is same as described above, except that only one inverter shall be operating at one time. The other inverter shall not be sharing the load but shall be synchronized with the running inverter and stabilized bypass supply and remain ready to accept the load in case of fault in the running inverter. Retransfer of load from stabilized bypass supply to the inverter shall be possible in auto as well as in manual mode.
 - ii. In all UPS configurations, the facility for uninterrupted manual transfer in either direction through static switches shall also be provided.
 - iii. For ease of maintenance, it shall be possible to isolate inverters and static switches from load through manually operated make before break switches. In case of larger rating UPS, where it is not possible to provide one power switch with make before break feature, combination of breakers with the control scheme having make before break logic may be provided which ensures momentary paralleling before tripping of selected breaker.

6.1.3 UPS DESIGN AND PERFORMANCE REQUIREMENTS

- a. Incoming AC supply shall be converted to DC through three phases full wave-controlled rectifiers. The rectifiers shall operate according to the constant voltage current limiting principle and shall incorporate a "Soft Start" feature to gradually accept load on initial energizing.
- b. The rectifier section of the UPS system shall be capable of precise regulation to prevent damage to the battery. The output voltage of rectifier's DC bus without the battery shall be stabilized to within $\pm 1\%$ of set value during load variation between 0 to 100% of the rectifiers and specified mains input supply voltage variation.
- c. Suitable protection shall be provided in the control circuits to guard against instability of phase-controlled rectifiers due to electrical oscillations which may be present in the input supply as caused by emergency DG set.
- d. The UPS system including the stabilized by-pass shall be galvanically isolated from input power supply system by providing double wound transformers. All transformers shall be natural air cooled, dry type suitable for location inside the panel. All rectifiers shall also have a double wound transformer at its input.
- e. An RFI filter shall be provided. The production of radio frequency interference voltage shall not exceed the value of suppression grade N' as defined in VDE-0875. The performance of UPS system shall not get affected or in any way be degraded by the

use of portable radio transmitter receiver in the vicinity of the UPS system and or UPS room.

- f. Transient/surge protection circuit shall be provided in the input circuit to rectifiers to protect the UPS from surges & voltage spikes.
- g. The UPS system shall be designed to draw power from mains supply at a minimum power factor of 0.85 while working at rated load in normal operating UPS configuration.
- h. The UPS shall be provided with automatic sequence and power walk in circuit(s) with time delay of up to 15 sec. such that the rectifiers and inverters can start operating automatically when incoming AC power is restored allowing the UPS to be loaded automatically.
- i. Facility for initial charging of batteries shall also be provided. The inverters may be disconnected during initial charging of the battery.
- j. For battery sizing, the following factors shall be considered unless specified otherwise in the Data Sheet:
 - i. Load Power Factor of 0.8.
 - ii. Minimum ambient temperature as specified in Data Sheet.

$$\text{iii. Battery Current} = \frac{\text{Inverter rated KVA} \times \text{Rated load p. f.}}{\text{Inverter Efficiency}^* \times \text{End cell voltage No. of cells}}$$

* At 50 % load on each inverter for parallel redundant UPS.

- iv. Aging factor of 0.8.
- v. Back up time of 8 / 10 / 12 hours in case of mains power failure unless specified otherwise in Data Sheet.
- vi. Minimum end cell voltage for lead acid/VRLA battery 1.85 V per Cell and 1.0 V per cell for Ni-Cd battery.
- vii. Battery state of charge factor of 0.95.
- k. The rectifierschargers shall be designed to completely charge the Lead acid and Nickel cadmium batteries in a maximum time of 8 / 10 / 12 hours after complete discharge. Facilities shall be provided to initiate battery rapid charge operation by manual & automatic means. An auto charging sequence should be provided for the rapid and float charging based on current sensing. Battery charger for VRLA battery shall be sized to provide boost charging of the battery up to 90% of rated Ampere hours within duration of 24 hours and to 100% within 4 days. In addition to above, the charging shall be transferred from rapid to float mode after a preset time adjustable through 0-24 hours timer as back up protection against overcharging.
- l. The rectifiers shall be sized based on the maximum inverter input load when inverter is delivering its rated output at 0.8 p.f. lagging and recharge the battery to nominal rated capacity of the battery. The DC load imposed by the inverters shall be considered under the most severe operating conditions where only one rectifier is operating but the UPS load is equally shared by all the inverters. The rating of each rectifier shall be not less than the value calculated as follows:



For Lead Acid Batteries = Inverter input current + 0.14Ah (10 hr. Rating of the battery)

For Nickel Cadmium Batteries = Inverter input current + 0.2Ah (5 hr. Rating of the battery)

For VRLA Batteries = Inverter input current + 0.2Ah (10 hr. Rating of the battery)
Rated KVA capacity of UPS x Load power factor

Where Inverter input current= $\frac{\text{Rated KVA capacity of UPS} \times \text{Load power factor}}{\text{Battery charging voltage} \times \text{Inverter efficiency}}$

- m. The DC rectifiers shall sense the battery charging current and adjust the DC bus voltage to maintain the charging current to preset level. A separate current limit circuit shall also be provided for adjustment of battery current. The rectifiers shall be protected against reverse battery connection at DC link voltage bus. Subsequent to a discharge cycle when battery is connected to rectifier, the battery current shall be monitored, controlled and limited to set value automatically irrespective of the inverter input current.
- n. The battery may be taken out of service for maintenance, during which period it shall be possible for the inverter to continue operation by drawing power from the rectifier. Ripple content at the DC link shall not exceed 2% even with battery disconnected.
- o. Battery / D.C. link shall be provided with a sensitive earth leakage protection.
- p. The inverter shall be of the current limiting type (short circuit proof) and have nominal output voltage and frequency as specified in the data sheet. The inverter output voltage and frequency shall not exceed the operational tolerances, as measured at the output terminals of the unit during the following conditions of UPS loading:
 - i. Load variations between 0-100% of the rated output of UPS
 - ii. Load power factor over the range of 0.7 lagging to unity.
 - iii. Load current waveform having a relative harmonic content varying between zero and 50% the latter waveform having a crest factor not exceeding 2.5 and individual harmonics not exceeding the following values:
 - 3rd harmonic- 44% of fundamental
 - 5th harmonic- 33 % of fundamental
 - 7th harmonic- 1.8 % of fundamental
 - 9th harmonic- 7% of fundamental
 - 11th harmonic-10% of fundamental
 - iv. The Relative harmonic content is the ratio of the r.m.s. value of the harmonic content to the r.m.s. value of the total non-sinusoidal periodic waveform i.e. relative harmonic content =
$$\sqrt{1 - \left(\frac{\text{Rms value of the fundamental component of the current or voltage}}{\text{Rms value of total waveform of current or voltage}} \right)^2}$$
- v. The UPS output voltage waveform shall be pure sine wave under linear load conditions, and not exceeding 5% under the non-linear load conditions specified above.

- q. The inverter shall control the output voltage of the UPS such as to maintain synchronism with the mains bypass voltage during variations in mains frequency up to the limits specified.
- During variations in mains frequency exceeding these limits, the inverter shall revert to internal frequency control.
- r. It shall be possible to vary the inverter output voltage steplessly within $\pm 5\%$ of the specified output voltage. This adjustment shall be possible to be made when the inverter is in operation.
- s. The steady state output voltage and frequency (free running) variation of inverters shall not exceed $\pm 1\%$ from the set value for specified input power supply conditions from no load to full load condition and load power factor variation from 0.7 lag to 1.0.
- t. The UPS system shall be able to operate satisfactorily on rated loads (in KVA) with power factors in the range of 0.7 lag to 1.0. The overall efficiency of the UPS system shall not be less than 80% at rated load and 0.8 p.f.
- u. The UPS shall have capacity to deliver a minimum overload of 125% for 10 minutes and 150% for 10 sec. UPS shall be provided with current limit circuit to avoid excessive loading beyond its permissible overload withstand capability.
- v. The inverters shall be 'phase locked' to the stabilized bypass power supply as long as stabilized bypass supply frequency remain within $\pm 4\%$ of nominal. When bypass supply frequency variation, exceeds the above limits, the inverters shall be delinked from mains. Free running frequency tolerance limit shall not exceed $\pm 1\%$. Facility shall also be provided for adjustment of range of synchronizing frequency.
- w. Unless otherwise specified, the UPS system output voltage variation shall not exceed $\pm 10\%$ and complete recovery to normal steady state shall be within 0.1 Sec. The above requirement shall be complied for following transient disturbances.
- i. 100% step load and unload (For single UPS and hot stand by UPS)
 - ii. 50% step load (for parallel redundant UPS)
 - iii. Momentary interruption in power supply
 - iv. Load transfer to stabilized bypass supply
 - v. Complete load transfer to other healthy inverter when one of the two parallel inverters develop a fault.
- x. For 3 phase UPS system, the maximum output voltage and angle variation between the phases should not exceed 5% and 3 degrees respectively even under the condition of 100% unbalanced loading of the 3 phase output.
- y. UPS system shall be suitable for floating output in case of single phase system.
- z. The stabilized bypass supply shall be designed to regulate the output voltage within $\pm 2\%$ of the rated voltage over complete range of load from no load to full load and for specified input supply voltage variation. The type of Voltage stabilizer in stabilized bypass supply shall be as indicated in data sheet.
- aa. The stabilized bypass supply shall have a continuous current rating equivalent to the rated output of the UPS unit and be capable of conducting a current ten times the rated output for the duration more than the fault clearing time of the type of fuse provided. The load transfer devices shall comprise of continuously rated static elements in both inverter and stabilized bypass supply.

- bb. Adequately rated static switches in required number & configuration shall be provided in the inverter(s) output and stabilized bypass supply to ensure positive isolation of faulty inverter section such that the other inverter and bypass circuits do not feed into the fault leading to under voltage / trip. The short time rating of all the static switches shall be at least 10 times the rated output for the duration more than the fault clearing time of the type of fuse provided.
- cc. Facility shall be provided to manually and automatically initiate transfer of the load from inverters to the stabilized bypass supply and from stabilized bypass supply to the inverters. Under voltage and over voltage sensing levels to initiate transfer shall be adjustable. The maximum transfer time between inverters and bypass supply shall not exceed 4 msec and 20 msec in synchronous and asynchronous mode respectively.
- dd. The criteria for load transfer:
- i. Load transfer from inverter to the stabilized bypass supply shall be as follows:
 - The load transfer shall only be possible when:
 - The stabilized bypass output voltage is within $\pm 5\%$ of rated UPS output voltage and the mains bypass frequency is within $\pm 4\%$.
 - Auto-transfer of the load from inverter to stabilized bypass supply shall be inverted when:
 - The inverter output voltage drops below 95% of nominal output voltage under steady state condition and/or if the inverter output voltage falls below 90% of the nominal value under transient conditions.
 - OR
 - The inverter output voltage exceeds 105% of the nominal output voltage under steady state condition and/or if the inverter output voltage reaches 110% of the nominal value under transient conditions.
 - OR
 - The inverter output current exceeds its tolerable limits.
 - ii. Retransfer of load from stabilized bypass supply to the inverter shall be as follows:
 - The load transfer shall be possible when:
 - The inverter output voltage is within $\pm 5\%$ of nominal output voltage for more than 5 sec. and
 - Inverter output and stabilized bypass supply are synchronized.
- Retransfer of load from stabilized by pass to the inverter shall be done manually only unless otherwise specified in the Data Sheet.
If automatic retransfer of load to the inverter is specified in the Data Sheet, then the retransfer of load to the inverter shall be inhibited following four automatic transfers of load to stabilize by pass within a period of 5 minutes.
- ee. All breakers shall be adequately rated for continuous rating as well as breaking capacity as applicable. Paralleling of breaker/ switch/ contactor poles to achieve the required current rating is not acceptable. All output isolating device shall be double pole type.

- ff. All electronic power devices including thyristors, transistors (IGBTs), diodes etc. shall be rated under operating conditions for approximately 200% of the maximum current carried by the device. All other electrical components such as transformers, reactors, breakers, contactors, switches, bus bars etc. shall be rated for at least 125% of the maximum required rating. No electronic device shall be subjected to PIV greater than 50% of its rated value.
- gg. All the thyristors, power transistors, diodes and other electronic devices of UPS shall be protected with high speed semiconductor fuses. I²t co-ordination between fuse and semi-conducting power devices shall be ensured.
- hh. The outgoing circuits of ACDB shall be protected by semiconductor fuses. Each inverter shall be designed to clear a fault in any of the branch circuits upto a maximum rating of 25 % of the system capacity without the assistance of the stabilized bypass supply. In case of any fault in branch circuits, the load connected to the healthy circuits shall not get affected. The fault clearing time shall be less than 4 msec.
- ii All PCBs shall be provided with a transparent epoxy coating for environmental protection and tropicalisation. They shall be suitably located away from heat sources.
- jj. All electronic control and monitoring printed circuit cards shall be installed in Standardized electronic equipment frames and shall be fitted with suitable means for easy removal. The frames shall incorporate guides for PCBs to facilitate correct insertion of PCB's and shall allow access to the wiring side of the connectors. All PCBs shall be placed in a manner to avoid replacement of a PCB by a wrong spare PCB. Monitoring points shall be provided on each of the PCBs and the PCB shall be firmly clamped in position so that vibration or long usage does not result in loose contacts. Failure of each PCB shall be indicated by visual alarms. Visual fault diagnostics shall preferably identify faults up to various sections in the card.
- kk. Forced ventilation of panel, if provided, shall be supplemented by 100% redundant fans. In normal operation, normal & redundant fans shall run together. The power supply for the fans shall be tapped from the inverter output. However, the rating of the UPS as specified in the Data Sheet shall be the net output of UPS after deducting power consumption for fans etc. However in case of non-operation of 50% of running fans the UPS output shall not be affected. The fans shall be arranged to facilitate removal of faulty fan for maintenance without requiring system shutdown.
- iii. Maximum noise level from UPS system at 1meter distance, under rated load with all normal cooling fans shall not exceed 75dBA.

6.1.4 CELL BOOSTER

- a. Cell booster shall be suitable for charging one to six cells within a time duration as specified. It shall be suitable for charging not only the new cells before being introduced to the battery bank but also any treatment to be given to the individual weak cells. Quantity of such boosters shall be as defined in the MR. Cell booster shall be suitable for 240 V \pm 10%, 50 Hz \pm 3% SPN input power supply. Cell booster output voltage shall be in the range of 0-18V and 0-12V for Lead Acid and Nickel Cadmium batteries respectively. Cell booster shall be sized as under:
 - I. For Lead Acid battery = 0.14 x Ah of cell (10 hr. Rating of the cell)
 - II. For VRLA battery = 0.2 x Ah of cell (10 hr. Rating of the cell)

- III. For Ni-Cd battery = $0.2 \times \text{Ah of cell}$ (5 hr. Rating of the cell)
- b. Cell booster shall have heavy duty switch fuse or MCCB on AC incomer and DC output, AC voltmeter, DC ammeter and voltmeter, indicating lamp for AC/ DC power ON. The output voltage and current of cell booster shall have manual control using a suitably rated variac or a full wave-controlled rectifier bridge. Suitable interlock shall be provided so as to ensure that the variac/controlled rectifier is at its minimum position while switching on the cell booster. Cell booster shall be portable type with wheels. Each cell booster shall be supplied with 5 m long flexible copper conductor. PVC insulated and braided cable for AC incomer power supply and DC output connection to the battery.

6.1.5 A.C. DISTRIBUTION BOARD

- a. Sheet steel enclosed AC distribution board shall be provided as part of the complete UPS package. It shall accommodate AC feeders as indicated in the Data Sheet. The distribution board shall be floor mounted fixed type with compartmentalized construction unless otherwise indicated in the Data Sheet. It shall be possible to operate the switches without opening the doors. Switches shall be provided with door interlock. Vertical cable alley of minimum 200mm width with suitable supports shall be provided for the termination of outgoing cables. Suitable supports shall be provided for supporting incoming and outgoing cables. All outgoing switches shall be air insulated load break type. Fuses on outgoing feeders shall be fast acting semiconductor type and cable entry shall be from bottom. The gland plate of the distribution board shall be non-magnetic type where single core cables are used as specified in the Data Sheet. Cable glands shall be of brass and single compression type and cable lugs shall be of tinned copper.

6.1.6 ALARM, CONTROL, INDICATION AND METERING REQUIREMENTS

If not specified otherwise in the Data Sheets, following schedule shall be followed for alarm, control, indication and annunciation. Any additional devices/features considered necessary for reliable operation and maintenance shall also be included in various panels and same shall be highlighted separately.. An illuminated one line diagram indicating operational status shall be provided on the front of the panel, metering, indications, audio-visual alarm shall be provided. Parameters/ information indicated shall be available in LCD panel or by other means directly or indirectly.

- a. Metering
- i. Rectifier
 - Incoming line voltages (For all the three phases).
 - Input line currents.(For all the three phases).
 - D.C. voltage at each rectifier output.
 - Battery current.
 - ii. Inverters
 - AC voltage at each inverter output (AC voltages for 3 phase inverter).
 - AC current at each inverter output (AC currents for 3 phase inverter).
 - Frequency meter at each inverter output.
 - iii. Stabilised bypass supply
 - Frequency meter for incoming supply.
 - Voltmeter with selector switch for incoming supply.

- Ammeter with selector switch for incoming supply.
- iv. ACDB

Following shall be provided for each of the ACDB incomers:

- Voltmeter (voltmeter selector switch shall also be provided for 3 phase inverter).
- Ammeter (ammeter selector switch shall also be provided for 3 phase inverter).
- Power factor meter.

b. Indications

All indication lamps shall be provided with series resistors. Clustered/Jumbo LED's of minimum 10mm dia. may be provided in place of lamps subject to their having at least equal illumination.

- AC mains 'ON' - Rectifier.
- AC mains 'ON' - Bypass.

i. Rectifiers (for each rectifier)

- Rectifier output 'ON'
- Battery on float charge
- Battery on rapid charge

ii. Inverters (for each inverter)

- DC input 'ON'
- Load on inverter
- Inverter synchronized with mains

iii. Load on bypass

c. Audio-Visual Alarm (separately for each circuit)

- Mains failure
- Battery charger failure
- Battery fault
- Inverter temperature high
- Low voltage from inverter
- Load on bypass
- Inverter overloaded
- All power Fuse failures

- i. 2 nos. changeover contacts shall be wired to the terminal strip, 1 no for common remote alarm of 'UPS fault' in owner's panel and 1 no. for load on bypass supply annunciation.

d. Controls

- All the switches for starting, shut down and testing sequence.
- Primary input circuit breakers for feeding chargers, bypass line and dc bus from battery including backup protection.
- Inverter ON/OFF switch (to initiate inverter operation).
- Static switch transfer test Push Button.

6.1.7 RELIABILITY

All necessary care shall be taken in selection, design, manufacture, testing and commissioning of the equipment for ensuring high system reliability. Following design consideration shall be taken into account to ensure maximum availability of the system.

- a. There shall be no common device, between main and redundant units (e.g. master oscillators etc.) in order to ensure that the failure of the same does not cause shutdown of more than one unit.
- b. It shall be possible to take out any individual power circuit for maintenance without affecting the total UPS supply.
- c. Series-parallel combination of smaller devices to achieve required rating shall not be acceptable.
- d. Vendors shall offer their nearest higher Standard size that will meet the requirement of the specified UPS rating.

6.1.8 FAULT DIAGNOSTIC UNIT

- a. If specified in the Data Sheet, each UPS set shall have provision for adding microprocessor based 'ON line' fault diagnostic unit. This shall supervise the UPS operation continuously. It shall identify and locate faults immediately so that corrective action can be taken. Fault Diagnostic unit shall be compatible to hook up with Owner's PC through RS232/RS485 interface. The software shall be provided on a CD ROM.
- b. The fault diagnostic unit shall have provision for automatic print out facilities for time, input/output voltages, currents, frequency as a minimum under the following conditions.
 - UPS power source changeover from mains to battery.
 - UPS power source changeover from battery to mains.
 - Changeover from inverter to stabilized bypass supply and vice versa.
 - Changeover from one inverter to other inverter.
 - Changeover time in case of inverter to stabilized bypass supply and from one inverter to other inverter.
 - UPS failure.
 - Type of failure incident along with diagnostic report.
- c. In addition to the above, any other feature which vendor feels may be useful shall be provided and highlighted separately.
- d. If any additional equipment (e.g. bin connector, adaptor cards etc.) are required for connecting this unit with UPS system as well as with Owner's PC. The same are also to be included in the vendor's scope.

7.0 FABRICATION

- 7.1 Rectifier/charger and inverter, stabilized bypass supply and static switch sections shall be suitably housed in sheet steel panels complete with all interconnections.
 - a. UPS panels, ACDB and cell booster enclosures shall be fabricated from Structural/CRCA sheet steel. The frames shall be fabricated by using minimum 2mm thick CRCA sheet steel while the doors and covers shall be made from 1.6mm thick CRCA sheet steel. Wherever required suitable stiffeners shall be provided.
 - b. The panels shall be free standing, fitted with suitable louvers for ventilation and cooling fans as required. Hinged doors shall be provided at the front and back with dust tight gaskets. Inter panel sheet steel barriers shall be provided. The enclosure shall provide minimum IP-31 degree of protection, if not specified otherwise in the Data Sheet. The maximum and minimum operating height of the switches shall be 1800 mm and 300 mm respectively.

- 7.2 Power cables shall be with aluminum / copper conductors and control cables shall be with copper conductors. All the cable connections shall be from bottom and front of the panel, if not specified otherwise in the Data Sheet. A removable bolted gland plate shall be provided along with single compression type nickel plated brass cable glands for external cable connections. Clamp type terminals shall be used for connection of all wires up to 10 mm². Bolted type terminals suitable for cable lugs shall be provided for wire size above this. Tinned copper lugs for all external connections shall be provided with the panels.
- 7.3 Bus bars shall be used in all power circuits which are rated minimum 100 Amp. Copper conductor PVC insulated cables or wires of 660V grade shall be used for power circuits rated less than 100 Amp. Bus bars shall be colour coded and live parts shall be shrouded to ensure complete safety to personnel intending routine inspection by opening the panel doors. All the equipment inside the panel and on the doors shall have suitable name plate and device tag numbers as per the schematic diagram. All wires shall be ferruled and terminals shall be numbered.
- 7.4 MCCBs and load break power switches shall be mounted inside the panel. The control switches shall be rotary type, mounted on the door and shall be externally operable. An 11 W CFL lamp controlled through a door switch shall be provided for illumination in each panel. All instruments shall be analogue/digital, switchboard type, back connected, (72x72) mm. square (Analogue type) of reputed make. Analogue instruments scale shall have red mark indicating maximum permissible operating rating. Separate test terminals shall be provided for measuring and testing of the equipment to check the performance.
- 7.5 A suitably sized earth bus shall be provided at the bottom of the panels including ACDB running through the panel's line up with provision for earth connection at both ends to purchaser's main earth grid. The minimum size of earth bus shall be (25x3) mm copper (or equivalent aluminum). All potential free metallic parts of various equipment shall be earthed suitably to ensure safety.
- 7.6 All panels shall be of same height so as to form a panel lineup which shall have good aesthetic appearance.
- 7.7 Inside the panels, the controls connections shall be done with 660V grade PVC insulated wires having stranded copper conductors: 1.5 mm² size wire shall normally be used for circuits with control fuse rating of 10 Amp. Or less. For control circuit having fuse of 16 Amps., 2.5 mm² size wire shall be used. Control wiring for electronic circuits shall be through flat ribbon cable or through copper wire minimum of 0.5 mm dia.
- 7.8 All control wiring shall preferably be enclosed in plastic channels or otherwise neatly bunched together. Each wire shall be identified at both ends by PVC ferrules. Ferruling of wires shall be as per relevant IS.
- 7.9 All metal surfaces shall be thoroughly cleaned and de-greased to remove mill scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The undersurface shall be prepared by applying a coat of phosphate paint and a coat of yellow zinc chromate primer. The under-surface shall be made free from all imperfections before undertaking the finished coat.

7.10 After preparation of the under-surface, the panels shall be spray painted with two coats of epoxy-based final paint or shall be powder-coated. Spray painted finished panels shall be dried in stoving ovens in a dust-free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint, etc. The vendor shall furnish the painting procedure along with the bids.

8.0 INSPECTION AND TESTING

8.1 During fabrication, the equipment shall be subjected to inspection by Consultant/Owner or by an agency authorized by the Owner. Manufacturer shall furnish all necessary information concerning the supply to Consultant's/Owner's inspector. Tests shall be carried out at manufacturer's works under his care and expense.

8.2 UPS system shall be tested in accordance with applicable Standards. The following acceptance tests shall be performed on each ups system as a minimum. All tests shall be witnessed by Owner or its authorized representative and 4 weeks prior notice shall be given before the date of commencement of tests. The tests certificates indicating test results shall be furnished.

Following system acceptance tests shall be conducted on each UPS system:

8.2.1 INSULATION TESTS

- a. Insulation tests shall be performed as per IEC 60146-1-1.
- b. The insulation tests shall be carried out using an AC power frequency voltage or by using DC Voltage at the choice of the vendor. In case of AC power frequency voltage test, the test voltage at the frequency available in the test facility or at the rated frequency, but not exceeding 100 Hz, of the full value starting at a maximum of 0.5 p.u. The unit on test shall withstand the specified voltage for 1 minute.
- c. In case DC voltage is used for the test, the value of DC voltage shall be equal to the crest value of the test voltage specified in the table.

$V_p/\sqrt{2}$ (V^* , is the highest crest voltage to be expected between any pair of terminals)	Test Voltage (AC rms value)
≤ 60 V	500 V
≤ 125 V	1000 V
≤ 250 V	1500 V
≤ 500 V	2000 V

8.2.2 INTERCONNECTION CABLE CHECK

The interconnection cables are to be checked for correct wiring, insulation and quality of the terminations

8.2.3 A.C. INPUT FAILURE TEST

The test is performed with the test battery and carried out by tripping a.c. incoming circuit breakers or by switching off rectifiers and bypass supply at the same time. Output voltage and frequency variations are to be checked for specified limits.

8.2.4 A.C. INPUT RETURN TEST

The test is performed by closing A.C. incoming circuit breakers or is simulated by energizing rectifiers and bypass supply. Proper operation of rectifiers starting and voltage and frequency variations of output are to be checked.

8.2.5 SIMULATION OF PARALLEL REDUNDANT UPS FAULT

The test is applicable for UPS with parallel redundant configuration. Fault of rectifier or inverter are to be simulated and output transients are to be recorded.

8.2.6 TRANSFER TEST

Transients shall be measured during load transfer from inverter to bypass supply caused by simulated fault and load retransfer after clearing the fault.

8.2.7 REGULATION TEST

- a. This test shall be carried out by measuring input voltage, input current, output voltage, output current, DC link voltage, output distortion, input active power, output active power and frequency at no load, 50% load and 100% load at 0.7 and 0.8 p.f.
- b. Following parameters of rectifiers and inverters are to be measured:
 - i. Measurement shall be carried out in the rectifier float charge mode and in rapid charge mode. Measurement shall be at nominal A.C. voltage and at no load, 50% load and 100% of rectifier full load. Rectifier measurement shall comprise of:-
 - Input voltage, frequency, phase current and input power. D.C. output voltage and current.
 - Ripple current at the DC link bus shall be recorded after isolating the test battery.
 - ii. Inverter measurement shall also be at no load, 50% load and 100% load of inverter rated output current and shall be repeated for inverter D.C. input voltages corresponding to battery float charge operation as well as rated inverter maximum and minimum input D.C. voltage. Measurement shall comprise of:
 - Input voltage, input current.
 - Output voltage, frequency and waveform distortion, output power and current.

8.2.8 UPS EFFICIENCY

This shall be determined by the measurement of the active power input and output at rated p.f. for 50%, 75% and 100% load.

8.2.9 CURRENT DIVISION IN PARALLEL UPS

Load sharing between UPS units shall be measured with a dummy load under parallel redundant UPS configuration.

8.2.10 LIGHT LOAD TEST

The test is to verify that all functions of the UPS system operate properly. The load applied is limited to some percentage of rated loads. The following points are to be checked.

- a. Output voltage and frequency and correct operation of meters.
- b. Operation of all control switches and other means to put UPS system into operation.
- c. Functioning of protective and warning devices

8.2.11 BURN-IN TEST FOR PRINTED CIRCUIT BOARDS

PCB's and other electronic components sub assemblies shall undergo a burn- in test for 96 hours at 50°C at a voltage varied between the maximum and minimum supply voltage. In case of failure of any component during testing, the tests shall be repeated after replacement of the faulty component.

8.2.12 CONTINUOUS FULL LOAD TEST AT 0.8 POWER FACTOR WITH TEMPERATURE RISE MEASUREMENT

- a. The test is required to be performed by connecting resistive load or resistive and inductive load to the UPS system output. The load shall be placed outside the test room to avoid influences of its heat upon UPS ventilation.
- b. UPS system in this test shall undergo a complete full load test for 32 hours at 0.8 power factor. Out of these 32 hours, each inverter section shall be subjected to full load test for 8 hours. Both invertors sections operating in parallel shall be subjected to full load test for 8 hours and the for remaining 8 hours, the bypass section shall be subjected to full load test. Steady state temperature of rectifier transformer, Rectifier set, D.C. choke, inverter set, static switch etc. shall be recorded during the test. The temperature of all UPS panels is also to be recorded.

8.2.13 AUXILIARY EQUIPMENT AND CONTROL CIRCUIT TESTS

The correct functioning of all measuring instruments, alarms, indications, protection devices and controls are to be verified. The functioning of auxiliary devices such as lighting, cooling fans, annunciation etc. should be checked.

8.2.14 SYNCHRONIZATION TEST

Frequency variation limits of inverter are to be tested by feeding bypass supply incoming line by variable frequency generator and inverter synchronization limit is to be checked as specified.

8.2.15 UNBALANCED LOAD TEST (FOR 3 PHASE UPS ONLY)

Unbalance load at specified limits is applied to the UPS system. The specified voltage and phase angle variation may be checked for compliance with specified values.

8.2.16 OUTPUT VOLTAGE UNBALANCE (FOR 3 PHASE UPS ONLY)

Output voltage unbalance shall be checked under symmetrical load conditions and unbalance load conditions. Phase to phase and phase to neutral output voltage are to be observed. The voltage unbalance is the ratio of highest phase voltage minus lowest phase voltage to the average value. Phase angle variation may be measured for phase to phase and phase to neutral voltages

8.2.17 OVERLOAD CAPABILITY TEST

Specified values of short time overload are to be applied for specified time interval. Values of output voltage and output current are to be recorded.

8.2.18 SHORT CIRCUIT CURRENT CAPABILITY TEST

Specified short circuit current capability is to be tested by application of a short circuit to UPS output if necessary via a suitable fuse. Short circuit current is to be recorded.

8.2.19 SHORT CIRCUIT FUSE TEST

Fuse tripping capability of the UPS system is to be tested by short circuiting the UPS system output via a specified rating of fuse. The test is carried out at an appropriate UPS load under normal operation.

8.2.20 RESTART

Manual restart to be tested after complete shutdown of UPS system.

8.2.21 OUTPUT OVER VOLTAGE

Operation of output over voltage protection is to be checked.

8.2.22 DYNAMIC RESPONSE TEST

Output recording at different loads and operating condition to be done.

8.2.23 HARMONIC COMPONENTS

Harmonic components of output voltage are to be recorded at no load, 50% load and 100% load conditions. Harmonic voltages caused by UPS system components in the A.C. incomer side shall be recorded at site.

8.2.24 EARTH FAULT TEST

An earth fault is to be applied to the output terminal of UPS system. UPS output transients are to be measured. An earth fault is also to be applied to the battery terminal and UPS system output transient shall be measured.

8.2.25 AUDIBLE NOISE TEST

- a. The audible noise is required to be measured at 1 meter distance from UPS system in at least 4 to 5 locations and its value shall be within permissible limit.
- b. The detailed test schedule and test procedure shall be formulated in line with above. Before giving call for the witness of the tests, vendor shall get Consultant approval on the test procedures. Vendor shall also indicate the max. Allowable tolerance for each test result along with the test procedures.
- c. If tests show that certain requirements of the specifications are not met, 'Vendor' shall make necessary corrections to the equipment so that it satisfies all the requirements before acceptance is made.

8.2.26 SITE ACCEPTANCE TESTS

Vendor shall furnish Site Acceptance Tests procedure to be followed. Final acceptance testing along with the batteries shall be done at site. It shall be Vendor's responsibility to arrange necessary instruments and tools as required by their commissioning engineer for these tests.

9.0 MARKING, PACKING AND SHIPMENT

All the equipment shall be divided in to several shipping sections for protection and ease of handling during transportation. The equipment shall be properly packed for transportation by ship/rail or trailer. The equipment shall be wrapped in polyethylene sheets before being placed in wooden crates /cases to prevent damage to the finish. Crates /cases shall have skid bottoms for handling Special notations such as 'Fragile', 'This side up', 'center of gravity', 'weight', 'Owner's particulars', 'PO nos.' etc. shall be clearly marked on the package together with other details as per purchase order. The equipment may be stored outdoors for long periods before installation. The packing shall be suitable for outdoor storage in areas with heavy rains and high ambient temperature unless otherwise agreed.







Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR FLAME PROOF LIGHTING AND POWER PANELS

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**STANDARD SPECIFICATION
FOR FLAME PROOF LIGHTING AND POWER
PANELS**

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ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
TPN	Triple Pole Neutral
SPN	Single Pole Neutral
FRP	Fiber Reinforced Concrete
SS	Stainless Steel
GI	Galvanized Iron



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1.0 SCOPE

This Specification covers the requirements of design, manufacture, testing, packing and supply of flameproof Lighting and Power panels/ accessories suitable for installation in locations handling flammable liquids and gases.

2.0 REFERENCE DOCUMENTS

2.1 The equipment shall comply with the requirements of latest revision of the following standards issued by BIS (Bureau of Indian Standards), unless otherwise specified:

IS-5:	Colors for ready mixed paints and enamels.
IS-1248 (Parts 1 & 2):	Direct acting indicating analogue measuring instruments and their accessories.
IS-2148:	Flameproof enclosures for electrical apparatus.
IS-5571:	Guide for selection of electrical equipment for hazardous areas
IS-8828:	Specifications for Circuit breakers for Over current protection for household and-similar installations
IS-12640:	Residual current operated circuit breakers.
IS-13346:	General requirements for electrical apparatus for explosive gas atmosphere.
IS-13408 (Part-1):	Code of practice for the selection, installation and maintenance of electrical apparatus for use in potentially explosive atmospheres (other than mining applications or explosives processing and manufacture).
IS-13947 (Parts 1 & 5):	L.V. Switchgear and Control gear.

2.2 Imported equipment shall conform to the International Standards such as IEC/ BS/ VDE/ NEMA or equivalent.

2.3 The equipment shall also conform to the provisions of Indian Electricity Rules and other statutory regulations currently in force in the country.

2.4 In case Indian Standards are not available for any equipment; Standards issued by IEC/BS/VDE/ NEMA or equivalent agency shall be applicable.

2.5 In case of any contradiction between various referred Standards/ Specifications/ at a Sheet and statutory regulations, the following order of decreasing priority shall govern:

- a. Statutory Regulations
- b. Data Sheets
- c. Job Specification
- d. Standard Specification



- e. Codes and Standards.

3.0 DEFINITIONS

- 3.1 For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

- 4.1 The enclosures of the lighting and power panels shall be made of cast light metal alloy and shall be free from frictional sparking hazard. The magnesium content in the alloy shall be as per IS-13346.

5.0 DESIGN

5.1 GENERAL REQUIREMENTS

- 5.1.1 The offered equipment shall be brand new with state of art technology and proven field track record. No prototype equipment shall be offered.

5.2 POWER SUPPLY

- 5.2.1 Unless otherwise specified, lighting and power panels shall be suitable for 415V, 50Hz, three phase and neutral (TPN) incoming supply and outgoing circuits for 240V, single phase and neutral (SPN).
- 5.2.2 For lighting and power panels falling under the jurisdiction of DGMS, the following additional requirements shall apply:
- The phase-to-phase voltage shall not exceed 250 volts.
 - The panels shall have 415V, three phase, 4-wire system.
 - Earth leakage protection shall be provided for all outgoing circuits, which shall isolate both poles.

5.3 TECHNICAL REQUIREMENTS

5.3.1 COMPOUND SPECIFICATION

- Busbars in the lighting and power panels shall be made of high-conductivity copper and shall be supported by non-hygroscopic insulators. Busbars shall be color coded for identification of phases and neutral.



- b. Unless otherwise specified, the incomer shall have one no. 4 pole 32A MCB isolator (without overload and short-circuit release) and one no. 4 pole ELCB. ELCB's shall have a maximum sensitivity of 30mA.
- c. Unless otherwise specified, the outgoing feeders shall be provided with double pole 10A MCBs having overload and short-circuit releases.
- d. Unless otherwise specified, all MCBs (except isolators) and ELCBs shall be with 9kA (M9. category) interrupting capacity.
- e. The ELCB. shall be hand reset type one no. door mounted reset push button shall be provided.
- f. The operating knobs (ON/ OFF/ RESET) shall be. provided with a suitable rack and pinion arrangement for operating them smoothly from outside.

5.3.2 TERMINAL & WIRING

- a. The panels shall be provided with sufficient number of terminals. More than 2 wires per terminal shall not be permitted. If required, additional terminal with shorting link may be used. Unless otherwise specified, the terminals for termination of incoming and outgoing external cables shall be suitable for termination of up to 70 mm² and 6 mm² copper conductors respectively. Terminals shall be suitable for termination of solid conductors upto 6 mm² and stranded conductors above 6 mm². Wherever lugs are required for cable termination, tinned copper type lugs shall be provided.
- b. All internal wiring in lighting and power panels shall employ adequately sized, 660V grade, PVC insulated copper conductor wires, color coded for phase, neutral and earth, with minimum conductor sizes as below:
 - i. Incomer 16 mm²
 - ii. Outgoing 2.5 mm²

6.0 FABRICATION

- 6.1 The enclosures of the lighting and power panels shall be made of cast light metal alloy and shall be free from frictional sparking hazard. The magnesium content in the alloy shall be as per IS-13346. The temperature of external surfaces shall be limited to 200°C, unless otherwise specified. The enclosures shall be sized to facilitate easy maintenance and heat dissipation.
- 6.2 The panels shall be suitable for use in outdoor open locations and shall have IP-55 degree (minimum) of protection. They shall preferably be provided with integral canopy. However, where the enclosure has been certified without integral canopy, a separate canopy can be accepted. The separate canopy shall be made of at least 14 SWG (2mm) galvanised sheet steel or FRP. The canopy shall be suitable for providing protection against rain from top and two sides.
- 6.3 The lighting and power panels shall be provided with gaskets made of non-inflammable and self-extinguishing material.
- 6.4 The enclosures shall be treated and prepared for painting with two coats of epoxy paint with final colour shade (both internal and external) as below:

Flame proof (Gas group IIA/IIB) : Dark admiralty grey shade 632 of IS-5



Flame proof (Gas group IIC) : Light yellow shade 355 of IS-5

- 6.5 A warning inscription "Isolate power supply elsewhere before opening" shall be provided on each enclosure. The warning inscription shall be embossed on the enclosure or a separate warning plate with above inscription shall be fixed to the enclosure with screws. The warning shall be of nickel plated brass or stainless steel. accessories like nuts, bolts, washers etc. shall be made of stainless steel SS-304.
- 6.6 All the non-current carrying metallic parts of the panel shall be inherently bonded together. Each lighting and power panel shall be provided with two earthing studs with lugs on the exterior of the panel enclosure suitable for termination of 10 mm diameter GI wire rope.
- 6.7 Each outgoing feeder shall be provided with distinct terminals for phase, neutral and earth. The terminal block enclosures shall be adequately sized to properly terminate the cables by taking into account the required bending radii of cable cores and shall have the following minimum gland to terminal distances.

Conductor size	Up to 2.5mm ²	Above 2.5mm ² & up to 10mm ²	Above 10mm ² & up to 35mm ²	Above 35mm ² & up to 70mm ²
Distance	40 mm	60 mm	100 mm	150

- 6.8 The panels shall be provided with suitably sized cable entries at the bottom/ sides, for incoming and outgoing cables. Panels shall be complete with double compression type nickel plated brass flameproof cable glands. Flameproof nickel plated brass sealing plugs shall be supplied, for plugging the unused cable entries. The quantity of sealing plugs shall be equal to 20% of the total number of outgoing cable entries.
- 6.9 The panels shall have external fixing lugs for mounting on wall or column. The holes, provided on these lugs shall be of oblong type.
- 6.10 A nameplate indicating TAG No. shall be provided on each panel Nameplates shall also be provided for each incoming and outgoing feeder Separate nameplate shall also be provided to indicate the details of testing agency (PESO or equivalent), test certificate no. with date, statutory approval no. with date and agency (PESO/ OISD/ DGFASLI/ DGMS), BIS license number and date, applicable gas group etc. The nameplates shall be engraved on 3 ply. black white black lami cold Sheds using square cutters. Black engraved per spex sheet nameplate shall also be acceptable. Nameplates shall be fixed by screws and shall not be pasted. In case the standard details given above are embossed on the enclosures, the same need not be repeated on the name plate.

7.0 INSPECTION AND TESTING

- 7.1 During fabrication, the equipment shall be subjected to inspection by Consultant/ Owner -or by an agency authorized by the Owner, if specified/ agreed in Inspection Test Plan. Manufacturer shall furnish all necessary information concerning the supply to Consultant



/ Owner's inspector. All routine/ acceptance tests shall be carried out at manufacturer's works under his care and expense. .

- 7.2 Type test certificates from CIMFR or equivalent test house, applicable PESO/ CCOE/ DOFASLI/ DGMS approval, certificates, BIS license and original drawings referred in type test Certificates shall be shown to the inspection agency on demand during inspection. The certificates and BIS license must be valid at the time of dispatch.
- 7.3 Test certificates of bought out components shall be shown to the inspection agency on demand during inspection.
- 7.4 All equipment shall be subjected to various acceptance tests as per standards but not limited to the following:
 - a. General visual inspection
 - b. Dimensional inspection
 - c. Verification of electrical operations
 - d. Dielectric tests
 - e. Routine pressure test as per IS-2148
 - f. Any other routine and acceptance test as per applicable Standards.
- 7.5 Type tests shall be carried out if specified in Data Sheet/ job Specification.

7.6 CERTIFICATION

- 7.6.1 The equipment shall have test certificates issued by recognized independent test house (PESO/OISD/ CPRI/ ERTL/ Baseefa/ LCIE/ UL/ FM or equivalent). All indigenous equipment shall conform to Indian standards and shall be certified by Indian testing agencies. All equipment (indigenous & imported) shall also have valid statutory approvals as applicable for the specified location. All indigenous flameproof equipment shall have valid BIS license and parking as required by statutory authorities.

8.0 MARKING, PACKING AND SHIPMENT

- 8.1 All the equipment shall be divided into several sections for protection and ease of handling during transportation. The equipment shall be properly packed for the selected mode of transportation, i.e. by ship/ rail-or trailer and shall be wrapped in air bubble polythene sheets before being placed in crates/ cases to prevent damage to finish. The crates/ cases shall have skid bottom for handling. Special notations such as `Fragile', This side up, `Center of gravity', `Weight', `Owner's particulars', `PO no.' etc, shall be clearly marked on the packages together with other details as per Purchase Order.
- 8.2 The equipment may be stored in a covered shed for long periods before installation. The packing should be suitable for such storage.







Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR LIGHTING FITTINGS FOR HAZARDOUS LOCATION

VCS – SS – EL - 4014

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**STANDARD SPECIFICATION
FOR LIGHTING FITTINGS FOR HAZARDOUS
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ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
CIMFR	Central Institute of Mines and Fuel Research
MSL	Mean Sea Level
BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards



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1.0 SCOPE

1.1 The intent of this specification is to define the requirements of lighting fixtures and accessories suitable for installation in classified hazardous locations.

2.0 REFERENCE DOCUMENTS

2.1 In general the equipment covered by this Specification shall, unless otherwise specified, conform to the latest edition of Indian Standards/International Standards but not limited to the following:

- | | | |
|----|--------------------------|--|
| a. | IS-2148 | Flameproof enclosures for electrical apparatus |
| b. | IS-5572
(Part-1) | Classification of hazardous area (other than mines) for electrical installation. |
| c. | IS-5571 | Guide for selection of electrical equipment for hazardous areas. |
| d. | IS-8239 | Classification of maximum surface temperature of electrical equipment for use in explosive |
| e. | IS-6381 | Construction and testing of electrical apparatus with type of protection |
| f. | IS-8289 | Electrical equipment with type of protection 'n'. |
| g. | IS-2206
(Part 1 to 4) | Flameproof electric lighting fittings (well glass and bulk head type, fittings using glass tubes). |
| h. | IS-8224 | Electrical lighting fitting for division 2 areas. |
| i. | IS-1913
(Part-I) | General and safety requirements for Luminaires. |

Wherever the requirements in this specification are in conflict with any of the above Standards, the requirements under this specification shall be binding.

3.0 DEFINITION

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.



4.0 DESIGN

4.1 GENERAL

4.1.1 The equipment shall be suitable for installation and satisfactory operation in classified hazardous locations in tropical, humid and corrosive atmosphere as prevalent in refineries/petrochemical plants or as specified in Material Requisition/ Data Sheet. If not specifically mentioned therein, design ambient temperature of 40°C and altitude not exceeding 1000 m above MSL shall be considered.

4.1.2 Unless otherwise specified, equipment shall be suitable for 220 - 250 volts, single Phase and neutral, 50Hz. +3% power supply.

4.1.3 All equipment shall be tested and certified by independent authority for use in specified gas group locations. Certification number/data and gas group/temperature classification must be indicated on the manufacturer's name plate on each item. All flameproof equipments shall have BIS marking which must be indicated on the manufacturer's name plate. All equipment for use in hazardous area shall be approved by PESO/CCOE/DGMS as applicable.

4.1.4 POWER SUPPLY

Unless otherwise specified, equipment shall be suitable for 220 – 250 volts, single phase and neutral, 50Hz \pm 3% power supply.

5.0 FABRICATION (TECHNICAL REQUIREMENT)

5.1 All equipment shall be suitable for use in outdoor open locations and shall have IP-55 degree (minimum) of protection.

5.2 The body of the lighting fixtures, control gear box and junction boxes shall be of cast aluminum LM-6 alloy and shall be free from frictional sparking hazard. The temperature rise of external surfaces shall be limited to 200°C, unless otherwise specified.

5.3 LIGHTING FIXTURES

5.3.1 The construction of lighting fixture shall be such that replacement of lamp or any normal maintenance of fixture shall not affect their suitability for use in classified area.

5.3.2 Glass used for lighting fixture shall be clear suitable for use under conditions involving exceptional risk of mechanical damage.

5.3.3 Well glass lighting fixture for zone-2 classified area shall meet requirement of IS6381. Mechanical strength of well glass shall satisfy requirement of IS-2206 (for type A glass) for flame proof lighting fixtures and IS-6381 for Div.2 lighting fixtures. All well glass fixtures shall be provided with a galvanized steel wire protective cage having mesh dimensions not exceeding 50mm.

5.3.4 Glass used for aviation and navigational lighting fixture shall be colored in itself. Painted glass shall not be accepted.



-
- 5.3.5 Glass shall be of approved make or as specified in Material Requisition.
- 5.3.6 The fixing parts of the enclosure which is to be opened for replacement of bulb shall be so fastened that they can be unfastened only with special tools. All fixtures shall carry a special warning inscription in English "Isolate supply elsewhere before opening".
- 5.3.7 All lighting fixtures which are not certified as flameproof construction but approved for use in Zone-2 area shall have approved enclosed break lamp holder and complete enclosure certified as having restricted breathing type construction. Lamp holder shall be screw type.
- 5.3.8 All lighting fixtures suitable for discharge lamps shall be provided with one 3/4 "ET threaded entry and supplied with approved type double compression nickel plated brass cable gland.
- 5.3.9 All lighting fixtures suitable for incandescent lamps shall be provided with two 3/4 "ET threaded entry. Two entries shall be used for looping of circuit wherever required. The fixtures shall be supplied with approved type two double compression nickel plated brass cable glands and one threaded plug for sealing unused entry.
- 5.3.10 The top of all well glass lighting fixtures shall be identically drilled / threaded to facilitate the installation on pole/column or ceiling.
- 5.3.11 All flood lighting fixtures shall be supplied with adjustable mounting arrangement both in horizontal and vertical plane.
- 5.4 CONTROL GEAR BOX
- 5.4.1 Lighting fixtures suitable for discharge lamps shall be provided with power factor, correction capacitor, choke starter to be housed in separate control gear box. The choke shall be copper wound. The complete control gear shall have power factor not less than 0.9. All components shall be of approved make or as specified in Material Requisition.
- 5.4.2 Control gear box shall be provided with three 3/4 ET threaded entry (Incoming supply to lighting fixture and for looping to other Fixture/Control gear box). The control gear box shall be supplied with approved type three double compression nickel plated brass cable glands and one threaded plug for sealing unused entry.
- 5.4.3 Control gear box for flame proof fixtures shall be flameproof type and for div.2 or increased safety fixtures shall be increased safety type unless specified otherwise in the material requisition.
- 5.5 JUNCTION BOXES
- 5.5.1 The junction boxes shall be 3 way or 4 way type as specified in material requisition. All junction boxes for looping of single phase lighting circuits using cables up to 4mm shall be minimum 100mm diameter in size. Each junction box shall be complete with requisite number of ET threaded cable entries and with approved type double compression nickel plated brass cable glands and one threaded plug for sealing unused cable entry.
- 5.6 TERMINALS & WIRING



-
- 5.6.1 All equipments shall be provided with sufficient number of terminals. More than 2 wires per terminal shall not be permitted. If required, additional terminal with shorting link may be used. Each terminal for external cable connection shall be suitable for termination of 4mm² copper conductor or as specified in material requisition using crimped type tinned copper lugs. All terminals shall be of non sparking, anti-loosening design such that they do not produce any arc or spark in normal operation.
- 5.6.2 Flexible wires used for internal wiring shall be minimum 1.5mm² copper conductor and connections, shall be done using crimped type tinned copper lugs.
- 5.6.3 Terminals shall be of approved make or as specified in Material Requisition.
- 5.6.4 All equipments on single phase supply shall be provided with an independent earth terminal inside the enclosure for connecting the earth core of the cable and shall have facility for looping.
- 5.6.5 All the hardwares shall be cadmium plated whereas clamps and supporting brackets shall be hot dip galvanized. The galvanizing shall be 610gms/m for clamps and 900gms/m² for supporting brackets. All gaskets shall be of neoprene.
- 5.6.6 External surfaces of all the equipment's shall be treated and prepared for painting with two coats of epoxy paint to shade 632 as per IS-5.

6.0 INSPECTION, TESTING & ACCEPTANCE

- 6.1** During fabrication, the equipment shall be subjected to inspection by Consultant / Owner or by an agency authorized by the Owner. Manufacturer shall furnish all necessary information concerning the supply to Consultant /Owner's inspector. Tests shall be carried out at manufacturer's works under his care and expense. 4 weeks prior notice shall be given before date of commencement of test for witnessing by Consultant /Owner's authorized representative. The test certificate indicating test result shall be furnished.
- 6.2** CMRS test certificates along with CCE/DGFASLI/DGMS approval certificates as applicable shall be furnished for each type of fixture. All equipments shall be routine tested as per applicable Indian standards.
- 6.3** During inspection, facility shall be provided for impact testing of random sample. One well glass of each fixture type from each lot shall be tested for impact strength

7.0 PACKING & SHIPMENT

- 7.1** The equipment shall be shipped to site packed in wooden crates. They shall be wrapped in polyethylene sheets before being placed in crates to prevent damage to the finish. The crates shall have skid bottoms for handling.



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR ELECTRICAL EQUIPMENT INSTALLATION

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ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
AC	Alternating Current
DC	Direct Current
CP	Cathodic Protection
SCADA	Supervisory Control and Data Acquisition
HV	High Voltage
MV	Medium Voltage
LV	Low Voltage
ACDB	Alternating Current Distribution Board
DCDB	Direct Current Distribution Board
CT	Current Transformer
PT	Potential Transformer
IR	Insulation Resistance
CTC	Carbon Tetra Chloride
MMI	Man Machine Interface

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1.0 SCOPE

- 1.1 Specification defines the requirements for the installation, field inspection, testing and commissioning of electrical equipment, forming part of electrical power distribution and utilization system, including communication and fire alarm system.

2.0 REFERENCE DOCUMENTS

- 2.1 The work shall be carried out in the best workmanlike manner in conformity with this specification, Consultant Installation Standards, layout drawings and to the following specifications/ codes of practice of Bureau of Indian Standards and OISD standards.

SP-30(BIS) National Electrical Code.

IS-7816 Guide for testing Insulation resistance of rotating machines.

IS 10028(Part-2) Code of practice for selection, Installation and maintenance of transformers; Part 2: Installation.

IS 10118(Part-3) Code of practice for selection, installation and maintenance of switchgear and control gear Part 3 Installation.

OISD 137 Inspection of Electrical Equipment.

OISD 147 Inspection and safe practices during electrical installations

- 2.2 In addition to the above it shall be ensured that the installation conforms to the requirements of the following as applicable:

- a. Indian Electricity Act and Rules.
- b. Regulations laid down by CEA/Electrical Inspectorate.
- c. Regulations laid down by CCE/DGMS (as applicable).
- d. The Petroleum Rules (Ministry of Industry, Government of India).
- e. Any other regulations laid down by central/state/local authorities and Insurance agencies.

3.0 INSTALLATION

- 3.1 Prior to start of installation of the electrical equipment contractor shall verify that equipment and complete materials have been received. Handling, shifting to required site location, installation, testing and commissioning of all electrical equipment shall be done by contractor with utmost care. Manufacturer's instructions and the requirements given in their technical manuals shall be strictly adhered. The substation/switchgear room wherein the equipment shall be installed shall be kept clean, dry and-free from all debris. Panel floor cutouts not in immediate use shall be suitably covered to avoid any mishap. When handling the switchboard panels, care shall be taken to observe the correct lifting arrangements and to make sure that slings are attached to the manufacturer's designated lifting points. No parts shall be subjected to undue strains or sudden stresses which could cause damage to the equipment.

- 3.2 The lifting position mark indicated on packing casing shall be adhered to strictly, for keeping it in required vertical position.
- 3.3 Contractor shall check and report to the Engineer-in-charge about any damaged item and / or missing component for getting the same replaced as per Specifications. During installation, all accessories and loose items shall also be inspected by the contractor before their assembly/mounting.
- 3.4 Switchboards and Bus Ducts
- 3.4.1 The term switchboard here includes all HV / MV/ LV switchboard panels, motor control centers, power and lighting distribution boards, UPS panels, ACDB, charger panels, DCDB etc. The switchboard panels shall be handled with care, avoiding any impact to the equipment. Dragging of the panels directly on floor shall be avoided. Roller bars may be used for shifting of panels. Use of a crane and trailer shall be made for handling of equipment. The switchboard panels shall be properly supported on the truck or trailer by means of ropes to avoid any chance of tilting. The switchboards shall be lifted after ensuring that panel supports, nuts and bolts are all intact and tightened. While lifting the panels in packed conditions utmost care shall be taken to avoid any damage to insulators, bushings, metering and protective equipment. The panels shall be preferably kept inside the packing cases till foundations are ready.
- 3.4.2 The switchboard panels shall be installed on prepared foundations or floor cutouts. Steel base channels shall be welded to inserts provided in floor slab. Cross members shall be provided at the junctions of each shipping section and other places as required. Alternatively, when the floor is being laid, base channel frame of panels supplied by the Vendor shall be grouted and leveled in cement concrete. It shall be ensured that the base plate level of HV switchboard shall match with the finished floor level. The foundation pockets and the grouted bolts shall be cured for a minimum period of 48 hours.
- 3.4.3 The switchboard panels shall be taken out from the packed cases and shifted one by one to its proper place. All the panels shall be assembled, aligned and leveled. Alignment of panels shall be checked in both longitudinal and lateral directions. It shall be ensured that panel to panel coupling bolts, bus bar links etc. fit properly without any strain on any part. No new holes for jointing of the panels other than those recommended by the Vendor shall be drilled. No gaps shall be left between the panels. The lifting, racking in and out operation of the breaker and all other motions shall be free from any obstruction.
- 3.4.4 The panels shall be checked for correct vertical position using pendulum weight and spirit levels. The switchboard panels shall be tack welded at suitable intervals at base channel.
- 3.4.5 After erection of switchboard panels, all uncovered portions of floor cutouts shall be covered with 6 mm thick removable chequered plates finished with floor level. The design of the chequered plates shall be such that the maximum allowable deflection is $L/200$ (where L is the span of the chequered plates in meters) for a live load of 500 kg/sq. meters. Suitable lifting arrangements shall be provided for chequered plates. The chequered plates shall be painted with a coat of red oxide zinc chromate primer after proper surface preparation as per specifications. Where specified, panel's cutouts provided for future use shall be filled with lean concrete.

- 3.4.6 After completion of erection of switchboards, all the cubicles, switchboard components such as switches, starters, C.T. and P.T. chambers, busbar chamber shall be cleaned and checked for tightness of all the components. Vacuum circuit breakers shall be checked for integrity of bottle seals. All loosely supplied items shall be fitted up. Bus bar sections or links shall be inserted and where specified, of high voltage equipment shall be insulated. Interconnection wiring between shipping sections shall be made by contractor. All the wiring connections shall also be checked. Phase sequence and polarity of PTs and CTs shall be checked. Contact resistance of all busbar joints and contactors shall be checked. Insulator shall be checked for any damage. All the starters, switches, contacts shall be cleaned with C.T.C. where required. All the moving parts shall be checked for easy and free movement. Hinges of panel doors shall be lubricated to give free and noise free movement. All -openings shall be kept completely closed to avoid ingress of any foreign particles inside the panel.
- 3.4.7 Functional scheme verification of individual feeder shall be carried out and minor wiring modifications in the panel wiring, if required shall be done as per the directions of Engineer-in-charge. Special attention shall be paid to CT circuits polarity, wiring continuity and correctness in the protection as well as measurement circuits. Auto transfer scheme shall be simulated and verified. During the course of scheme verification tests, defective components if any shall be taken out, after bringing to the notice of Engineer-in-charge. The same shall be replaced by component supplied by Owner.
- 3.4.8 Where switchboard is damp or having a low IR value due to damaged insulators/ bushings/any other insulated parts, or any other reason, the entire-switchboard shall be dried up according to the instruction of the Engineer-in-charge for the IR value-to improve to a safe level for commissioning. Care shall be taken to protect the surrounding insulation from direct local heating during the drying up process.
- 3.4.9 All the metering instruments, protective relays and other relays and contactors shall be tested as per manufacturer's recommendations and according to the instructions of the Engineer-in-charge. Protection relays shall be inserted and connected and settings adjusted as required by the Engineer- in- charge.
- 3.4.10 All moving parts, of closing/tripping mechanism racking in and racking out mechanism, spouts and shutter closing mechanism shall be checked for proper operation. All the auxiliary contacts of breaker shall be checked-up cleaned and contact pressure measured.
- 3.4.11 All the control wiring, PTs, bushings, bus bars other live parts of switchgear, incoming and outgoing cables shall be meggered.
- 3.4.12 Electrical simulation tests shall be named out for all the protective alarm and annunciation relays and external interfaces to ascertain proper functioning.
- 3.4.13 Safety insulation mats of approved make and of required voltage grade shall be provided in the sub-station.
- 3.4.14 Pre-Commissioning Checklist

Before commissioning any switchboard, following points shall be checked and ensured for safe energizing of the switchboard:

- a. That the installation of equipment to be commissioned is complete in all respects with its auxiliaries and all other mounting including earthing. Openings in floor within and outside panels have been sealed off. All cover and door gaskets are intact to-make the enclosure vermin proof.
- b. That all the metering instruments have been checked and found in working order. Indicating lamps are healthy and are in correct position. All power and control fuses are of proper rating.
- c. That the polarity test and ratio test of all the PT s and CT s is complete and phase sequence of CTs conforms to the correct vector group connections. Wiring continuity and correctness are ensured in the protection and measurement circuits. Polarity of D.C. supply for all the circuits-is correct.
- d. That the high voltage tests of incoming and outgoing cables have been conducted and results are satisfactory.
- e. That all the protective relays including both conventional and microprocessor based numerical relays and thermal overload relays have been tested for secondary injection tests. (Primary injection tests shall be carried out for differential protection, Restricted Earth fault protection at full / reduced current to ensure correctness of complete wiring). Relay settings, status indications, fault annunciations, data logging, and display of switchboard SLDs shall be verified from MMI in case the same is provided.
- f. That I.R. Value have been recorded for bus bars, circuit breaker, incoming and outgoing cables, control wiring and potential transformers. Where required joint resistance of bus bars have been recorded and found to be satisfactory. All the surroundings and panels have been cleaned and temporary earth leads have been removed.

3.4.15 Bus Ducts:

The bus ducts as per issued drawings will be supplied in parts and all the parts shall be assembled and the bus bar connections shall be made at site. The insulators in bus ducts shall be inspected for any possible damage during transit and the defective ones shall be replaced. The insulators shall be cleaned. Contact surface of bus bars, bus bar bolts and nuts shall be thoroughly cleaned. Petroleum jelly shall then be applied and bolted connection made. The bus duct enclosure shall be checked for earth continuity and then earthed at two places. The bus duct shall be properly supported between switchgear and transformer. The opening in the wall where the bus duct enters the switchgear room. shall be completely sealed to avoid rain water entry. Expansion joints, flexible connections etc. supplied by the manufacturer of the bus duct shall be properly connected. The bus duct leveling shall be checked with spirit level and pendulum weight.

3.5 Transformers

- 3.5.1 Transformers on receipt at site shall be unloaded by means of crane or lifting devices of adequate capacity. All lifting lugs shall be used to avoid unbalanced lifting and undue stresses on lugs. Lifting lugs if any provided for partial lifting (e.g., for. active part, conservator) etc. shall not be used for lifting complete transformer. Parts other than those identified for lifting of the transformer shall not be used for lifting. While slinging,

care shall be taken to avoid slings touching other parts.

- 3.5.2 Before lifting transformer, it shall be ensured that all cover bolts are tightened fully. In case when it is necessary to use jacks for lifting, projections provided for the purposes of jacking shall be used. Lifting jacks shall not be used under the valves or radiator tubes. For transporting transformers from stores to site, the transformers shall be loaded on a suitable capacity truck or trailer. The transformers shall be properly supported by steel ropes and stoppers on the trailer to avoid tilting of the transformers in transit due to jerks and vibrations. At no instance the transformer shall be kept on bare ground. Where it is not possible to unload the transformer directly on a foundation, it shall be unloaded on a properly built wooden sleeper platform. A transformer shall never be left without putting stoppers to the wheels.
- 3.5.3 Transformers shall be examined, for any sign of damage in transit Particular attention shall be given to the following in this regard.
- a. Dents on tank wall or cooling tubes.
 - b. Damage to protruding parts like valves, sight glass etc.
 - c. Loosening of bolts due to vibration in transit.
 - d. Cracked or broken bushings.
 - e. Oil leakage particularly along welds.

Anything adverse is noted the same shall be brought to the notice of Engineer- in- charge.

- 3.5.4 Contractor shall examine the transformer base, oil pit, fire walls and foundations laid by the civil contractor. It shall be surged that oil spills cannot propagate along cable trenches. Any discrepancy noted will be brought to the notice of Engineer- in- charge. Transformers shall be placed on channels or rails over concrete foundation. The transformers shall be leveled, aligned and checked for free movement on the channels or rails. Stoppers shall be provided to the transformer immediately to prevent any movement. Normally transformers up to 1000 kVA rating shall be received duly fitted- with radiator tubes, conservator tanks, valves, wheels and other accessories. While the transformers of above 1000 kVA rating may be supplied with loose accessories. All the accessories like radiators, cooling fans, valves, conservator tanks, explosion vent pipe, bushings and other devices which are supplied indifferent packages shall be checked for any transit damage and cleaned thoroughly before fixing on the transformer. All loosely supplied parts shall be assembled as per manufacturer's instruction manuals/ drawings and documents. All the connections for C.T.s bushings and other wiring shall be checked for tightness and correctness before replacing the lid or tightening all the bolts.

3.5.5 TOPPING OF TRANSFORMER WITH OIL

Before topping up with oil, transformer shall fit with all accessories such as valves, gauges, thermometers etc. Oil samples shall be taken from each drum and tested for determination of dielectric strength. Any sign of leakage of the barrel or of its having been opened shall be recorded and reported. It is necessary to filter the oil before the transformers are filled. It shall be ensured in oil filling operation that no air pockets are left in the tank and that no dust or moisture enters the oil. All air vents shall be opened. Oil shall be filled through a Streamline oil filter using metal hose. To prevent aeration of the oil, the transformer tank shall be filled through the bottom drain valve. In a transformer

with conservator tank, the rate of oil flow shall be reduced when the level is almost up to the bottom of the main cover to prevent internal pressure from rupturing the pressure relief-pipe diaphragm. Sufficient time shall be allowed for the oil to permeate the transformers and also for the locked -up air bubbles to escape. Any air accumulation in the Buchholz relay shall be released.

3.5.6 TRANSFORMER OIL

- a. Sample of oil from the transformer shall be taken from the bottom of the tank.
- b. Testing of oil: -

For dielectric test, the oil shall be tested as described in IS: 335. The oil shall also be tested for acidity in accordance with methods prescribed.

- ### 3.5.7 Drying out of the transformer's if required shall be carried out and record maintained in accordance with IS: 10028. Normally a streamline filter shall be used for drying-up. I.R. value versus time of both windings shall be recorded during the drying up process.

Precaution when drying:

- a. The maximum sustained temperature to which transformer oil may be subjected shall be limited to 80° C.
- b. The transformer shall be carefully monitored throughout the drying out process and all observations shall be carefully recorded
- c. Drying out shall be continued so that the insulation resistance as prescribed in the standard code of practice is attained and the value remains constant for more than 12 hours. However, a minimum number of cycles shall be done for each transformer as found necessary by the engineer-in-charge. Generally, a megger reading of 2 mega ohms / KV at 60° C temp. with a 5 KV megger may be a rough indication for stopping the dehydration.

- ### 3.5.8 The following work on transformers shall be performed by the contractor if specifically called for:

Before finally commissioning the transformer, it may sometimes be desired to run it for a few hours on short-circuit, applying a low voltage, approximately equal to the impedance voltage of the transformer. During this process, regular readings of the insulation resistance of the winding to earth and winding to winding and temperature against time shall be recorded.

Testing of radiator tubes for any leakage and rectifying these by welding / brazing.

3.5.9 PRE-COMMISSIONING CHECK LIST:

Before commissioning of any transformer, the following points shall be checked for safe energization of the transformer:

- a. That all the accessories have been fixed properly and transformer body and neutral are properly earthed. The transformer dehydration is over and results are satisfactory and approved by the Engineer-in-charge. In case transformers are idle for more than one month after dehydration, transformer oil has been given at least two circulations.

- b. That the oil level, in the transformer conservator tank and all the bushings is up to the marked point and the oil have been tested for dielectric strength and acidity.
- c. That the silica gel is in reactivated condition. The breather pipe is clear from any blocking and contains oil up to the proper level.
- d. The explosion vent diaphragm does not have any dents. Accumulation of any oil and air had been released.
- e. That the operation of off-load and. on-load tap changers on all the tap positions is satisfactory. The mechanical parts of the on-load tap changer are lubricated. Motor IR value has taken and found satisfactory. Tap position mechanical indicator on the transformer and tap position indication meter on the control panel are reading the same tap positions. Tap changer limit switches are operating satisfactorily on the maximum and minimum tap positions. On-load tap changer contact pressure and resistance is as per manufacturers recommendations. Oil level of tap changer tank is up to the required level and oil has been tested for dielectric strength. The tap setting on which the off-load tap switch is locked shall be recorded. Generally, the off-load tap switch shall be kept on nominal tap.
- f. That the Buchholz relay has been tested and checked up for any friction in the movement, and floats are free. All the other protective relays, alarm and annunciation relays have been tested.
- g. That all the metering equipment's have been tested and polarity test of PT's and transformer winding is satisfactory. Phase sequence and connections have been checked for proper vector group.
- h. That the ratio test and winding resistance on all the tap positions is satisfactory.
- i. That gaps of arcing horns for the bushings where provided are in order and earth connections for the surge diverters have been checked.
- j. That the winding and oil temperature thermometer -pockets contain oil and the winding and oil temperature settings on dial gauges are in order.
- k. That the transformers fitted with fans for forced air cooling have been checked up for automatic starting and stopping of the fans and air-displacement has been verified.
- l. That the simulation tests for all external interface connection alarm, annunciation and trip circuits have been checked and are order.
- m. That the insulation resistance of all the control circuits and IR value of the transformer windings and all the incoming and outgoing cables have been checked.
- n. That all the valves in the codling system and valve between the Buchholz relay and the conservator tank is in open position.
- o. That the setting of all the protective relays is at the desired value and D.C. Trip supply is healthy.

3.5.10 Observations after Commissioning:

After switching on-the transformer the following points shall be observed and recorded.

- a. The inrush magnetizing current and no-load current.
- b. Alarm if any, or if any relay flag has operated.
- c. Voltage and current on all the three phases
- d. Transformer hums or abnormal noise.

- e. Circulation of oil and leakages.
 - f. Record current, voltage, cooling air temperature, winding temperature and oil temperature readings, hourly for 24 hours.
 - g. Cable end boxes for any overheating.
- 3.6 H.V. and M.V. motors
- 3.6.1 All the motors generally would be erected by the mechanical contractor.
- 3.6.2 Electrical contractor shall keep the, motor space heater energized, as per the directions of Engineer-in-charge. Electrical contractor shall measure the insulation resistance of motor windings. Insulation resistance of the motors shall be measured between the winding the machine and its frame by means of a 500/1000 V megger in case of 415 V motors. A minimum value of 1 mega ohm for 415V motors shall be considered a safe value. In case of lower I.R. Value, the insulation value shall be improved by any of the following methods as directed by the Engineer-in-charge.
- a. Blowing hot air from external source.
 - b. Putting the motor in oven.
 - c. Placing heaters or lamps around and inside after making suitable guarding and covering arrangements so as to conserve the heat.
- 3.6.3 In case the insulation is low, the following method of drying has to be adopted, after consultation with Engineer-in-charge. During drying the temperature rise of winding shall not exceed the permissible value for the class of insulation used.
- a. By locking the motor so that it cannot rotate and then applying such a low voltage to the stator terminals so as to pass full load current in the stator keeping the stator winding temperature below 90° C. In this case a close watch shall be kept for any possible overheating and I.R. Values vs. temperature shall be plotted and heating continued till I.R. value becomes steady.
 - b. By blasting hot air from external source, Maximum temperature of winding while drying shall be 70° C to 80° C (thermometer) or 90° C to 95° C by resistance method. Heating shall be done slowly first till steady temperature of winding is reached after 4 to 5 hours, and for large machines after 10 hours. A record has to be kept for drying process, with half an hour reading and, till steady temperature is reached. In case it is essential, the drying process can be supplemented by blower.
- 3.6.4 It shall be ensured that the motor leads are correctly connected in the terminal box, as indicated in the 'Name Plate'. The covers of all terminal boxes shall be properly fixed, the gaskets intact. The control circuit shall be tested for proper functioning as per circuit diagram.
- 3.6.5 In case of synchronous machines, slip rings and brush gear shall be polished and brushes shall be fixed in their holders with clearance and pressure as recommended by the manufacturers.
- 3.6.6 Before commissioning, the ventilation and cooling system of the motor must be inspected. In case of motor with forced ventilation the air inlet shall be examined to ensure that it is free from moisture and any foreign material. It shall also be ensured

that recommended flow and pressure of air is available to produce the required cooling effect.

- 3.6.7 The motor control gear shall also be carefully examined, the over-load settings may be reduced or time lags bypassed from protective gear to ensure rapid tripping of switchgear in event of faults. The direction of rotation of a new motor especially of large capacity, and phase sequence of supply shall be kept in view while joining and connecting to the motor terminals.
- 3.6.8 Finally, the motor shall be started on no-load after decoupling, and shall be allowed to run for a minimum period of 4 hours, or for a time as instructed by Engineer-in-charge. Attention shall be given to the proper running of the bearings, vibration or unusual noises if any. Voltage, starting current, no-load current, stator winding and bearing temperature shall be recorded after every 1 hour during this test. Direction of rotation shall be checked and recorded. Normally the motors run in clockwise direction as viewed with reference to the phase sequence R, Y, B.
- 3.6.9 After switching off the motor, the insulation resistance of the motor shall be recorded under hot and cold conditions.
- 3.6.10 If the no load test run is found satisfactory, the motor shall be allowed to run for 8 hours and all readings shall be recorded.
- 3.6.11 The following work on motors may be performed by the contractor if specifically called for.
- a. The proper level of bearing oil has to be checked. The condition of grease in bearings shall be checked and in case it is necessary, complete replacement of bearing with specified grade of grease after proper cleaning of the bearing shall have to be done. Wherever external greasing facility exists, the condition of grease may be checked by pumping some new grease of specified grade at start. If the grease coming out is deteriorated grease shall be replaced.
 - b. All the motors, -motor exciter set and induction generators directly coupled or coupled through reduction gears shall be checked for abnormal vibration, if any Large rated HV motors with journal type bearings are liable to get damaged from shock, rough handling during transit. Any minor defect in a race or roller may give rise to considerable amount of vibration and noise. Contractor shall check and bring to the attention of Engineer-in-charge any defect noticed in this regard.
 - c. Due care shall be taken to avoid any damage to bearing insulation wherever provided.

3.7 Batteries

- 3.7.1 Battery (Lead acid, Nickel Cadmium or VRLA type as specified) shall be erected on stands and insulators supplied by the manufacturer of the batteries. The installation shall be done as per the layout drawings and manufacturer's instructions. Electrolyte if required / as applicable shall be filled as per manufactures instructions. Interrow connections shall be made with the leads supplied by the manufacturer.

3.8 Neutral Earthing Resistor

- 3.8.1 The neutral earthing resistor shall be inspected for any damage to the resistor grid and

other components. The resistor shall be leveled and installed. All covers etc. shall be checked for lightness to ensure that the enclosure of the resistor is dust, vermin acid weatherproof. Earthing conductors shall be taken from the out-end terminal of the resistor for connection to earth electrodes and to the main grid.

3.9 welding Receptacles

3.9.1 The welding receptacles shall be erected on steel/concrete structures as per the drawings, in isolated places a separate support shall be fabricated and installed.

3.10 Push Button/Control Stations

3.10.1 The push buttons / control stations shall be installed near to the motors to be controlled. Individual channel support shall be installed as per standard installation drawings. If control stations for hazardous areas are to be supplied by contractor. These shall be of Ex(d) type tested by CMRI and approved by CCOE or other applicable certifying authorities. All outdoor push buttons / control stations shall preferably have integral canopies for additional weather protection. The canopy shall be made of 2 mm thick galvanized sheet steel or FRP where these are not integral with the equipment.

3.11 Gang operated Isolators/outdoor Disconnectors

3.11.1 The isolators shall be transported to site in the dismantled condition. All the insulators may be also supplied loose. The contractor shall inspect, clean assemble and install the isolator on the base structure previously fabricated erected and leveled by him. The operating mechanism shall be installed on the structure and connected to the isolator poles. The operating mechanism shall be tested by slowly bringing the isolator to the closed position and carrying out the necessary adjustment as per the manufacturer's instructions. The earthing switches, frames and operating handle etc. shall be earthed.

3.11.2 Contractor shall provide the following items in substation as per Indian Electricity Rules:

- a. Fire buckets filled with clean dry sand and ready for immediate use for extinguishing fires and fire extinguisher (carbon dioxide, dry chemical extinguisher etc.) suitable for dealing with electric fires shall be conspicuously marked and kept.
- b. First aid boxes containing ointments and medicines for immediate treatment of injuries (As prescribed by Indian Red Cross Society or equivalent).
- c. Instructions of restoration of persons suffering from electric shock in English, Hindi and local language of the district shall be affixed in a conspicuous place.
- d. Danger boards (H.V, M.V.) shall be provided on transformer gate, switchboards, entrance to switchgear room and at other places as required by Engineer-in-charge.
- e. The Communication system and Fire alarm system panels and equipment shall be installed complying to manufacturer's instructions. The location of field station (call back station unit, break glass unit, telephone set etc.) shown on, the drawing is indicative. The exact location shall be decided at site by contractor in consultation with Engineer-in-charge. Correct type of equipment with regard to hazardous protection as specified on drawing shall be adhered to by contractor, for installation.

4.0 INSPECTION, TESTING AND COMMISSIONING

- 4.1.1 Field inspection, testing and commissioning of the complete electrical installation shall be carried out as per consultants Specification.
- 4.1.2 After the equipment is installed properly in accordance with drawings and Specifications, Contractor shall carry out all pre-commissioning checks and tests as per company format in the presence of Engineer-in-charge and test readings shall be recorded and furnished to Consultant/Owner in triplicate.
- 4.1.3 All equipment layout drawings shall be marked by the Contractor for "AS BUILT STATUS" and two sets of copies shall be submitted to Consultant/Owner.

5.0 SPARES AND ACCESSORIES

- 5.1.1 The Contractor shall have all necessary construction equipment, tools and tackles and testing instruments to carry out the erection works and to commission the system as specified. These shall include but not be limited to the following, and these shall be brought to site by Contractor before the start of work.

Equipment:

- a. Portable grinder.
- b. Portable welding machine.
- c. Portable gas cutting / welding set.
- d. Pipe threading machine.
- e. Pipe bending machine (hydraulic).
- f. Portable drill machine suitable to take up drilling for different sizes as per requirement.
- g. Dewatering pump sets (diesel driven).
- h. Power Hacksaw.
- i. Conduit dye set.
- j. Hydraulic crimping machine.
- k. Hand crimping tool.
- l. Portable electric blowers, vacuum cleaners.
- m. Miscellaneous items such as slings, pulleys, tarpaulins, wooden sleepers, ladders. etc. as required.
- n. Safety belts, safety goggles, and gloves.
- o. Separate tool kit for each Electrician.
- p. Insulation tester 1000 V hand driven.
- q. Insulation tester 2500 V motor/hand driven.
- r. Insulation tester 5000 V motor/hand driven
- s. Phase sequence indicator.
- t. Earth Resistance tester.
- u. Single phase variac
- v. 3 phase variac of adequate capacity.
- w. Secondary injection testing kit.



- x. Multimeter both analogue and digital
- y. Portable Ammeters, Wattmeter, P.F. meters.
- z. Portable Voltmeters.
 - aa. Clip on meters of different ranges.
 - bb. Tacho-meter.
 - cc. Kelvin's double bridge for measurement of very low resistance.
 - dd. D.C. high pot test kit.
 - ee. D.C. high pot test kit.
 - ff. Oil filtration machine of adequate capacity.
- 5.2 Lux meter to measure illumination levels.



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR CABLE INSTALLATION

VCS – SS – EL - 4024

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ABBREVIATION

BIS/IS	Bureau of Indian standards
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
CEA	Central Electrical Authorities
GI	Galvanized Iron
MS	Mild Steel
FLP	Flam Proof
RCC	Reinforced Concrete Cement
PV	Poly Vinyl Chloride

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1.0 SCOPE

1.1 This Specification defines the requirements for supply of materials, wherever applicable, installation, testing and commissioning of cable installation.

2.0 REFERENCE DOCUMENTS

2.1 The work shall be carried out in the best workman like manner in conformity with this Specification, Installation standards, layout drawings, the latest edition of relevant Specifications, codes of practice of Bureau of Indian Standards and OISD Standards listed below:

SP: 30 (BIS) Special Publication - National Electrical Code.

IS:1255 Code of practice for installation and maintenance-of power cables up to and including 33 KV rating.

IS:10810 Method of Test for cables; Part 43 Insulation resistance. (Part 43)

IS:10810 Method of Test for cables; Part 45 High voltage test. (Part45)

OISD 147 Inspection and safe practice during electrical installation

OISD I 73 Fire prevention and protection system for electrical installation

2.2 In addition to the above it shall be ensured that the installation conforms to the requirements of the following as applicable:

- a. Indian Electricity Act and Rules.
- b. Regulations laid down by CEA/Electrical Inspectorate.
- c. Regulations laid down by CCE/DGMS/DGFASLI (as applicable).
- d. The Petroleum rules (Ministry of Industry Government of India).
- e. Any other regulations- laid down by central/state/local authorities and insurance agencies

3.0 DEFINITION

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 DESIGN

4.1 MATERIAL SPECIFICATIONS

All materials and hardware to be supplied by the contractor shall be new, unused and of best quality and shall conform to the latest Specifications of Bureau of Indian Standards.

4.2 CABLE TRAYS

These shall be ladder type trays either prefabricated hot dip galvanized sheet steel trays or site fabricated angle iron painted trays as specified in job Specification.

4.3 PRE-FABRICATED HOT DIPPED GALVANISED TRAYS

The cable trays shall comply with the requirements specified in Installation std.

4.4 SITE FABRICATED ANGLE IRON TRAYS

4.4.1 Angle iron cable trays shall be fabricated from standard rolled angle iron sections of size 75x75x8 for runners for supporting spans limited to 3000 mm. Cross support shall be 25 x 6 mm MS flat for tray width up to 500 mm and 32 x 6 mm flat for tray of more than 500 mm wide and spacing between two cross supports shall not exceed 250 mm.

4.4.2 Vertical supports for both the prefabricated and site fabricated type trays shall be fabricated out of ISMC 100 and horizontal supports shall be with 65 x 65 x 6 mm angle iron sections. Outer most tier of all vertical cable trays shall be covered with GI sheet for protection against physical damage to cables.

4.4.3 Cable racks and trays shall be covered by removable top covers on upper most tier allowing adequate ventilation in following cases where:

- a. Mechanical damage of cables is likely to occur during maintenance in the plant.
- b. Oil or spillage of chemicals can be expected.
- c. Protection from exposure to sun is required.

4.4.4 GI cover sheet shall allow adequate ventilation to the cables and shall be in standard length of 3000 mm, flanged on both sides for fixing on cable tray. Covers shall be complete with required GI hardware's.

4.5 CABLE GLANDS

4.5.1 Cable glands shall be of nickel plated brass unless otherwise specified. The single compression type cable glands shall be used for _indoor. -panels/equipment, (e.g., Substation, control room etc.). The cable glands for outdoor terminations shall be weather protected, double compression type and shall have PVC shroud for additional weather protection. Cable glands forming a part of relevant FLP enclosure shall be FLP type, tested by CMRI or any other recognized independent testing laboratory and approved by CCE/DGMS or any other statutory authority as applicable. Indigenous FLP glands shall have valid BIS license as per the requirements of statutory authorities. The size of the cable glands supplied shall be appropriate to the size of cable so that flame proofness of glands is retained.

4.5.2 Entry thread of cable gland shall be compatible to the entry thread provided in the equipment (BS, ET, NPT, and PG as applicable). If required, suitable reducers/adopters shall be used.

4.6 CONNECTORS

Power cable terminations shall be made with crimped type tinned copper solder less lugs which shall be suitable for the cable size mentioned in cable schedule.

4.7 FERRULES

Ferrules shall be of approved type and of size to suit core size mentioned and shall be employed to designate the various cores of control cable by the terminal numbers to which the cores are connected, for ease of identification.

5.0 INSTALLATION

5.1 CABLE LAYING (GENERAL)

5.1.1 Cable installation shall include power, control, lighting, fire alarm, telephone and communication cables. These shall be laid in trenches/ cable trays as detailed in the cable layout drawings. Cable routing given on the cable layout drawings shall be checked in the field so as to avoid interference with structures, heat sources, drains, piping, air-conditioning duct etc. Any change in routing shall be -done to suit -the field conditions wherever deemed necessary, 'after obtaining approval of Engineering-charge.

5.1.2 High voltage, medium voltage power and control cables shall be separated from each other by adequate spacing or by running through independent pipes, trenches or cables trays, as shown on layout drawings/installation standards, Details of-cable routes and, cable spacing not shown in detail on these drawing shall be determined by the Contractor and approved by the Engineer in charge.

5.1.3 When single core cables are laid in flat formation, the individual cable fixing clamps and spacers shall be of non-magnetic material. As a general practice, the sheath of single core cables shall be earthed at one point to keep sheath at earth potential unless otherwise stated. Single core cables, when laid in trefoil formation shall be braced by suitable clamps at a distance, not exceeding 3 meters along the cable routing.

5.1.4 If straight through joints are required to be provided on single core cables, armor shall be broken at joints as per manufacturer's recommendations. For single core cables armor shall be earthed at one end for the cable run length as per manufacturer's recommendation.

5.1.5 The Telephone, Communication and Fire alarm cables shall run on instrument trays/ducts/ trenches in the units. Wherever these are not available, cables shall be taken in, a separate trench/tray with a min spacing of 600mm from power, and control cables but in any case, such separation shall not be less than 300mm.

5.1.6 Telephone, fire alarm and plant communication cables shall be directly buried in road berm area, (unless otherwise specified in cable layout drawings). These cables shall cross power cables preferably at right angles. Streetlighting cables shall be laid on the other side of road berm area.

- 5.1.7 The lengths indicated in the cables schedule are only approximate. The contractor shall ascertain the exact length of cable for a particular feeder by measuring at site. All cable routes shall be carefully measured. Before the start of cable laying, the contractor shall prepare cable drum schedule and get that approved by Engineer-in-charge to minimize/avoid straight through joints and then the cables cut to the required lengths, leaving sufficient lengths for the terminations of the cable at both ends. The various cable lengths cut from the cable reels shall be carefully selected to prevent undue wastage of cables. Extra loop length shall be given for feeder cables where required as per the directions of Engineer-in-charge to meet contingencies.
- 5.1.8 Cables shall be laid in directly buried trench or in RCC trench (underground trench) or in cable tray along pipe sleepers or in overhead trays as shown on cable layout drawings.
- 5.1.9 Overhead trays shall be installed 2700-mm (minimum) above grade level. At road crossings overhead trays shall be installed at 7000mm(minimum) above grade level or cables shall be routed cable tray culvert/ Electrical Road crossings as per layout drawings. Sufficient care shall be taken while laying cables to avoid formation of twist, sharp bend etc. in order to avoid mechanical injuries to cables. Rollers shall be used for pulling of cables.
- 5.1.10 Cable installation shall provide minimum cable bending radii as recommended by cable manufacturer.
- 5.1.11 Cables shall be neatly arranged in the trenches / trays in such a manner that crisscrossing is avoided and final take off to the motor / switchgear is facilitated. Arrangement of cables within the trenches / trays shall be in line with cable layout drawings. Cable routing between cable trench and equipment/motors shall be taken through GI pipe sleeves of adequate size. Pipe sleeves shall be laid at an angle of maximum 45 to the trench wall. Bending radii of pipes shall not be less than 8D. It is to be ensured that both the ends of GI, pipe sleeves shall be sealed with approved weather proof sealing plastic compound after cabling. In places where it is not possible, cables shall be laid in smaller branch trenches.
- 5.1.12 All cables shall be identified close to their termination point by cable tag numbers as per cable schedule. Cable tag numbers shall be punched on aluminum straps (2mm thick, 20 mm wide and of enough length) securely fastened to the cable-and wrapped around it.
- 5.1.13 Each underground cable shall be provided with cable tags of lead securely fastened every 30 m of its underground length with at least one tag at each end before the cable enters/leaves the ground. In unpaved areas, cable trenches shall be identified by means of cable markers as per installation drawing. These cable markers shall be placed at location of changes in the direction of cables and at intervals of not more than 30 m and also at cable straight through, joint locations.
- 5.1.14 All temporary ends of cables must be protected against dirt and moisture to prevent, damage to the insulation. For this purpose, ends of cables shall be taped with an approved PVC end cap or rubber insulating tape.
- 5.1.15 Each row of cables shall be laid in place and before covering with sand. All wall openings/pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water inside building/lined trench. Every cable shall be given an insulation

test in presence of Engineer-in-charge/Owner before filling the cable trench with sand
Any cable which is found defective shall be replaced:

- 5.1.16 Where cables pass through, foundation walls, the necessary openings shall be provided in advance for the same by another agency. However, should it become necessary to cut holes in existing structures for example floor slab etc., the electrical contractor shall determine their location and obtain approval of the Engineer-in-charge before carrying out the same.
- 5.1.17 Cables for road crossings shall be taken through ERC (Electrical Road Crossing) as shown in the cable layout drawings.
- 5.1.18 At road crossing and other places where cables enter pipe sleeves adequate bed of sand shall be given so that the cables do not slack and get damaged by pipe ends.
- 5.1.19 Wherever cable trench crosses storm water, waste water channel/drain, cables shall be taken through PVC/RCC pipes. Where cables are required to cross drains of depth more than 1200 mm, cables shall be taken over the drain on cable trays supported suitably using ISMC 150/200 sections.
- 5.1.20 Ends of cables leaving trench shall be coiled & capped and provided with protective cover till such time the final termination to the equipment is completed.

5.2 CABLES LAID DIRECT IN GROUND

- 5.2.1 Cables shall be laid underground in excavated cable trenches where specified in cable layout drawings. Trenches shall be of sufficient depth and width for accommodation of all cables. Cables shall be properly spaced and arranged with a view of heat dissipation and economy of design. Maximum number of cable layers in trench shall be preferably limited to 5 layers.
- 5.2.2 Minimum depth of cable trench shall be 750 mm for medium voltage and 900 mm for H.V. Cables. The depth and the width of the trench shall vary depending upon the number of layers of cables as per Installation Standard.
- 5.2.3 Cables shall be laid in buried trenches depth as shown in the cable layout drawings. It is to be insured by the contractor that the bottom of buried trenches shall be cleared of all rocks, stones and sharp objects before cables are placed. The trench bottom shall be filled with a layer of sand. This sand shall be leveled and cables laid over it. These cables shall be covered with 150 mm of sand on top of the largest diameter cable and sand shall be lightly compacted. A flat protective covering of 75 mm thick second-class red bricks shall then be laid and the remainder of the trench shall then be back filled with soil, rammed and leveled.

5.3 CABLES LAID IN CONCRETE TRENCH

- 5.3.1 Cables shall be laid in 3 or 4 tiers in concrete trench as shown on layout drawings. Concrete cables trenches shall be filled with sand in hazardous area to avoid accumulation of hazardous gases and oil. RCC covers of trenches shall be effectively sealed to avoid ingress of chemical and oil in process area. Removal of concrete covers where required for the purpose of cable laying and reinstating them in their proper position after cables are laid shall be done by electrical contractor.

- 5.3.2 All wall openings/pipe sleeves shall be effectively sealed after installation of cables to avoid seepage of water.
- 5.4 Above ground cables
- 5.4.1 Cables installed above grade shall run in cable trays, clamped on walls, ceiling or structures and shall be run parallel or at right angles to beams, walls or column. Cable routing shall be planned to be away from heat sources such as hot piping, gas, water, oil drainage piping, air conditioning duct etc. Each cable shall contain only one layer of cables as far as possible for power cables. However control may be laid in double layer in the cable trays.
- 5.4.2 Individual cable or small group of cables (up to 3 to 4 cables) which run along structures / walls etc. shall be clamped by means of 16 SWG GI saddles on 25 x 6 mm saddle bars. Alternatively small group of cables can be taken through 100/150 mm slotted channel tray / ISMC 100. Cables shall be supported so as to prevent sagging. In general, distance between supports shall be approximately 300mm for cables upto 25 mm diameter and maximum 450 mm for cables larger than 25mm dia. To prevent the sagging of cables.
- 5.4.3 Cable laid on supporting angle in cable trenches structures, columns and vertical run of cable trays shall be suitably clamped by means G.I. saddles /clamps, whereas cables in horizontal run of cable trays shall be tied by means of nylon cords. Distance between supporting angles shall not exceed 600 mm.
- 5.4.4 All cable trays (other than galvanized trays) and supporting steel structures. shall be painted before laying of cables. The under surfaces shall be properly degreased, dedusted, descaled and cleaned. The painting shall be done with one coat of red oxide zinc chromate primer. Final painting shall be done with two coats of approved bituminous aluminum paint unless otherwise specified.
- 5.4.5 Where cables rise from trench to motor, lighting panel, control station, junction box etc., they shall be taken in GI pipe for mechanical protection up to a minimum of 300 mm above grade. Cable ends shall be carefully pulled through conduit to prevent damage to cable.
- 5.4.6 All G.I. Pipes shall be laid as per layout drawings and site conditions. Before fabrication of various profiles of pipes by hydraulically operated bending machine (which is to be arranged by the contractor) all the burrs from the pipes shall be removed. GI Pipes having bends shall be buried in soil / concrete in such a way that the bend shall be totally concealed. For G.I. pipes buried in soil, bitumen coating shall be applied on the buried lengths, Installation of G.I. pipes shall be undertaken well before paving is completed and necessary coordination with paving agency shall be the responsibility of Electrical Contractor.
- 5.4.7 Following guide shall be used for sizing of G.I. pipe.
- a) 1 cable in a pipe -53% of pipe cross-sectional area occupied by cables.
 - b) 2 cables in a pipe -31% of pipe cross-sectional area occupied by cables.
 - c) 3 cables in a pipe - 43% of pipe cross-sectional area occupied by cables

d) And above cables in a pipe - 40% of pipe cross-sectional: area occupied by cables.

5.4.8 After the cables are installed and all testing is complete, conduit ends above grade shall be plugged with a suitable weatherproof plastic compound/bitumen/suitable sealing compound. Alternatively, rubber bushes shall be employed for the purpose of sealing

5.5 TERMINATIONS

5.5.1 All PVC cables up to 1100V grade shall be terminated at the equipment by, means of compression type cables glands suitable for the cable size. They shall have a screwed nipple with conduit electrical threads and check nut. The cables shall be identified close to their termination points at both the ends of cable (cable numbers shall be punched on aluminum 2mm thick and securely fastened to the cable, Wrapped around it) and also along the, route at recommended intervals, by cable tag numbers.

5.5.2 All cable entries for outdoor termination shall be preferably through bottom. Outdoor cable termination through top of equipment shall not be permitted.

5.5.3 Power cables cores wherever color coding is not available shall be identified with red, yellow and blue PVC tapes. Where copper to aluminum connections is made, necessary bimetallic washers shall be used.

5.5.4 In case of control cables, all cores shall be identified at both ends by their terminal numbers by means of PVC ferrules suitable for core size. Wire numbers shall be as per schematic/ wiring/inter-connection diagram. All unused spare cores of control cables shall be neatly bunched and ferruled with cable tag at both ends, for future use. For trip circuit identification additional red ferrules shall be used only in the particular cores of control cables at the termination points in the Switchgear/ Control panels and Control Switches

5.5.5 Contractor shall drill holes for fixing glands wherever necessary. Gland plate shall be of nonmagnetic material/ aluminum sheet in case of single core cables. All unused cable entries on equipment/panels shall be plugged/sealed.

5.5.6 The cable shall be terminated at electrical equipment /switchboards through glands of proper size. The individual cores shall then be dressed and taken along the cables ways or shall be fixed to the panels with polyethylene straps. The cable glanding shall be done as per manufacturer's instructions. Cable armor shall not be exposed after termination is complete.

5.5.7 In case of termination of cables at the bottom of a panel over a cable trench having no access from the bottom close fit holes shall-be drilled in the gland plate for all the cables in one line, then gland plate shall be split in two parts along the center line of holes. After fixing bottom plate, uncovered cable holes/gaps shall be sealed with cold settings compound.

5.5.8 Crimping of lugs to cable leads shall be done by hand crimping / hydraulically operated tool as per requirement Insulation of the leads shall be removed before crimping. Conductor surface shall be cleaned and shall not be left open. Suitable conducting jelly shall be applied on the conductor lead. Lugs shall enclose all strands of cable core. Cutting of strands shall not be allowed.

- 5.5.9 The contractor shall bring to the notice of Engineer-in-charge any mismatch in cable glands, lugs provided with the equipment vis-a-vis to the cable size indicated in cable schedule for taking corrective action.
- 5.5.10 The cable joints in-power and control tables shall be avoided as far as possible. In case a joint is unavoidable, the following shall be insured:
- a. The number of joints shall be restricted to minimum as far as possible,
 - b. The location of joints shall be identified with permanent markers.
 - c. No joints shall be allowed in hazardous areas without the approval of Engineer-in-charge
- 5.5.11 The jointing and termination of medium voltage power cables shall be carried out by trained personnel only. Jointing and termination of high voltage cables shall be done by skilled and experienced jointer duly approved by Engineer-in-charge. Only type tested termination kits of approved make shall be used.
- 5.5.12 No unauthorized repairs modifications shall be carried-out on the hazardous area equipment terminal boxes and junction boxes. Damaged enclosures of hazardous area equipment shall bring to the notice of Engineer-in-charge by Contractor. After termination is complete all the bolts, nuts, hardware of terminal box shall be properly placed in its position and tightened.
- 5.5.13 Where required, cable sealing boxes intended to be used with the apparatus shall be filled with solid setting type bituminous compound unless otherwise specified.

6.0 TESTING AND COMMISSIONING

- 6.1** Field testing and commissioning of electrical installation shall be carried out as per Standard Specification.
- 6.2** Before energizing the insulation resistance of every-circuit-shall-be measured from phase to phase, phase to neutral and from phase/neutral to earth.
- 6.3** Where splices or terminations are required in circuits rated above 650 volts, insulation resistance of each length of cable shall be measured before splicing and or /terminating. After completion of splices and /or terminations measurements shall be repeated.
- 6.4** The insulation resistance of directly buried cables shall be measured before cable trenches are backfilled. Measurements shall be repeated after back filling.
- 6.5** For cables up to 1.1 kV grade 1000VMegger and for H.V. Cables 2.5 kV / 5 kV Megger shall be used.
- 6.6** D.C. High Voltage test shall be conducted on cables given below after installation. .
- 6.7** All 1100 volts grade cables in which straight through joints have been made.
- 6.8** All cables above 1100 V grade.
- 6.9** The D.C. High Voltage test shall be performed as detailed below in the presence of the Engineer in charge or his authorized representative only,

- 6.10** Cables shall be installed in final position with all the straight through joints complete. During the high voltage test, all other electrical equipment related to the cable installation, such as switches, instrument transformers, bus bars, etc., must be earthed and adequate clearance shall be maintained from the other equipment and framework to prevent flash over.
- 6.11** In each test, the metallic sheath/screen/armor shall be connected to earth.
- 6.12** All checks and tests shall be made as per Consultant standard test Performa available with site engineer.
- 6.13** All test readings shall be recorded and submitted to Consultant / Owner in triplicate sets.
- 6.14** Cable schedule, cable layout drawings, Interconnection drawings shall be marked by contractor for `AS BUILT STATUS' and two sets of copies shall be submitted to Consultant / Owner.

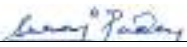





Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR EARTHING INSTALLATION

VCS – SS – EL - 4025

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
02	09.03.2022				
01	16.10.2019	MG	VV	AD	SK
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ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
GI	Galvanized Iron
MS	Mild Steel

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1.0 SCOPE

1.1 This specification defines the requirements for the supply of earthing and lightning protection materials and installation of the earthing and lightning protection systems.

2.0 REFERENCE DOCUMENTS

2.1 The work shall be carried out in the best workman like manner in conformity with this specification, consultant installation standards, layout drawings, the latest edition of relevant specifications, codes of practice of Bureau of Indian standards and OISD standards listed below:

SP: 30 (BIS):	Special Publication-National Electrical Code
IS: 2309:	Protection of buildings and allied structures against lightning.
IS: 3043:	Code of practice for earthing.
IS: 7689:	Guide for control of undesirable static electricity.
OISD 110:	Recommended practices on static electricity
OISD 147:	Inspection and safe practice during electrical installation.

2.2 In addition to the above it shall be ensured that the installation conforms to the requirements of the following as applicable:

- a. Indian Electricity Act and Rules.
- b. Regulations laid down by CEA/Electrical Inspectorate.
- c. Regulations laid down by OISD/PESO (as applicable).
- d. The petroleum rules (Ministry of Industry Government of India).
- e. Any other regulations laid down by central/state/local authorities and Insurance agencies.

3.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

4.1 MATERIAL SPECIFICATIONS

- 4.1.1 All materials and hardware's to be supplied by the contractor shall be new, unused and of best quality and shall conform to the specifications given here under and to latest Specifications of Bureau of Indian Standards. Contractor shall bring material samples to site and get it approved by engineer-in-charge before installation.
- 4.1.2 The main earth grid conductor shall be hot dip galvanized M.S. flat unless otherwise specified. Sizes for main conductors shall be as indicated on the earthing layout drawing. Amount of galvanizing shall be 610gm per sq. meter. Earth electrodes and Earth plate shall be as per job specification.

5.0 DESIGN

5.1 EARTHING NETWORK

- 5.1.1 This consists of main earth conductor (grid conductor) forming a closed ring network with required number of earth electrodes connected to it to provide a common earth for electrical devices and metallic structures. From each earth electrode two distinct connections shall be made to the main earth conductor. The earth plates shall be used for taking multiple earth connections to two or more equipment.
- 5.1.2 The earth conductor shall be laid along cable trays/cable trench/pipe racks as indicated on the earthing layout drawing. Where lined cable trenches are available, the earth conductor shall be laid in the trenches and shall be firmly cleated to the sidewall of concrete trenches using GI clamps at interval of 400 mm to 500 mm and near to the termination end. The earthing conductor shall run along one of the cable trays along a cable route. The earthing conductor shall be suitably cleated and electrically bonded to all the other cable trays on the same cable route at a regular interval of 25 to 30 meter. The earthing for equipment shall be tapped from the main earth conductor and not from cable tray support structure. Earth conductor when laid underground shall be at a depth of 500mm below finished grade level.
- 5.1.3 Joints and tapping's in the main earth loop shall be made in such a way that reliable and good electrical connections are permanently ensured. All joints below grade shall be welded and shall be suitably protected by giving two coats of bitumen and covering with hessian tape. Earth strip laid above ground shall be welded across straight through joints and joints shall be suitably protected by giving two coats of bitumen to avoid oxidation and insulation film formation of the strip surface. When two earth strips are to be joined by means of welding, lap welding with an overlapping of strip equivalent to double the width of the strip and all four sides shall be continuously welded. All joints at tapping's above ground shall be by means of connector/lugs. A minimum of two bolts of adequate size shall be used for this purpose. Earthing strip joints at earth plate and equipment shall be through GI bolts, nut etc.

6.0 INSTALLATION

6.1 INSTALLATION OF EARTH ELECTRODE

- 6.1.1 Earth Electrode shall be installed as shown on installation standard and layout drawings. The location shown on the layout drawings are indicative.
- 6.1.2 The exact location of earth electrodes in the field shall be determined by contractor in consultation with the Engineer-in-charge, depending on the soil strata and resistivity. Earth electrodes shall be located avoiding interferences with road, building foundation, column, pipelines etc. The civil area drawings shall be referred for this. The distance between two electrodes shall not be less than twice the depth of electrode.
- 6.1.3 Electrodes shall preferably be located in a moist soil which has a fine texture, grain size and distribution. Wherever practicable the soil shall be dug up, all lumps broken and stones removed from the immediate vicinity of the electrodes and soil packed by watering and ramming as tight as possible.
- 6.1.4 The electrodes shall have a clean surface, not covered by paint, enamel, grease or other materials of poor conductivity.
- 6.1.5 All earth electrodes shall be tested for earth resistance by means of standard earth test meter. The tests shall take place in dry months, preferably after a protracted dry spell.
- 6.1.6 The disconnect facility shall be provided for the individual earth electrode to check its earth resistance periodically.
- 6.1.7 Location of earth electrodes shall be marked by permanent markers for easy identification. All earth Electrodes shall be serial numbered and also marked on 'As Built' drawing for future reference.
- 6.1.8 Individual earth electrodes shall be provided for each lightning arrestor and flood light mast.
- 6.1.9 Earthing system provided for concrete paved area by other agency where applicable; shall be connected to the plant earthing system below ground by minimum two earth connections.

6.2 CONNECTION

- 6.2.1 The earth system connections shall generally cover the following:
- a. Equipment earthing for personnel safety
 - b. System neutral earthing
 - c. Static and lightning protection
 - d. System neutral
 - e. Current and potential transformer secondary neutral
 - f. Metallic non-current carrying parts of all electrical apparatus such as transformers, switchboards, bus ducts, motors, neutral earthing resistors, capacitors, UPS, battery charger panels, welding receptacles, power sockets, lighting/power panels, control stations, lighting fixtures etc.

- g. Steel structures/columns, rail loading platforms etc.
 - h. Cable trays and racks, lighting mast and poles
 - i. Storage tanks, spheres, vessels, columns and all other process equipment.
 - j. Fence and Gate for electrical equipment (e.g., transformer, yard etc.)
 - k. Cable shields and armor.
 - l. Flexible earth provision for Wagon, Truck
 - m. Shield wire
- 6.2.2 Conductor size for branch connection to various equipment shall be as per consultant Installation Standards unless otherwise stated on earthing layout drawings.
- 6.2.3 All process pipelines shall be bonded and earthed at the entry and exist points of battery limit of hazardous area. Earth continuity conductors across pipe line flanges shall not be provided as per OISD 110.
- 6.2.4 Steel pipe racks in the process units and offsite area shall be earthed at every 24 meters.
- 6.2.5 Equipment / street light pole etc. located remote from main earth network may be earthed by means of individual earth electrode and earth conductor unless otherwise stated in Job Specifications.
- 6.2.6 Lightning protection shall be provided for the equipment, structures and buildings as shown on layout drawing. Self-conducting structures shall not require separate aerial rod and down conductors. These shall however be connected to the earthing system at two or more points as shown on layout drawing. An independent earthing network shall be provided for lightning protection and this shall be bonded at least at two points with the main earthing network below ground. Lightning down conductor shall be brought to earth electrode in shortest straight path as feasible to minimize surge impedance.
- 6.2.7 The main earthing network shall be used for earthing of equipment to protect against static electricity.
- 6.2.8 All medium and high voltage equipment (above 250V) shall be earthed by two separate and distinct connections with earth.
- 6.2.9 Plant instrument system clean earthing, UPS system clean/safety earth shall be separate from the electrical earthing system.
- 6.2.10 All paint, scale and enamel shall be removed from the contact surface before the earthing connections are made.
- 6.2.11 All earthing connections for equipment earthing shall be preferably from the earth plate mounted above ground wherever provided.
- 6.2.12 Equipment foundation bolts shall not be used for earthing connection.
- 6.2.13 Earth connections shall be made through compression type cable lugs/by welded lugs.

- 6.2.14 All hardware used for earthing installation shall be hot dip galvanized or zinc passivated. Spring washers shall be used for all earthing connections and all connections adequately locked against loosening.
- 6.2.15 Lighting fixtures and receptacles shall be earthed through the extra core provided in the lighting circuit/cable for this purpose.
- 6.2.16 The reinforcements of sub-station building and the sub-station floor shall be connected to main earth grid.

7.0 INSPECTION AND TESTING

- 7.1.1 Field inspection, testing and commissioning of electrical installation shall be done as per specification no.00004-PL-EL-SP-21-R0. Earthing systems/connections shall be tested as follows:
- 7.1.2 Resistance of individual earth electrodes shall be measured after disconnecting it from the grid by using standard earth test meggar.
- 7.1.3 Earthing resistance of the grid shall be measured after connecting all the earth electrodes to the grid. The resistance value of an earth grid to the general mass of earth shall be as follows:
- a. For the electrical system and equipment, a value that ensures the operation of the protection device in the electrical circuit but not in excess of 4 ohm. However, for generating stations and large sub-systems the value shall not be more than 1 ohm.
 - b. For lightning protection, the value of 5ohms as earth resistance shall be desirable, but in no case, it shall be more than 10 ohms.
- 7.1.4 The resistance to earth shall be measured typically at the following points.
- a. At each electrical system earth or system neutral earth.
 - b. At each earth provided for structure lightning protections.
 - c. At each point on earthing system used to earth electrical equipment enclosures.
 - d. At one point on earthing system used to earth wiring system, enclosures, such as metal conduits and cable sheaths or armor.
 - e. At one point on fence enclosing electrical equipment.
- 7.1.5 All earthing layout drawing shall be marked by contractor for 'AS BUILT STATUS' and two sets of copies shall be submitted to consultant.



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR LIGHTING INSTALLATION

VCS – SS – EL - 4026

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ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
AC	Alternating Current
DC	Direct Current
CP	Cathodic Protection
SCADA	Supervisory Control And Data Acquisition
FRP	Fiber Reinforced Plastic
TPN	Triple Pole Neutral
MCB	Miniature Circuit Breaker
ELCB	Earth Leakage Circuit Breaker
MDB	Main Distribution Board
HPMV	High Pressure Mercury Vapor
HPSV	High Pressure Sodium Vapor
PVC	Poly Vinyl Chloride
GI	Galvanized Iron
HRC	High Rupturing Capacity
MS	Mild Steel
CFM	Cubic Flow Meter

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1.0 SCOPE

- 1.1 This specification defines the requirements for the supply of equipment; materials, installation, testing and commissioning of the lighting system (lighting fixtures, lighting power distribution, telephone wiring etc.).

2.0 REFERENCE DOCUMENTS

- 2.1 The work shall be carried out in the best workmanlike manner, in conformity with this specification, and the relevant specifications/codes of practice of the bureau of Indian standards.
- 2.2 In addition to the above it shall be ensured that the installation conforms to the requirements of the following as applicable:
- Indian Electricity Act and Rules.
 - Regulations laid down by CEA/Electrical Inspectorate.
 - Regulations laid down by OISD/PESO (as applicable).
 - The petroleum rules (Ministry of Industry Government of India).
 - Any other regulations laid down by central/state/local authorities and Insurance agencies.

3.0 DEFINITION

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 FABRICATION (EQUIPMENT SPECIFICATION)

All materials, fittings and appliances to be supplied by the contractor shall be new, unused and of the best quality and shall conform to the specifications given hereunder. These shall be manufactured in accordance with the latest revision of the specifications of Bureau of Indian 'Standards/International Standards. In the absence of any specifications for a particular item contractor shall bring material samples along with proven track record to site and get the same, approved by Engineer-in-Charge/Owner before installation.

4.1 Lighting and Power Panels

- 4.1.1 Lighting and power panels (general purpose panels for safe area) shall be made of 1.6mm thick sheet steel and shall be dust and vermin proof. All metal surfaces shall be cleaned free of rust, given a coat of red-oxide primer and finished with two coats of epoxy-based paint of shade 632 of IS 5. Panels shall be indoor/outdoor type as specified. Indoor type panels shall have IP42 degree of protection and shall be suitable for surface or flush mounting on wall surface as specified. Lighting and power panels located outdoor shall be IP55 weather protected and shall also preferably have integral canopy for additional weather protection. The canopy shall be made of 2mm thick galvanized sheet steel or FRP where these are separate from the equipment.
- 4.1.2 Lighting and Power panels shall have TPN incoming feeder and single phase outgoing feeders. Lighting circuit feeders shall be rated for 10 amps and power circuit feeders shall have current rating of 16Amps. In power panels for window Air conditioning units, power circuit feeder shall be rated for 20 amps. Panels shall be equipped with phase and neutral bus bars of required current carrying capacity. The outgoing feeders shall be provided with single pole miniature circuit breakers (MCBs) for safe areas and double pole MCBs for hazardous areas. The incomer shall be with MCB and ELCB unit unless otherwise specified. Miniature circuit breakers shall be mounted in such a way that the operating levers project outside the front Bakelite covers plates for ease of operation. A hinged door to cover the operating knobs shall be provided. In addition, a circuit diagrams indicating incomer details and outgoing details viz. Circuit number, circuit rating, and load connected and details of the load shall be pasted inside the panel. Also a laminated copy of the diagram shall be provided inside the panel in a suitably designed pocket. Two external earthing studs for connection to the plant earthing grid shall be provided on the panel. Further, the panel shall be provided with an earth bus bar with terminal studs for connection to the third core of each outgoing circuit. Each circuit phase and neutral shall be given ferrule numbers. Complete wiring inside the panel, shall be neatly bunched with PVC tape and button. Sufficient terminals shall be provided in the terminal block so as to ensure that not more than one wire (core) is connected to a terminal. The panel shall have knock out holes or removable gland plate for the entry of incoming and outgoing conduits or cables. The panels shall be complete with requisite number of cable glands as specified.
- 4.1.3 The Main distribution board (MDB) where used, shall be made of 2mm thick sheet steel panel, dust and vermin proof similar-in construction to Lighting and Power panels but with TPN MCB incoming and TPN outgoing (MCB with ELCB units and MCB without ELCB unit as applicable) of required numbers as specified.
- 4.1.4 All MCBs shall be of M9 category as per IS 8828 and sensitivity of ELCBs shall be 100 mA unless otherwise specified.
- 4.1.5 Wherever the size of incoming cable to lighting, power panels/MDB is more than 35 sq.mm a suitable cable adapter box shall be provided and attached to the panel. The incoming cable leads shall be connected to terminal block (bolted type terminals) of required size. This terminal block shall be connected to TPN incomer unit through separate PVC insulated copper conductor wires/bus bars. Sufficient space shall be provided (200 to 250mm) between gland plate and the bottom of terminal block for easy termination.

4.2 Lighting fixtures

The types, Makes and catalogue numbers of various types of lighting fixtures shall be as given in Fixture schedule job Data Sheet. HPMV/HPSV lighting fixtures shall be complete with ballast, starters and capacitor, as required. Control gears shall be integral or non-integral as specified in lighting layout drawings. Unless otherwise specified all fixtures shall be supplied complete with lamps. Ballast for fixture shall be copper wound or electronic type. The fixtures shall be of high power factor type i.e. at least 0.9 or more.

4.3 Switches

Switches, manufactured in accordance with IS: 13947 shall be used for non-hazardous areas. Switches in areas where concealed wiring has been adopted, shall be flush mounting piano type unless otherwise specified. For surface conduit wiring, piano type switches in surface mounted box shall be provided. Industrial Type switches (Weather protected) shall be used for outdoor areas.

4.4 Receptacles

Three pin type 5A/15A receptacles manufactured in accordance with IS:1293 shall be used for non-hazardous areas. The receptacles and the controlling ON/OFF switch shall be mounted in the same enclosure box but these shall be in separate units to facilitate replacement by parts. Flush mounting type receptacles shall be used in areas where concealed wiring has been adopted and surface type shall be used in other areas. For exhaust fans and wall mounted air circulators, socket and switch enclosures shall be separate. In buildings such as sub-station, D.G. shed, Workshop, maintenance shop etc. industrial type metal clad socket outlets and plugs shall be provided. These sockets shall be supplied complete with plugs.

4.5 Outlet Boxes

The outlet boxes used as point outlets shall be prefabricated type 65mm deep junction boxes. Outlet boxes custom fabricated for sockets, switches, fixtures and fan regulators etc. shall be made of M.S. Sheet having minimum thickness of 1.6mm. Outlet boxes shall be galvanized after fabrication. These shall be complete with terminal block suitable for connection of wires up to 4 sq. mm Front cover plate shall be of 3mm thick bakelite/PE sheet. The color shall suit the shade of the walls or shall be white if the shade of the walls is not finalized. The sheet shall extend at least 2 cm on all sides of outlet box. Cover plate shall be fixed by cadmium plated brass screws and cup washers. Outlet boxes shall be provided with adequate number of knock outs on all the sides for ease of wiring either with conduits or without conduits.

4.6 Conduit and Accessories

Conduits for Electrical installations shall conform to IS:9537. The type of conduit (steel/GI/PVC) shall be as specified on drawing. Black enameled-steel or GI conduit shall be of 1.6mm thick and the minimum wall thickness of PVC conduit shall be 1.6mm. Generally, PVC conduits shall be used in concealed wiring and for surface wiring GI conduit (in plant buildings) and black enameled steel conduit (in-non plant buildings) shall be used.

4.7 Lighting Poles

Lighting poles shall be fabricated from ERW steel tubular pipes of specified section, with joints, swaged together when hot and beveled on outside edges. Poles shall be coated with bituminous preservative solution on the ground portion of the outside surface. Remainder of the outside surface shall be given one coat of red oxide primer and finished with two coats of aluminum paint. The pole shall have, a marshalling, box near the bottom to contain HRC fuses, a neutral link earth stud and terminal block.

4.8 Lighting HIGH Mast

Lighting HIGH masts (Lattice tower) where used. They shall be complete with 2 nos. MS flats provided at the base plate for connection to the plant earthing grid. A ladder, platform, handrail, a weather protected TPN switch (at 1500mm from ground-level) and ;a weather protected distribution board fabricated out of sheet steel shall be provided at the top of mast. The TPN Switch and the distribution board shall also have a canopy for additional weather protection. The TPN switch shall be suitable for looping one more lighting high mast from the same incoming, power supply. The distribution board shall have TP & N bus bars of 30 Amps. rating and 12 Nos. outgoing circuits each with a 6A single pole MCB. The distribution board shall have cable entries from bottom. Necessary space provision and suitable mounting arrangement shall be made on top of the tower for mounting of ballast (choke) and condensers for all the circuits and the lighting fixtures. The high masts shall GI coated or painted one coat of red oxide primer and two coats of aluminum paint. Distribution board shall he fabricated out of 2mm thick sheet steel and shall be painted with two coats of enamel over a basecoat of red oxide.

Unless otherwise specified the flood lighting high masts shall be telescopic type.

4.9 Wires

Wires shall be PVC insulated and shall be of 660 Volts grade as per IS694. Conductor shall be of stranded copper and size shall be minimum 1.5 Sq. mm for lighting, 2.5 Sq. mm for 15A power socket circuits and 4 sq. mm for split A/C power socket circuits. Red/Yellow/blue wires for phases, black wire for neutral and green wire for earth shall be used (size of earth wire shall be same as for phase and neutral size). Wire size for air conditioning circuit feeders shall be as indicated in the panel schedule.

4.10 Ceiling Fan/Exhaust Fan

Ceiling fans shall be of 1200mm sweep unless otherwise specified with double ball bearing and regulator. The suspension down rod shall be sturdy mild steel rod of adequate diameter and of minimum length of 300mm with shakles suspension arrangement as per IS. For exhaust fans, the sweep dia. and air CFM shall be as specified in job specification. Exhaust fans for battery room shall be with anticorrosive blades suitable for use in acidic fumes.

4.11 Decorative switches and sockets

Decorative lighting switches and sockets where specified, shall be modular in design. All these items shall fit into the same frame with overall standard dimensions. Frames shall be suitable for surface and flush mounting in brick / concrete wall. The frames shall be

suitable for conduit entry from all the sides. Switches and sockets shall match colors of the frame and cover plates to obtain a combination which shall match decor of the interiors of Control Room, Administrative buildings, offices rooms etc.

5.0 INSTALLATION

Lighting system installation shall be as per follows.

5.1 General

- 5.1.1 The lighting fixtures in the plant shall be fed from lighting panel. All outdoor lighting shall be group controlled manually or through synchronous timer or photocell. Lighting wiring between panel and lighting fixtures shall be done with PVC insulated 3core (phase, neutral and earth) copper conductor armored cable for hazardous areas. Wiring in the building shall be done by means of 3core copper, conductor. PVC insulated, un-armored cables, or PVC insulated copper conductor wires in conduit/Metsec channel as specified. All joints of conductors in Switch boards/JBs Fittings shall be made only by means of approved mechanical connectors (nylon/PVC connectors). Bare twisted joints shall not be permitted anywhere in the wiring system.
- 5.1.2 The lighting layouts furnished by Owner will indicate approximate locations of lighting fixtures. The electrical contractor shall determine, with approval of Engineer-in-Charge, The exact location of each fixture in order to avoid interference with the piping or other mechanical equipment and also with a view to obtain as much uniform illumination as practicable, and to avoid objectionable shadows. Conduits shall be laid out by the contractor to suit field conditions and as per directions of the Engineer-in-Charge.
- 5.1.3 On walkways, platforms and other outdoor area, lighting fixtures shall be located nearer to landing of stairs or ladders, gauges, flow meters, panel boards and other equipment to provide proper illumination.
- 5.1.4 The minimum height of any lighting fixture shall be preferably not less than 2.5 meters above the floor level.
- 5.1.5 All outdoor cable terminations to outdoor junction boxes, panels, socket outlets etc. shall be through bottom or from side. Top entries for cables shall be avoided to avoid water entry. All cable glands for outdoor terminations shall be double compression type and the gland shall be covered with PVC or rubber boot shroud. All unused cable entries shall be plugged with suitable blanking plugs.
- 5.1.6 Mounting height of equipment shall be as under: -
- | | |
|--------------------------------|---|
| a. Top of Switch Box | 1200 mm from FFL(Finished floor level) |
| b. Top of Lighting/Power Panel | 1800mm from FFL |
| c. 5/15 Amp. Receptacle | 300mm from FFL unless otherwise specified
(1200 mm for process areas and industrial sheds) |
| d. Lighting fixture | As indicated in layout drawing |
| e. Exhaust fan | in the cutout provided / as indicated in Layout drawings. |

- 5.1.7 Fixtures shall be firmly supported from the structures. Support (clamps etc. may be bolted or welded to the existing steel work or metal inserts. In case of concrete, structures, where metal inserts are not available, fixtures shall be suspended from concrete surfaces with the help of anchor fasteners. In such cases special care shall be taken to see that anchoring is firm. In places where ceiling fans are provided, lighting fixtures shall be suspended below the level of fan to avoid shadow effect.
- 5.1.8 Circuit cables in a group shall be cleated to structure by using galvanized strip clamps or cable run in cable trays wherever trays are available. Spacers and cleats shall be of required size to accommodate the cables. All hardware shall be galvanized or zinc passivated. Underground lighting cables (in paved areas), shall be taken in suitable G I sleeves buried at a minimum depth of 300 mm from FFL. GI pipe sleeves shall be extended to 300mm above. FFL Exact termination/layout of pipes (for protection of cables) shall be decided at site as per site convenience in consultation with Engineer-in charge.
- 5.1.9 Wiring for all outlet sockets shall be done with 3 cores of equal sizes for, phase, neutral and earth. The terminals of switch sockets shall be suitable to receive the size of wire specified.
- 5.1.10 All lighting fixtures shall be provided with terminal block with required terminals suitable for connection of wire up to 2.5 sq mm copper conductor.
- 5.1.11 The cable shall be straightened after unwinding it from the drum. All cables be clamped/laid in straight run without any sag and link.
- 5.1.12 For location where fan points are shown, fan hooks with junction box during concreting.
- 5.1.13 Where fan hooks and JB's are provided separately JB shall be located within a distance of 300mm from hook for mounting of ceiling rose.
- 5.1.14 Industrial type plug sockets with 20A MCB or rating as per job specification shall be provided at a height of 500mm from FFL for window AC units.
- 5.1.15 Socket outlets and plugs for installation in Substation building, DG shed, workshop, and maintenance shop etc. shall be of industrial metal clad type.
- 5.1.16 Wiring for exhaust fans shall be terminated in receptacles as specified in layout drawing and the connection from receptacle to the exhaust fan shall be by means of a flexible cord equivalent in size to the main run of wires. Switch for exhaust fan shall be located in a separate switch board along with other switches.
- 5.2 Conduit System
- 5.2.1 Surface or concealed conduit system of wiring shall be adopted, as specified in the drawings. Required number of pull boxes shall be used at intervals to facilitate easy drawing of wires. Separate conduit shall be run for lighting and power circuits. Further, conduits for Normal lighting/Emergency lighting/DC critical lighting shall be separate. Conduit layout shall be decided at site as per site conditions. Drop conduits for switch boards shall be decided by contractor as per wall locations shown in Architectural drawings. All exposed run of conduits on surface, shall be vertical or horizontal.

- 5.2.2 Only threaded type conduit fittings shall be used for metallic conduit system. Pin grip type or clamp type fittings are not acceptable. Conduit ends shall be free from sharp edges or burrs. The ends of all conduits shall be reamed and neatly bushed.
- 5.2.3 Conduit shall be of minimum 25mm dia. Maximum number of wires permissible in a conduit shall be seven/nine for wire size of 2.5 sq mm/1.5 sq mm. respectively.
- 5.2.4 The exposed outer surface of the conduit pipes, including all accessories forming part of the conduit system, shall be adequately protected against rusting. In all cases, bare threaded portion of conduit pipe shall not be exposed unless such bare threaded portion is treated with anti-corrosive preservative or covered with approved plastic compound.
- 5.2.5 Conduit connection to outlet boxes shall be by means of screwed hubs or check nuts on either side. Where concealed wiring is done, junction boxes (65mm deep) shall be used so as to rest on shuttering properly. Conduits shall be laid above reinforcement. All conduit connections shall be properly screwed and Junction box covers shall be properly fitted so as to avoid entry of concrete slurry.
- 5.2.6 Conduit pipes shall be fixed by 1.6mm thick G.I. saddles on 3mm thick G.I. saddle bars of required width in an approved manner at intervals of not more than 50cms for straight run. At places near junction boxes, bends, or similar fittings, saddle and bars shall be provided on either side.
- 5.2.7 Where concealed wiring is to be adopted, conduits shall be laid in time before concreting of the slab. Pull wire (GI or steel) shall be provided inside conduit for the ease of wire pulling. The contractor shall coordinate his work with other agencies involved in the civil works in, such a way, that the work of the other agencies is not hampered or delayed. Vertical conduit runs shall be made in wall before plate ring is done so as to avoid chasing. Where chases are made for conduit run contractor shall fill these chases or any other openings made by them after completing the work and patch the surface. During installation, care shall be taken to see that proper covers are provided to prevent rusting of conduits. Locations of all point outlets, junction boxes shall be marked with brick powder or sand so that these are easily identified after shuttering removal. As built conduit layout drawing shall be submitted by contractor after completion of the work.
- 5.2.8 All junction boxes, bends and other accessories shall be of the same material as that of conduit and shall have the same protective coatings.
- 5.2.9 After erection, the entire conduit system shall be tested, for mechanical and electrical continuity and shall be permanently connected to earth by means of approved type of earthing clamps.
- 5.3 Hazardous Area Installation
- 5.3.1 Wiring in hazardous area shall be done by using minimum 2.5mm copper conductor armored cable. Circuit wiring feeding hazardous areas shall be controlled by two pole switches/MCBs (for phase as well as neutral isolation).
- 5.3.2 Correct type of lighting equipment (fixtures and JB's) with regard to hazardous protection as specified in the drawing shall be installed for the areas classified as Zone 1, Zone 2 etc.

- 5.3.3 The terminations in the junction boxes and the lighting fittings shall be done avoiding possibility of loose connections due to vibrations. After the terminations are made the cover of the junction boxes and the lighting fittings shall be closed properly with all bolts and hard wares in correct position, retaining its explosion and weather protections. In fixtures having double cable entries, both the entries shall be used for looping in and looping out connection, thus minimizing the use of separate junction box wherever separate control gear boxes (C.G. box) are provided looping in and looping out, connections shall be through CG-box, thus avoiding the use of an additional junction box. All unused cable entries shall be sealed with suitable plugs.
- 5.3.4 Circuit cables shall be firmly cleated in a group along, columns/ beam/ladders/side channels/platform using 1.6 mm thick GI saddles on, 25x3 mm GI saddle bar at intervals of 400mm to 500mm for straight run and on either side close to bending and at both termination ends as per the direction of Engineer-in-charge. Where required 3 or more of cables may be taken in slotted channel tray after getting the approval of Engineer-in-charge. Cables shall not be routed along hand rails.
- 5.3.5 Where fire proofing column/structures are encountered, all cabling shall be taken in GI pipes of required size and both ends shall be sealed, well before fire proofing is done. Similarly, equipment such as lighting fixture, control gear box, lighting/ power panels, field call stations, junction-boxes etc. shall be installed on suitable steel mounting frame/distance bracket, thereby direct contact with the concrete used for fire proofing.
- 5.3.6 Cable glands for terminating cable on flameproof equipment shall be of double compression FLP type. Any material/equipment specified to be supplied by contractor for installation in hazardous areas, shall be tested by CMRI and duly approved by C.C.E. Nagpur or DGMS Dhanbad or any other applicable statutory authority. All indigenous FLP equipment shall also have valid BIS license as required by statutory authorities.
- 5.4 Building Lighting
- 5.4.1 The type of wiring system shall comprise surface/concealed conduit system or cable wiring as specified on layout drawings.
- 5.4.2 Mounting details of fixtures shall be indicated on the drawings. If specified on the drawings, a group of fluorescent lighting fixtures which are to be mounted end to end shall be fixed to mild steel cold Trolled sections of 50mm x 50mm and of 1.2mm thick (Metsec channel). The entire assembly shall be fixed to the ceiling with necessary number of supports which may be by means of steel conduit or chromium plated chain link as required. The 'Metsec' Channel shall run continuous in suitable sections from one end to other end of wall. The complete channel shall be spray painted, with approved color as per the directions of Engineer-in-Charge. All wires inside channel shall be neatly bunched by nylon tape & buttons.
- 5.4.3 Wiring in areas above false ceiling shall be done in Surface Conduit (25mm die GI conduit) suitably clamped to the true ceiling. Vertical drops from true ceiling for panels, switches, receptacles etc. shall be taken in 25mm die PVC conduit concealed in walls up to switchboards/panels. Lighting fixtures shall be supported from true ceiling. Exact location of fixtures shall be finalized in co-ordination with air-conditioning duct-diffuser layout, panels layout and false ceiling grid layout. To facilitate easy maintenance Looping

back system' of wiring shall be followed throughout. Accordingly supply tapping's and other interconnections including for earthing are made only at fixture connector blocks or at switch boards. Required number of junction boxes shall be used at intervals for wire pulling and inspection.

- 5.4.4 All wires in conduit shall be color coded as specified. Each circuit shall have independent phase neutral and earth wire. However when group of circuits are run in a single conduit the earth wire can be common.
- 5.4.5 Building conduit lighting system of wiring where measurement is done on point wiring basis generally consists of two parts. The first part is the circuit wiring which includes the work necessary from lighting panel up to switch box and from switch box to another switch box. The second part is the point wiring which shall include the work necessary from tapping point in the switch box up to various fixtures or fan outlets/ceiling roses.
- 5.4.6 In no case, two different sources or two different phases of supply shall be combined in one switchboard.
- 5.4.7 Switches for light fixtures/exhaust fans in battery room shall be provided outside the Battery room.
- 5.4.8 Lighting layouts for non-plant buildings (such house, cement go down, gate house, workshop, service building, rest room, etc.) shall be prepared by installation contractor.
- 5.4.9 The following basic data/document for layouts will be provided to the contractor.
- f. Architectural drawings
 - g. Illumination level required
 - h. Type of lighting fixture
 - i. Type of wiring (concealed/surface conduit/cable wiring etc.)
- 5.4.10 Based on the above input, contractor shall prepare and submit lighting layout drawings, panel schedules, conduit layout drawings for concealed wiring, design calculations wherever required, for review by purchaser before erection work is started. The lighting layout drawing shall show the location, type and mounting details of lighting fixtures, receptacles, junction boxes, layout of circuit indicating number of wires etc. The number of points in a circuit shall not exceed ten and the load in each circuit shall be less than 1000 Watts.
- 5.4.11 The panel schedule shall include rating of incoming and outgoing feeders, number of outlets, load for each outgoing circuit, etc.
- 5.4.12 All drawings shall be prepared preferably in AO and AI size. Panel schedules shall be in A4 size drawings (Final submission of drawings shall be in soft copies and in bound volumes together with one transparency of each document).
- 5.5 Street Lighting

- 5.5.1 Street lighting poles to be located on road side shall be installed at a minimum distance of 300mm from the edge of the walkway of the road (road berm). Size of wires from marshalling box up to fixture shall be 1.5mm²/2.5mm², copper conductor PVC insulated.
- 5.5.2 Each pole shall be earthed at two points by connecting to the plant earth grid as shown on Installation standards.
- 5.5.3 Street lighting fixture shall be mounted on steel tubular poles as per standard drawings. The foundation for the street lighting poles will be made by electrical contractor Street lighting poles shall be supplied with a base plate.
- 5.5.4 The poles shall be numbered as per the drawings/ directions of Engineer-in-charge.

5.6 HIGH Mast Lighting

- 5.6.1 The lattice structure high masts shall be installed on concrete foundations with the base plate bolted on to the anchor bolts. The lattice structure shall be GI coated or painted with a coat of primer and two coats of aluminum paint, the second coat to be given just before handing over to the owner. The high masts shall be numbered as per drawings. The high masts shall be connected to the plant earth grid at two points.
- 5.6.2 The main feeder up to the distribution board of lighting high Mast shall be through PVC insulated armored cable of size as specified in the respective drawing. Wiring from Distribution Board to each flood-light fixture shall be by means of a 3core 2.5sqmm, copper conductor PVC insulated armored cable. All the cables shall be neatly clamped to the structure at intervals not exceeding 25 cms.
- 5.6.3 Exact orientation of flood lighting fixtures shall be decided at site to achieve optimum utility of these fixtures.

5.7 Telephone Wiring

- 5.7.1 Conduits for telephone wiring in buildings shall be of 1.6mm thickness. 25mm dia black enameled steel conduit/PVC as per IS 9537, installed on wall surface or concealed or as specified in job specification.
- 5.7.2 Conduit installation system shall comply to the requirements given in conduit system. Required number of pull boxes shall be provided at interval for easy drawing of wires. The telephone wiring shall be done with 0.63mmdiaannealed copper conductor PVC insulated 660V grade, twin flat wire, unless otherwise specified in Job Specification. One telephone socket outlet shall be provided for connection to telephone instrument.

6.0 INSPECTION & TESTING

- 6.1 Lighting installation shall be tested and commissioned by installation contractor as per Specifications. Pre commissioning checks and tests shall include but not be limited to the following:
- 6.1.1 The insulation resistance of each circuit without the lamps (load) being in place shall be measured and it should not be less than 500,000 ohms. (Between phases, phases to neutral, phase/neutral to earth).

-
- 6.1.2 Current and voltage of all the phases shall be measured at the lighting panel bus bars with all the circuits switched on with lamps. If require load shall be balanced on the three phases.
 - 6.1.3 The earth continuity for all socket outlets shall be checked. A fixed relative position of the phase and neutral connections inside the socket shall be established for all sockets.
 - 6.1.4 After inserting all the lamps and switching on all the circuits, minimum and maximum illumination level shall be measured in the area and recorded.
 - 6.1.5 It shall be ensured that switch provided for ON/OFF control of point (light/fan/socket) is only on LIVE side.
 - 6.1.6 Operation of ELCB's shall be checked
 - 6.2 Contractor shall duly fill in all the above test results and submit the test reports to Engineer-in-Charge in triplicate.
 - 6.3 All lighting layout drawings shall be marked by contractor for 'AS BUILT STATUS' and two sets of copies shall be submitted to the consultant.







Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR FIELD INSPECTION, TESTING AND COMMISSIONING OF ELECTRICAL INSTALLATION

VCS – SS – EL - 4027

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ABBREVIATION

CEA	Central Electricity Authority
CCE	Chief Controller of Explosive
DC	Direct Current
DGMS	Director General Mines & Safe
GI	Galvanised Iron
OISD	Oil Industries Safety Directorate
AFC	Approved For Construction
DCS	Distributed Control System
ECS	Emergency Control System
HV	High Voltage
MV	Medium Voltage



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1.0 SCOPE

1.1 This Specification covers the requirements for the field inspection, testing and commissioning of electrical equipment and installation, forming part of electrical power distribution and utilization system.

2.0 REFERENCE DOCUMENTS

2.1 The field inspection, testing and commissioning of electrical equipment shall be carried out in line with this Specification and the latest edition of following Indian Standards and OISD standards.

SP-30(BIS)	National Electrical Code
IS-7816	Guide for testing Insulation resistance of rotating machines.
IS 1255	Code of practice for installation and maintenance of power cables up to & including 33 kV rating.
IS 10810(Part 43)	Method of Test for cables; Part 43 Insulation resistance.
IS 10810(Part 45)	Method of Test for cables; Part 45 High voltage test.
OISD 137	Inspection of Electrical Equipment.
OISD 147	Inspection and safe practice during electrical installation.

2.2 In addition to the above it shall be ensured that the installation conforms to the requirements of the following as applicable:

- a. Indian Electricity Act and Rules.
- b. Regulations laid down by CEA / Electrical Inspectorate.
- c. Regulations laid down by Tariff Advisory Committee/Loss prevention council.
- d. Regulations laid down by OISD/PESO (as applicable).
- e. The petroleum rules (Ministry of Industry Government of India).
- f. Any other regulations laid down by central / state / local authorities / insurance agencies.

3.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.

BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.
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4.0 FIELD INSPECTION, TESTING AND COMMISSIONING

- 4.1** Contractor shall carry out complete field inspection, testing and commissioning of electrical equipment as per Inspection Test plans.
- 4.2** Before the completed installation or an addition to the existing installation is put into service, inspection / pre-commissioning checks and tests shall be carried out by contractor. In the event of defects being found out, the same shall be rectified and the installation retested as applicable.
- 4.3** The pre-commissioning inspection among other requirements shall include visual inspection, checking the workmanship of the installation, the rating of equipment, safety clearances, sizes of cables installed, conformance to the AFC document, soundness of switchgear bus connections, wiring properly dressed and labeled, sealing of unused cable entries, checking of all safety interlocks, control/interface functions as per requirement etc.
- 4.4** Visual inspection for soundness of bus bar connections of bus ducts, terminal connections of equipment/motor shall be carried out. It shall be ensured that no foreign materials are present inside bus duct and equipment terminal boxes. After the visual inspection, all the covers of terminal boxes, inspection chambers shall be refitted with gaskets, bolts & nuts as per equipment manufacturer's instructions.
- 4.5** Pre-commissioning tests shall include but not be limited to the following:
- a. Continuity test for each winding and power and control circuits.
 - b. Insulation test for each winding and power and control circuit
 - c. High voltage test for cables
 - d. Dielectric strength test on transformer oil.
 - e. Checking the correctness of wiring schemes, control circuit interlocks for intended functioning.
 - f. Verification of phase sequence.
 - g. Testing of all types of relays/releases for required operation. Testing of measuring instruments for proper functioning Earth continuity test for all circuits.
 - h. Checking of safety features for correctness of operation etc.
 - i. Checking of all wired interface contacts (analog, digital input/output contacts) for, DCS and ECS interface, at panel and equipment terminal chambers as applicable.
 - j. (Electrical contractor shall co-ordinate with other agencies involved for the above and, provide support services for checking interfaces of electrical equipment and the intended functioning)

- k. Earth resistance measurement for each earth electrode, and the earthing system as a whole.
 - l. Lighting installation shall be tested for correct illumination levels, with the fittings installed. Fittings shall be operated only with specified type of a lamp or tube.
- 4.6** After the above tests and inspection are completed, control circuits shall be tested for correct operation under all operating combinations and proved correct before applying power to main circuits.
- 4.7** Plant Communication, Fire alarm, telephone and security system shall be checked for correct operation and intended function.
- 4.8** A close visual inspection of electrical equipment in hazardous areas shall be made to ensure that equipment is suitable for the classified zone and gas group and correctly installed, with all covers, bolts, nuts and hardware intact and there is no physical damage mark seen on the enclosure.
- 4.9** Site Acceptance Test procedure for specific equipment shall be furnished by the respective equipment Vendor. The contractor shall provide necessary assistance to the equipment Vendor to perform site acceptance testing to enable the equipment Vendor to perform the same.
- 4.10** All pre-commissioning checks and tests shall be carried-out as per the directions of Engineer in-charge. In addition to the equipment manufacturer's instructions, pre-commissioning check requirements shall also be complied. All tests shall be carried out by contractor in the presence of Consultant /Owner's representatives
- 4.11** The contractor shall bring to site all required tools, tackles, and testing instruments for carrying out field testing. Contractor shall use only calibrated measuring and test instruments and shall maintain calibration records.
- 4.12** The Insulation Resistance test values for various electrical equipment shall be as below.

4.12.1 Cables

The insulation resistance test values for cables shall be as per following table:

Rated voltage of the Cable	DC Voltage Volts	Test in	Minimum Insulation resistance in Mega ohms
Lighting and power circuit Wiring	250		1
650/1100 V grade cables	1000		1
1,900/3, 300V grade cables	1000		200
3,800/6,600V grade cables	1000		200
6,350/11,000V grade cables	5000		200
8,700/115,000V grade cables	5000		200
12,700/22 000V grade cables	5000		200
19,000/33000V grade cables	5000		200

4.12.2 HV, MV and miscellaneous switchboards

The insulation resistance test values for the switchboards shall be as per following table:

Rated voltage of the Switchboard	DC Voltage Volts	Test in	Minimum Insulation resistance in Mega ohms
33,000V		5,000	200
11,000V		5,000	200
6,600V		1,000	200
3,300		1,000	200
415V		1,000	100
240V		500	10
110V		500	10

4.12.3 Generators and motors

The insulation resistance test values for the Generators and Motors shall be as per following table:

Rated voltage of the Generators and Motors	DC Test Voltage in	Minimum Insulation resistance in Mega 40 °C
11,000V	5,000	120
6,600V	1,000	80
3,300V	1,000	50
415V	1,000	15
240V	500	12

4.12.4 Transformers

The insulation resistance test values for the Transformers shall be as per following table:

Rated Voltage of the Transformer	DC Test Volt in volts	Minimum Insulation resistance in Mega ohms at 40°C
Up to 600V	1,000	100
601 to 5000V	2,500	1,000
5001 to 15,000V	5,000	5,000
15001 to 35,000V	5,000	10,000

It shall be ensured that during insulation tests; electronic devices and components that are liable to get damaged on applied test voltage shall be disconnected from circuit. The instructions of equipment/panel manufacturer shall be followed strictly in this regard.

4.12.5 High-voltage testing

D.C. high voltage test shall be conducted as per following table on all H. V. feeder cables and also on 1100 V grade cables where straight through joints have been made.

Rated Voltage of Cable (kV)	TEST VOLTAGE (kV) BETWEEN		Duration (Minutes)
	Conductor and Metallic sheath/ Screen/Armour	Conductor to Conductor (For Unscreened Cables)	
0.65/1.1	3	3	5
1.9/3.3	5	9	5
3.3/3.3	9	9	5
3.8/6.6	10.5	18	5
6.6/6.6	18	18	5
6.35/11	18	30	5
11/11	30	30	5
12.7/22	37.5	-	5
19 / 33	60	-	5

* U_o: Phase Voltage U: Line Voltage

The cable cores must be discharged on completion of DC high voltage test and cable shall be kept earthed until it is put into service.

DC test voltage for old cables shall be 1.5 times rated voltage or less depending on the age of cables, repair work or nature of jointing work carried out, etc. In any case, the test voltage shall not be less than the rated voltage.

All protective relays including thermal overload relays shall be tested by secondary injection current. Primary injection tests shall be carried out for differential protection, restricted earth fault protection at full/reduced current to ensure correctness of complete wiring.

Before energizing any equipment, 'COMMISSIONING CLEARANCE FORM' as per standard format shall be, duly filed in by contractor and submitted to Consultant / Owner.

It shall be ensured that the electrical inspectorate approval is available before energizing the equipment.

5.0 RECORDS

Contractor shall keep up-to-date records of all activities carried out and test results. Field inspection / test reports shall be submitted to Consultant / Owner by the contract in bound volume (triplicate copies).



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR FLAMEPROOF LOCAL CONTROL STATIONS

VCS – SS – EL - 4032

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02	14.03.2022	SP	RD	AA	HK	New revision system updated

ABBREVIATION

BIS/IS	Bureau of Indian Standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
TPN	Triple Pole Neutral
SPN	Single Pole Neutral
FRP	Fiber Reinforced Concrete
SS	Stainless Steel
GI	Galvanized Iron

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1.0 SCOPE

This Specification covers design, manufacture, testing and supply of Flameproof Local Control Stations.

2.0 REFERENCE DOCUMENTS

All materials, equipment and accessories, shall conform to latest edition of relevant Indian Standards, some of which are listed below:

IS 2148	Flameproof enclosure of Electrical apparatus.
IS 6875 (PART II)	Push buttons and related control switches
IS 4794	Push button switches
IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories.
IS 2147	Degree of Protection provided by enclosures for low voltage switchgear and control gear.
IS 1336	Recommendations for the colour of push buttons.
IS 13346	General requirements for electrical apparatus for explosive gas atmospheres.

3.0 DEFINITIONS

3.1 For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 DESIGN (CONSTRUCTION)

4.1 ENCLOSURE

4.1.1 Local control station shall be of cast aluminum LM 6 alloy as specified in the enquiry with flameproof enclosure suitable for use in Zone 1 hazardous areas with Gr. IIA & IIB gases and temperature class (as per Data Sheet) as per IS 2148. Enclosures shall be certified and approved for the use in gas group specified. Enclosures shall comprise the following distinct sections / parts: -

- a. Main enclosure for mounting the equipment.

- b. Terminal Chamber. In case, a separate terminal chamber is not provided, a FLP sealing conduit with a nipple shall be provided.
- 4.1.2 For outdoor use, enclosures of local control stations shall be flameproof and weatherproof. Neoprene gaskets provided for weatherproofing should not be put in the flame path.
- 4.1.3 Padlocking facility for the stop pushbutton to be provided on the front plate if specified.
- 4.2 TERMINALS
- 4.2.1 Suitable for connection of 2.5 mm² aluminum /copper conductors. Terminal design must ensure secure & vibration-proof connections. Terminals for each push button to be brought out separately into the terminal chamber. 20% spare terminals shall also be provided with a min. of two Terminals.
- 4.3 MOUNTING
- 4.3.1 Enclosure of local control station shall be provided with external fixing lugs.
- 4.4 EARTHING
- 4.4.1 Enclosure of local control station shall be provided with two nos. external earth terminals each complete with 2 plain and one spring washers, and a nut.
- 4.5 CABLE ENTRY
- 4.5.1 Enclosure of all local control stations shall be provided with two cable entries ¾" E.T. at bottom unless specified otherwise. One entry to be blocked with FLP m.s. plug..
- 4.6 ELECTRICAL COMPONENTS
- 4.6.1 Push buttons and other components required for local control station shall be as per Data Sheet.
- 4.7 PUSH BUTTONS
- 4.7.1 Push buttons element shall have 1 NO & 1 NC momentary (unless specified otherwise in Data Sheet) type contacts of rating 5A, 500 V AC. The knobs of start and stop push buttons shall be green and red in colour respectively. All stop push buttons shall have stay put feature and mushroom knobs.
- 4.8 AMMETERS
- 4.8.1 Ammeters shall be CT operated (CT provided elsewhere) with 1 Amp. CT secondary rating. All ammeters shall be Industrial grade 'A' accuracy and shall have a basic range of 0-1/6 with suppressed scale for 1-6. Calibration will be as per Data Sheets. Ammeters shall conform to IS 1248.
- 4.9 INDICATING LAMPS
- 4.9.1 Indicating lamps shall be low burden filament type/neon/LED, as specified in Data Sheet, with bayonet cap, complete with ballast resistors. Lamp lenses to be glass or other equivalent unbreakable material suitable for FLP enclosure.

4.10 SELECTOR SWITCHES

4.10.1 Selector switches shall be cam type, spring loaded with rating and other details as per purchase Data Sheet.

4.11 WIRING

4.11.1 Local control stations shall be completely wired up to terminals with 2.5 sq.mm. Copper conductor PVC insulated cables. Wiring shall be carried out as per Contractor's wiring diagrams, where furnished. A terminal block to be provided for connection of external cables. Terminals to be clamp type and suitable for 2.5 sq. mm. conductor. Ample space to be provided between gland plate and terminals.

4.12 PAINTING

4.12.1 All metal surfaces shall be thoroughly cleaned and degreased to remove scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer. The surface shall be made free from all imperfections before undertaking the finishing coat.

4.12.2 After preparation of the surface, it shall be powder coated with two coats of epoxy based final paint. Colour shade of final paint shall be as specified in datasheet. The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc.

4.12.3 All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.

4.13 NAME PLATES

4.13.1 Each control stations to be provided with rear engraved Perspex nameplates with white letters on black background. (Inscription details will be furnished separately).

4.13.2 Caution nameplates as per IS 2148 to be provided on each local control station.

5.0 INSPECTION AND TESTING

5.1 Vendor to make all arrangement to carry out the following tests:-

5.1.1 Physical Inspection.

5.1.2 Operation test.

5.1.3 Insulation test.

5.1.4 H.V. test.

5.2 All control stations shall be certified and approved by Competent Authority and copies of certificates shall be furnished.

5.3 Purchaser reserves the right to inspect the control stations and witness the tests at manufacturer's works.

- 5.4 Drawings and Test Certificates as stipulated in Vendor Document Requirements shall be furnished.
- 5.5 General Arrangement drawing showing all dimensions, cable entry details, earthing terminals, mounting arrangement etc. shall be furnished for Owner / Consultant's approval before manufacturing is started.



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VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR INDUSTRIAL LOCAL CONTROL STATION

VCS – SS – EL - 4033

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02	14.03.2022	SP	RD	AA	HK	New revision system updated



ABBREVIATION

BIS/IS	Bureau of Indian Standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
TPN	Triple Pole Neutral
SPN	Single Pole Neutral
FRP	Fiber Reinforced Concrete
SS	Stainless Steel
GI	Galvanized Iron



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1.0 SCOPE

This Specification covers design, manufacture, testing and supply of Industrial Control stations.

2.0 REFERENCE DOCUMENTS

All materials, equipment and accessories, shall conform to latest edition of relevant Indian Standards, some of which are listed below:

IS 2147	Degree of Protection provided by enclosures for low voltage switchgear and control gear.
IS 6875 (PART II)	Push buttons and related control switches
IS 694 (PART I)	PVC insulated cables (for voltages upto 1100 volts) with copper conductors.
IS 4794	Push button switches
IS 1248	Direct acting indicating analogue electrical measuring instruments and their accessories
IS 1336	Recommendations for the colour of push buttons

3.0 DEFINITIONS

3.1 For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 DESIGN (CONSTRUCTION)

4.1 ENCLOSURE

4.1.1 Local control station shall be cast iron / cast aluminium enclosure as specified in the datasheet with IP55 protection. For outdoor use enclosure of local control station shall be weatherproof & shall be provided with canopy.

4.1.2 Enclosure door shall be bolted type with no component mounted on it except the push button / selector switch operating knobs. Contact elements shall be mounted inside/ on the base of control station. Suitable cutout with cemented clear glass shall be provided on the door for Ammeter.

4.1.3 Padlocking facility for the stop pushbutton to be provided on the front plate if specified.



4.2 TERMINALS

4.2.1 Suitable for connection of 2.5 mm² aluminium / copper conductors. Terminal design must ensure secure & vibration - proof connections. Terminals for each push button to be brought out separately into terminal chamber.

4.3 MOUNTING

4.3.1 Enclosure of local control station shall be provided with external fixing lugs.

4.4 EARTHING

4.4.1 Enclosure of local control station shall be provided with two nos. external earth terminals each complete with 2 plain and one spring washers, and a nut.

4.5 CABLE ENTRY

4.5.1 Enclosure of all local control stations shall be provided with two cable entries ¾" E.T. at bottom unless specified otherwise. One entry to be blocked with rubber grommet.

4.6 ELECTRICAL COMPONENTS

4.6.1 Push buttons and other components required for local control station shall be as per Data Sheet.

4.7 PUSH BUTTONS

4.7.1 Push buttons element shall have 1 NO & 1 NC momentary (unless specified otherwise in Data Sheet) type contacts of rating 5A, 500 V AC. The knobs of start and stop push buttons shall be green and red in colour respectively. All stop push buttons shall have stay put feature and mushroom knobs.

4.8 AMMETERS

4.8.1 Ammeters shall be CT operated (CT provided elsewhere) with 1 Amp. CT secondary rating. All ammeters shall be Industrial grade 'A' accuracy and shall have a basic range of 0-1/6 with suppressed scale for 1-6. Calibration will be as per Data Sheets. Ammeters shall conform to IS 1248.

4.9 INDICATING LAMPS

4.9.1 Indicating lamps shall be low burden filament type / neon / LED with bayonet cap. Lamp cover shall be glass or other equivalent unbreakable material.

4.10 SELECTOR SWITCHES

4.10.1 Selector switches shall be cam type, spring loaded with rating and other details as per purchase Data Sheet.

4.11 WIRING

4.11.1 Local control stations shall be completely wired up to terminals with 2.5 sq.mm. Copper conductor PVC insulated cables. Wiring shall be carried out as per Contractor's wiring



diagrams, where furnished. A terminal block to be provided for connection of external cables.

4.11.2 Terminals to be clamp type and suitable for 2.5 sq. mm. conductor. Ample space to be provided between gland plate and terminals.

4.12 PAINTING

4.12.1 All metal surfaces shall be thoroughly cleaned and degreased to remove scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer. The surface shall be made free from all imperfections before undertaking the finishing coat.

4.12.2 After preparation of the surface, it shall be powder coated with two coats of epoxy based final paint. Colour shade of final paint shall be as specified in Data Sheet. The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc.

4.12.3 All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.

4.13 NAME PLATES

4.13.1 Each control stations to be provided with rear engraved perspex nameplates with white letters on black background. (Inscription details will be furnished separately).

4.13.2 Push buttons switches, indicating lamps etc. to be provided with legend plates giving their respective function.

5.0 INSPECTION AND TESTING

5.1 Vendor to make all arrangement to carry out the following tests:-

5.1.1 Physical Inspection.

5.1.2 Operation test.

5.1.3 Insulation test.

5.1.4 H.V. test.

5.2 Purchaser reserves the right to inspect the control stations and witness the tests at manufacturer's works.

5.3 Drawings and Test Certificates as stipulated in Vendor Document Requirements shall be furnished.

5.4 General Arrangement drawing showing all dimensions, cable entry details, earthing terminals, mounting arrangement etc. shall be furnished for Owner / consultant's approval before manufacturing is started.



Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION FOR MV SWITCHBOARDS – INDOOR TYPE (UPTO 33 KV)

VCS – SS – EL - 4036

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02	14.03.2022	SP	RD	AA	HK	New revision system updated



ABBREVIATION

BIS/IS:	Bureau of Indian standards
IEC:	International Electro-Technical Commission
BS:	British Standards
IEEE:	Institute of Electrical and Electronics Engineers
NEMA:	National Electrical Manufacturers Association
OISD:	Oil Industries Safety Directorate
CCE:	Chief Controller of Explosive
DGMS:	Director General Mines Safety
IE Rules:	Indian Electricity Rules
CPRI:	Central Power Research Institute
SWG:	Switchgear
CRCA:	Cold Rolled Cold Annealed
PCC:	Power Control Centre
PMCC:	Power and Motor Control Centre
MCCB:	Moulded Case Circuit Breaker
MCB:	Miniature Circuit Breaker
MCC:	Motor Control Centre
CT:	Current Transformer
PT:	Potential Transformer
PVC:	Polyvinyl chloride



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1.0 SCOPE

This specification covers the design, manufacture, performance, inspection, testing and supply of indoor type-High Voltage Switchboards up to 33 KV.

2.0 REFERENCE DOCUMENTS

2.1 All equipment, material and components shall comply with the requirements of the latest editions of standards and codes of practices of the Indian Standards Institutions, Statutes and Regulations applicable in the area where equipment is to be installed unless noted otherwise.

2.2 Should equipment be offered complying with other standards, these standards shall be equal to or superior to those specified and full details of the differences shall be furnished along with the tender

2.3 Some of the more important relevant Indian and IEC Standards are listed below: -

IS 13118 - High Voltage alternating - current circuit breakers.

IS 3427 - AC Metal enclosed switchgear & control gear for rated voltages above 1KV & up to & including 52 KV

IS 5578 - Guide for marking of insulated conductors

IS 11353 - Guide for uniform system of marking and identification of conductors and apparatus terminals.

IEC 298 - AC Metal enclosed switchgear and control gear for rated voltages above 1Kv and up to and including 52 kV.

IEC 529 - Degree of protection provided by enclosures.

IEC 470 - HV alternating current contactors.

IEC 694 - Common specification for high voltage switchgear and control gear

IS 9431 - Indoor post insulators of organic material for systems with nominal Voltages greater than 1000 V up to and including 300 kV.

IS 2705 - Current Transformers (Parts 1 to 4)

IS 3156 - Voltage Transformer (Parts 1 to 4)

IS 722 - A.C. Electric Meters.

IS 1248 - Direct acting Indicating analogue Electrical Measuring Instruments & their accessories.

IS 3618 - Phosphate treatment of iron and steel for protection against corrosion.

IS 3231 - Electrical Relays for Power System Protection.

IS 5082 - Wrought aluminum and aluminum alloy bars, rods, tubes, sections, Plates & sheets for electrical applications.



IS 9385 - High Voltage fuses

IS 6005 - Code of practice for phosphate coatings of iron and steel.

IS 3618 - Phosphate treatment of iron and steel for protection against corrosion

IS12729 - General requirements for switchgear and control gear for voltages exceeding 1000V.

IS 9920 - Switches & Switch isolators for voltages above 1000V.

IS 9921 - Alternating current disconnectors (isolators) & earthing switches for voltages above 1000 V.

IS 12661 -High voltage motor starter – Direct on-line (full voltage) ac starters. Part 1

IS 9046 - AC Contactors of voltage above 1000V up to & including 11000 V.

IS 694 - PVC insulated cables for working voltages up to & including 1100 V.

IS:13703- Low voltage fuses.

IS: 6875 - Control switches and push buttons.

3.0 DEFINITION

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY	OWNER of the particular Project (Project Specific).
CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor

4.0 MATERIALS

- 4.1 One complete set of all special or non-standard tools required for installation, operation and maintenance of the switchboard shall be provided. The manufacturer shall provide a list of such tools individually priced, with his quotation.
- 4.2 A suitable universal type circuit breaker handling truck shall be provided with each switchboard. The truck shall have platform of adequate mechanical strength for bearing



the weight of the largest circuit-breaker and shall be provided with necessary guide rails and stops.

5.0 DESIGN

5.1 CONSTRUCTION

- 5.1.1 The Switchboards shall be metal enclosed cubicle type, suitable for indoor installation, floor - mounting and free - standing. The design shall be totally enclosed, dust-tight, damp-proof and vermin proof offering degree of protection not less than IP4X.
- 5.1.2 Separate, segregated compartments shall be provided for circuit breakers, bus bars, cable box, voltage transformers, wire ways, relays, instrument and control devices. Switchgear cubicles / modules shall be provided with hinged doors in front with facility for padlocking door handles.
- 5.1.3 Earthed metallic automatic safety shutters shall be provided over the isolating contacts in the stationery portion of the circuit breaker cubicle.
- 5.1.4 Vent openings shall be covered with grills and these shall be so arranged that hot gases cannot be discharged through them in a manner that can injure the operating personnel. These vent openings shall be vermin proof.
- 5.1.5 All panels shall be preferably with same height, width & depth. Panels shall be bolted together to form a continuous flush front switchboard, suitable for front of board operation. The switchboard shall be extensible on both sides.
- 5.1.6 The switchgear cubicles shall be rigid and robust in design & construction. Sheet steel used for fabrication shall be cold rolled. Cubicles shall be made from rigid welded structural frames made of structural steel sections or of pressed / formed sheet steel of not less than 3 mm thickness. The frames shall be enclosed by sheet steel of at least 2mm thickness, smoothly finished, levelled and free from flaws. Stiffeners shall be provided wherever necessary.
- 5.1.7 All doors, panels, removable covers shall be provided with non-deteriorating gaskets all around the perimeter.
- 5.1.8 All doors shall be removable and supported by concealed type hinges. The hinges shall be strong and braced to ensure freedom from sagging, bending and general distortion of panel or hinged part.
- 5.1.9 All floors – standing cubicles shall be provided with a 50 mm high channel base frame. The total height of the cubicle shall not exceed 2500 mm.
- ### **5.2 BUSBARS & BUSBAR CHAMBER**
- 5.2.1 Busbars shall be TP or TPN as indicated in Purchase Data Sheets. Except as noted, bus bars shall be of high conductivity electrolytic copper / aluminum as stated in Purchase data Sheet.



- 5.2.2 The busbars shall be air insulated and housed in a separate compartment, segregated from all other compartments.
- 5.2.3 Busbars shall be of uniform cross section throughout the entire length of the switchboard and suitable for carrying rated current continuously and short circuit current for specified duration without overheating. The busbars shall be adequately supported on insulators to withstand dynamic stresses due to short circuit current specified. Maximum operating temperature for busbars shall be 85°C.
- 5.2.4 All busbar joints and bus tap joints shall be silver or tin plated. Joints shall be bolted type and shall be insulated. Spring washers shall be provided to ensure good contact at the joints. All nuts, bolts and washers shall be cadmium plated.
- 5.2.5 Direct access to, or accidental contact with bus bars and primary connections shall be avoided by providing shrouds. All apertures and slots shall be protected by barriers to prevent accidental shorting of busbars. To provide a tight seal between cubicles, bushings or insulating panels shall be provided for busbars crossing from one cubicle into another.
- 5.2.6 All insulating materials used shall be non-hygroscopic and shall be treated for preventing fungus growth. Surface of insulators shall be highly glazed and treated with silicone compounds to minimize accumulation of dust, condensation and tracking.
- 5.2.7 Bimetallic connectors shall be provided for connection between dissimilar metals.
- 5.3 CIRCUIT BREAKERS
- 5.3.1 The circuit breaker/s shall be one of the following types as specified in the Purchase Data Sheet:
- Minimum oil
 - Air-break (oil – less)
 - Vacuum
 - SF6
- 5.3.2 The circuit breaker/s shall be of horizontal draw out construction, with or without vertical isolation. The circuit breaker including its operating mechanism shall be mounted on a wheeled carriage moving on guides, designed to align correctly and allow easy movement on the circuit breaker. There shall be three discrete positions viz. 'Service', 'Test' and 'Isolated'. Locking facility in all three positions shall be available. Position indicator shall be provided on the panel to indicate the position of the circuit breaker. 'Test' position shall offer testing of circuit breaker operation / interlocks without energising the power circuit.
- 5.3.3 Circuit breakers may be hand operated or electrically operated as called for in purchase data sheet.
- 5.3.4 The closing mechanism of the circuit breakers shall be of one of the following types:



- a. Hand operated, spring charged, independent manual type.
 - b. Motor would, spring charged with a provision for manual charging
 - c. Solenoid operated, with diode rectifier or discharge resistor across solenoid.
- 5.3.5 The operating mechanism shall be mechanically & electrically trip-free and non-pumping. Anti-pumping feature may be built-in or separate anti-pumping relay may be provided. In case of spring charged mechanism 'spring charged' indication shall be provided.
- 5.3.6 A local manual trip device shall be provided on the operating mechanism. The trip device shall be suitable for front of board operation and positive mechanical 'ON-OFF' indication shall be provided.
- 5.3.7 Main contacts of circuit breaker shall have ample area and adequate contact pressure to carry the rated and short time current without excessive temperature rise. The contacts shall be adjustable for wear and easily replaceable. Main contacts shall open before and close after the arcing contacts, when these are provided. Arcing contacts shall be easily accessible for inspection and replacement.
- 5.3.8 Each breaker shall normally be provided with auxiliary contacts of 6NO+6NC directly operated from breaker operating mechanism. These contacts shall be in addition to those used in circuit breaker internal wiring. These contacts shall be rated for 10 amps at 240V AC and 2 amp (inductive breaking) at 220V dc. If more breaker auxiliary contacts are required, latching relay shall be used to multiply the contacts.
- 5.3.9 Shunt trip coil/s as called for shall be provided for tripping the circuit breakers. The closing and trip coil/s shall operate satisfactorily between 70% - 110% of rated control voltage. Wattage of trip coils will be sufficiently high to prevent it from picking-up or holding on with specified number of 'trip circuit supervisory' indicating lamps wired in series.
- 5.3.10 Circuit breaker type duty and rating shall be as stated on the Purchase Data Sheet.
- 5.3.11 Circuit breakers of identical rating shall be physically and electrically interchangeable.
- 5.3.12 In case of failure of control supply it shall be possible to trip the breaker.
- 5.3.13 For vacuum circuit breaker suitably designed surge suppresser shall be provided in motor feeders to reduce over voltage at motor terminal to specified limit. For SF6 circuit breaker, facility for gas filling arrangement including regulating valves, pipes, vacuum pumps, cylinder gas indicator shall be provided for SF6 gas filling at site and Subsequent maintenance. SF6 circuit breakers shall be provided with proper gas leakage detection system.
- 5.4 SWITCHES
- 5.4.1 HV Switches shall be manually operated air break/oil break; quick break and fault make type.
- 5.4.2 HV Switches shall be provided with fuses when specified in data sheet. The fuses shall be HRC non-deteriorating type, fitted with striker pins, which actuate a common trip bar in



the switch mechanism for automatic tripping. Fuses shall not be accessible unless the switch is in fully open condition.

- 5.4.3 An auxiliary switch with two normally closed and two normally open contacts shall be provided for control / indication.
- 5.4.4 The switches shall be housed in draw out or non-draw out type panels as specified in data sheet.
- 5.4.5 Built-in earth-switch shall be provided when specified in data sheet. Operating handle or handles shall have mechanical interlocks to prevent inadvertent direct operation from 'ON' to 'EARTH' or simultaneous closing of both switches. Padlocking facility shall be provided for all positions of the switches. A mechanical ON-OFF-EARTH indicator shall be provided.

5.5 CURRENT TRANSFORMERS

- 5.5.1 Current transformers shall be of ratio, burden, class/accuracy specified in Single Line Diagram or Purchase Data Sheet.
- 5.5.2 Current transformers shall conform to latest edition of relevant standards and shall be of approved make. Current transformers shall be epoxy resin cast with bar primary or ring type.
- 5.5.3 The design and construction shall be sufficiently robust to withstand thermal and dynamic stresses due to the maximum short circuit current of the circuit.
- 5.5.4 The current transformer shall preferably be capable of being left open circuited on the secondary side with primary carrying rated full load current, without overheating or damage. Short time current rating & rated withstand time shall be same as corresponding circuit breaker.
- 5.5.5 Current transformer core laminations shall be of high grade silicon steel.
- 5.5.6 Secondary terminals of the current transformer shall be brought out suitably to a terminal block, which will be easily accessible for testing and external connections. Facility shall be provided for short circuiting and earthing of current transformer Secondary leads through a removable and accessible link with provision for attaching test link.
- 5.5.7 Rating plate details and terminal markings shall be according to the latest edition of relevant Indian standard specification.
- 5.5.8 Separate cores of current transformers shall be used for metering and protection.

5.6 POTENTIAL TRANSFORMERS

- 5.6.1 Potential transformers shall be of ratio, output and class as specified in the Single Line Diagram or purchase data sheet.
- 5.6.2 Potential Transformers shall conform to latest edition of relevant standards and shall be of approved make.



- 5.6.3 Potential transformers shall be oil filled or dry, cast epoxy resin type. The potential transformers shall be of shell type single phase or three phase construction as specified in Purchase Data Sheet.
- 5.6.4 The potential transformers shall be capable of operating continuously at 110% of the rated voltage, without any damage. When star – star connection is required in non-effectively or ungrounded system, the potential transformers shall be suitable for continuous operation with a persistent phase to ground fault.
- 5.6.5 Maximum temperature rises of the transformer at rated burden and with rated primary voltage and frequency, shall not exceed 40°C above an ambient of 40°C.
- 5.6.6 The potential transformers shall be mounted on with drawable trolley/chassis, with plug-in type connections on primary. An interlock or automatic shutters shall be provided to prevent access to live HV parts when transformer chassis/trolley is withdrawn.
- 5.6.7 HRC fuses shall be provided on primary & secondary side. It shall be possible to replace potential transformers fuses easily without having to de- energise the main bus bars. Prospective interrupting current rating of the fuses shall be same as the system fault level.
- 5.6.8 Potential transformer ratio, output and class shall be as specified in the data sheet. Nameplate as per relevant standards shall be provided on the potential transformer.
- 5.7 PROTECTIVE RELAYS
- 5.7.1 Type and number of relays shall be in accordance with the protective scheme specified.
- 5.7.2 Relays shall be numerical / communicable type of latest version suitable to communicate with MMI and ECS.
- 5.7.3 All relays shall be enclosed in rectangular shaped cases, suitable for flush mounting, with only the dust-tight covers projecting from the front of the panel. The cases shall be dust-tight, damp-proof and tropicalised.
- 5.7.4 All relays shall be accessible for setting and resetting from the front. Access to setting devices shall be possible only after removal of front cover. Resetting facility shall however be accessible external to the relay case.
- 5.7.5 All protective relays shall be draw out type. Where it is not possible to provide protective relays of the draw out pattern, fixed type relays with facilities for plugging in a portable test plug shall be provided. Necessary test plugs shall be furnished along with the relays.
- 5.7.6 All relays shall be provided with positive action hand reset type mechanical operation indicator. The indicator/s shall be visible from the front.
- 5.7.7 Relays shall conform to relevant standards in all respects
- 5.7.8 All relays shall be provided with minimum two pairs of self or hand reset type contacts as specified. Auxiliary relays shall have the number of NO and NC contacts as specified in data sheet.



- 5.8 All tripping relays shall be lock out with hand reset contacts and shall be suitable to operate off the specified D.C. voltage. These relays shall have self-coil-cut off contacts and shall be provided with hand reset operation indicators.
- 5.9 SAFETY / PROTECTION INTERLOCKS / FEATURES
- 5.9.1 Following interlocks and features shall be incorporated for equipment protection and personnel safety under mal-operation. No deviations on these interlocks and safety features are allowed. These interlocks and safety features shall be fail-safe, positive and foolproof.
- 5.9.2 The circuit breaker (C.B.) cannot be moved from the 'isolated' position to the 'service' position unless the LV plug and socket connections have been made.
- 5.9.3 The LV plug and socket cannot be disconnected so long the C.B. is in 'service' position. An attempt to do so shall trip the C.B.
- 5.9.4 The C.B. truck cannot be withdrawn past the 'isolated' position without disconnecting the LV plug and socket. Additional flexible jumper with plug and socket shall be provided to permit testing of the C.B. outside the panel.
- 5.9.5 The C.B. truck cannot be moved from the 'service' position to the 'isolated' position with the circuit in the 'ON' position.
- 5.9.6 The C.B. truck cannot be closed when the truck is in between the 'isolated' and "service" position.
- 5.9.7 The C.B. truck cannot be moved from the 'isolated' to "service" position with the earth switch in "ON" position.
- 5.9.8 The earthing switch can be switched "ON" only when the C.B. truck is in the "isolated" position.
- 5.9.9 There shall be no access to any live part when the C.B. is in the 'service' position.
- 5.9.10 Isolating switches, if provided, shall be interlocked with respective circuit breakers to prevent them making or breaking the current.
- 5.9.11 Automatic safety shutters for all openings which will lead to access to the live parts of the switchgear upon withdrawal or any operation the switchgear components/parts shall be provided, preferably with a padlocking facility.
- 5.9.12 Spring of motor operated spring charged mechanism shall not discharge until they are fully charged and charging means are fully disconnected.
- 5.9.13 Where key interlocking is employed, tripping of a closed circuit breaker shall not occur if any attempt is made to remove the trapped key from the mechanism.
- 5.9.14 Any other interlocks which manufacturer may deem are required for safety and specifically specified interlocks in Purchase data sheet shall be provided.



- 5.9.15 All terminals, connections, which may be 'live' and exposed for accidental contact shall be adequately shrouded.
- 5.9.16 Components within the cubicles shall be properly labelled to facilitate testing.
- 5.10 REMOTE OPERATION / DCS INTERFACE
- 5.10.1 The switchboard shall have provision for remote operation from DCS in terms of closing / tripping and micro-processor based metering suitable for communication with DCS or SCADA for remote indication of current, voltage, real and reactive power, energy, power factor, frequency etc. through communication interface such as RS 485 port.
- 5.11 EARTHING
- 5.11.1 The switchboard shall be provided at the bottom, throughout its entire length with an earth bus of electrolytic copper or aluminum of adequate size to carry the fault current for the duration same as short time rating of the circuit breaker. Earth bus shall have two earthing connection facility at its both ends to suit Contractor's earthing conductor.
- 5.11.2 All non-current carrying metal work, frames and equipment mounted in the switchboard shall be bonded to earth bus.
- 5.11.3 Earthing of moving carriage of draw out equipment shall be achieved by scraping earthing device. The earthing device shall maintain positive earth continuity in all 'Service', 'Test' and 'Isolated' positions.
- 5.11.4 It shall be possible to connect each circuit or set of three phase busbars to earth, either through earthing switches or through the circuit breakers.
- 5.11.5 Alternatively, one earthing trolley suitable for earthing of cables or busbars and common for all circuit breakers of the same type/rating shall be provided / offered.
- 5.12 INSTRUMENT & METERS
- 5.12.1 Electrical indicating instruments shall be with 90° deflection scale and provided with zero adjustment screw outside the cover.
- 5.12.2 Ammeters and voltmeters shall be moving iron type for AC and moving coil type for DC. Watt c meters, power-factor meters, energy meters, reactive volt ampere meters etc. shall be induction disc type.
- 5.12.3 Instruments/meters shall be suitable for mounting flush on the panel with only flanges protecting outside the panel.
- 5.12.4 Instrument dials shall be white with black numbers and lettering. Dials shall be parallax-free.
- 5.12.5 All meters shall be industrial grade with accuracy of class 1.5 unless specifically indicated.



5.12.6 Timers, unless otherwise stated, shall be electronic type and shall have adjustable time setting of 0-60 secs. The time settings, where specified, shall be accurately set before dispatch of the switchboard.

5.13 CONTROL WIRING

5.13.1 All wiring for control, protection, alarm and indicating circuits on all equipment shall be carried out with at least 650V grade, PVC insulated, stranded, and tinned copper, 2.5 sq. mm. Conductors.

5.13.2 All wiring shall be run on the sides of the panels and shall be neatly bunched and cleated without affecting access to equipment mounted in the panel. The control wiring shall be carried in PVC ducts with detachable Snap-On cover and shall have enough length. Where wiring enters or passes through compartments containing HV apparatus then they shall be in earthed metallic conduits or ducts.

5.13.3 All wiring shall be taken to terminal blocks without joints or tees in their run.

5.13.4 All wiring shall be colour coded as follows:

Instrument Transformer AC circuit - Red, Yellow & Blue determined by the phase
with which the wire is associated

AC Phase Wire	-	White
AC Neutral	-	Black
DC Circuits	-	Grey
Earth connections	-	Green

5.13.5 Engraved core identification ferrules, marked to correspond with the wiring diagram shall be fitted to each wire. Ferrules shall fit tightly on the wires and shall be of interlocking type, without falling off when wire is removed. Ferrules shall be of white colour with black lettering. Each wire shall be identified by letter to denote its function followed by a number to denote its identity at both ends.

5.13.6 All wiring for external connections shall be brought out to individual terminals on a readily accessible terminal block.

5.13.7 All unused auxiliary contacts of the circuit breaker and relays shall be wired up to terminal block.

5.14 FITTINGS AND ACCESSORIES

5.14.1 INDICATING LAMPS

a. Indicating lamps shall be LED or low wattage filament type with series resistor except where neon lamps are specifically called for.



- b. Lamp covers shall be provided with interchangeable coloured lenses of Perspex or equivalent unbreakable material. The lenses shall not discolour in course of time due to heat of the lamp.
- c. Bulbs and lenses shall be interchangeable and replaceable from the front.
- d. Following colours shall be used for the function indicated, unless otherwise specified: -
 - Red - Circuit breaker 'ON'
 - Green - Circuit breaker 'OFF'
 - White - Continuous trip circuit supervision
 - Amber - Auto trip
 - White - Spring charged
 - R,Y,B - Potential indication

5.14.2 PUSH BUTTONS

- a. All push buttons shall be of double break parallel contact design type.
- b. 'Start' & 'Stop' push buttons shall be coloured green and red respectively. Reset push buttons shall be yellow in colour and test push buttons shall be blue in colour. All other push buttons shall be black in colour.
- c. Emergency stop push buttons shall be lockable in the operated position, i.e. push to operate and key to release type. Push buttons for emergency stop shall be recessed /shrouded type to avoid accidental operation.

5.14.3 CONTROL & SELECTOR SWITCHES

- a. Control & Selector Switches shall be of rotary type, having enclosed contacts accessible only after removal of cover.
- b. All control & selector switches for circuit breakers and instruments shall be mounted on the front of the panel. Control switches for space heater/s and control supplies shall be mounted inside the panel.
- c. Circuit Breaker control switches shall be provided with pistol grip handles. Selector switches shall be provided with round, knurled handles. All handles shall be black in colour. Properly designated name plates clearly marked to show the operating positions shall be provided on all switches.
- d. Circuit breaker control switches shall be with pistol grip handle and shall have three position Trip – Neutral – Close with spring return to Neutral position. Switch operating mechanism shall prevent the switch from being operated twice successively in the same direction. Circuit breaker control switch shall have one NAC – contact along with other contacts as required.
- e. All other instruments and selector switches shall have stay put contacts.



- f. Contacts of all control & selector switches shall be rated for 10 Amps at 240V AC or 2amps at 220V dc (Inductive break). Switch for space heater supply and control voltage supply shall normally be two pole rated for 25A A.C.

5.14.4 CONTROL TERMINAL BLOCKS

- a. Box – clamp type, 650V grade line-up terminals of minimum 2.5 sq.mm. size shall be provided. Connection to terminals shall not be from the back.
- b. Not more than one wire on each side shall be connected on any terminal where duplication of terminals block/s is necessary, suitable solid bonding links shall be incorporated.
- c. Terminal blocks at different voltage shall be segregated into groups and distinctly labelled.
- d. Current transformer secondary leads shall be brought to terminal blocks having facility for short circuiting and grounding the secondary.
- e. Terminals shall be numbered for identification and grouped according to function. Engraved back-on-white PVC labels shall be provided on the terminal blocks describing the function of the circuit.
- f. Separate terminal stems shall be provided for internal and external wiring.
- g. Control terminal blocks shall be so located that control cables are fully segregated from power cables. Suitable insulated or earthed metal race ways shall be provided for control wiring. Separate undrilled removable gland plate shall be provided for the control cable sat the bottom of each panel.
- h. Minimum 10% or 4 number spare terminals shall be provided for future use.

5.14.5 NAMEPLATES & LABELS

- a. One nameplate giving designation of the HV switchboard shall be affixed prominently on top of the switchboard. Details of designation will be specified.
- b. Labels giving following details shall be affixed on each feeder panel:
- i. Feeder No.
 - ii. Equipment reference No. & description
 - iii. Rating (HP / KW / KVA / Amp.)
- d. All components whether mounted inside or on the door shall be permanently & clearly labelled with reference number and/or letter or their function. Rating of fuse shall be part of fuse designation. Paper labels, stickers or labels fixed with adhesives are not acceptable. All labels shall be properly fixed by screws with provision to prevent distortion due to expansion.



- e. All labels shall be non-corroding, preferably laminated plastic or rear engraved Perspex with white letters on black background.
- f. Labels for feeder panel designation fixed on front side shall be fitted with chrome-plated, self-tapping, countersunk-head screws. These labels shall be of identical size to permit Interchangeability.

5.14.6 SPACE-HEATERS

- a. Adequately rated anti-condensation space heaters shall be provided in each cubicle.
- b. Space heater/s shall be strip type, rated for operation at 240V, single phase 50 Hz AC supply unless otherwise specified.
- c. Each space-heater shall be complete with a rotary type ON/OFF switch, HRC fuse in the phase, neutral link in neutral and a control thermostat with temperature range of 25 –750C.
- d. The space heaters shall be rated for maintaining the panel inside temperature 10°C above outside ambient temperature.

5.14.7 CUBICLE LIGHTING

Each cubicle shall be provided with interior lighting by means of 20W fluorescent tube light fixture. An ON / OFF switch shall be provided. The lighting fixture shall be suitable for operation from a 240V, single phase, 50 Hz, A.C. supply unless otherwise specified.

5.14.8 AUXILIARY SUPPLY

Auxiliary supply for control, indication, space heater, etc. shall be made available at one point on the switchboard. Vendor shall provide suitable distribution of auxiliary supply in the switchboard.

5.14.9 FUSES

- a. All fuses in control, indication & metering circuit shall be HRC link type fuse fittings of English Electric make, NS type.
- b. Mounting of fuse fitting shall ensure adequate dissipation of heat generated and shall facilitate inspection & easy replacement of fuse.

5.14.10 CABLE TERMINATION

- a. The switchboard panel shall be complete with suitable cable and sealing boxes for termination of various types & no. of cables as specified elsewhere. Cable and sealing box shall preferably be mounted inside the panel. Where XLPE cables are indicated cabling space & clearances shall be adequate for heat shrinkable termination e.g., Raychem or cold-flowing stress grading joints e.g., Tape x or cold shrinkable type.
- b. Two earthing terminals shall be provided in each panel in cable box/cabling chamber, for earthing or armour / screen.



- c. Where more than one core is terminated on each phase, links suitably designed and properly supported shall be provided to avoid unnecessary bending of cable cores, without decreasing the length of insulated cable tail. Electrical clearances which would normally be obtained when using one core per phase shall be maintained.
- d. Compression type cable glands shall be provided for other power & control cables with PVC / XLPE insulated cables.
- e. Where core-balance type current transformers are provided on switchgear feeder circuit cable/s for earth fault protection sufficient space, clearance and supporting / mounting arrangement shall be provided for the current transformer.
- f. When specifically called for, a throat connection may be provided for connection to the bus trunking for incoming supply.

5.14.11 PAINTING

- a. All metal surfaces shall be thoroughly cleaned and degreased to remove scale, rust, grease and dirt. Fabricated structures shall be pickled and then rinsed to remove any trace of acid. The surface shall be prepared by applying a coat of phosphate paint and coat of yellow zinc chromate primer. The surfaces shall be made free from all imperfections before undertaking the finishing coat.
- b. After preparation of the surfaces, the switchboard shall be powder coated with two coats of epoxy based final paint. Colour shade of final paint shall be as specified in datasheet. The finished panels shall be dried in stoving ovens in dust free atmosphere. Panel finish shall be free from imperfections like pinholes, orange peels, runoff paint etc.
- c. All unpainted steel parts shall be cadmium plated or suitably treated to prevent rust formation. If these parts are moving elements then they shall be greased.

6.0 INSPECTION AND TESTING

- 6.1 After completion of all work at the manufacturer's works the switchboards shall be inspected and tests witnessed by the Purchaser's representative. However, stage inspection may be carried out from time to time to check progress of work and workmanship. The following tests shall be carried out:
 - 6.1.1 All routine tests specified in relevant Indian / British Standards shall be carried out on all circuit breakers.
 - 6.1.2 Test for protective relay operation by primary or secondary injection method.
 - 6.1.3 Operation of all meters.
 - 6.1.4 Secondary wiring continuity test.
 - 6.1.5 Insulation test with 1000 Volts megger, before and after High voltage test.
 - 6.1.6 HV test on primary & secondary circuits and components on which such test is permissible.



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- 6.1.7 Simulating external circuits for remote operation of breaker, remote indicating lights and other remote operations, if any.
- 6.1.8 Measurement of power required for closing / trip coil of the breaker.
- 6.1.9 Pick-up and dropout voltages for shunt trip and closing coils.
- 6.1.10 CT Polarity test.
- 6.1.11 Heat run test of bus bars (if specified)
- 6.2 Vendor shall provide all facilities such as power supply, testing instruments, and apparatus required for carrying out the tests. Required copies of test certificates for all the tests carried out along with copies of type test certificates and certificates from Sub-Vendor for the components procured from them are to be submitted before dispatch of switchboards.
- 6.3 DRAWINGS AND INFORMATION
- 6.3.1 The Vendor shall furnish following drawings/documents in accordance with "Vendor Document Requirements" attached elsewhere.
- General Arrangement Drawing of the Switchboard, showing front view, plan, foundation plan, floor cutouts / trenches for external cables and elevations, transport sections and weights.
 - Sectional drawings of the circuit breaker panels, showing general constructional features, mounting details of various devices, busbars, current transformers, cable boxes, terminal boxes for control cables etc.
 - Schematic and control wiring diagram for circuit breaker and protection including indicating devices, metering instruments, alarms, space heaters etc. Vendor drawings to be based on Contractor's Control Wiring Diagram, if furnished.
 - Terminal plans showing terminal numbers, ferrules markings, device terminal numbers, function etc.
 - Relay wiring diagrams
 - Equipment List.
 - Detailed calculations of bus bar sizing shall be furnished.
- 6.3.2 Vendor shall furnish required number of copies of above drawings for Purchaser's review. Fabrication of Switchboards shall start only after Purchaser's clearance for the same. After final review, required number of copies and reproducible shall be furnished as final certified drawings.
- 6.3.3 The information furnished shall include the following:
- Technical literature, giving complete information of the equipment.
 - Erection, Operation and Maintenance Manual, complete with all relevant information, drawings, and literature for auxiliary equipment and accessories, characteristics curves for relays etc.
- A comprehensive spare parts catalogue.







Energising Quality

VCS Quality Services Pvt. Ltd

STANDARD SPECIFICATION FOR SEALED MAINTENANCE FREE VRLA BATTERIES

VCS – SS – EL - 4042

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
02	14.03.2022				
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01	16.10.2019	MG	VV	AD	SK	New revision system updated
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ABBREVIATION

BIS/IS	Bureau of Indian standards
IEC	International Electro-Technical Commission
BS	British Standards
IEEE	Institute of Electrical and Electronics Engineers
NEMA	National Electrical Manufacturers Association
OISD	Oil Industries Safety Directorate
CCE	Chief Controller of Explosive
DGMS	Director General Mines Safety
IE Rules	Indian Electricity Rules
CPRI	Central Power Research Institute
DC	Direct Current
Ah	Ampere hour
PVC	Poly Vinyl Chloride
VRLA	Valve-regulated lead-acid

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1.0 SCOPE

The intent of this Specification is to define the design, manufacture, testing & supply of stationary SEALED MAINTENANCE FREE VRLA batteries for DC power system /AC UPS application.

2.0 REFERENCE DOCUMENTS

2.1 The equipment shall comply with the requirements of the latest revision of the following Standards issued by BIS (Bureau of Indian Standards) unless otherwise specified.

IS-15549	Stationary SEALED MAINTENANCE FREE VRLA batteries
ANSI T1 330	SEALED MAINTENANCE FREE VRLA Batteries used in the telecommunication Environment.
ASTM D2863	Test method for measuring the minimum oxygen concentration to support candle like combustion of plastics (Oxygen Index).
IEC 60896-21	Stationary lead-acid batteries - Part 21: VRLA types -Methods of test
IEC 60896-22	Stationary lead-acid batteries - Part 22: VRLA types- Requirements
IEC-60068-2	Environmental testing

2.2 The equipment shall also conform to the provisions of CEA regulations with latest amendments and other statutory regulations currently in force in the country.

2.3 In case of imported equipment, Standards of the country of origin shall be applicable if these Standards are equivalent or more stringent than the applicable Indian Standards.

2.4 The equipment shall also conform to the provisions of Indian Electricity Rules and other statutory regulations currently in force in the country.

2.5 In case Indian Standards are not available for any equipment, Standards issued by IEC/ BS/ VDE/ IEEE/ NEMA or equivalent agency shall be applicable.

2.6 In case of any contradiction between various referred Standards / Specifications / Data Sheets and statutory regulations, the following order of priority shall govern:

- a. Statutory regulations.
- b. Data Sheets.
- c. Job Specification.
- d. Standard Specification.
- e. Codes and Standards.

3.0 DEFINITIONS

For the purpose of this document, the words and expressions listed below shall have the meanings assigned to them as follows:

OWNER / COMPANY OWNER of the particular Project (Project Specific).

CONSULTANT	The party which is doing engineering, procurement, construction, pre-commissioning and assistance for commissioning, monitors and controls the overall project management.
BIDDER / SUPPLIER / VENDOR	The party(s) which manufactures and / or supplies material, equipment, technical documents / drawings and services to perform the duties specified by Contractor.

4.0 MATERIALS

- 4.1 The terminal posts shall be suitable for acidic condition operation. The terminals shall be suitable for short circuit current and specified discharge current without damage to the cell as a result of terminal heating.
- 4.2 Stationary SEALED MAINTENANCE FREE VRLA cells shall be designed to withstand the mechanical stresses encountered during normal transportation and handling.

5.0 DESIGN

5.1 General Requirements

- 5.1.1 The offered equipment shall be brand new with state-of-the-art technology and proven field track record. No prototype equipment shall to be offered.
- 5.1.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 3 years from the date of supply.
- 5.1.3 Vendor shall give a notice of at least one year to the end user of equipment before phasing out the product/ spares to enable the end user to place order for spares and services.

5.2 Technical Requirements

- 5.2.1 The standard rated ampere hour capacity of the cell/ battery shall be at a reference temperature of 27°C, constant current discharge at 10 hours rate (C10) and an end cell voltage of 1.85V/cell.
- 5.2.2 The SEALED MAINTENANCE FREE VRLA cell/battery shall be suitable for float duty operation with a constant voltage permanently applied to its terminals which is sufficient to maintain it in a state close to full charge and shall be designed to supply load in the event of normal power supply failure. Type of plate construction for batteries shall be as per the Data Sheet.
- 5.2.3 The components such as containers, lids, covers and seals used in manufacture shall meet the Fire, flame and smoke resistance rating as defined in IS 15549 and have an oxygen Index of at least 28 in accordance with ASTM D-2863.

- 5.2.4 Each cell/battery shall have a separate container of 2.0V (nominal voltage). The cell container shall be made of high strength acid resistant material and designed to withstand mechanical stresses, shocks, vibrations and shall be consistent with the life of the battery.
- 5.2.5 The design of SEALED MAINTENANCE FREE VRLA cell shall be such that regulating valve shall not allow the gas (air) to enter into the cell but shall allow the gas to escape from the cell above certain internal pressure which shall not lead to deformation or cause container to crack or cause failure of seals or shall not cause bulging/ cracking of cell cover.
- 5.2.6 The hydrogen released from SEALED MAINTENANCE FREE VRLA cells shall be sufficiently low to make these cells suitable for use in office, control rooms and equipment environments. The gas leakage rate of the cell shall not exceed 0.05cm³/hr at 27°C and 101.3kpa
- 5.2.7 SEALED MAINTENANCE FREE VRLA stationary cells/battery shall be designed to withstand the mechanical stresses encountered during normal transportation and handling.
- 5.2.8 The terminal posts shall be casted of lead alloy with copper/brass insert for enhancement of conductivity. The terminals shall be suitable for maximum discharge current and short circuit current without damage to the cell as a result of terminal heating. The temperature of the SEALED MAINTENANCE FREE VRLA cells shall be sufficiently low to prevent thermal runaway (critical condition arising due to constant voltage charging).
- 5.2.9 On float, the cell/battery shall be suitable for being recharged to 90% of ampere hours within 24 hours and to 100% within 4 days
- 5.2.10 Ampere hour of the battery shall be selected based on the following:
- a. Minimum site ambient temperature of 10°C or as defined in the Data Sheet.
 - b. Discharge duty cycle.
 - c. End cell voltage.
 - d. Ageing factor of 0.8
 - e. Design margin of 10%, if not defined in the Data Sheet
 - f. Capacity rating factor.
- 5.2.11 Number of cells and end cell voltage shall be decided by the Vendor on the basis of maximum permissible voltage to the load when batteries are float charged while feeding the Load and minimum DC system voltage. However, the number of cells and end cell voltage shall be as per the Data Sheet, unless otherwise specified.
- 5.2.12 The battery shall be suitable for being boost charged to fully charged condition from fully discharged condition within 10 hours, unless otherwise specified.
- 5.2.13 Battery assembly shall be supplied fully charged condition.
- 5.2.14 The following information shall be permanently marked on the cell.
- a. Nominal voltage

- b. Name of manufacturer/model reference
- c. Rated capacity in ampere hours (Ah) with End Cell Voltage
- d. Voltage for float operation at 27°C with tolerance of $\pm 1\%$, Month and year of manufacture
- e. Polarity Marking.

5.2.15 Each set of battery shall be supplied with all the accessories, including, but not limited to the following:

- a. Battery stands in formation as per Data Sheet. Mild steel stand pretreated and epoxy painted /PVC coated.
- b. Inter cell, inter row and interbank connectors and end take offs. These shall be of tin plated copper/flexible-insulated copper cable.
- c. Stand insulator & Portable voltmeter for cell voltage measurements.
- d. Cell number plates, Lugs for cable termination.
- e. Other accessories and their quantity as per Data Sheet.

5.3 Performance

SEALED MAINTENANCE FREE VRLA Stationary batteries shall have been type tested to meet the performance requirements for each design and Ah rating of cells as per the relevant Indian standard referred in clause 2.1 above.

5.4 Site condition

SEALED MAINTENANCE FREE VRLA stationary cell/battery shall be suitable for operating satisfactorily in humid and corrosive atmosphere found in fertilizer plants, refineries, CNG stations, petrochemical and gas processing plants, metallurgical plants and other industrial plants. Service conditions shall be as specified in the data sheets/job specification. If not specifically mentioned therein, a design ambient temperature of 45°C and an altitude not exceeding 1000m above MSL shall be considered, with minimum temperature of 10°C for battery sizing.

6.0 FABRICATION

- 6.1 Flame arrestor shall be mounted on the cell so that all the vented gases diffuse through the arrestor to the outside environment. The construction of the arrestor shall be such that hydrogen burning on the external surface of the arrestor shall not propagate back into the cell to cause explosion.
- 6.2 Each cell shall have a separate container. The cell container shall be of high strength alkali resistant material and designed to withstand mechanical stresses, shocks and vibrations. The cell container shall be translucent /transparent.

7.0 INSPECTION AND TESTING

- 7.1 Batteries shall be subject to inspection by Consultant/Owner or by an agency authorized by the Owner to assess the progress of work. The manufacturer shall furnish all the necessary information concerning the supply to Consultant/Owner's representative.
- 7.2 Consultant/Owner's Representative shall be given free access in the works from time to time for stage wise inspection and progress reporting. Four weeks advance notice shall

be given to witness the final routine tests and other tests as agreed upon.

7.3 The routine, acceptance & type testing shall be carried out as per Inspection & test plan for stationary SEALED MAINTENANCE FREE VRLA battery. Routine tests shall be conducted on each cell/battery. Acceptance tests & Type tests shall be conducted on few Cells/batteries as per relevant Indian standard. Battery load test shall also be performed at site after installation as part of commissioning

7.4 Following tests shall be carried out as a minimum for each Ah rating of cells/battery:

a. Routine test

- i. Physical examination test.
- ii. Polarity and absence of short circuit.
- iii. Dimension, Mass and layout.
- iv. Marking and packing.

b. Acceptance test

- i. Marking and packing.
- ii. Verification of dimensions.
- iii. Test for Ah capacity
- iv. Test for voltage during discharge
- v. Internal resistance test.

c. Type test

- i. Verification of constructional requirement.
- ii. Test for voltage during discharge.
- iii. Test for Ah capacity.
- iv. Test for charge retention/loss of capacity if specified in the data sheet.
- v. Air pressure test.
- vi. Ampere hour and Watt-hour efficiency test.

7.5 Battery duty cycle test to meet the load cycle requirement shall also be performed at site after installation as part of commissioning unless otherwise defined in the Data Sheet.

8.0 MARKING, PACKING AND SHIPMENT

8.1 All the equipment shall be divided into several sections for protection and ease of handling during transportation. The equipment shall be properly packed for transportation by ship/rail or trailer. The equipment shall be wrapped in polythene sheets before being placed in crates/cases to prevent damage to finish. Crates/cases shall have skid bottom for handling. Special notations such as 'Fragile', 'This side up', 'Centre of gravity', 'Weight', 'Owner's particulars', 'PO nos.' etc., shall be clearly marked on the package together with other details as per purchase order.

The equipment may be stored outdoors for long periods before installation. The packing shall be completely suitable for outdoor storage in areas with heavy rains/high ambient temperature, unless otherwise agreed.



ENERGISING QUALITY

VCS QUALITY SERVICES PRIVATE LIMITED

DATA SHEET FOR SERVO CONTROLLED STABILIZER

VCS – DS – EL - 096

00	18.01.2021	ISSUED AS STANDARD	MG	RD	AD	SK
Rev. No	Date	Purpose	Prepared By	Checked By	Approved By	Approved By



**DATA SHEET
FOR
SERVO CONTROLLED VOLTAGE STABILIZER**

**DOCNO: VCS-DS-EL-096
Rev No : 00**

Servo-Voltage Stabilizer Copper Wound Outdoor/Indoor Type

Rated Capacity	As per SOR
Input Voltage Range	320 to 490V AC Phase voltage 3Ph 50Hz, UNBALANCED SUPPLY
Output Voltage Ranges	415V +/- 1%
Load Power Factor	0.80
Control Power Supply	Not Available
Cooling	Oil Cooled
Control Type	Digital Microcontroller Based. Each phase to be separately controlled to provide balanced output voltages
Ambient temperature	45°C
Temperature Rise (max):	45°C Above ambient temp.
Voltage Correction	Step less with no overshooting or hunting during automatic operation.
Correction Speed	60 V/Sec or better
Output Voltage Regulation	+/-1% from No-load to Full-load.
Winding	Copper wound vacuum impregnated
Location/Mounting	Outdoor/ Indoor floor mounting.
Trip and Restart	Auto System
Overload Capacity	120%
Protection/Switching	<ul style="list-style-type: none"> • Input and Output MCCB with O/L and S/C protection • Bypass with contactor • High/Low input voltage cut-off • Protection against phase failure/phase reversal.
Duty Cycle	100% Continuous
Frequency	50 Hz
Waveform Distortion	Nil
Effect of Load PF	Nil
Mounting	On Unidirectional Wheel
Audio-Visual Alarm	For tripping condition
Reset	Manual / Auto reset with time delay and programmable
Transient Suppression	Above 270 V 1ph & 450 V 3ph
System	Unbalanced 4 wire R Y B N
Connection	Star
System Construction	As per IS:9815-1994
Terminations	As per IS:3347



**DATA SHEET
FOR
SERVO CONTROLLED VOLTAGE STABILIZER**

**DOCNO: VCS-DS-EL-096
Rev No : 00**

Efficiency	Above 98%
Environment	For outdoor/ Indoor Continuous Operation
Provision for Cabling	Input and output terminations with provisions for fixing Cable Glands
Start	Manual and Auto start facility
Response time	Less than 100ms
Earthing	With Earthing terminals
Digital Metering Display Type:	Following shall be provided for input and output: A. Input phase to neutral. B. Input phase to phase. C. Output phase to neutral. D. Output phase to phase. E. Load current in all phases. F. Frequency. G. Indicating Lamps
Insulation	Class F
Testing	Voltage stabilizer shall be tested at site for 6 hours with available voltage and the load
Guaranteed/warranty	Stabilizer shall carry a guaranty/warranty of 24 months from the date of installation, against manufacturing defects.

OtherFeatures:

1. Electronic over and under voltage trip with time delay for input and output.
2. Electronic overload protection and Short circuit protection through MCB/MCCB (35kA).
3. Manual Bypass arrangement. By means of On-load changeover switch
4. Phase reversal protection and Cutoff.
5. Single Phase Prevention and Cutoff.
6. Neutral failure protection.
7. Frequency cut-off protection.
8. Earth neutral voltage cut-off protection.
9. Including first filling of cooling oil.
10. Compatible to Generator Supply.
11. Supplier should undertake to support the product for a minimum period of 5 years (post- warranty). Post Warranty, AMC charges for a period of 3 years (annual basis) should also be quoted separately in the bid.
12. Pre-dispatch/Installation Inspection: The designated officials of VCS/Client will inspect the stabilizer to their satisfaction before actual supply of the product.
13. Pre-installation Site Requirements should be informed to VCS/Client at least 15 Days of the actual installation.

AcceptanceTestRequirements

- a. Acceptance Tests as per conditions mentioned in Clause 11.15 of IS: 9815(Part-1) /1994 (Reaffirmed 2004).
- b. Servo motors, auto transformer, MCB, MCCB & meters etc fitted should be of approved make and meters should be of accuracy class-1.5 .

- c. Output voltage test shall be done by direct loading for ratings up to 5 KVA. For ratings above 5KVA impedance voltage shall be measured by short circuiting the output terminals and full load current shall be passed through the short circuited output and corresponding input voltage shall be measured as impedance voltage (variac of servo LVC shall be at the minimum input voltage position of SLVC). Output voltage shall be checked at no load with an input voltage = minimum of input voltage range of servo LVC - impedance voltage, and the output voltage obtained shall be within specified limits.

**TECHNICAL COMPLIANCE STATEMENT FOR ___ KVA SERVO
CONTROLLED AUTOMATIC VOLTAGE STABILIZER. TO BE
FILLED IN BY THE VENDOR**

TECHNICAL REQUIREMENTS	COMPLIED YES/NO
Rated Capacity	_____ KVA
Input Voltage Range	320-490V AC Phase voltage 3Ph 50Hz, UNBALANCED SUPPLY
Output Voltage Ranges	415V +/- 1%
Load Power Factor	0.80
Cooling	Oil Cooled
Control Type	Digital Microcontroller Based. Each phase to be separately controlled to provide balanced output
Ambient temperature	45°C
Temperature Rise (max):	45°C Above ambient temp.
Voltage Correction	Step less with no overshooting or hunting during automatic operation.
Correction Speed	60 V/Sec or better
Output Voltage Regulation	+/-1% from No-load to Full-load.
Winding	Copper wound vacuum impregnated
Mounting	Indoor floor mounting.
Trip and Restart	Auto System
Overload Capacity	120%
Protection/Switching	<ul style="list-style-type: none"> • Input and Output MCCB with O/L and S/C protection • Bypass with contactor • High/Low input voltage cut-off • Protection against phase failure/phase reversal.
Duty Cycle	100% Continuous
Frequency	50 Hz
Waveform Distortion	Nil



**DATA SHEET
FOR
SERVO CONTROLLED VOLTAGE STABILIZER**

**DOCNO: VCS-DS-EL-096
Rev No : 00**

ENERGISING QUALITY

Effect of Load PF	Nil	
Mounting	On Unidirectional Wheel	
Audio-Visual Alarm	For tripping condition	
Reset	Manual / Auto reset with time delay and	
Transient Suppression	Above 270 V 1ph & 450 V 3ph	
System	Unbalanced 4 wire R Y B N	
Connection	Star	
System Construction	As per IS:9815-1994	
Terminations	As per IS:3347	
Efficiency	Above 98%	
Environment	For Indoor Continuous Operation	
Provision for Cabling	Input and output terminations with provisions for fixing Cable Glands	
Start :	Manual and Auto start facility	
Response time	Less than 100ms	
Earthing	With Earthing terminals	
Digital Metering Display Type:	Following shall be provided for input and output: H. Input phase to neutral. I. Input phase to phase. J. Output phase to neutral. K. Output phase to phase. L. Load current in all phases. M. Frequency. N. Indicating Lamps	
Insulation	Class F	
Testing	Voltage stabilizer shall be tested at site for 6 hours with available voltage and the load	
Guaranteed/warranty	Stabilizer shall carry a guaranty/warranty of 24 months from the date of installation, against manufacturing defects.	

Signature & Seal of the Supplier

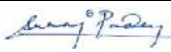





Energising Quality

VCS Quality Services Pvt Ltd

STANDARD DATASHEET FOR UPS SYSTEM

VCS-DS-EL-4031

Rev	Date	Prepared By	Checked By	Approved By	Authorized By
02	25.04.2022				
01	14.09.2020	MG	VV	AD	SK
00	14.11.2017	MG	RD	AD	SK

UNCONTROLLED COPY	:	If printed
CONTROLLED COPY	:	If in soft and signed



Energising Quality

STANDARD DATA SHEET FOR UPS SYSTEM

Doc number: VCS-DS-EL-4031

Rev : 02

Rev.	Revision Date	Prepared by	Checked by	Approved by	Authorized by	Revision Description	
00	14.11.2017	MG	RD	AD	SK		
01	14.09.2020	MG	VV	AD	SK		
02	25.04.2022	SP	RD	AA	HK		



Energising Quality

STANDARD DATA SHEET FOR DISTRIBUTION UPS

Doc number: VCS-DS-EL-4031

Rev : 02

GENERAL INFORMATION

Applicable To: Proposal	Purchase	As Built	Vendor shall complete Data Sheet with information not otherwise provided by Buyer.	
Client:				
Facility:			Tag Number:	
Location:			Manufacturer/Model No.:	
Service:				

[TECHNICAL DATA SHEET]

A	Site conditions			
1	Ambient temperature:		3	Altitude: <1000m
(a)	Maximum ambient temperature:	50°C	4	Atmospheric condition: Highly corrosive
(b)	Minimum ambient temperature:	5°C	5	Location: Indoor
(c)	Design ambient temperature:	55/-4 °C	6	Applicable specification - VCS-SS-EL-4011
2	Design temperature for battery sizing	10 °C		
B	Input power supply			
1	Voltage :	415V ± 10%	3	Phase : TPN
2	Frequency :	50Hz ± 3%	4	System fault level : 19 kA
C	System requirements			
1	Equipment tag no.:		11	Type of battery : SMF VRLA
2	Type of Inverter : IGBT/Transistorised		12	Battery backup time : As per SOR
3	Rating :	kVA (0.8 P.F.)		Load Description
4	Phase :			Dispenser -
5	Output voltage :	230V ± 1%		LCV -
6	Output frequency :	50Hz ± 1%		Compressor PLC -
7	Mode of operation :	Parallel Redundant		
8	Load power factor		13	Battery rack : Double row double tier
	Rated :	0.8 (lag)	14	IP of enclosure: IP-42 min.
	Variation :	0.6-1.0 (lag)	15	Cable entry: Top & Bottom
9	Fault diagnostic unit :		16	Colour shade: RAL 7032
10	Cell booster			
D	UPS distribution board (Outgoing feeder details)			
1	Incomer Rating			
2	Mounting - wall			
3	Nos of outgoing feeders			
4	KVA rating of feeders			
5	Switching rating of fuse			
6	Voltmeter - yes			
7	Busbar material - copper			
8	Paint - RAL 7032			
	* Refer SLD for more detail of UPSDB			
F	Specific requirements			
	a) All interconnecting cables between all panels of UPS system are included in vendor's scope			
G	UPS system			
1	Make :		9	Noise level : db
2	Type designation :		10	Guaranteed overall dimensions of UPS system except UPSDB and battery,
3	Rating :	kVA at 0.8 p.f.		
4	Mode of operation :			- Length: mm
5	Output voltage distortion under the following conditions,			- Depth: mm
	For 50% step load :	V± %		- Height: mm
	For 100% step load :	V± %	11	Efficiency of each rectifier and inverter module including input and output transformer
	For 100% step unload :	V± %		
	Power supply interruption and restoration :	V± %		At 100% load : %
	Load transferred to bypass line :	V± %		At 75% load : %
	When one inverter gets faulty and load transferred to healthy inverter :	V± %		At 50% load : %
				At no load : %
6	Phase angle distortion under the following conditions,		12	Efficiency of bypass stabiliser including input transformer,

	(for three phase inverter only)		At 100% load :	%
	For 50% step load :	120°± %	At 75% load :	%
	For 100% step load :	120°± %	At 50% load :	%
	For 100% step unload :	120°± %	At no load :	%
	Power supply interruption and restoration :	120°± %	13 Heat loss for the total system :	kW
	Load transferred to bypass line : 120°± %		14	
	When one inverter gets faulty and load transferred to healthy inverter : 120°± %		Overall efficiency of UPS system	
7	Maximum recovery time to reach steady state after above disturbances :	milli sec.	At 100% load :	%
			At 75% load :	%
8	Redundancy of cooling system :		At 50% load :	%
			At no load	%
H Inverter				
1	Rating :	kVA	10	Short circuit capacity & duration :
2	No. of phase(s) :		11	Output voltage/phase angles (for 3 phase only),
3	Steady state output voltage,			For 30% unbalance load :
	Nominal : V			For 40% unbalance load :
	Variation : V			For 50% unbalance load :
4	Output voltage adjustment range at rated load :			For 100% unbalance load :
			12	Type of control circuit :
5	Input DC voltage,		13	Max. allowable rating of outgoing feeders for fault clearance of feeder fault by UPS with mains bypass supply back up,
	Nominal : V			
	Range : V			
6	Frequency variation limit for inverter when phase locked with mains :			- With fast acting semiconducting fuses : amps.
7	Allowable unbalance between phases : (for 3 phase only)			- With normal HRC fuses : amps.
8	Harmonic distortion at inverter output at rated load,			
	For linear load:			
	For non linear load:			
9	Overload capacity & duration :			
	For 110% load:			
	min.			
	For 125% load: min.			
	For 150% load: sec.			
I Static switches				
1	No. of static switches in the UPS system :		3	Type of static switch :
2	Current rating at specified ambient,		4	Transfer time,
	Continuous :	A		Synchronised mode : milli sec
	Short time :	A		Unsynchronised mode : milli sec
J Battery charger (Connected to Grid Supply)				
1	Current rating :		(a)	Float charging condition : V
2	Output voltage accuracy under specified input		(b)	Boost charging condition : V
3	Maximum ripple content on DC side with battery		5	Maximum harmonic content in input current :
(a)	Connected :		6	Input transformer rating : kVA
(b)	Dis Connected :			
K Manual transfer devices				
1	Make		(a)	Continuous :
2	Type designation		(b)	Short time :
L Battery				
1	Make :		11	Overall rack dimension
2	Type designation			Length : mm
3	Type :			Depth : mm
4	AH rating :			Height mm
5	End cell voltage :		12	Battery charging requirements,
6	Nominal Voltage :		13	Nominal voltage/cell : V
7	Boost charging time :		14	Float voltage/cell V
8	No. of cells in each bank :		15	Boost charging voltage/cell :
9	No. of battery banks :		16	Container type :
10	No. of racks :		17	No. of recommended air changes/hour for battery room : m ³

M	Step-down bypass transformer with solid state voltage stabiliser								
1	Make :	5	Accuracy of stabiliser :	%					
2	Type designation	6	Type of control :						
3	Rating : kVA	7	Type of cooling :						
4	Voltage ratio :	8	Type of stabiliser :						
N	UPS distribution board								
1	Make :	6	Overall dimensions:						
2	Type designation :		Length :	mm					
3	Rating :		Depth :	mm					
4	Degree of protection		Height	mm					
5	No. of outgoing Feeder / rating of each								
O	Cell booster								
1	Make :	5	Overall dimensions:						
2	Type designation :		Length:	mm					
3	Voltage range		Depth:	mm					
4	Current range		Height	mm					
P	Reliability								
1	Safety factor used for selecting the components		4	MTBF/MTTR:					
2	Electronic devices		5	Availability factor:					
3	Electrical devices								



Energising Quality

PROJECT NUMBER: C231099



Goa Natural Gas Pvt.Ltd.
A Joint Venture of GAIL Gas Ltd & BPCL

DATA SHEET FOR INSULATING JOINT

TOTAL SHEET

05

DOCUMENT NO

C231099

00

PP

DS

2002

GOA NATURAL GAS PRIVATE LIMITED (GNGPL)

CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

REV	DATE	DESCRIPTION	PREP	CHK	APPR
C1	15.11.2023	ISSUE FOR CLIENT REVIEW	MNH	VI	AK

Insulating Joint Manufacturer

-



Goa Natural Gas Pvt.Ltd.
A Joint Venture of GAIL, Gas L&F & BPL

CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

IJ Material Requisition (MR).	C231099-00-PP-MR-2002
IJ Specification No.	VCS-SS-PP-2029
<u>DESIGN DATA FOR INSULATING JOINT FOR CS LINE</u>	
Service, Design Life (Minimum)	Natural Gas, 25 yrs.
Size (OD), mm	114.3 (4") to 406.4 (16")
Design Pressure	49 kg/cm ²
ANSI Rating / Design Factor	300# /0.4
Design Temperature (°C)	-29 to 65
Corrosion Allowance (mm)	1.5
Design Code (Pipeline / Insulating Joint)	ASME B31.8 / ASME Sec VIII Div -I
End Connection/End Finish	Butt weld ends. Bevelled as per Line pipe Specification /API 5L
Insulating Joint type	Monolithic
Installation	Above ground
Piggability	Not Required
Bevel end protection	Required, metallic or high impact plastic bevel protectors;
<u>TESTING</u>	
Charpy Impact Test	Required, at (-)29° C
Hardness Test	Required, maximum hardness of base metal, weld metal & HAZ of all the pressure containing parts shall not exceed 248 HV10
Di-Electric test	5 KV AC, 50 Hz For One Minute Minimum
Insulation Resistance Test	Min. 25 Mega Ohms, when checked with 500-1000 v dc
Hydrostatic Test	At 75 Kg/Cm ² for Minimum Time 15 Minute
Pneumatic Test	5 Kg/cm ² g for minimum Time 10 Minutes.
Internal Vacuum Sustainability	One (1) Millibar
Torsional Test	Required, as per Manufacturer Std
Chemical Test	Required, as per Specification
Allowable Force and Moments	Vendor to Specify



Energising Quality

DATA SHEET FOR INSULATING JOINT

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C231099-00-PP-DS-2002

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C1

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Goa Natural Gas Pvt.Ltd.
A Joint Venture of GAIL, Gas L&F & BPL

CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

Dimensional Check	Required, as per Specification & Approved Drawings/ITP
Visual Inspection	Required, As per Specification & Approved ITP
Other Testing	Required, As per Specification
NDE	<ul style="list-style-type: none"> • Wet MPI on 100% Forged Surfaces (MSS SP 53) • 100% RT of Butt Weld (API 1104) • 100% UT / MPI of fillet welds (As per ASME SEC. VIII) , Refer spec for Fillets Thickness • 100 % UT of Finished Bevel Ends • DP of Butt Weld - 100%

SURFACE PREPARATION, PAINTING & MARKING

Surface Preparation	Shot Blasting to SP10 in accordance with "Steel Structures Painting Council- Visual Standard SSPC-VIS-I
Painting (Internal Coating)	Two-pack (solvent free) non-conducting epoxy compound (cold or hot curing). Total DFT –200 micron. Shade Brown
Painting- External (Non-conducting epoxy :3 Layer Paint System)	Primer: Two Pack Non-Conducting Epoxy, (Total DFT – 200 -micron) Finish Coat: Polyurethane Epoxy – DFT 100-micron, Shade Orange, The coating shall end approximately 75mm from the ends of the joint.
Final Colour Shade	Canary Yellow
Marking	On stainless-steel name plate as per Specification

INSULATING JOINT MATERIAL (EQUIVALENT OR SUPERIOR)

Part	Material of Construction	
	Specified	Offered
Body	<ul style="list-style-type: none"> • ASTM A694 Gr. F56 	
Pups	<ul style="list-style-type: none"> • As per PMS 	
Epoxy resin Filler Material	<ul style="list-style-type: none"> • CIBA Araldite CY-220 & Araldite HT-951 hardener. 	
Spacing Ring (Insulating Ring)	<ul style="list-style-type: none"> • Epoxy glass fiber reinforced laminate (comply with ASTM D 709 Type TV, Group G-11 properties) Average dielectric strength shall be minimum 15 KV. (Compressive Strength \geq 450 MPa) 	

 Energising Quality	DATA SHEET FOR INSULATING JOINT	Document No.	Rev
		C231099-00-PP-DS-2002	C1
		Page 3 of 5	



Goa Natural Gas Pvt.Ltd.
A Joint Venture of GAIL, Gas Ltd & BPL

CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

Sealing Ring /Gasket	<ul style="list-style-type: none">Hardness test, Viton ASTM D2000 or as per Vendor Recommendation		
Sealant Material	<ul style="list-style-type: none">Cold Curing Thermosetting Resin + Hardner. (Compressive Strength \geq 150 Mpa)		
Double Seal Requirement	<ul style="list-style-type: none">Yes		
CONNECTING PIPE DETAILS			
S. No.	Outside Diameter, OD mm (inch)	Wall Thickness, (mm)/ Schedule	Material
1	114.3 (4") to 406.4 (16")	As per PMS	As per PMS

Notes:

1. The internal diameter of Insulating Joint shall be uniform through out the entire length and shall not be less than specified internal diameter of connecting Pipeline.
2. Insulating joint shall comply the requirement of Project Specification VCS-SS-PP-2029.
3. The Charpy Impact temperature shall be (-)29° C as specified in data sheet and shall supersede the temperature requirement specified in Specification
4. For the welding end, the out of roundness and tolerance on internal diameter at pipe ends shall be same as diameter tolerance for the pipe ends indicated in line Pipe Specification & API 5L.
5. Insulating Joint shall be suitable for all type of pigging operation including intelligent pigging.
6. Insulating Joint shall be monolithic boltless.
7. Vendor to ensure that all material specified herein/ offered is suitable for specified fluid type & design & operating Condition.
8. All applicable test (Impact, hardness, Chemical, mechanical etc) shall also be carried out on pup piece.
9. Overall isolating joint's length shall be such that the heat generated by field welding is not detrimental to the insulating, filler materials, and internal/external coating.
10. Vendor shall furnish the allowable forces & moments for the axial, lateral & transverse (i.e., X, Y & Z) directions

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Goa Natural Gas Pvt.Ltd.
A Joint Venture of GAIL, Gas L&E & BPL



CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

11. Manufacturing shall not commence until materials, dimension (including the calculation sheet), drawings, manufacturing process and welding procedure qualification selected by the Manufacturer are approved by COMPANY.
12. Manufacturer shall ensure that the wall thickness (W.T.) of all parts of insulating joint shall be adequate to sustain design pressure and selected W.T. shall be suitable for welding with W.T. of connected pipeline.



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 		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099	
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001A	
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision C1 15.11.2023
Location		-		MR No.	
Sr. No.		-		P.O No.	
1		Valve Manufacturer			
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) / P&ID	
3		Company's Specification No.		VCS-SS-PP-2004	
4		Category		Station Piping Ball Valve	
5		Pipeline Line No		Not Required	
6		Class		30HC	
7		Size		DN 50 (NPS 2") to DN 400 (NPS 16")	
8		Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design/ Fully Welded Body Design as specified in MR, Tight Shut Off (As Applicable)	
9		Type of Port (Full/ Reduced)		As per P&ID	
10		Design Temperature (°C)		Maximum	
11				65	
12				Minimum	
13				-29	
14		Corrosion Allowance (mm)		1.5	
15		Installation (Aboveground/Underground)		AboveGround	
16		Service		Natural Gas (NG)	
17		End Connection		As per P&ID	
18		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)	
19		Design Standards		API 6D	
20		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)	
21		ASME Class		300#	
22		Stem Extension Requirement (If required, Note - 20)		Not Required	
23		Length of Stem Extension		Not Applicable	
24		Orientation of Stem		Perpendicular to Valve axis	
25		Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated	
26		Valve Actuator Operating Time		Not Applicable	
27		Requirement of Locking Mechanism (LO / LC)		As per P&ID	
28		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification	
29		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification	
30		Operator Specification No.		Not Applicable	
31		Valve Design Pressure (kg/cm ²)		49 kg/cm ²	
32		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 73.5 kg/cm ² & Test Duration - 30 Minutes	
33				Seat : 54 kg/cm ² & Test Duration 30 Minutes	
34		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes	
35		Charpy Impact Test (° C)		Yes (at -29 °C)	
36		Fire Safe Design (Note-24)		API 6FA / ISO10497	
37		Anti Static Testing Requirement		As per API 6D Latest Edition	
38		Hardness Test		248 HV10 max	
39		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21	
40		Operator Data Sheet No.		Not Applicable	
41		Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable	
42		Pressure (Min/Nor/Max) (barg)		Not Applicable	
43		Temperature (Min/Nor/Max) (° C)		Not Applicable	
44		Max Shutoff DP (barg)		Not Applicable	
45		Viscosity (cP)		Not Applicable	
46		Density (Kg/m ³)		Not Applicable	
47		Mol . Wt		Not Applicable	
48		Sp Heat Ratio (Cp/Cv)		Not Applicable	
49		Compressibility (Z)		Not Applicable	
50		Ambient Temperature		Not Applicable	
51		Outside Diameter (Inch)		DN 50 (NPS 2") to DN 400 (NPS 16")	
52		Thickness (mm) / Schedule		As per Piping Material Specification	
53		Pipe Material		As per Piping Material Specification	
54		Design Code		ASME B31.8	
55		ASME Rating		300#	
56		Piping Class		30HC	
57		Orientation of Pipe		Suitable for all orientation	



 		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001A		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300#, PIPING CLASS - 30HC, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision	
Location	-		MR No.	-		
Sr. No.	-		P.O No.	#		
55	VALVE MATERIAL	Part Description	Material Specified		Material Offered (By Bidder)	
56		Body	ASTM A216 GR. WCB/ASTM 105			
57		Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid) OR (ASTM A105/ ASTM A216 Gr. WCB) + 75 micron ENP			
58		Seat Rings (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410/ SS 304/ SS 316			
59		Seat Seal	Primary Devlon V/ PEEK/ Viton with Secondary Metal to Metal			
60		Stem (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410 / SS 304 / SS 316			
61		Stem Seal	GRAFOIL / R-PTFE			
62		Body Seal	GRAFOIL / R-PTFE			
63		Gland	13% Cr. Steel/ SS 316 / SS 304 / ASTM A105			
64		Stud Bolts/Nut	ASTM A 193 Gr. B7/ ASTM A 194 Gr. 2H			
65	Handle / Lever / Hand Wheel	Carbon Steel				
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.			*	
67		Flow Coefficient, Kv (Cubic Meters per Hour)			*	
68		Valve Cavity Volume(CC)	Open position			*
69			Closed position			*
70		Operator Manufacturer / Model No.			*	
71		Break-away Torque Under Max. Diff Pressure(Nm)			*	
72		Running Torque (Open - Close/Close - Open) (Nm)			*	
73	NOTES	NOTES:				
74		1. Bidder to submit in offer, Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during welding of valve ends at site.				
75		2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification & other Tender Documents.				
76		3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.				
77		4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.				
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.				
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.				
80		7. Valves shall have support foot & lifting lugs as per valve Specification.				
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.				
82		9. Wrench operated valves shall be supplied with wrench.				
83		10. The Charpy Impact temperature shall be -29°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2004) requirement at 0°C				
84		11. A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.				
85		12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.				
86		13. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease				
87		14. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.				
88		15. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".				
89		16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats & seals.				
90		17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25				
91		18. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34.				
92		19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs				
93		20. Stem extension length shall be finalized during drawing approval stage after award of order.				
94		21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating				
95		22. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.				
96		23. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.				
97		24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.				
98		24. Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.				
99		25. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve. Vendor to guarantee the suitability of seat/ seal material for the given service condition				
100		26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.				
101		27. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.				
102	28. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.					
103	29. Vendor to guarantee the suitability of seat/ seal material for the given service condition					

 		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001B		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HLT, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision	
Location		-		MR No.		
Sr. No.		-		P.O No.		
				#		
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) Item No / As per P&ID		
3		Company's Specification No.		VCS-SS-PP-2004		
4		Category		Station Piping Ball Valve		
5		Pipeline Line No		Not Required		
6		Class		30HLT		
7	DESIGN AND TEST REQUIREMENTS	Size		DN 50 (NPS 2") to DN 400 (NPS 16")		
8		Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design/ Fully Welded Body Design as specified in MR, Tight Shut Off (As Applicable)		
9		Type of Port (Full/ Reduced)		As per P&ID		
10		Design Temperature (°C)	Maximum		65	
11			Minimum		-45	
12		Corrosion Allowance (mm)		1.5		
13		Installation (Aboveground/Underground)		AboveGround		
14		Service		Natural Gas (NG)		
15		End Connection		As per P&ID		
16		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)		
17		Design Standards		API 6D		
18		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)		
19		ASME Class		300#		
20		Stem Extension Requirement (If required, Note - 20)		Not Required		
21		Length of Stem Extension		Not Applicable		
22		Orientation of Stem		Perpendicular to Valve axis		
23		Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated		
24		Valve Actuator Operating Time		Not Applicable		
25		Requirement of Locking Mechanism (LO / LC)		As per P&ID		
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification		
28		Operator Specification No.		Not Applicable		
29		Valve Design Pressure (kg/cm ²)		49 kg/cm ²		
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 73.5 kg/cm ² & Test Duration - 30 Minutes	Seat : 54 kg/cm ² & Test Duration 30 Minutes	
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes		
32		Charpy Impact Test (° C)		Yes (at -45 °C)		
33		Fire Safe Design (Note-24)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per API 6D Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21		
37		Operator Data Sheet No.		Not Applicable		
38	PROCESS DATA (Applicable for Actuator)	Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable		
39		Pressure (Min/Nor/Max) (barg)		Not Applicable		
40		Temperature (Min/Nor/Max) (° C)		Not Applicable		
41		Max Shutoff DP (barg)		Not Applicable		
42		Viscosity (cP)		Not Applicable		
43		Density (Kg/m ³)		Not Applicable		
44		Mol . Wt		Not Applicable		
45		Sp Heat Ratio (Cp/Cv)		Not Applicable		
46		Compressibility (Z)		Not Applicable		
47		Ambient Temperature		Not Applicable		
48	CONNECTING PIPE DETAIL	Outside Diameter (Inch)		DN 50 (NPS 2") to DN 400 (NPS 16")		
49		Thickness (mm) / Schedule		As per Piping Material Specification		
50		Pipe Material		As per Piping Material Specification		
51		Design Code		ASME B31.8		
52		ASME Rating		300#		
53		Piping Class		30HLT		
54		Orientation of Pipe		Suitable for all orientation		



		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001B		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300# , PIPING CLASS - 30HLT, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision C1 15.11.2023	
Location	-		MR No.	-		
Sr. No.	-		P.O No.	#		
55	VALVE MATERIAL	Part Description	Material Specified		Material Offered (By Bidder)	
56		Body	ASTM A352 GR. LCB / ASTM A350 GR. LF2 CL. 1			
57		Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid)			
58		Seat Rings (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410/ SS 304/ SS 316			
59		Seat Seal	Primary Devlon V/ PEEK/ Viton with Secondary Metal to Metal			
60		Stem (No Casting)	SS - 304/SS - 316			
61		Stem Seal	GRAFOIL / R-PTFE			
62		Body Seal	GRAFOIL / R-PTFE			
63		Gland	ASTM A350 GR. LF2 CL. 1			
64		Stud Bolts/Nut	ASTM A320 GR. L4 / ASTM A194 GR. 4			
65	Handle / Lever / Hand Wheel	Carbon Steel				
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.			*	
67		Flow Coefficient, Kv (Cubic Meters per Hour)			*	
68		Valve Cavity Volume(CC)	Open position			*
69			Closed position			*
70		Operator Manufacturer / Model No.			*	
71		Break-away Torque Under Max. Diff Pressure(Nm)			*	
72	Running Torque (Open - Close/Close - Open) (Nm)			*		
73	NOTES	NOTES:				
74		1. Bidder to submit in offer, Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during welding of valve ends at site.				
75		2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification & other Tender Documents.				
76		3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.				
77		4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.				
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.				
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.				
80		7. Valves shall have support foot & lifting lugs as per valve Specification.				
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.				
82		9. Wrench operated valves shall be supplied with wrench.				
83		10. The Charpy Impact temperature shall be -45°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2004) requirement at 0°C				
84		11. A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.				
85		12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.				
86		13. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease				
87		14. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.				
88		15. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".				
89		16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats & seals.				
90		17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25				
91		18. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34.				
92		19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs				
93		20. Stem extension length shall be finalized during drawing approval stage after award of order.				
94		21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating				
95		22. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.				
96		23. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.				
97		24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.				
98		24. Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.				
99		25. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve. Vendor to guarantee the suitability of seat/ seal material for the given service condition				
100		26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.				
101		27. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.				
102	28. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.					
103	29. Vendor to guarantee the suitability of seat/ seal material for the given service condition					

 		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001C		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 150# , PIPING CLASS - 15HC, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision	
Location		-		MR No.		
Sr. No.		-		P.O No.		
				#		
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) Item No / As per P&ID		
3		Company's Specification No.		VCS-SS-PP-2004		
4		Category		Station Piping Ball Valve		
5		Pipeline Line No		Not Required		
6		Class		15HC		
7	DESIGN AND TEST REQUIREMENTS	Size		DN 50 (NPS 2") to DN 400 (NPS 16")		
8		Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design/ Fully Welded Body Design as specified in MR, Tight Shut Off (As Applicable)		
9		Type of Port (Full/ Reduced)		As per P&ID		
10		Design Temperature (°C)	Maximum		65	
11			Minimum		-29	
12		Corrosion Allowance (mm)		1.5		
13		Installation (Aboveground/Underground)		AboveGround		
14		Service		Natural Gas (NG)		
15		End Connection		As per P&ID		
16		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)		
17		Design Standards		API 6D		
18		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)		
19		ASME Class		150#		
20		Stem Extension Requirement (If required, Note - 20)		Not Required		
21		Length of Stem Extension		Not Applicable		
22		Orientation of Stem		Perpendicular to Valve axis		
23		Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated		
24		Valve Actuator Operating Time		Not Applicable		
25		Requirement of Locking Mechanism (LO / LC)		As per P&ID		
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification		
28		Operator Specification No.		Not Applicable		
29		Valve Design Pressure (kg/cm ²)		19 kg/cm ²		
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 28.5 kg/cm ² & Test Duration - 30 Minutes	Seat : 21 kg/cm ² & Test Duration 30 Minutes	
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes		
32		Charpy Impact Test (° C)		Yes (at -29 °C)		
33		Fire Safe Design (Note-24)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per API 6D Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21		
37	Operator Data Sheet No.		Not Applicable			
38	PROCESS DATA (Applicable for Actuator)	Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable		
39		Pressure (Min/Nor/Max) (barg)		Not Applicable		
40		Temperature (Min/Nor/Max) (° C)		Not Applicable		
41		Max Shutoff DP (barg)		Not Applicable		
42		Viscosity (cP)		Not Applicable		
43		Density (Kg/m ³)		Not Applicable		
44		Mol . Wt		Not Applicable		
45		Sp Heat Ratio (Cp/Cv)		Not Applicable		
46		Compressibility (Z)		Not Applicable		
47		Ambient Temperature		Not Applicable		
48	CONNECTING PIPE DETAIL	Outside Diameter (Inch)		DN 50 (NPS 2") to DN 400 (NPS 16")		
49		Thickness (mm) / Schedule		As per Piping Material Specification		
50		Pipe Material		As per Piping Material Specification		
51		Design Code		ASME B31.8		
52		ASME Rating		150#		
53		Piping Class		15HC		
54		Orientation of Pipe		Suitable for all orientation		

		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001C		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 150#, PIPING CLASS - 15HC, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision	
Location	-	MR No.	-	C1	15.11.2023	
Sr. No.	-	P.O No.	#			
55	VALVE MATERIAL	Part Description	Material Specified		Material Offered (By Bidder)	
56		Body	ASTM A216 GR. WCB/ASTM 105			
57		Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid) OR (ASTM A105/ ASTM A216 Gr. WCB) + 75 micron ENP			
58		Seat Rings (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410/ SS 304/ SS 316			
59		Seat Seal	Primary Devlon V/ PEEK/ Viton with Secondary Metal to Metal			
60		Stem (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410 / SS 304 / SS 316			
61		Stem Seal	GRAFOIL / R-PTFE			
62		Body Seal	GRAFOIL / R-PTFE			
63		Gland	13% Cr. Steel/ SS 316 / SS 304 / ASTM A105			
64		Stud Bolts/Nut	ASTM A 193 Gr. B7/ ASTM A 194 Gr. 2H			
65	Handle / Lever / Hand Wheel	Carbon Steel				
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.			*	
67		Flow Coefficient, Kv (Cubic Meters per Hour)			*	
68		Valve Cavity Volume(CC)	Open position			*
69			Closed position			*
70		Operator Manufacturer / Model No.			*	
71		Break-away Torque Under Max. Diff Pressure(Nm)			*	
72		Running Torque (Open - Close/Close - Open) (Nm)			*	
73	NOTES	NOTES:				
74		1. Bidder to submit in offer, Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during welding of valve ends at site.				
75		2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification & other Tender Documents.				
76		3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.				
77		4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.				
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.				
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.				
80		7. Valves shall have support foot & lifting lugs as per valve Specification.				
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.				
82		9. Wrench operated valves shall be supplied with wrench.				
83		10. The Charpy Impact temperature shall be -29°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2004) requirement at 0°C				
84		11. A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.				
85		12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.				
86		13. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease				
87		14. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.				
88		15. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".				
89		16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats & seals.				
90		17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25				
91		18. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34.				
92		19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs				
93		20. Stem extension length shall be finalized during drawing approval stage after award of order.				
94		21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating				
95		22. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.				
96		23. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.				
97		24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.				
98		24. Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.				
99		25. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve. Vendor to guarantee the suitability of seat/ seal material for the given service condition				
100		26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.				
101		27. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.				
102	28. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.					
103	29. Vendor to guarantee the suitability of seat/ seal material for the given service condition					

  Energising Quality		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001D		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 150# , PIPING CLASS - 15HLT, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision	
Location		-		MR No.		
Sr. No.		-		P.O No.		
				#		
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) Item No / As per P&ID		
3		Company's Specification No.		VCS-SS-PP-2004		
4		Category		Station Piping Ball Valve		
5		Pipeline Line No		Not Required		
6		Class		15HLT		
7	DESIGN AND TEST REQUIREMENTS	Size		DN 50 (NPS 2") to DN 400 (NPS 16")		
8		Type of Valve		Trunnion Mounted, Double Block and Bleed, Antistatic, Vent Drain/ Flush Connection with Anti Blowout Stem, Split Body Design/ Fully Welded Body Design as specified in MR, Tight Shut Off (As Applicable)		
9		Type of Port (Full/ Reduced)		As per P&ID		
10		Design Temperature (°C)	Maximum		65	
11			Minimum		-45	
12		Corrosion Allowance (mm)		1.5		
13		Installation (Aboveground/Underground)		AboveGround		
14		Service		Natural Gas (NG)		
15		End Connection		As per P&ID		
16		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)		
17		Design Standards		API 6D		
18		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)		
19		ASME Class		150#		
20		Stem Extension Requirement (If required, Note - 20)		Not Required		
21		Length of Stem Extension		Not Applicable		
22		Orientation of Stem		Perpendicular to Valve axis		
23		Type of Valve Operator		DN ≤ 100 mm (4") - Wrench / Lever - Pull Force 350N max. DN ≥ 150 mm (6") - Gear Operated		
24		Valve Actuator Operating Time		Not Applicable		
25		Requirement of Locking Mechanism (LO / LC)		As per P&ID		
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification		
28		Operator Specification No.		Not Applicable		
29		Valve Design Pressure (kg/cm ²)		19 kg/cm ²		
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 28.5 kg/cm ² & Test Duration - 30 Minutes	Seat : 21 kg/cm ² & Test Duration 30 Minutes	
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes		
32		Charpy Impact Test (° C)		Yes (at -45 °C)		
33		Fire Safe Design (Note-24)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per API 6D Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21		
37	Operator Data Sheet No.		Not Applicable			
38	PROCESS DATA (Applicable for Actuator)	Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable		
39		Pressure (Min/Nor/Max) (barg)		Not Applicable		
40		Temperature (Min/Nor/Max) (° C)		Not Applicable		
41		Max Shutoff DP (barg)		Not Applicable		
42		Viscosity (cP)		Not Applicable		
43		Density (Kg/m ³)		Not Applicable		
44		Mol . Wt		Not Applicable		
45		Sp Heat Ratio (Cp/Cv)		Not Applicable		
46		Compressibility (Z)		Not Applicable		
47		Ambient Temperature		Not Applicable		
48	CONNECTING PIPE DETAIL	Outside Diameter (Inch)		DN 50 (NPS 2") to DN 400 (NPS 16")		
49		Thickness (mm) / Schedule		As per Piping Material Specification		
50		Pipe Material		As per Piping Material Specification		
51		Design Code		ASME B31.8		
52		ASME Rating		150#		
53		Piping Class		15HLT		
54		Orientation of Pipe		Suitable for all orientation		

		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2001D		
		DATA SHEET OF FE/BW, ABOVEGROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 150# , PIPING CLASS - 15HLT, SPLIT /WELDED BODY DESIGN		No. of Pages : 02	Revision	
		C1	15.11.2023			
Location	-	MR No.	-			
Sr. No.	-	P.O No.	#			
55	VALVE MATERIAL	Part Description	Material Specified	Material Offered (By Bidder)		
56		Body	ASTM A352 GR. LCB / ASTM A350 GR. LF2 CL. 1			
57		Ball (Single Piece, Solid Construction)	SS-304 / SS-316 (Solid)			
58		Seat Rings (No Casting)	(AISI 4140 +75 micron ENP)/ AISI 410/ SS 304/ SS 316			
59		Seat Seal	Primary Devlon V/ PEEK/ Viton with Secondary Metal to Metal			
60		Stem (No Casting)	SS - 304/SS - 316			
61		Stem Seal	GRAFOIL / R-PTFE			
62		Body Seal	GRAFOIL / R-PTFE			
63		Gland	ASTM A350 GR. LF2 CL. 1			
64		Stud Bolts/Nut	ASTM A320 GR. L4 / ASTM A194 GR. 4			
65	Handle / Lever / Hand Wheel	Carbon Steel				
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.		*		
67		Flow Coefficient, Kv (Cubic Meters per Hour)		*		
68		Valve Cavity Volume(CC)	Open position		*	
69			Closed position		*	
70		Operator Manufacturer / Model No.		*		
71		Break-away Torque Under Max. Diff Pressure(Nm)		*		
72		Running Torque (Open - Close/Close - Open) (Nm)		*		
73	NOTES	NOTES:				
74		1. Bidder to submit in offer, Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during welding of valve ends at site.				
75		2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification & other Tender Documents.				
76		3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.				
77		4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.				
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.				
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.				
80		7. Valves shall have support foot & lifting lugs as per valve Specification.				
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.				
82		9. Wrench operated valves shall be supplied with wrench.				
83		10. The Charpy Impact temperature shall be -45°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2004) requirement at 0°C				
84		11. A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.				
85		12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.				
86		13. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease				
87		14. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.				
88		15. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".				
89		16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats & seals.				
90		17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25				
91		18. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34.				
92		19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs				
93		20. Stem extension length shall be finalized during drawing approval stage after award of order.				
94		21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating				
95		22. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.				
96		23. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.				
97		24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.				
98		24. Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.				
99		25. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve. Vendor to guarantee the suitability of seat/ seal material for the given service condition				
100		26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.				
101		27. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.				
102	28. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.					
103	29. Vendor to guarantee the suitability of seat/ seal material for the given service condition					

	CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA						
CLIENT	GOA NATURAL GAS PRIVATE LIMITED (GNGPL)						
PMC	VCS QUALITY SERVICES PVT. LTD.						
DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED							
GENERAL SPECIFICATION							
Process Fluid	NG	ANSI Pressure Rating	800#				
Design Temperature	(-)29°C to 65°C	Design Pressure	49 barg				
Size, Inch (DN)	Less than 2" (50)						
Valve Type	Full Bore, Floating Ball						
End Connection Type	Socket Welded	Design Standard	BS EN ISO 17292				
Face Finish	Not Applicable	Locking Arrangement	As per P&ID				
VALVE DESIGN CONDITIONS							
Corrosion Allowance	1.5 mm	Design Factor	0.5				
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable				
VALVE OPERATION							
Actuation Type	Not Applicable	Type of Actuator	Not Applicable				
PUP PIECE DETAILS							
100mm extension pups in ASTM A106 Gr.B, Sch 160 (for 3/4") and Sch XS (for 1 1/2")							
VALVE MATERIAL SPECIFICATION							
PART DESCRIPTION	MATERIAL SPECIFIED		MATERIAL OFFERED (Equivalent or Higher)				
Body	ASTM A105						
Ball	13% Cr Steel						
Body Seat	RPTFE/ DELRIN						
Gland	13% Cr Steel						
Stem (No Casting)	13% Cr Steel						
Body Seal	Grafoil						
Stem Seal	Grafoil						
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H						
TESTING REQUIREMENT							
Hydrostatic Test Pressure & Time	Body: 210 kg/cm ² & 30 Minutes		Seat: 155 kg/cm ² & 30 Minutes				
Pneumatic Test Pressure & Time	7 kg/cm ² & 15 Minutes						
Hardness Test	248 HV10 max.						
Charpy Impact Test @ Temperature	Yes (at -29°C)						
Anti-Static Testing Requirement	As per BS EN ISO 17292						
Fire Safe Test	API 607 / API 6FA						
DOCUMENT NO.							
C231099-00-PP-DS-2001E							
	D1	15.11.2023	VI	AK	SKN	ISSUED FOR BID	
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS



CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA



CLIENT

GOA NATURAL GAS PRIVATE LIMITED (GNGPL)

PMC

VCS QUALITY SERVICES PVT. LTD.

DATA SHEET : BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED

Valve Painting Specification :

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : As indicated in P&ID / Schedule of Rates (SOR).

NOTES :

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for purchaser's approval prior to manufacture of the valves.
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of ball with ports and ensure proper installation of handle.
8	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
9	Painting procedure of valves shall be as per Manufacturer's standard.
10	All tests shall be as per BS EN 12266.
11	Inspection and Testing shall be as per attached QAP, this datasheet, BS EN 12266, other relevant standards.
12	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

DOCUMENT NO.							
C231099-00-PP-DS-2001E		D1	15.11.2023	VI	AK	SKN	ISSUED FOR BID
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS

  Energising Quality		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2002A		
		DATA SHEET OF FE/BW, ABOVEGROUND, PLUG VALVE DN 50 TO DN 200 (NPS 2" to NPS 8"), RATING 300#, PIPING CLASS - 30HC		No. of Pages : 02	Revision C1 15.11.2023	
Location	-		MR No.	-		
Sr. No.	-		P.O No.	#		
1	GENERAL	Valve Manufacturer				
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) Item No / As per P&ID		
3		Company's Specification No.		VCS-SS-PP-2051		
4		Category		Plug Valve		
5		Pipeline Line No		Not Required		
6		Class		30HC		
7	DESIGN AND TEST REQUIREMENTS	Size		DN 50 (NPS 2") to DN 200 (NPS 8")		
8		Type of Valve		Regular Pattern		
9		Type of Port (Full/ Reduced)		As per P&ID		
10		Design Temperature (°C)	Maximum	65		
11			Minimum	-29		
12		Corrosion Allowance (mm)		1.5		
13		Installation (Aboveground/Underground)		AboveGround		
14		Service		Natural Gas (NG)		
15		End Connection		As per P&ID		
16		Flange Face Finish		RF/125AARH for Flanged Ends (As applicable)		
17		Design Standards		API 6D		
18		End Connection Standard		ANSI B16.5 for Flanged Ends (As applicable)/ ANSI 16.25 for Butt Welded Ends (As applicable)		
19		ASME Class		300#		
20		Stem Extension Requirement (If required, Note - 20)		Not Required		
21		Length of Stem Extension		Not Applicable		
22		Orientation of Stem		Perpendicular to Valve axis		
23		Type of Valve Operator		As per Standard Specification		
24		Valve Actuator Operating Time		Not Applicable		
25		Requirement of Locking Mechanism (LO / LC)		As per P&ID		
26		Length of Pup Piece / Nipple (mm), (If Required) (Note-16) (Integrally welded to the BW valve on each side)		Required for Welded End Valves, as per Standard Valve Specification		
27		Pup Piece Size / Material Grade / Schdeule/ Thickness (Note-16)		As per Piping Material Specification		
28		Operator Specification No.		Not Applicable		
29		Valve Design Pressure (kg/cm ²)		49 kg/cm ²		
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 73.5 kg/cm ² & Test Duration - 30 Minutes	Seat : 54 kg/cm ² & Test Duration 30 Minutes	
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes		
32		Charpy Impact Test (° C)		Yes (at -29 °C)		
33		Fire Safe Design (Note-24)		API 6FA / ISO10497		
34		Anti Static Testing Requirement		As per API 6D Latest Edition		
35		Hardness Test		248 HV10 max		
36		Painting (Note-21)		As per specification (Suitable for Highly Corrosive Environment) Note-21		
37		Operator Data Sheet No.		Not Applicable		
38		PROCESS DATA (Applicable for Actuator)	Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable	
39			Pressure (Min/Nor/Max) (barg)		Not Applicable	
40			Temperature (Min/Nor/Max) (° C)		Not Applicable	
41			Max Shutoff DP (barg)		Not Applicable	
42			Viscosity (cP)		Not Applicable	
43			Density (Kg/m ³)		Not Applicable	
44	Mol . Wt		Not Applicable			
45	Sp Heat Ratio (Cp/Cv)		Not Applicable			
46	Compressibility (Z)		Not Applicable			
47	Ambient Temperature		Not Applicable			
48	CONNECTING PIPE DETAIL	Outside Diameter (Inch)		DN 50 (NPS 2") to DN 200 (NPS 8")		
49		Thickness (mm) / Schedule		As per Piping Material Specification		
50		Pipe Material		As per Piping Material Specification		
51		Design Code		ASME B31.8		
52		ASME Rating		300#		
53		Piping Class		30HC		
54		Orientation of Pipe		Suitable for all orientation		

 		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2002A		
		DATA SHEET OF FE/BW, ABOVEGROUND, PLUG VALVE DN 50 TO DN 200 (NPS 2" to NPS 8"), RATING 300# , PIPING CLASS - 30HC		No. of Pages : 02	Revision	
Location	-	MR No.	-	C1	15.11.2023	
Sr. No.	-	P.O No.	#			
55	VALVE MATERIAL	Part Description	Material Specified	Material Offered (By Bidder)		
56		Body	ASTM A216 GR. WCB/ASTM 105			
57		Cover (Bolted)	ASTM A 105/ASTM A 216 GR.WCB			
58		Plug	(ASTM A216 GR. WCB/ASTM A105) + 75 microns ENP Coating / SS 304			
59		Stem	(ASTM A216 GR. WCB/ASTM A105) + 75 microns ENP Coating / SS 304			
60		Gland	ASTM A216 GR. WCB/ASTM 105			
61		Stem Seal / Gland Packing	GRAFOIL / R-PTFE			
62		Cover Gasket	SP WND SS 316 - GRAFOIL FILLER			
63		Lubricant Screw	SS 410/ASTM A105			
64		Stud Bolts/Nut	ASTM A 193 Gr. B7/ ASTM A 194 Gr. 2H			
65	Handle / Lever / Hand Wheel	Carbon Steel				
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.		*		
67		Flow Coefficient, Kv (Cubic Meters per Hour)		*		
68		Valve Cavity Volume(CC)	Open position		*	
69			Closed position		*	
70		Operator Manufacturer / Model No.		*		
71		Break-away Torque Under Max. Diff Pressure(Nm)		*		
72	Running Torque (Open - Close/Close - Open) (Nm)		*			
73	NOTES	NOTES:				
74		1. Bidder to submit in offer, Soft Seal details and type, grade & class selected with manufacturer's recommendation like Pressure-Temperature Curve/Table for not to damage the soft seal during welding of valve ends at site.				
75		2. This Data Sheet shall be read in conjunction with Material Requisition, Piping Material Specification, valve Specification & other Tender Documents.				
76		3. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.				
77		4. Manufacturer shall have valid API 6D license to use API monogram. API monogram is required.				
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.				
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.				
80		7. Valves shall have support foot & lifting lugs as per valve Specification.				
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.				
82		9. Wrench operated valves shall be supplied with wrench.				
83		10. The Charpy Impact temperature shall be -29°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2051) requirement at 0°C				
84		11. A supplementary air seat test as per API 6D (Annex I, Para I.9 Type II) shall be carried out for all valves. A bubble tight seal is required without the use of any sealant. No leakage is allowed. Test pressure shall be held for at least 15 minutes.				
85		12. Design of weld end valves shall be such that during field welding operations, the soft seals or plastic components of the valve (where ever used) is not liable to be damaged. The manufacture shall furnish necessary field welding instructions and post-weld test procedure to demonstrate integrity and leak-tightness of valves after field welding operations.				
86		13. Gear operators, when provided, shall have a self-locking provision and shall be fully encased in water proof/ splash proof enclosure and shall be filled with suitable grease				
87		14. For the manual operator of all valves, the diameter of the hand wheel or the length of operating wrench shall be such that under the maximum differential pressure, the total force required to operate the valve does not exceed 350N.				
88		15. Manufacturer shall also indicate the number of turns of hand wheel in case of gear operators (along with their offer) required for Operating the valve from full open to full close position. The numbers of turn shall not exceed 250 for valves sizes up to 24" and 450 for valve size above 24".				
89		16. Adequacy for Length of pup piece/ Nipple shall be confirmed by manufacturer so as to avoid damage to seats during field welding or post weld heat treatment. These nipples shall be welded to the valve body by the manufacturer before fitting the packings, seats & seals.				
90		17. Name plate material shall be minimum stainless steel. Marking shall be as per MSS-SP-25				
91		18. Valve body & other pressure containing parts shall be designed as per ASME Sec-VIII Div-I. Minimum thickness shall not be less than ASME B16.34.				
92		19. For tag No./ Fluid Data/ Operating Data refer Process Document , P&IDs				
93		20. Stem extension length shall be finalized during drawing approval stage after award of order.				
94		21. For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy(Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating				
95		22. Bidder shall clearly write all / any deviation against each part material of valve in the space provided for. Wherever bidder agrees with company's spec bidder shall indicate "agreed". Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.				
96		23. All Elastomeric material used for pressure tight sealing or drip sealing shall be of anti Explosive Decompression type and must be certified according to testing Procedures. Manufacturer shall submit test certificate confirming conformance with Anti Explosive Decompression. Manufacturer shall confirm the suitability of soft sealing and seating material for the pressure and temperature & service mentioned above in this data sheet.				
97		24. Not only during commissioning, but also during life cycle of all valves, sediments/corrosion deposits/ silica/ mill scale of less than 40 mesh percent in process fluid have to be tolerated by all valves with malfunctioning.				
98		24.Fire Safe test certificate qualifying the valves as per API 6FA/ API 607/ ISO 10497 carried out in last 10 years shall be furnished.				
99		25. Flanges of flanged end cast/ forged body shall be integrally cast/ forged with the body of valve.Vendor to guarantee the suitability of seat/ seal material for the given service condition				
100		26. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.				
101		27. Cyclic test is required. The valve shall be subjected to at least 200 open close cycle with maximum differential pressure corresponding to valve rating.				
102		28. Stem seal / body seal, gland packing materials shall be provided with corrosion inhibitor.				
103	29. Vendor to guarantee the suitability of seat/ seal material for the given service condition					



CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA



CLIENT

GOA NATURAL GAS PRIVATE LIMITED (GNGPL)

PMC

VCS QUALITY SERVICES PVT. LTD.

DATA SHEET : PLUG VALVE (LESS THAN 2.0 INCH) SOCKET WELDED

GENERAL SPECIFICATION

Process Fluid	NG	ANSI Pressure Rating	800#
Design Temperature	(-)29°C to 65°C	Design Pressure	49 barg
Size, Inch (DN)	Less than 3/4" (20)		
Valve Type	Regular Pattern		
End Connection Type	Socket Welded	Design Standard	BS 5353
Face Finish	Not Applicable	Locking Arrangement	As per P&ID

VALVE DESIGN CONDITIONS

Corrosion Allowance	1.5 mm	Design Factor	0.5
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable

VALVE OPERATION

Actuation Type	Not Applicable	Type of Actuator	Not Applicable
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PUP PIECE DETAILS

100mm extension pups in ASTM A106 Gr.B, Sch 160 at both ends

VALVE MATERIAL SPECIFICATION

PART DESCRIPTION	MATERIAL SPECIFIED	MATERIAL OFFERED (Equivalent or Higher)
Body	ASTM A105	
Plug (Lubricated)	ASTM A105 + 75 microns ENP	
Stem (No Casting)	(AISI 4140 + 75 microns ENP Coating)/ AISI 410	
Stem Seal	GRAFOIL/ PTFE V-RINGS + GRAFOIL	
Gland	ASTM A 105	
Gland Packing	Graphite/ PTFE	
Gasket	N.A	
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H	
Lubricant Screw	Manufacturer's Standard	

TESTING REQUIREMENT

Hydrostatic Test Pressure & Time	Body: 210 kg/cm ² & 30 Minutes	Seat: 155 kg/cm ² & 30 Minutes
Pneumatic Test Pressure & Time	7 kg/cm ² & 15 Minutes	
Hardness Test	248 HV10 max.	
Charpy Impact Test @ Temperature	Yes (at -29°C)	
Fire Safe Test	API 607 / API 6FA	

DOCUMENT NO.

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Energising Quality

PROJECT NUMBER: C231099



Goa Natural Gas Pvt.Ltd.
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LIST OF ATTACHMENT

Client Job Number

C231099

Total Sheets

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Document No

C231099

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PP

LST

2001

**GOA NATURAL GAS PRIVATE LIMITED
(GNGPL)**

CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR
A1	15.11.2023	Issued For Client Review	MNH	VI	AK



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CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

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1.0 LIST OF ATTACHMENTS

CONTRACTOR shall carry out all works strictly in accordance with the drawings/documents/specifications indicated in subsequent paragraphs.

2.0 DATA SHEETS

Sr. No	Data Sheet Number	Description	Rev No	Page No
1.	C231099-00-PP-DS-2002	DATA SHEET FOR INSULATING JOINT (NPS 4" to NPS 16")	C1	566-570
2.	C231099-00-PP-DS-2001A	DATA SHEET OF FE/BW, ABOVE GROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300#, PIPING CLASS - 30HC	C1	571-572
3.	C231099-00-PP-DS-2001B	DATA SHEET OF FE/BW, ABOVE GROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 300#, PIPING CLASS - 30HLT	C1	573-574
4.	C231099-00-PP-DS-2001C	DATA SHEET OF FE/BW, ABOVE GROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 150#, PIPING CLASS - 15HC	C1	575-576
5.	C231099-00-PP-DS-2001D	DATA SHEET OF FE/BW, ABOVE GROUND, MANUAL BALL VALVE DN 50 TO DN 400 (NPS 2" to NPS 16"), RATING 150#, PIPING CLASS - 15HLT	C1	577-578
6.	C231099-00-PP-DS-2001E	DATA SHEET OF BALL VALVE (LESS THAN 2.0 INCH) SOCKET WELDED, RATING 800#	C1	579-580
7.	C231099-00-PP-DS-2002A	DATA SHEET OF FE/BW, ABOVEGROUND, PLUG VALVE DN 50 TO DN 200 (NPS 2" to NPS 8"), RATING 300#, PIPING CLASS - 30HC	C1	581-582
8.	C231099-00-PP-DS-2002B	DATA SHEET OF PLUG VALVE (LESS THAN 2.0 INCH) SOCKET WELDED, RATING 800#	C1	583-584

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Sr. No	Data Sheet Number	Description	Rev No	Page No
9.	C231099-00-PP-DS-2003A	DATA SHEET OF FLANGED/ BW, ABOVEGROUND, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300# , PIPING CLASS - 30HC	C1	585-586
10.	C231099-00-PP-DS-2003B	DATA SHEET OF FLANGED/ BW, ABOVEGROUND, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300# , PIPING CLASS - 30HLT	C1	587-588
11.	C231099-00-PP-DS-2003C	DATA SHEET OF GLOBE VALVE (LESS THAN 2.0 INCH) SOCKET WELDED, RATING 800#	C1	589-590

3.0 STANDARD SPECIFICATIONS & INSPECTION TEST PLAN

Sr. No	Specification number	Description	Rev No	Page No
1.	C231099-00-PP-PMS-2001	PIPING MATERIAL SPECIFICATION	C1	591-629
2.	VCS-SS-PP-2004	STANDARD SPECIFICATION FOR PIPELINE BALL VALVES	04	630-648
3.	VCS-SS-PP-2029	STANDARD SPECIFICATION FOR INSULATING JOINT	04	649-662
4.	VPC-SS-PL-0037	WELDING SPEC FOR ONSHORE PIPE LINE FOR TRANSPORTATION OF GAS	00	663-710
5.	VCS-SS-PP-2019	WELDING OF ONSHORE PIPELINE	04	711-754
6.	VPC-SS-PP-2509	WELDING SPECIFICATION FOR FABRICATION OF PIPING	01	755-784
7.	VCS-SS-PP-2044	STANDARD SPECIFICATION FOR QUALITY MANAGEMENT SYSTEM	01	785-793
8.	VCS-SS-PP-2031	STANDARD SPECIFICATION FOR THIRD PARTY INSPECTION	01	794-801
9.	VCS-SS-PP-2032	STANDARD SPECIFICATION FOR FLAME ARRESTORS	01	802-811

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Sr. No	Specification number	Description	Rev No	Page No
10.	VCS-SS-PP-2036	STANDARD SPECIFICATION FOR SEAMLESS (SMLS) LINE PIPE (ONSHORE)	03	812-836
11.	VCS-SS-PP-2510	TECHINCAL NOTES FOR BOLTS AND NUTS	01	837-842
12.	VCS-SS-PP-2511	TECHINCAL NOTES FOR GASKETS	01	843-848
13.	VCS-SS-PP-2501	STANDARD SPECIFICATION FOR INSPECTION, FLUSHING & TESTING OF PIPING SYSTEM	01	849-858
14.	VCS-SS-PP-2507	STANDARD SPECIFICATION FOR FABRICATION AND ERECTION OF PIPING	01	859-873
15.	VCS-SS-PP-2503	STANDARD SPECIFICATION FOR ASSORTED PIPES	01	874-886
16.	VCS-SS-PP-2504	STANDARD SPECIFICATION FOR ASSORTED VALVES	01	887-902
17.	VCS-SS-PP-2505	STANDARD SPECIFICATION FOR ERECTION OF MACHINERY AND EQUIPMENT	01	903-918
18.	VCS-SS-PP-2506	DESIGN GUIDE FOR RADIOGRAPHY REQUIREMENTS	01	919-926
19.	VCS-SS-PP-2014	STANDARD SPECIFICATION FOR HYDROSTATIC TESTING	03	927-953
20.	VPC-SS-PP-2024	STANDARD FOR SEAMLESS FITTINGS & FLANGES	01	954-960
21.	VPC-SS-PI-0011	TECHNICAL NOTES FOR PIPE	00	961-972
22.	VCS-SS-ME-3003	CO2 TYPE EXTINGUISHER	02	973-977
23.	VCS-SS-ME-3005	DRY CHEMICAL POWDER	02	978-983
24.	VCS-SS-ME-3006	PORTABLE FIRE EXTINGUISHER	02	984-989
25.	VCS-SS-PP-2502	STANDARD SPECIFICATION FOR PAINTING	04	990-1025
26.	VCS-SS-PP-2043	DOCUMENTATION REQUIREMENT	01	1026-1035
27.	VCS-SS-PL-0008	FABRICATION AND ERECTION OF PIPING	00	1036-1047

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Sr. No	Specification number	Description	Rev No	Page No
28.	VCS-SS-PI-0012	STAINLESS STEEL – MULTI TUBES FOR CNG STATIONS	00	1048-1056
29.	VCS-SS-PI-0015	STAINLESS STEEL TUBE LAYING AND TESTING	00	1057-1061
30.	VCS-SS-PL-0025	SEAMLESS FITTINGS AND FLANGES	00	1062-1068
31.	VCS-SS-PL-0014	SS FITTING	00	1069-1074
32.	SS_VPC-SS-PL-0016	SS VALVE	00	1075-1077
33.	VCS-SS-PP-2051	PLUG VALVE SPEC)	00	1078-1093
34.	VCS – SS – PI - 0001	ASSORTED PIPES	00	1094-1105
35.	ITP-PP-2006	ITP FOR INSULATING JOINT	02	1106-1112
36.	VCS-ITP-PP-2007	ITP FOR BALL VALVE	04	1113-1119
37.	VCS-ITP- PP-2015	ITP FOR SEAMLESS	03	1120-1127
38.	VCS-ITP-PP-2005	ITP FOR FORGED SEAMLESS WELDED FITTINGS	01	1128-1135
39.	VCS-ITP-PP-2004	ITP FOR LR BENDS FOR ONSHORE PIPELINES	02	1136-1142
40.	VCS-ITP-PP-2003	ITP FOR FLANGES & SPECTACLE BLINDS	01	1143-1148
41.	VCS-C & P-TPIA-001	APPROVED TPIA LIST	00	1149
42.	VCS-00-00-VL-0001	VCS Approved Vendor List	04	1150-1209

4.0 STANDARD DRAWINGS

Sr. No	Standard Drawings Number	Description	Rev No	Page No
1.	SD-PI-001	SPECTACLE BLIND FLANGE	00	1211
2.	SD-PI-002	ANCHOR FOR BARE PIPE SIZE 2" THRU 24' TYPE-G5 (FOR OFFSITE)	00	1212
3.	SD-PI-003	CROSS GUIDE FOR BARE PIPE SIZE 2 " THRU 24" TYPE – G4 (OFFSITE)	00	1213

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4.	SD-PI-004	CROSS GUIDE FOR BARE PIPE SIZE 2" THRU 24" TYPE - G3	00	1214
5.	SD-PI-005	GUIDE SUPPORT FOR BARE PIPE SIZE ½" THRU 24" TYPE - G1	00	1215
6.	SD-PI-006	DUMMY PIPE SUPPORT FOR BARE PIPE SIZE 2" THRU 24" TYPE - B-39	00	1216
7.	SD-PI-007	LOW SUPPORT STANCHION TYPE-L16 AND L-16A	00	1217
8.	SD-PI-008	LOW SUPPORT SLIDING AND FIXED FOR PIPE SIZE ¾" THRU 1.1/2" TYPE L -15	00	1218
9.	SD-PI-009	LOW SUPPORT SLIDING FOR BARE & INSULATED PIPE SIZE 2" THRU 24" TYPE-L6	00	1219
10.	SD-PI-010	LOW SUPPORT SLIDING FOR BARE PIPE SIZE 3/4" THRU 36" TYPE-L5 & L5A	00	1220
11.	SD-PI-011	PRESSURE TAPPINGS (PA, PG, PC, PT, PIC ETC.)	00	1221
12.	SD-PI-012	DETAIL OF PRESSURE CONNECTIONS ABOVE GROUND PIPE	00	1222
13.	SD-PI-013	DETAIL OF PRESSURE CONNECTIONS UNDER GROUND PIPE	00	1223
14.	SD-PI-014	DETAIL OF TEMPERATURE CONNECTIONS ABOVE GROUND PIPE	00	1224
15.	SD-PI-015	DETAIL OF TEMPERATURE CONNECTIONS UNDER GROUND PIPE	00	1225
16.	SD-PI-016	GUIDE SUPPORT FOR BARE PIPE (SIZE ½" TO 24") TYPE G2	00	1226
17.	SD-PI-017	U-BOLT FOR BARE PIPE (SIZE ½" TO 24")	00	1227
18.	SD-PI-018	VENTS AND DRAINS (ON LINES 2" AND ABOVE)	00	1228

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19.	SD-PI-019	VENTS AND DRAINS (ON LINES 1.1.2" AND BELOW)	00	1229
20.	SD-PI-021	SPACERS BLINDS	00	1230
21.	SD-PI-023	SYMBOLS OF PIPING ELEMENTS ON DRAWINGS	00	1231-1234
22.	SD-PI-024	GASKET THICKNESS	00	1235
23.	SD-PI-025	SUPPORTING ARRANGEMENT FOR ANGLE AND RELIEF VALVES TYPE-SP2	00	1236
24.	SD-PI-026	LOW SUPPORT SLIDING FOR BARE & INSULATED PIPE SIZE 2" THRU 36" TYPE-L1 AND L1A	00	1237
25.	SD-PI-027	LOW SUPPORT FIXED FOR BARE & INSULATED PIPE SIZE 2' THRU 24" TYPE - L6	00	1238
26.	SD-PI-028	TOLERANCE FOR FABRICATION	00	1239
27.	SD-PI-029	ABBREVIATIONS	00	1240
28.	SD-ME-001	LCV LOADING POST WITH FLOW METER	00	1241
29.	SD-ME-002	LCV UNLOADING POST WITH FLOW METER	00	1242
30.	--	TYPICAL ISOMETRIC FOR ONLINE STATION WITH TWO CAR DISPENSER	00	1243
31.	--	TYPICAL ISOMETRIC FOR ONLINE STATION WITH ONE CAR DISPENSER	00	1244
32.	--	TYPICAL CNG TUBING WITH TWO CAR DISPENSER	00	1245
33.	--	TYPICAL DAUGHTER STATION WITH ONE CAR DISPENSER	00	1246

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Sr. No	Standard Drawings Number	Description	Rev No	Page No
34.	--	TYPICAL CNG STATION WITH TWO CAR DISPENSER	00	1247

5.0 STANDARD DOCUMENTS

Sr. No	Standard Documents Number	Description	Rev No	Page No
1.	VCS-SD-CS-001	COMPILANCE STATEMENT	00	1248
2.	VCS-SD-DS-001	DEVIATION SHEET	00	1249
3.	VCS-SD-ITB-001	INSTRUCTION TO BIDDER	00	1250
4.	VCS-SD-CK-001	CHECKLIST - TECHNICAL	00	1251
5.	VCS-SD-LS-001	LIST OF SPARES	00	1252
6.	VCS-SD-RL-001	REFERENCE LIST	00	1253
7.	VCS-SD-VS-001	VENDOR DRAWINGS DOCUMENT SCHEDULE	00	1254
8.	VCS-SD-DD-001	DRAWINGS & DOCUMENTS	00	1255

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CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA



CLIENT

GOA NATURAL GAS PRIVATE LIMITED (GNGPL)

PMC

VCS QUALITY SERVICES PVT. LTD.

DATA SHEET : PLUG VALVE (LESS THAN 2.0 INCH) SOCKET WELDED


Valve Painting Specification :

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : As indicated in P&ID / Schedule of Rates (SOR).


NOTES :

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Gland Packing Assembly shall permit repair of gland packing under full line pressure.
4	Valve shall have an inherent feature using the line pressure to ensure that the line pressure cannot cause taper locking of the plug / plug movement into the taper i.e. valves shall be of " pressure balanced design"
5	All valves shall be provided with valve position indicator.
6	Separate wrench shall be provided with each wrench operated valve.
7	Stops shall be provided to ensure positive alignment of plug with ports and ensure proper installation of handle.
8	Valve body & other pressure containing parts shall be designed as per ASME Sec-VII Div.-1. Minimum thickness shall not be less than ASME B16.34.
9	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
10	Valve design shall ensure repair of stem seals / packing under full line pressure.
11	Painting procedure of valves shall be as per Manufacturer's standard.
12	Inspection and Testing shall be done as per data sheet, specification & BS:12266 (Part-I).
13	Minimum port area for regular pattern shall be 55%.
14	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.



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		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGLP)		JOB NO : C231099	
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2003A	
		DATA SHEET OF FLANGED / BW, ABOVEGROUND, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300# , PIPING CLASS - 30HC		No. of Pages : 02	Revision C1 15.11.2023
Location		-		MR No.	
SR.NO		-		P.O No.	
1		Valve Manufacturer			
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) Item No / As per P&ID	
3		Company's Specification No.		VCS-SS-PP-2504	
4		Category		-	
5		Pipeline Line No		Not Required	
6		Class		30HC	
7		Size		DN 50 (NPS 2") to DN 200 (NPS 8")	
8		Type of Valve		Rising Stem, Plug type disc, OS & Y , Straight Pattern	
9		Type of Port (Full / Reduced)		Not Applicable	
10		Design Temperature (° C)		Maximum	
11				Minimum	
12		Corrosion Allowance (mm)		1.5	
13		Installation (Aboveground/Underground)		Aboveground	
14		Service		Natural Gas (NG)	
15		End Connection		As per P&ID	
16		Flange Face Finish		RF/125AARH for Flanged Ends	
17		Design Standards		BS 1873, ASME 16.34 & API 598	
18		End Connection Standard		ASME B16.5 - Flanged End ASME B16.25 - Butt Welded End	
19		ASME Class		300#	
20		Stem Extension Requirement		Not Required	
21		Length of Stem Extension (If required, Note - 15)		Not Applicable	
22		Orientation of Stem		Perpendicular to Valve Axis	
23		Type of Valve Operator		As per Standard Specification	
24		Valve Actuator Operating Time		Not Applicable	
25		Requirement of Locking Mechanism (LO / LC)		As per P&ID	
26		Length of Pup Piece / Nipple (mm), (If Required) (Integrally welded to the BW valve on each side)		Not Applicable	
27		Pup Piece Size / Material Grade / Schdeule/ Thickness		Not Applicable	
28		Operator Specification No.		Not Applicable	
29		Valve Design Pressure (kg/cm ²)		49 (kg/cm ²)	
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 73.5 kg/cm ² & Test Duration - 30 Minutes	Body : 54 kg/cm ² & Test Duration - 30 Minutes
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes	
32		Charpy Impact Test (°C)		Yes (at -29 °C)	
33		Fire Safe Design (Note- 16 & 17)		API 6FA / ISO10497	
34		Anti Static Testing Requirement		As per BS-1873 Latest Edition	
35		Hardness Test		248 HV10 max	
36		Painting (Note-14)		As per specification (Suitable for Highly Corrosive Environment)	
37		Operator Data Sheet No.		Not Applicable	
38		Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable	
39		Pressure (Min/Nor/Max) (barg)		Not Applicable	
40		Temperature (Min/Nor/Max) (° C)		Not Applicable	
41		Max Shutoff DP (barg)		Not Applicable	
42		Viscosity (cP)		Not Applicable	
43		Density (Kg/m ³)		Not Applicable	
44		Moi . Wt		Not Applicable	
45		Sp Heat Ratio (Cp/Cv)		Not Applicable	
46		Compressibility (Z)		Not Applicable	
47		Ambient Temperature		Not Applicable	
48		Outside Diameter (Inch)		DN 50 (NPS 2") to DN 200 (NPS 8")	
49		Thickness (mm) / Schedule		As per Piping Material Specification	
50		Pipe Material		As per Piping Material Specification	
51		Design Code		ASME B31.8	
52		ASME Rating		300#	
53		Piping Class		30HC	
54		Orientation of Pipe		Suitable for all orientation	

  ENERGISING QUALITY. <i>Our Ethical One Pillar</i>		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGLP)		JOB NO : C231099	
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2003A	
		DATA SHEET OF FLANGED / BW, ABOVEGROUND, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300# , PIPING CLASS - 30HC		No. of Pages : 02	Revision
Location		-	MR No.	-	
SR.NO		-	P.O No.	#	
55	VALVE MATERIAL	Part Description	Material Specified	Material Offered (By Bidder)	
56		Body (Forged / Cast)	ASTM A216 GR. WCB/ASTM 105		
57		Bonnet (Pressure Seal Type)	ASTM A216 GR. WCB/ASTM 105		
58		Disc (Plug Type)	Hard faced (Trim 5), Loose Plug, Conical		
59		Stem (Rising)	SS - 304 / SS - 316 (NO CASTING)		
60		Body Seat Ring	STELLITED-6		
61		Gland / Stem Packing	Corrosion inhibited die formed flexible graphite with braided anti-extrusion ring (Renewable with valve open on stream)		
62		Bonnet Gasket	Soft Iron (Max 90 BHN)/ Graphite with Braided Anti Extrusion Ring		
63		Body Stud	ASTM A 193 Gr. B7		
64		Body Nut	ASTM A 194 Gr. 2H		
65		Handle / Lever / Hand Wheel	Carbon Steel		
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.		*	
67		Flow Coefficient, Kv (Cubic Meters per Hour)		*	
68		Valve Cavity Volume(CC)	Open position	*	
69			Closed position	*	
70		Operator Manufacturer / Model No.		*	
71		Break-away Torque Under Max. Diff Pressure(Nm)		*	
72	Running Torque (Open - Close/Close - Open) (Nm)		*		
73	NOTES	NOTES:			
74		1. This Data Sheet shall be read in conjunction with Tender Documents & Specifications.			
75		2. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.			
76		3.All tests shall be carried out as per BS 1873 & BSEN 12266 part-1.			
77		4. Gland packing assembly shall permit repair of gland packing under full line pressure.			
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.			
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.			
80		7. Valves shall have support foot & lifting lugs as per valve Specification.			
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.			
82		9. Wrench operated valves shall be supplied with wrench.			
83		10. The Charpy Impact temperature shall be -29°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2504) requirement at 0°C			
84		11. Design of Welded Valves shall be such that during field welding operation, the soft or plastic components of valve are not liable to be damages.			
85		12. Gasket Material Graphite Shall Be Provided With Corrosion Inhibitor.			
86		13. Valve wall thickness shall be as per ANSI B16.34 / API 623. Manufacturer shall have valid API 623 license to use API monogram. API monogram is required.			
87		14 .For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy (Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating			
88		15. Stem extension length shall be finalized during drawing approval stage after award of order.			
89		16. For Metal Seated Valves, Bidder to Confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle. For Soft Seated Valves, Bidder to carry out Fire Safe Design & test as per API 6FA/ ISO 10497/API 6FD.			
90		17. The offered valve shall deemed to have been fire-tested if vendor submit Fire Test Certificate (Approved & Certified by Governing TPIA) of earlier tested valve of similar design & size.(Qualification Size as per API 6FA/ ISO 10497/API 6FD Codes)			
91	18. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.				

		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099	
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2003B	
		DATA SHEET OF FLANGED / BW, ABOVEGROUND, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300#, PIPING CLASS - 30HLT		No. of Pages : 02	Revision C1 15.11.2023
Location		-		MR No.	
SR.NO		-		P.O No.	
1		Valve Manufacturer			
2		Tag Numbers / Material Requisition Item No.		Refer Material Requisition (MR) Item No / As per P&ID	
3		Company's Specification No.		VCS-SS-PP-2504	
4		Category		-	
5		Pipeline Line No		Not Required	
6		Class		30HLT	
7		Size		DN 50 (NPS 2") to DN 200 (NPS 8")	
8		Type of Valve		Rising Stem, Plug type disc, OS & Y , Straight Pattern	
9		Type of Port (Full / Reduced)		Not Applicable	
10		Design Temperature (° C)		Maximum	
11				Minimum	
12		Corrosion Allowance (mm)		1.5	
13		Installation (Aboveground/Underground)		Aboveground	
14		Service		Natural Gas (NG)	
15		End Connection		As per P&ID	
16		Flange Face Finish		RF/12SAARH for Flanged Ends	
17		Design Standards		BS 1873, ASME 16.34 & API 598	
18		End Connection Standard		ASME B16.5 - Flanged End ASME B16.25 - Butt Welded End	
19		ASME Class		300#	
20		Stem Extension Requirement		Not Required	
21		Length of Stem Extension (If required, Note - 15)		Not Applicable	
22		Orientation of Stem		Perpendicular to Valve Axis	
23		Type of Valve Operator		As per Standard Specification	
24		Valve Actuator Operating Time		Not Applicable	
25		Requirement of Locking Mechanism (LO / LC)		As per P&ID	
26		Length of Pup Piece / Nipple (mm), (If Required) (Integrally welded to the BW valve on each side)		Not Applicable	
27		Pup Piece Size / Material Grade / Schdeule/ Thickness		Not Applicable	
28		Operator Specification No.		Not Applicable	
29		Valve Design Pressure (kg/cm ²)		49 (kg/cm ²)	
30		Hydrostatic Test Pressure (kg/cm ²) & Time		Body : 73.5 kg/cm ² & Test Duration - 30 Minutes	Body : 54 kg/cm ² & Test Duration - 30 Minutes
31		Pneumatic Test Pressure (kg/cm ²) & Time		7.0 kg/cm ² & Test Duration - 15 Minutes	
32		Charpy Impact Test (°C)		Yes (at -45 °C)	
33		Fire Safe Design (Note- 16 & 17)		API 6FA / ISO10497	
34		Anti Static Testing Requirement		As per BS-1873 Latest Edition	
35		Hardness Test		248 HV10 max	
36		Painting (Note-14)		As per specification (Suitable for Highly Corrosive Environment)	
37		Operator Data Sheet No.		Not Applicable	
38		Flow (Min/Nor/Max) (m ³ /hr)		Not Applicable	
39		Pressure (Min/Nor/Max) (barg)		Not Applicable	
40		Temperature (Min/Nor/Max) (° C)		Not Applicable	
41		Max Shutoff DP (barg)		Not Applicable	
42		Viscosity (cP)		Not Applicable	
43		Density (Kg/m ³)		Not Applicable	
44		Moi . Wt		Not Applicable	
45		Sp Heat Ratio (Cp/Cv)		Not Applicable	
46		Compressibility (Z)		Not Applicable	
47		Ambient Temperature		Not Applicable	
48		Outside Diameter (Inch)		DN 50 (NPS 2") to DN 200 (NPS 8")	
49		Thickness (mm) / Schedule		As per Piping Material Specification	
50		Pipe Material		As per Piping Material Specification	
51		Design Code		ASME B31.8	
52		ASME Rating		300#	
53		Piping Class		30HLT	
54		Orientation of Pipe		Suitable for all orientation	

  ENERGISING QUALITY		CLIENT : GOA NATURAL GAS PRIVATE LIMITED (GNGPL)		JOB NO : C231099		
		PROJECT : CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA		DOC. NO.: C231099-00-PP-DS-2003B		
		DATA SHEET OF FLANGED / BW, ABOVEGROUND, GLOBE VALVE DN 50 TO DN 200 (NPS 2" TO NPS 8"), RATING 300#, PIPING CLASS - 30HLT		No. of Pages : 02	Revision	
Location		-	MR No.	-		
SR.NO		-	P.O No.	#		
55	VALVE MATERIAL	Part Description	Material Specified	Material Offered (By Bidder)		
56		Body (Forged / Cast)	ASTM A352 Gr.LCB/ ASTM A350 Gr.LF2 CL1			
57		Bonnet (Pressure Seal Type)	ASTM A352 Gr.LCB/ ASTM A350 Gr.LF2 CL1			
58		Disc (Plug Type)	Hard faced (Trim 5), Loose Plug, Conical			
59		Stem	SS - 304 / SS - 316 (NO CASTING)			
60		Body Seat Ring	STELLITED-6			
61		Gland / Stem Packing	Corrosion inhibited die formed flexible graphite with braided anti-extrusion ring (Renewable with valve open on stream)			
62		Bonnet Gasket	Soft Iron (Max 90 BHN)/ Graphite with Braided Anti Extrusion Ring			
63		Body Stud	ASTM A320 GR.L7			
64		Body Nut	ASTM A194 GR.4			
65		Handle / Lever / Hand Wheel	Malleable Iron/ Cast Steel/ Ductile Iron/Carbon Steel			
66	DATA TO BE PROVIDED BY VENDOR (if Applicable)	Valve Model No.		*		
67		Flow Coefficient, Kv (Cubic Meters per Hour)		*		
68		Valve Cavity Volume(CC)	Open position		*	
69			Closed position		*	
70		Operator Manufacturer / Model No.		*		
71		Break-away Torque Under Max. Diff Pressure(Nm)		*		
72	Running Torque (Open - Close/Close - Open) (Nm)		*			
73	NOTES	NOTES:				
74		1. This Data Sheet shall be read in conjunction with Tender Documents & Specifications.				
75		2. Dimension / Input Data as & where marked " * " shall be supplied by Vendor.				
76		3.All tests shall be carried out as per BS 1873 & BSEN 12266 part-1.				
77		4. Gland packing assembly shall permit repair of gland packing under full line pressure.				
78		5. Valve design shall ensure repair of stem seals / packing under full line pressure.				
79		6. 100.0 % Valve castings shall undergo Radiographic Examination.				
80		7. Valves shall have support foot & lifting lugs as per valve Specification.				
81		8. Valve design shall ensure repair of stem seals / packing under full line pressure.				
82		9. Wrench operated valves shall be supplied with wrench.				
83		10. The Charpy Impact temperature shall be -45°C as specified in data sheet and it shall superceded the Specification (VCS-SS-PP-2504) requirement at 0°C				
84		11. Design of Welded Valves shall be such that during field welding operation, the soft or plastic components of valve are not liable to be damages.				
85		12. Gasket Material Graphite Shall Be Provided With Corrosion Inhibitor.				
86		13. Valve wall thickness shall be as per ANSI B16.34 / API 623. Manufacturer shall have valid API 623 license to use API monogram. API monogram is required.				
87		14 .For the valves to be installed underground the external surfaces of buried portion of the valve shall be painted with 100% Solid high build epoxy (Powercrete R-95) with a minimum dry film thickness of 1000 microns or 1.5 mm thick polyurethane coating				
88		15. Stem extension length shall be finalized during drawing approval stage after award of order.				
89		16. For Metal Seated Valves, Bidder to Confirm that in offered valves, there shall not be any external leakage during fire and valve is capable of handling fire for the mentioned time as specified in API 6FA/ ISO 10497/API 6FD. Bidder also to confirm that in case of fire, the valve shall be unseated from the closed position against the high test pressure and moved to the fully open position i.e. In case of fire, valve shall complete one open-close cycle. For Soft Seated Valves, Bidder to carry out Fire Safe Design & test as per API 6FA/ ISO 10497/API 6FD.				
90		17. The offered valve shall deemed to have been fire-tested if vendor submit Fire Test Certificate (Approved & Certified by Governing TPIA) of earlier tested valve of similar design & size.(Qualification Size as per API 6FA/ ISO 10497/API 6FD Codes)				
91	18. Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.					

	CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA						
CLIENT	GOA NATURAL GAS PRIVATE LIMITED (GNGPL)						
PMC	VCS QUALITY SERVICES PVT. LTD.						
DATA SHEET : GLOBE VALVE (LESS THAN 2.0 INCH) SOCKET WELDED							
GENERAL SPECIFICATION							
Process Fluid	NG	ANSI Pressure Rating	800#				
Design Temperature	(-)-29°C to 65°C	Design Pressure	49 barg				
Size, Inch (DN)	Less than 2" (50)						
Valve Type	Rising Stem						
End Connection Type	Socket Welded	Design Standard	BS 5352				
Face Finish	Not Applicable	Locking Arrangement	As per P&ID				
VALVE DESIGN CONDITIONS							
Corrosion Allowance	1.5 mm	Design Factor	0.5				
Installation	Above Ground	Stem Ext Length (mm)	Not Applicable				
VALVE OPERATION							
Actuation Type	Not Applicable	Type of Actuator	Not Applicable				
PUP PIECE DETAILS							
100mm extension pups in ASTM A106 Gr.B, Sch 160 (for 3/4") and Sch XS (for 1 1/2")							
VALVE MATERIAL SPECIFICATION							
PART DESCRIPTION	MATERIAL SPECIFIED		MATERIAL OFFERED (Equivalent or Higher)				
Body	ASTM A105						
Bonnet (Bolted)	ASTM A105						
Disc (Loose Plug/ Ball Type)	SS316 + Stellite						
Stem (Rising)	13% Cr Steel (No Casting)						
Body Seat Ring	SS316 + Stellite						
Stem Packing (Renewable with valve open on stream)	Corrosion inhibited die formed flexible graphite with braided anti extrusion rings						
Hand Wheel (Rising)	Malleable Iron/ Cast Steel/ Fab. Steel						
Bonnet Gasket	Spiral Wound SS316 + Grafoil						
Body Studs/ Nuts	ASTM A193 Gr. B7/ A194 Gr. 2H						
TESTING REQUIREMENT							
Hydrostatic Test Pressure & Time	Body: 210 kg/cm ² & 30 Minutes		Seat: 155 kg/cm ² & 30 Minutes				
Pneumatic Test Pressure & Time	7 kg/cm ² & 15 Minutes						
Hardness Test	248 HV10 max.						
Charpy Impact Test @ Temperature	Yes (at -29°C)						
Fire Safe Test	API 607 / ISO10497						
DOCUMENT NO.							
C231099-00-PP-DS-2003C							
	D1	15.11.2023	VI	AK	SKN	ISSUED FOR BID	
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD	REMARKS



CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA



CLIENT

GOA NATURAL GAS PRIVATE LIMITED (GNGPL)

PMC

VCS QUALITY SERVICES PVT. LTD.

DATA SHEET : GLOBE VALVE (LESS THAN 2.0 INCH) SOCKET WELDED

Valve Painting Specification :

1	Surface Preparation by Short Blasting as per grade SA 2 1/2, Swedish Standard SIS-055 909.
2	For above ground installation - Three coats of corrosion resistant paint shall be applied with minimum thickness of 300 micron (Permissible thickness in each coat shall be within 80 to 120 micron). Colour of paint shade shall be RAL-7038, however any change in colour shall be finalized during drawing approval stage.
3	Lock open/ lock close requirement : As indicated in P&ID / Schedule of Rates (SOR).

NOTES :

1	This Data Sheet shall be read in conjunction with Tender Documents & Specifications.
2	Material test certificates and hydrostatic test reports shall be furnished prior to dispatch.
3	Stem packing shall be renewable with valve open on stream.
4	Detailed dimensional drawings showing cross-section with part numbers and materials shall be submitted for purchaser's approval prior to manufacture of the valves.
5	All tests shall be carried out as per BS 5352 & BS EN 12266 part-1.
6	Gland packing assembly shall permit repair of gland packing under full line pressure.
7	The Charpy Impact Test temperature specified in datasheet shall supersede the specification requirements.
8	Painting procedure of valves shall be as per Manufacturer's standard.
9	Minimum all pressure containing and controlling parts of the valve shall be provided with EN 10204-3.2 certificate.

DOCUMENT NO.						
C231099-00-PP-DS-2003C						
	D1	15.11.2023	VI	AK	SKN	ISSUED FOR BID
SHEET NO.	1 OF 2	REV	DATE	PRPD	CHKD	APVD
REMARKS						



PROJECT NUMBER: C231099



PIPING MATERIAL SPECIFICATION

Total Sheets

39

Document No

C231099

00

PP

PMS

2001

GOA NATURAL GAS PRIVATE LIMITED (GNGPL)

CITY GAS DISTRIBUTION PROJECT OF NORTH GOA GA

REV	DATE	DESCRIPTION	PREP	CHKD	APPR
C1	14.11.2023	Issued for Client Review	MNH	AK	SKN

ABBREVIATION

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AARH	Arithmetic Average Roughness Height
BS	British Standards
CS	Carbon Steel
MS	Mild Steel
IS	Indian Standard Code
NFPA	National Fire Protection Association
OISD	Oil Industry Safety Directorate
PNRGB	Petroleum & Natural Gas Board
ERW	Electric Resistance Welding
BE	Bevel End
BW	Butt Welded
FF	Flat Face
PBE	Plain Both End
PE	Plain End
RF	Raised Face
SCRF	Screwed End - Female
SCRM	Screwed End - Male
CA	Corrosion Allowance
M	To Match Pipe

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1.0 INTRODUCTION

This specification covers minimum requirements for the material specification for pipe, fittings, flanges, line blinds, bolts, gaskets, and valves that shall be used for natural gas pipeline and associated facilities in accordance with ASME B31.8, OISD-226 and PNGRB guideline.

This specification also defines, by piping class for each listed service, and defines the pressure/temperature limitations within which they may be used.

This specification shall be read in conjunction with various codes and standards as applicable.

2.0 CODES AND STANDARDS

Pipeline and pipeline terminal facilities envisaged as part of this project shall be designed and engineered primarily in accordance with the provisions of the latest edition of the following codes:

ASME 31.3	:	Process Piping
ASME 31.8	:	Gas Transmission and Distribution Piping Systems
OISD STD-226	:	Natural Gas Transmission Pipeline and City Gas Distribution Networks
PNGRB	:	Petroleum and Natural Gas Regulatory Board

All codes, standards and specifications referred herein shall be the latest edition of such documents.

For sake of brevity the initials of the society to which the codes are referred may be omitted in the specifications, for example, B16.5 is a code referring to ASME A106 is a code referring to ASTM.

In addition to this PMS, various piping and pipeline materials shall also be applicable.

3.0 MATERIAL SPECIFICATIONS

Individual piping class has been generally designed to cover a set of service operating within pressure-temperature consideration as per ASME B16.5/ B16.34 or part of it. Deviations of material from class specifications may occur due to specific design conditions and/or availability. These deviations are permissible if they equal or better the individual class requirements and shall be subjected to approval on case-to-case basis.

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4.0 CLASS DESIGNATION CODE

The piping class designation shall generally consist of three digits made up of a letter, number & letter e.g. 15HC, 15HLT, 30HC, 30 HLT, 60HC etc. as follows:

First two numerals letter indicates ASME class rating, e.g.

- 15 - 150 Class
- 30 - 300 Class
- 60 - 600 Class

The first alphabet indicates differences in the Fluid Services within the same class rating and material, e. g. H stands for Hydrocarbon, W stands for Water, G stands for Galvanize etc.

The last one or two letter (as applicable) indicates type of material, e.g.

- C - Carbon steel
- LT - Low Temperature (Carbon Steel)

5.0 TECHNICAL REQUIREMENTS

5.1 General Notes

1. All piping materials selected under this specification shall be in compliance with the project specification.
2. Material selections shall comply with the maximum pressure and temperature limitation as specified in the service summary.
3. Substitution of equivalent materials is subject to approval of the Client /PMC. All requests for substitution shall be accompanied with sufficient data, drawings and descriptive details to permit evaluation by the Client /PMC.
4. Cast iron, ductile or malleable iron, aluminum, plastic or copper-bearing alloys shall not be used in hydrocarbon service.
5. Piping design pressure is based on flange maximum-allowable working pressure, unless otherwise noted in Job Specification.
6. When required, impact testing shall comply with applicable standards and material specifications.
7. All gaskets shall be asbestos free.
8. Aluminum jumper shall be provided across the flanged joint and length of the bolt shall be taken such that at least two threads remain exposed after the nut for fixing the continuity jumper.

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5.2 Units

1. All units are expressed in SI system with the exception of nominal pipe sizes (NPS) and bolting diameters, which are in inches.
2. Pressures are gauge pressures (in Kg/cm²g) and temperatures are in deg. Celsius (°C).
3. Pressures and Temperatures ratings are based ASME 16.5.

6.0 PIPELINE

- Line pipe material grade and wall thickness details are indicated in PMS.

7.0 PIPES

- Carbon steel pipe shall be made by open hearth, electric furnace or basic oxygen process only. The steel used shall be fully killed and made with fine grain structure. The grade and wall thickness of various sizes of pipes shall be as per piping material specification for the applicable class.
- Pipe dimensions shall be in accordance with ASME B 36.10 for carbon steel ASTM standard pipes & API 5L for carbon steel API 5L grade pipes.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- For butt weld end, bevel shall be in accordance with API specification 5L or ASME B16.25 as applicable.
- Where difference in thickness of matching pipe ends exist, bevels for such matching pairs shall be prepared in accordance with ASME B 31.8.
- Pipes shall be supplied with beveled end. Beveling shall be in accordance with ASME B16.25. Where plain end pipes are specified, as for small bore pipes for socket welded piping, the pipes shall be supplied with square cut ends.
- All pipe threads shall conform to American Standard taper as per ASME B 1.20.1 NPT, unless otherwise specified.
- Dimensions of socket weld ends shall confirm to ASME B 16.11. Bore shall match pipe OD and pipe ID.
- Pipe to pipe joints shall be made as follows:

For sizes upto & including DN40

Socket weld/ As per Piping Class

For size DN50 and above

Butt Welded

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8.0 FITTINGS

- Fully killed carbon steel shall be used in the manufacture of fittings. The fitting shall have carbon equivalent not exceeding 0.45, based on check analysis.
- Threaded joints, if used, shall conform to American Standard taper as per ASME B1.20.1 NPT.
- Dimensions of socket welded/screwed fittings shall conform to ASME B 16.11. Swage shall be as per BS 3799.
- Dimensions of steel butt welded fittings shall be as per ASME B 16.9.
- Bore of socket welded fittings shall suit outside diameter (OD) of pipe and its thickness.
- Butt welding ends shall conform to API specification 5L or ASME B 16.25 as applicable. In case of difference in thickness of matching ends, requirements of ASME B 31.4 shall apply.
- Integrally reinforced forged branch fittings such as Sockolet, Weldolet etc. shall be as per MSS-SP-97. Fittings not covered in ASME B16.9 and MSS-SP-97 shall conform to manufacturer's standard.
- Fittings thickness tolerances shall match pipe thickness tolerance.

9.0 BENDS

- Unless otherwise specified for process piping, elbow of radius $R = 1.5 D$ shall only be used.
- In order to accommodate changes in vertical and horizontal alignment in piggable section of pipeline, Elastic bends/ Cold field bends/ Hot formed long radius bends shall be used. Radius of bend shall be as per Design Basis.

$D =$ Specified Outside Diameter

- Miters shall not be used.

10.0 FLANGES

- Pressure Temperature rating of flanges shall conform to B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Dimensions of flanges shall be in accordance with B16.5/ MSS-SP44/ B16.47 Series A, as applicable.
- Neck of weld neck (WN) flanges shall suit pipe bore and thickness.
- Bore of socket welded (SW) flanges shall suit pipe O.D. and its thickness.
- Threads for screwed flanges, if used, shall conform to American Standard taper as per ASME B 1.20.1 NPT.
- Sizes for blind flanges shall be indicated by nominal pipe size.

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- Unless specified otherwise in Piping Material Specification the flange face finish shall be as per ASME B16.5.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B 16.48/ manufacturer's standard.
- Flange face finish for raised face flanges shall be as per ASME B16.5/ ASME B 16.47 as applicable. For RTJ flanges groove finish shall be 32-63 micro inches AARH as per MSS-SP-6. Hardness of groove surface shall be minimum 140 BHN.
- Butt welding ends of WN flanges shall conform to ASME B 16.25.
- Spectacle blind/spacer & blinds shall be in accordance with ASME B16.48 / manufacturer's standard.
- Two jackscrews, 180° apart shall be provided for all RTJ flange assemblies and Spacer blind/ Figure 8 assemblies. Holes for jackscrews shall be drilled and tapped at site. Jackscrews shall be as per ASTM A193 Gr. B7. Heads of jackscrews shall be heavy hexagonal type and jackscrew end shall be rounded. Dimensions shall be as per ASME B18.2.1.
- Flanges shall be packed and shipped in such a way as to prevent damage of machined parts.
- All machined or threaded parts shall be protected in accordance with ASTM A700. Suitable protection shield, or cover shall be provided on the gasket contact surface.
- Carbon steel forgings shall be supplied with a maximum carbon content of 0.25% and CE of 0.45 by product analysis.
- The finish of contact faces of pipe flanges & connecting end flanges of valves & fittings shall be governed by ASME B16.5 & following:
Roughness requirements (Finish: AARH standards per ASME B46.1):
 - a) Raised Face (RF): Serrated finish 125 to 250 μ m Ra.
 - b) Flat Face (FF): Serrated finish 125 to 250 μ m Ra.
 - c) Ring Type Joint (RTJ): Extra-smooth finish 63 μ m Ra max.
- Flat face flanges, unless specified on the Piping Specifications, shall not be used without specific Client/PMC approval. Full-face gaskets shall be used with flat-face flanges as per ASME B16.20.
- All flanged joints shall be installed with a single gasket between contact faces.
- Spectacle blank (figure 8 blank), blank (blind) & spacer shall confirm to the requirement of ASME B16.48 up to sizes 24". For 150#, 300# and 600# spectacle blank shall be used up to 8", blank (blind) & spacer for sizes 10" & above

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11.0 GASKETS

- Spiral wound metallic gasket with Graphite filled winding with SS304 inner ring and CS outer ring/ Soft iron octagonal ring type joint gasket, and shall conform to ASME B 16.20/ API 601
- Spiral wound gaskets shall be self-aligning type.

12.0 BOLTING & THREADS

- Nuts for stud bolts shall be American Standard Hexagon Heavy Series and double chamfered.
- Dimension and tolerances for stud bolts and nuts shall be as per ASME B18.2.1 and 18.2.2 with full threading to ASME B 1.1 Class 2A thread for bolts and Class 2B for nuts. Diameter and length of stud bolts shall be as per ASME B16.5/ASME B16.47 with full threading.
- Threads for nuts shall be as per ASME B 1.1 as follows:

Nuts for stud bolts Dia ¼" to 1"	:	UNC-2B
Nuts for stud bolts Dia 1½" to 3¼"	:	8UN-2B
- Threads for stud bolts shall be as per ASME B 1.1, as follows:

Stud bolts Dia ¼" to 1"	:	UNC-2A
Stud bolts Dia 1½" to 3¼"	:	8UN-2A
- Threads for threaded pipe, fitting, flanges and valve shall be in accordance with B1.20.1 taper threads, unless specified otherwise.
- Heads of jack screws shall be heavy hexagonal type. Jack screw end shall be rounded. Stud bolts shall be fully threaded with two hexagonal nuts.

13.0 THREAD SEALANT

- Threaded joints shall be made with 1" wide PTFE jointing tape.

14.0 VALVES

- Valve ends shall be as per valve data sheets for various piping class.
- Sectionalizing valves, Block valves and other isolation valves installed on the main pipeline shall be ball valves with butt welding ends. All inline isolation valves on the mainline (pipeline) shall be full bore valves to allow smooth passage of cleaning as well as intelligent pigs.
- All buried valves shall be provided with stem extension shall have Butt Welded ends as per relevant specification/ data sheet.
- All valves in the piggable section of pipeline and Main Process Flow Line shall be Full Opening valve as per API 6D. Other valves shall be Reduced Opening type unless specified otherwise in P&ID.

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- Flange dimensions and face finish of flanged end valves shall conform to clause 10.0 of this specification.
- Butt welding ends of Butt Welded valves shall conform to ASME B 16.25.
- Face to face and end to end dimensions shall conform to applicable standards.
- Valves shall conform to following standards unless specified otherwise in piping material specification for various piping class.

Flanged/Socket Welded end valves (1½" and below)
Design STD. for Process lines

Gate Valves	:	API 602
Globe Valves	:	BS EN ISO 15761
Check Valves	:	BS EN ISO 15761
Ball Valve	:	BS EN ISO 17292
Plug Valve	:	BS 5353

Flanged/Butt Welded end valves (2" and above)
Design STD. for Process Lines

Gate Valves	:	API 6D
Globe Valves	:	BS 1873
Check Valves	:	API 6D
Ball Valve	:	API 6D
Plug Valve	:	API 6D

- All manual operated valves shall be provided with wrench / hand wheel or gear operator as specified here in below.

- **Gate Valves**

<p>For ANSI class 150 and 300</p> <p>For ANSI class 600</p>	-	<p>Hand wheel operated for size ≤ 12" NB.</p> <p>Gear operated for size ≥ 14" NB.</p> <p>Hand wheel operated for size ≤ 10" NB.</p> <p>Gear operated for size ≥ 12" NB.</p>
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- **Globe Valves**

For ANSI class 150, 300, 600 and 900 - Hand wheel operated for all Size.

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- **Ball Valves & Plug Valves**

- For all ANSI class
- Wrench operated for size ≤ 4 " NB.
 - Gear operated for size ≥ 6 " NB.

- **Actuated Valves**

Actuated valves shall be as per P&IDs. The actuator shall have provision for remote operation as per P & IDs. All Actuated valves shall have additional provision of hand wheel operation.

15.0 QUICK OPENING END CLOSURE

Quick opening end closure to be installed on scraper traps shall be designed in accordance with Section VIII of ASME Boiler and Pressure Vessel Code and equipped with safety locking devices in compliance with Section VIII, division 1, UG-35.2 of ASME Boiler and Pressure Vessel Code.

16.0 HYDROTESTING VENTS AND DRAINS

In terminal piping, high point vents and low point drains required for the purpose of hydro testing shall be of size 0.75". These vents & drains shall consist of gate valves with blind flange assembly.

17.0 PIPING SPECIALTY ITEMS

- Primary material Pipeline specialty items viz. flow tees, insulating joints, LR bends etc. shall be as per respective data sheets and specification.
- For mainline items, corrosion allowance shall be as per respective data sheet.

18.0 INSULATING GASKET, SLEEVE AND WASHER

The insulating gasket shall consist of a PTFE (Teflon) spring-energized face seal, or an elastomeric O-ring, seated in an isolating laminate, which shall be permanently bonded to a high strength metal gasket core. Due to this unique pressure activated sealing mechanism, the gasket requires far less bolt stress to seal than any other gasket. The gasket inner diameter shall be exactly matched to the flange bore to eliminate turbulent flow and flange face erosion/ corrosion. The seal elements shall be replaceable in the reusable gasket retainer. The core of gasket shall be made of annealed 316 stainless steel or other metals including duplex and Inconel etc.

Insulating gasket shall include the following applications,

- Flange isolation in conjunction with Cathodic protection.
- Isolation between dissimilar metals to prevent galvanic corrosion.

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- Mating mismatched ring-joint to raised –face flanges.
- Eliminate fluid trap corrosion between ring-joint (RTJ) flanges where high concentrations of Co₂, H₂S and other aggressive hydrocarbon media are present.
- Eliminate turbulence and flow induced erosion between ring-joint (RTJ) flanges.
- Protect against coating impingement on coated flange faces.
- To seal between flanges subjected to vibration/ cavitation.

18.1 Insulating Gaskets, Sleeves and Washer Materials Properties

Compressive Strength	:	65000 psi
Average Dielectric Strength	:	15 kV or more
Electrical Resistance	:	>1 MΩ (When tested with 500-1000 V DC merger)
Max. Operating Temperature	:	302°F (150°C)
Min. Operating Temperature	:	(-) 200°F (-129°C)
Water Absorption	:	5%
Flexural Strength	:	70000 psi
Tensile Strength	:	50000 psi
Bond Strength	:	2600 lb.
Shear Strength	:	22000 lb.

18.2 Seal Material

The sealing elements shall intend to provide an impervious barrier through which no contained media or other substance can penetrate. The composite retainer backing material behind the seal remains uncontaminated and thus permanently holds the seal in place in a static, fully encapsulated manner.

Viton as a seal material shall consist following properties,

- General purpose oilfield elastomer.
- Excellent resistance to aliphatic hydrocarbons, glycols and H₂S.
- Good resistance to aromatic hydrocarbons.

Isolating Sleeve

Mylar as a seal material shall consist following properties,

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- Spiral wound Mylar is a general-purpose material recommended for bolting application with flange temperatures below 250°F.
- Material shall be fair resistance to crushing, cracking, breaking and thread pinch.

Insulating washer: 1/8" (0.125) Thick washer

Steel Washer: ZPS standard – Zinc plated steel washers.

Butt weld (BW) ends of the insulating assembly shall be protected by metallic or high impact plastic bevel protectors.

The dimensions of insulating components (gaskets, sleeves and washers) shall be as indicated in Data Sheet. The insulating gasket and washers shall have adequate compressive strength to permit proper tightening of flange bolts for leak proof joint.

The insulating material shall be suitable for pressure and temperature indicated in Data Sheet under connecting pipeline details and shall be resistant to the fluid to be handled through the pipeline.

I.D. and O.D. of insulating washers shall be designed to fit over insulating sleeves and within spot faces on flanges.

After the hydrostatic test, insulating flange assembly shall be tested with air at 5 kg/cm² for 10 minutes. The tightness shall be checked by immersion or with a frothing agent. No leakage shall be accepted.

Insulating gasket, sleeve and washer after the field hydrostatic test shall be tested for dielectric integrity at 5000 V A.C., 50 Hz for one minute and the leakage current before and after shall be equal. Testing time, voltage and leakage shall be recorded and certified. The test shall be carried out in dry conditions.

19.0 CHARPY V-NOTCH TEST & HARDNESS TEST

All piping material like valves, fittings, flanges bolting etc. shall be Charpy impact tested. Charpy V-notch impact tests are required for the base metal weld metal and heat-affected zone (HAZ)

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Appendix – A

Piping Material Specification – Index

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Sr. No.	Piping Class	Rating	C. A. (MM)	Spl. Reqt.	Basic Material	Service	Remarks
1	15HC	150	1.5	NON IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE /NONFLAMMABLE, NON LETHAL- HYDROCARBONS	Page 17
2	15HLT	150	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE /NON-FLAMMABLE, NON LETHAL- HYDROCARBONS	Page 22
3	30HC	300	1.5	NON IBR	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON LETHAL- HYDROCARBONS	Page 28
4	30HLT	300	1.5	LOW TEMPER ATURE SERVICE	CARBON STEEL	NON-CORROSIVE PROCESS-FLAMMABLE / NONFLAMMABLE, NON LETHAL- HYDROCARBONS	Page 35

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Appendix – B
Piping Class

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PIPE CLASS	15HC
DESIGN CODE	ASME B31.8
RATING	150#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-29	38	93	149	204	260	316	343	371
Pressure	20.03	20.03	18.28	16.17	14.06	11.95	9.84	8.78	7.73

NOTES:

- All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
- NDT of welds shall be as follows:
Radiography : All butt welds 100%
MPI : Socket welds 100%
- Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 29°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- For valves, refer valve data sheets.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing
Vents	ON LINES <= 1.5"	Refer std Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing

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Temp. Connection	1.5"	Flanged, installation as per std. Drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. Drawing

Branch Table

																T	24	BRANCH PIPE (INCH)
															T	T	20	
														T	T	T	18	
													T	T	T	T	16	
												T	T	T	T	T	14	
											T	T	T	T	T	12		
										T	T	T	T	T	T	10		
									T	T	T	T	T	T	W	8		
								T	T	T	T	T	T	W	W	W	6	
							T	T	T	W	W	W	W	W	W	4		
						T	T	T	W	W	W	W	W	W	W	3		
					T	T	T	W	W	W	W	W	W	W	W	2		
				T	T	T	T	S	S	S	S	S	S	S	S	1.5		
			T	T	T	S	S	S	S	S	S	S	S	S	S	1		
		T	T	T	T	S	S	S	S	S	S	S	S	S	S	0.75		
T	T	T	T	S	S	S	S	S	S	S	S	S	S	S	S	0.05		
0.05	0.75	1	1.5	2	3	4	6	8	10	12	14	16	18	20	24			
PIPE RUN Size (INCH)																		

CODES

T
W
S

DESCRIPTION

Tees
Weldolet
Sockolet

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 106 GR.B	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 106 GR.B	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 106 GR.B (Charpy)	BE, SEAMLESS
PIPE	03.000	14.000	STD	B-36.10	ASTM A 106 GR.B (Charpy)	BE, SEAMLESS
PIPE	16.000	24.000	STD	B-36.10	ASTM A 672 B65 CL-12 (Charpy)	BE, E.FS.W
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 106 GR.B	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	00.500	01.500	M	B-16.5	ASTM A 105	150, RF/125AARH
FLNG.WN	2.000	24.000	M	B-16.5	ASTM A 105 (Charpy)	150, RF/125AARH
FLNG.BLIND	00.500	01.500		B-16.5	ASTM A 105	150, RF/125AARH
FLNG.BLIND	00.500	24.000		B-16.5	ASTM A 105 (Charpy)	150, RF/125AARH
FLNG.FIG.8	00.500	08.000		ASME B16.48	ASTM A 105 (Charpy)	150, FF/125AARH
SPCR&BLND	10.000	24.000		ASME B16.48	ASTM A 105 (Charpy)	150, FF/125AARH
FITTING GROUP						
ELBOW.90	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	02.000	12.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW, 1.5D
ELBOW.45	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW, 1.5D
T.EQUAL	00.500	01.500		B-16.11	ASTM A 105	SW, 6000
T.EQUAL	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
T.RED	00.500	01.500		B-16.11	ASTM A 105	SW, 6000

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T.RED	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. CONC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
REDUC. ECC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 105 (Charpy)	PBE
SWAGE.ECC	00.500	03.000	M, M	BS-3799	ASTM A 105	PBE
CAP	00.500	00.750		B-16.11	ASTM A 105	SCRF, 6000
CAP	01.000	01.500		B-16.11	ASTM A 105	SCRF, 3000
CAP	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (Charpy)	BW
PLUG	00.500	00.750		B-16.11	ASTM A 105	SCRM, 6000
O'let						
WELDOLET	02.000	06.000	M, S160	MSS-SP97	ASTM A 105 (Charpy)	BW
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 105	SCRF, 6000
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
VALVES GROUP						
VLV.GLOBE	00.250	01.500		BS EN 15015761	BODY-ASTM A 105,TRIM-STELLITED,STEM-13%CR STEEL	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	24.000		BS-1873	BODY-ASTM A 216 GR.WCB,TRIM- 13% CR.STEEL	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	00.250	01.500		BS EN 15015761	BODY-ASTM A 105,TRIM-STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	24.000		API-6D	BODY-ASTM A 216 GR.WCB,TRIM- 13% CR.STEEL	FLGD, 150, B-16.5, RF/125AARH

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
VLV.BALL	00.500	01.500		BS EN 15017292	BODY-ASTM A 105,TRIM-13% CR.STEEL, SEAT-RPTFE	SW, 800, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000		API-6D	BODY-ASTM A216 GR.WCB,TRIM/BALL SEAT-(AISI 4140 + 0.003"ENP)/AISI 410	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000		API-6D	BODY-ASTM A 216 GR.WCB, TRIM-BALL, SEAT-(AISI 4140 + 0.003"ENP) /AISI 410	BW, 150, B-16.25
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 105,PLUG - A105 + 0.003" ENP	SW, 800, 3000, B-16.11,
VLV.PLUG	02.000	24.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 150, B-16.5, RF/125AARH
VLV.PLUG	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 150, B-16.25
BOLT GROUP						
BOLT.STUD	00.500	48.000		B-18.2	BOLT:A193 GR.B7, NUT:A194 GR.2H	
GASKET GROUP						
GASKET	00.500	24.000		B-16.20-ANSI B16.5	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150
GASKET	26.000	48.000		B-16.20-ANSI B16.47A	SP.WND METTALIC WITH GRAPHITE FILLER	SPIRAL, 150

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPE CLASS	15HLT
DESIGN CODE	ASME B31.8
RATING	150#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93
Pressure	18.63	18.63	17.92

NOTES:

- All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
- NDT of welds shall be as follows:
Radiography : All butt welds 100%
MPI : Socket welds 100%
- Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- For valves, refer valve data sheets.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. Drawing
Vents	ON LINES <= 1.5"	Refer std. Drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std Drawing

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Temp. Connection	1.5"	Flanged, installation as per std. Drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std. Drawing

Branch Table

								T	6	BRANCH PIPE (INCH)
						T	T	4		
				T	T	T	3			
			T	T	T	W	2			
		T	T	T	T	S	1.5			
	T	T	T	S	S	S	1			
	T	T	T	T	S	S	0.75			
T	T	T	T	S	S	S	S	0.05		
0.05	0.75	1	1.5	2	3	4	6			
PIPE RUN Size (INCH)										

CODES	DESCRIPTION
T	Tees
W	Weldolet
S	Sockolet

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 333 GR.6	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
PIPE	03.000	06.000	STD	B-36.10	ASTM A 333 GR.6	BE, SEAMLESS
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 333 GR.6	PBE, SEAMLESS
FLANGE GROUP						
FLNG.WN	00.500	06.00	M	B-16.5	ASTM A 350 GR.LF2	150, RF/125AARH
FLNG.BLIND	00.500	06.00		B-16.5	ASTM A 350 GR.LF2	150, RF/125AARH
FLNG.FIG.8	00.500	06.00		ASME B16.48	ASTM A 350 GR.LF2	150, FF/125AARH
FITTING GROUP						
ELBOW.90	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.90	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.90	02.000	6.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
ELBOW.45	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
ELBOW.45	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
ELBOW.45	02.000	6.000	M	B-16.9	ASTM A 420 GR.WPL6	BW, 1.5D
T.EQUAL	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
T.EQUAL	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
T.EQUAL	02.000	06.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
T.RED	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
T.RED	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
T.RED	02.000	06.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. CONC	02.000	06.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
REDUC. ECC	02.000	06.000	M, M	B-16.9	ASTM A 420 GR.WPL6	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 350 GR.LF2	PBE
SWAGE.ECC	00.500	03.000	M, M	BS-3799	ASTM A 350 GR.LF2	PBE
CAP	00.500	01.500		B-16.11	ASTM A 350 GR.LF2	SCRFB, 3000
CAP	02.000	06.000	M	B-16.9	ASTM A 420 GR.WPL6	BW
PLUG	00.500	01.500		B-16.11	ASTM A 350 GR.LF2	SCRM, 3000
COUPLING FULL	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
COUPLING FULL	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000
COUPLING HALF	00.500	00.75		B-16.11	ASTM A 350 GR.LF2	SW, 6000
COUPLING HALF	01.000	01.500		B-16.11	ASTM A 350 GR.LF2	SW, 3000

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch. / Thk.	Dmn. STD	Material (Charpy)	Description
O'let						
WELDOLET	02.000	06.000	M, XXS	MSS-SP97	ASTM A 350 GR.LF2	BW
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 350 GR.LF2	SW, 6000
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 350 GR.LF2	SW, 3000
VALVES GROUP						
VLV.GLOBE	00.50	01.500		BS EN 150 15761	BODY-ASTM A 350 GR.LF2, TRIMSTELLIT ED, STEMSS304	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	06.000		BS-1873	BODY-ASTM A 350 GR.LF2, / ASTM A 352 GR.LCB	FLGD, 150, B-16.5, RF/125AARH
VLV.CHECK	00.50	01.500		BS EN 150 15761	BODY-ASTM A 350 GR.LF2,	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	06.000		API-6D/BS-1868	BODY-ASTM A 350 GR.LF2, / ASTM A 352 GR.LCB TRIM-STELLIT ED	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	00.500	01.500		BS EN 150 17292	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1, TRIM-BODY SEAT-RPTFE	SW, 800, 3000, B-16.11
VLV.BALL	02.000	06.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	FLGD, 150, B-16.5, RF/125AARH
VLV.BALL	02.000	06.000		API-6D	BODY-ASTM A352 GR.LCB / ASTM A350 GR.LF2 CL.1,	BW, 150, B-16.25
BOLT GROUP						

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BOLT.STUD	00.500	6.000		B-18.2	BOLT:A320 GR.L7, NUT:A194 GR.4	
GASKET GROUP						
GASKET	00.500	6.000		B-16.20- ANSI B16.5	SP.WND SS316+ GRAFOIL	SPIRAL, 150

Note: For all Valves, valve data sheets shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPE CLASS	30HC
DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Non IBR
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-29	38	93	149	204	260	316
Pressure	52.02	52.02	47.45	46.05	44.64	42.18	40.66

NOTES:

- All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
- NDT of welds shall be as follows:
 - Radiography : All butt welds 100%
 - MPI : Socket welds 100%
- Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 29°C.
- Corrosion allowance of 1.5 mm has been considered for terminal piping.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- For valves, refer valve data sheets as enclosed.
- Design Factor 0.5
9. Ball Valve to be used in main pipeline shall have butt welded ends.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing

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Vents	ON LINES \leq 1.5"	Refer std. drawing
	ON LINES \geq 2.0"	As per P&ID or 0.75". Refer std. drawing
Temp. Connection	1.5"	Flanged, installation as per std. drawing, except skin temperature measurement.
Press. Connection	0.75"	SW nipple with Plug/ Ball Valve to spec. as per Refer std drawing

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch ./ Thk	Dmn. STD	Material (Charpy)	Description
PIPE GROUP						
PIPE	00.500	00.750	S160	B-36.10	ASTM A 106 GR.B	PE, SEAMLESS
PIPE	01.000	01.500	XS	B-36.10	ASTM A 106 GR.B	PE, SEAMLESS
PIPE	02.000	02.000	XS	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, SEAMLESS
PIPE	03.000	14.000	STD	B-36.10	ASTM A 106 GR.B (CHARPY)	BE, SEAMLESS
PIPE	16.000	20.000	XS	B-36.10	ASTM A 672 Gr B65 CL-12 (CHARPY)	BE, E.FS.W
PIPE	24.000	24.000	S30	B-36.10	ASTM A 672 Gr B65 CL-12 (CHARPY)	BE, E.FS.W
NIPPLE	00.500	01.500	M	B-36.10	ASTM A 106 GR.B	PBE, SEAMLESS
FLANGE GROUP						
FLNG.SW	00.500	01.500	M	B-16.5	ASTM A 105	300, RF/125AARH
FLNG.WN	02.000	24.000	M	B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.BLIND	00.500	01.500		B-16.5	ASTM A 105	300, RF/125AARH
FLNG.BLIND	02.000	24.000		B-16.5	ASTM A 105 (CHARPY)	300, RF/125AARH
FLNG.FIG.8	00.500	01.500		ASME- B 16.48	ASTM A 105	300, FF/125AARH

Item	Lower Size (Inch)	Upper Size (Inch)	Sch. /Thk	Dmn. STD	Material (Charpy)	Description
FLNG.FIG.8	02.000	08.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
SPCR&BLND	10.000	24.000		ASME- B 16.48	ASTM A 105 (CHARPY)	300, FF/125AARH
FITTING GROUP						
ELBOW.90	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
ELBOW.90	01.000	01.500		B-16.11	ASTM A 105	SW, 3000

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ELBOW.90	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
ELBOW.45	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
ELBOW.45	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
ELBOW.45	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW, 1.5D
T.EQUAL	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
T.EQUAL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T.EQUAL	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
T.RED	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
T.RED	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
T.RED	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. CONC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
REDUC. ECC	02.000	24.000	M, M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
SWAGE. CONC	00.500	03.000	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
SWAGE. ECC	00.500	03.000	M, M	BS-3799	ASTM A 105 (CHARPY)	PBE
CAP	00.500	00.750		B-16.11	ASTM A 105	SCRIF, 6000
CAP	01.000	01.500		B-16.11	ASTM A 105	SCRIF, 3000
CAP	02.000	24.000	M	B-16.9	ASTM A 234 GR.WPB (CHARPY)	BW
PLUG	00.500	00.750		B-16.11	ASTM A 105	SCRM, 6000
PLUG	01.000	01.500		B-16.11	STM A 105	SCRM, 3000
CPLNG.FULL	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.FULL	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.HALF	00.500	0.750		B-16.11	ASTM A 105	SW, 6000

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Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description
CPLNG.HALF	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.LH	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.LH	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
CPLNG.RED	00.500	00.750		B-16.11	ASTM A 105	SW, 6000
CPLNG.RED	01.000	01.500		B-16.11	ASTM A 105	SW, 3000
O'let						
SOCKOLET	00.500	00.750		MSS-SP97	ASTM A 105	SW, 6000
SOCKOLET	01.000	01.500		MSS-SP97	ASTM A 105	SW, 3000
WELDOLET	02.000	08.000	M, XX	MSS-SP97	ASTM A 105 (CHARPY)	BW
VALVE GROUP						
VLV.GATE	00.500	01.500		API-602	BODY-ASTM A 105, TRIM- STELLITED, STEM 13%	SW, 800, 3000, B-16.11
VLV.GATE	02.000	24.000		API 600/ ISO 10434	BODY-ASTM A 105/ ASTM A 216 GR.WCB STELLITED, STEM- SS304	FLGD, 300, B-16.5, RF/125AARH
VLV.GLOBE	00.500	01.500		BS EN 150 15761	BODY-ASTM A 105, TRIM- STELLITED, STEM- 13%	SW, 800, 3000, B-16.11
VLV.GLOBE	02.000	24.000		BS 1873	BODY-ASTM A 105 / ASTM A 216 GR.WCB , TRIM-13% CR.STEEL	FLGD, 300, B-16.5, RF/125AARH
VLV.CHECK	00.500	01.500		BS EN 150 15761	BODY-ASTM A 105, TRIM- STELLITED	SW, 800, 3000, B-16.11
VLV.CHECK	02.000	24.000		API-6D/BS-1868	BODY-ASTM A 105 / ASTM A 216 GR.WCB	FLGD, 300, B-16.5, RF/125AARH
Item	Lower Size (Inch)	Upper Size (Inch)	Sch./ Thk.	Dmn. STD	Material (Charpy)	Description

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VLV.BALL	00.500	01.500		BS EN 150 17292	BODY-ASTM A 105,	SW, 800, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000		API-6D	BODY-ASTM A 216 GR.WCB/ ASTM 105	FLGD, 300, B-16.5, RF/125AARH
VLV.BALL	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB/ASTM 105,	BW, 300, B- 16.25
VLV.PLUG	00.500	01.500		BS-5353	BODY-ASTM A 105,PLUG- A105 +0.003" ENP	SW, 800#, 3000, B-16.11
VLV.PLUG	02.000	24.000		API-6D	BODY- A 216GR. WCB, PLUG: A216 GR.WCB + 0.003" ENP	FLGD, 300, B-16.5, RF/125AARH
VLV.PLUG	02.000	24.000	M	API-6D	BODY-ASTM A 216 GR.WCB, PLUG: A216 GR.WCB + 0.003"ENP	BW, 300, B- 16.25
BOLT GROUP						
BOLT.STUD	00.500	30.000		B-18.2	BOLT:A193 GR.B7, NUT:A194 GR.2H	
GASKET						
GASKET	00.500	24.000		B-16.20- ANSI B16.5	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300
GASKET	26.000	30.000		B-16.20- ANSI B16.47A	SP.WND METTALIC WITH GRAPHITEFILLER	SPIRAL, 300

Note: For Valve Material, valve data sheet shall also be referred, stringent requirement among data sheet and above details shall be followed.

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PIPE CLASS

30HLT

DESIGN CODE	ASME B31.8
RATING	300#
BASE MATERIAL	CARBON STEEL
CA	1.5 MM
SPECIAL REQUIREMENT	Low Temperature Service
SERVICE	Natural Gas, Utilities (water, inst. air, plant air, nitrogen, carbon dioxide)

Temperature (Deg. C) and Pressure (Kg/cm²g) Ratings

Temperature	-45	38	93	120	149	204
Pressure	48.86	48.86	46.05	45.54	44.99	43.59

NOTES:

- All vents and drains shall be provided with gate valve with blind flange assembly unless otherwise indicated in P&ID.
- NDT of welds shall be as follows:
Radiography : All butt welds 100%
MPI : Socket welds 100%
- Piping design as per ASME B 31.8, OISD 226 & PNGRB Guidelines
- Flanged end shall be as per ASME B 16.5 for valve up to 24" (excluding 22"), for 22" as per MSS-SP-44.
- Charpy V notch test and hardness test shall be conducted for pipes, fittings and flanges at (-) 45°C.
- All branch connections including vent, drain, pressure and temperature connection shall be as per branch connection table.
- For valves, refer valve data sheets.

ITEM	SIZE	DESCRIPTION
Maintenance joints	ALL	Flanged, to be kept minimum
Pipe joints	1.5" & BELOW	SW coupling
	2.0" & ABOVE	Butt welded
Drains	ON LINES <= 1.5"	Refer std. drawing
	ON LINES >= 2.0"	As per P&ID or 0.75". Refer std. drawing
Vents	ON LINES <= 1.5"	Refer std. drawing

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