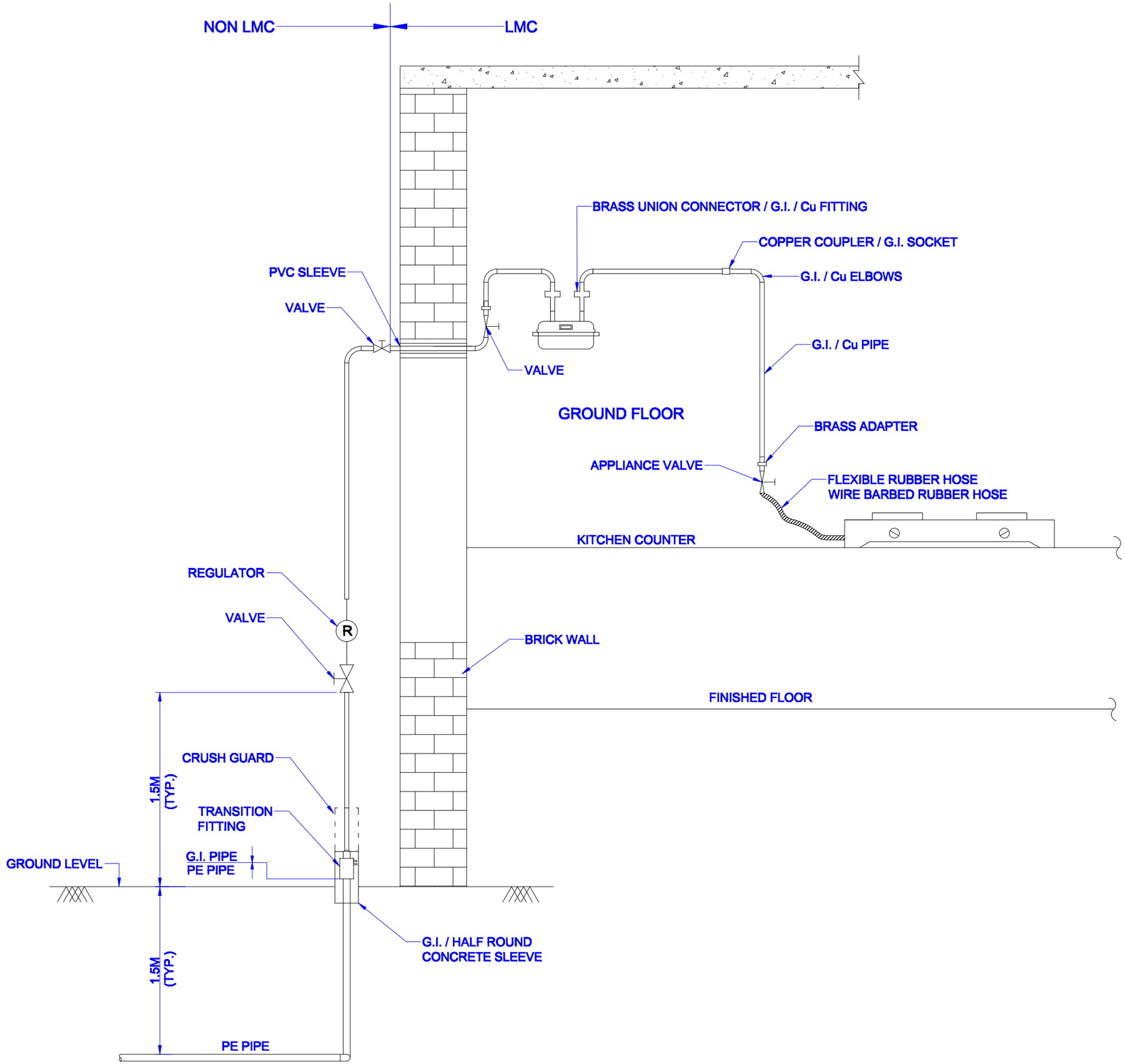


REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
3. PIPING DOWNSTREAM METER SHALL BE COPPER IN CASE METER IS INSTALLED WITHIN THE KITCHEN.
4. TENTATIVE RISER LENGTH (FROM OUTLET OF TRANSITION FITTING TO INLET OF ISOLATION VALVE) SHALL BE 1.5M. ANY CHANGES IN RISER LENGTH SHALL BE AFTER APPROVAL FROM EIC.
5. G.I. INSTALLATION / METER INSTALLATION SHALL BE DECIDED BY OWNER / OWNER'S REPRESENTATIVE AS PER SITE CONDITIONS.
6. IF COPPER PIPE GOES TO THE APPLIANCE VALVE THEN BRASS FITTING SHALL BE USED AT THE OUTLET OF METER OR IF G.I. PIPE GOES TO THE APPLIANCE VALVE THEN G.I. FITTING SHALL BE USED AT THE OUTLET OF THE METER.
7. MAXIMUM DISTANCE BETWEEN CLAMPS SHALL BE 1.5M WHEN PIPE GOES IN THE STRAIGHT LENGTH, IF ANY TEE OR ANY FITTING IS USED IN BETWEEN THE PIPE THEN CLAMP SHALL BE PLACED 150 MM AWAY FROM CENTER LINE OF THE FITTING AT EVERY SIDE. HOWEVER, THE SAME MAY BE CHANGED AS PER SITE CONDITIONS / AS DIRECTED BY EIC.
8. TAPPING SHALL BE LEFT NEAR OUTSIDE THE KITCHEN AS DIRECTED BY OWNER / OWNER'S REPRESENTATIVE..

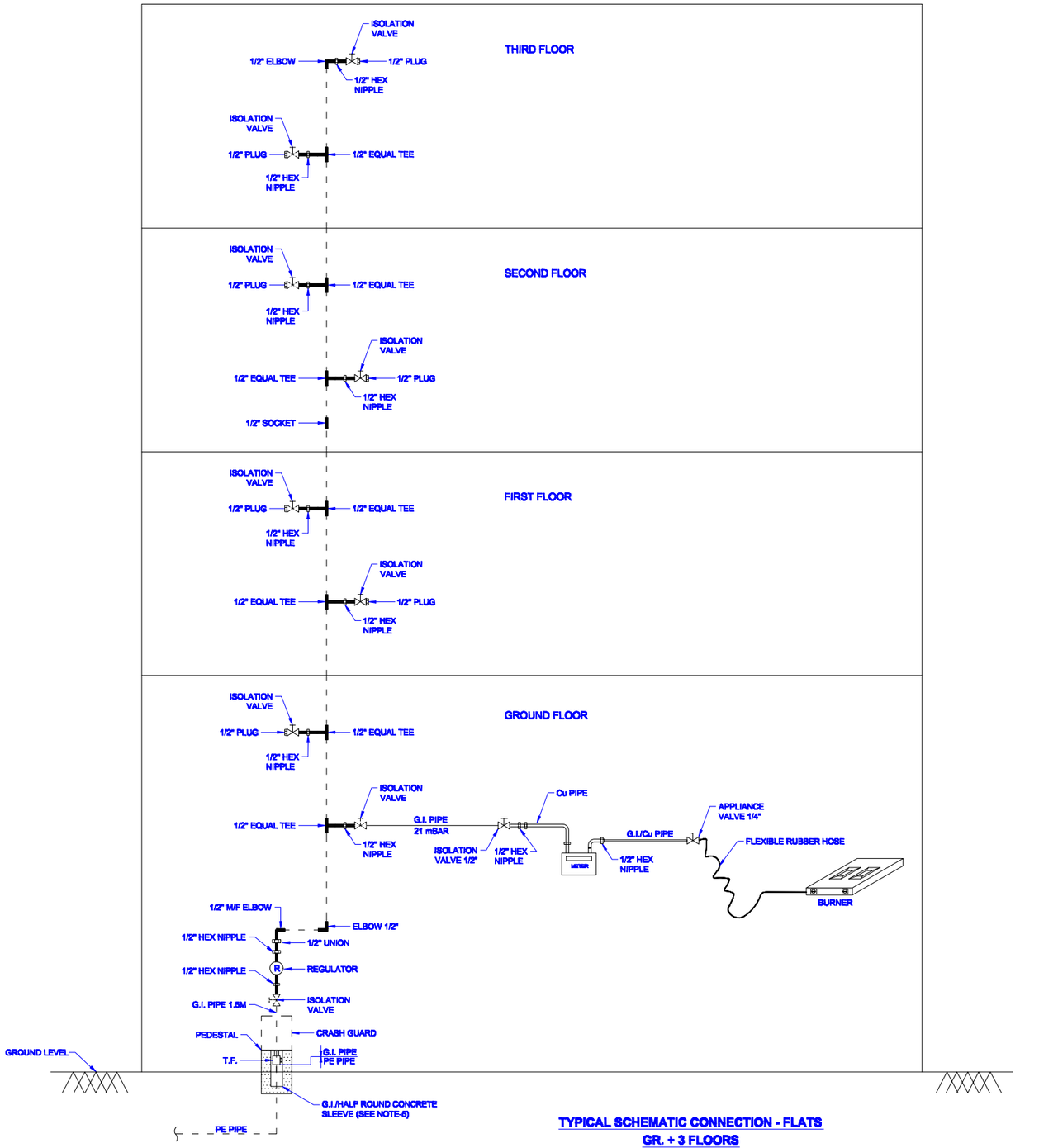
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION (NON LMC & LMC)

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE: A3	JOB NO.: -----	DRAWING NUMBER: GAIL-STD-RP-2026 / REV.: 0



TYPICAL SCHEMATIC CONNECTION - FLATS
GR. + 3 FLOORS

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
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8. METER CLAMP SHALL BE APPROVED FROM OWNER / OWNER'S REPRESENTATIVE..

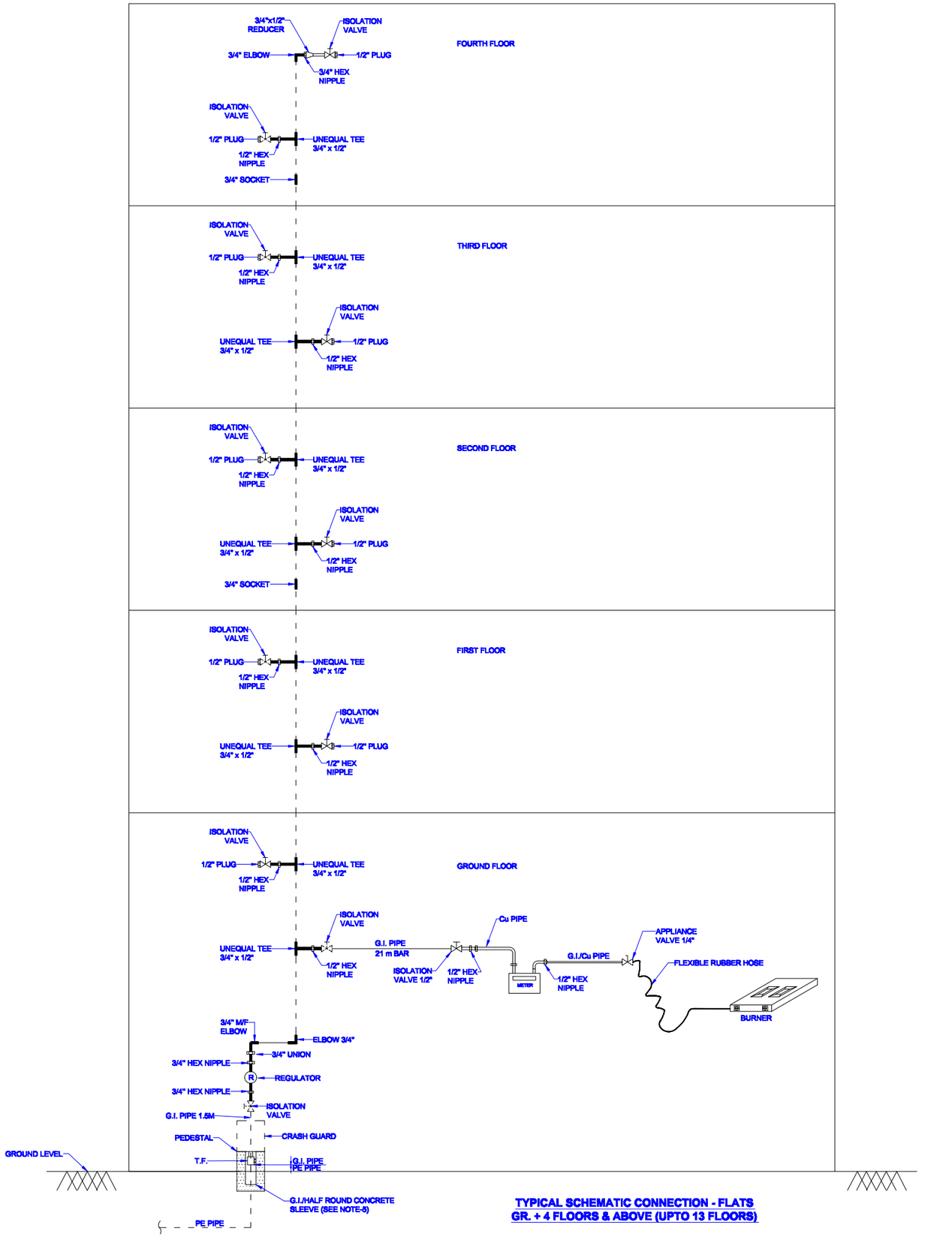
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL SCHEMATIC CONNECTION- FLAT GR. + 3 FLOORS

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	BGCTP-2027	0



TYPICAL SCHEMATIC CONNECTION - FLATS
GR. + 4 FLOORS & ABOVE (UPTO 13 FLOORS)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
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8. METER CLAMP SHALL BE APPROVED FROM OWNER / OWNER'S REPRESENTATIVE..

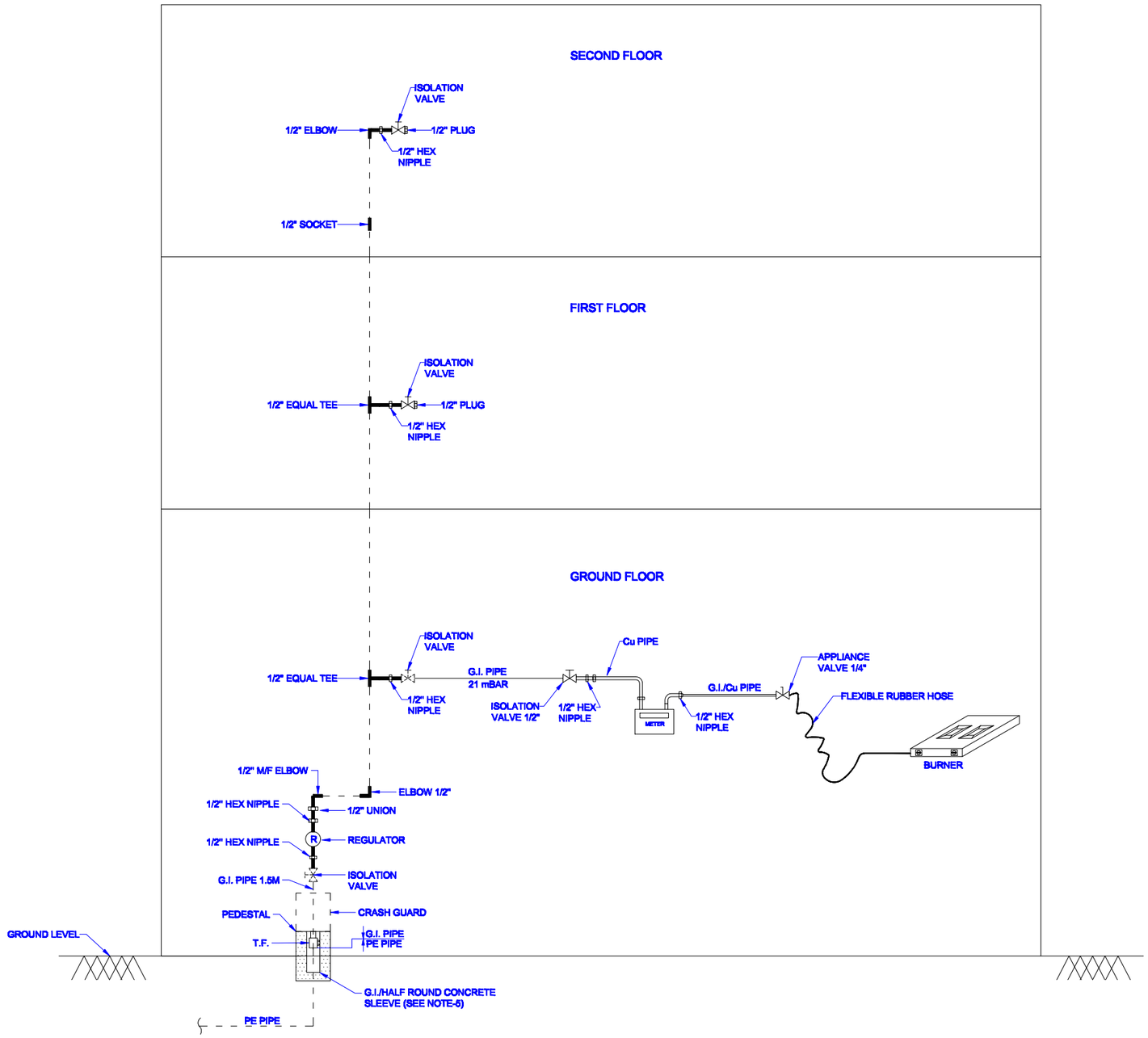
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL SCHEMATIC CONNECTION- FLAT GR. + 4 FLOORS & ABOVE (UPTO 13 FLOORS)

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	MGTD-PP-2028	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

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8. METER CLAMP SHALL BE APPROVED FROM OWNER / OWNER'S REPRESENTATIVE..

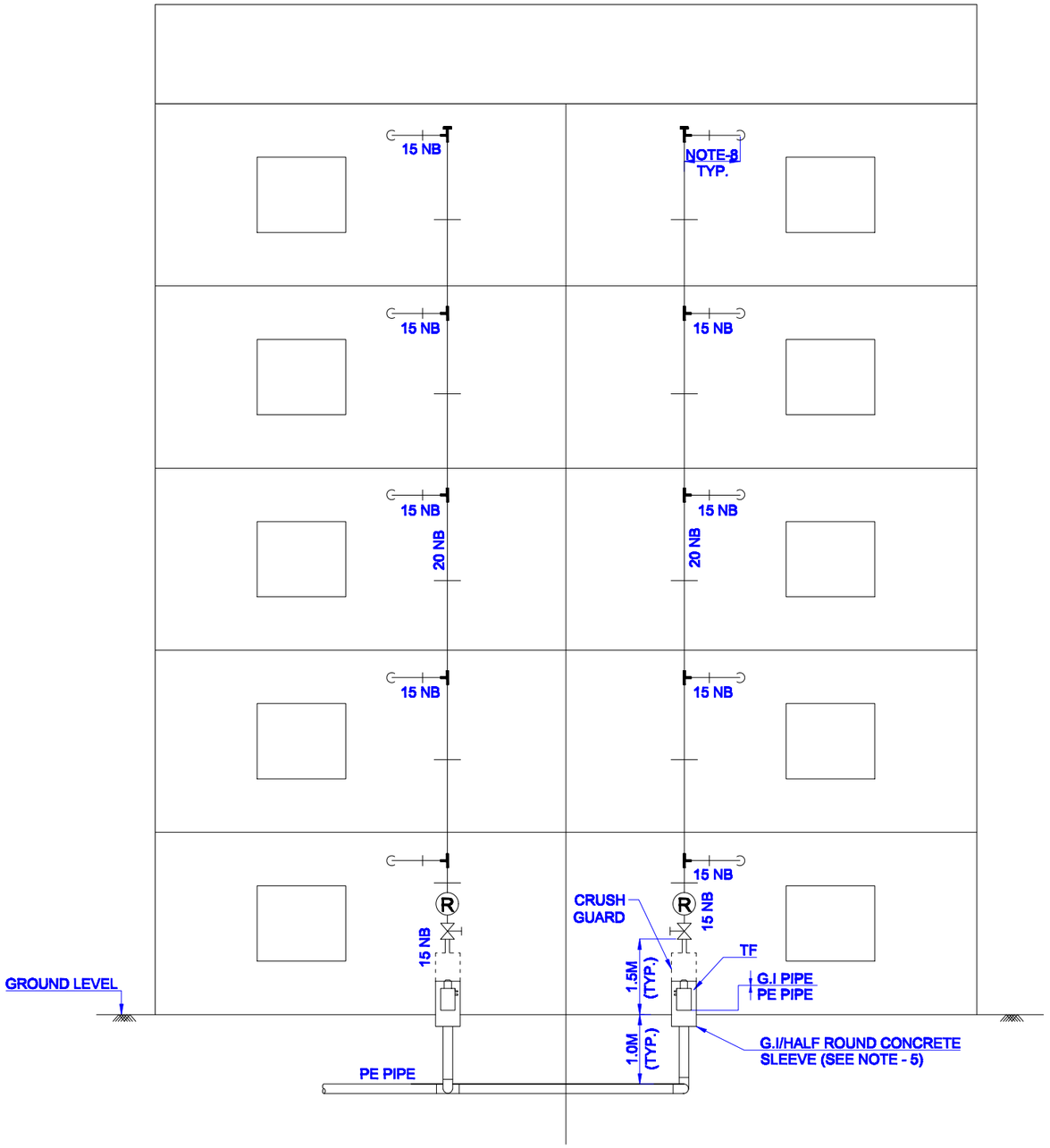
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL SCHEMATIC CONNECTION- KOTHI

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	BGCTPL-AP-2029	0



INDICATIVE RISER ARRANGEMENT IN GR+4 & ABOVE BUILDING (METER INSTALLED INSIDE THE KITCHEN)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
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8. TAPPING SHALL BE LEFT NEAR OUTSIDE THE KITCHEN AS DIRECTED BY OWNER / OWNER'S REPRESENTATIVE.
9. FROM TRANSITION FITTING TO THE ISOLATION VALVE, SHALL BE CONSIDERED IN THE OUTSIDE KITCHEN PIPING.

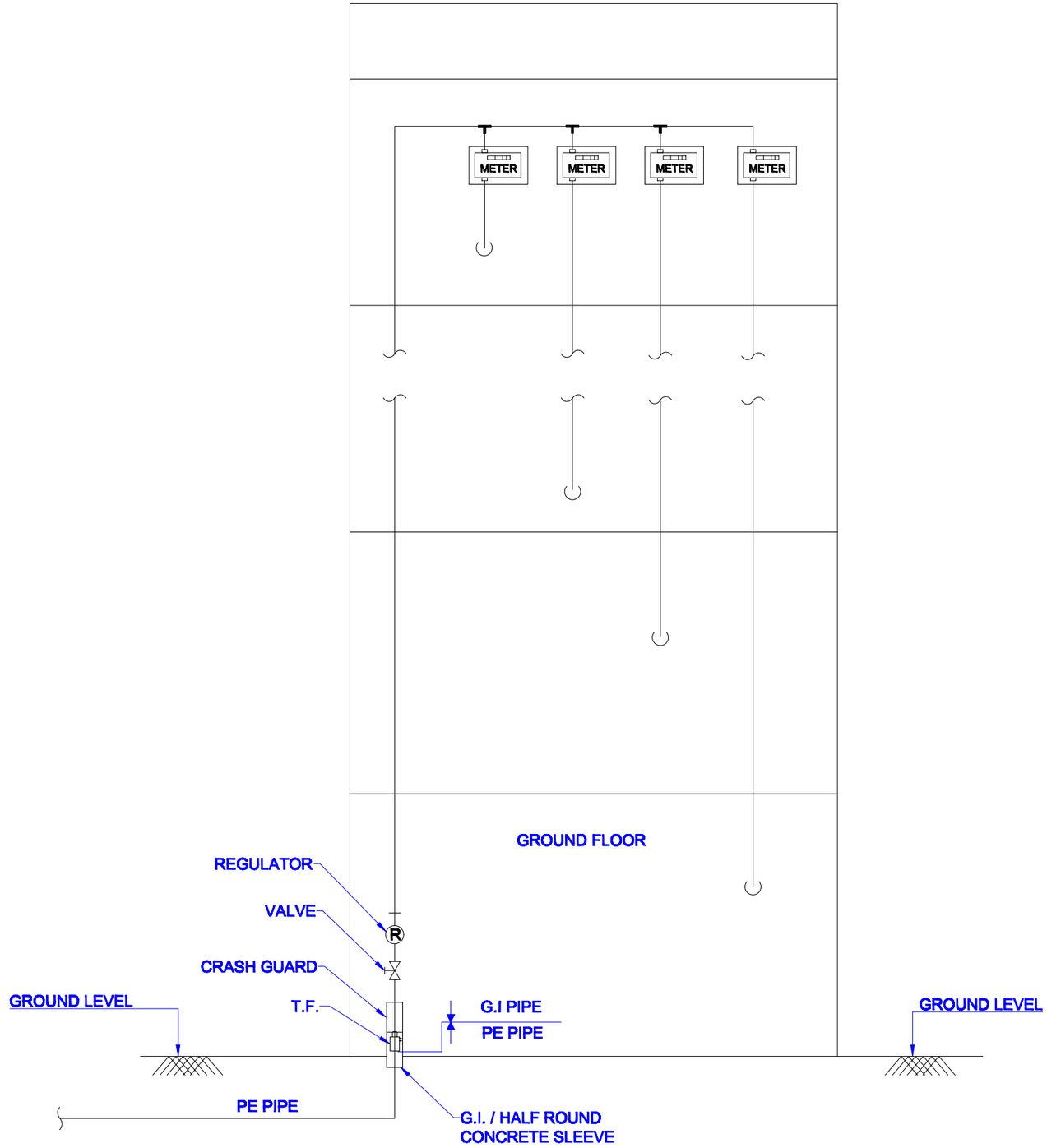
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	BGSTD-ZP-2030 / 0



INDICATIVE RISER ARRANGEMENT IN BUILDING, IF METER IS INSTALLED AT TOP OF FLOOR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
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8. TAPPING SHALL BE LEFT NEAR OUTSIDE THE KITCHEN AS DIRECTED BY OWNER / OWNER'S REPRESENTATIVE.
9. FROM TRANSITION FITTING TO THE ISOLATION VALVE, SHALL BE CONSIDERED IN THE OUTSIDE KITCHEN PIPING.
10. AT THE TIME OF MEASURING LENGTH OF G.I./COPPER PIPE, G.I./COPPER FITTINGS SHALL BE COUNTED IN THE PIPE LENGTH.

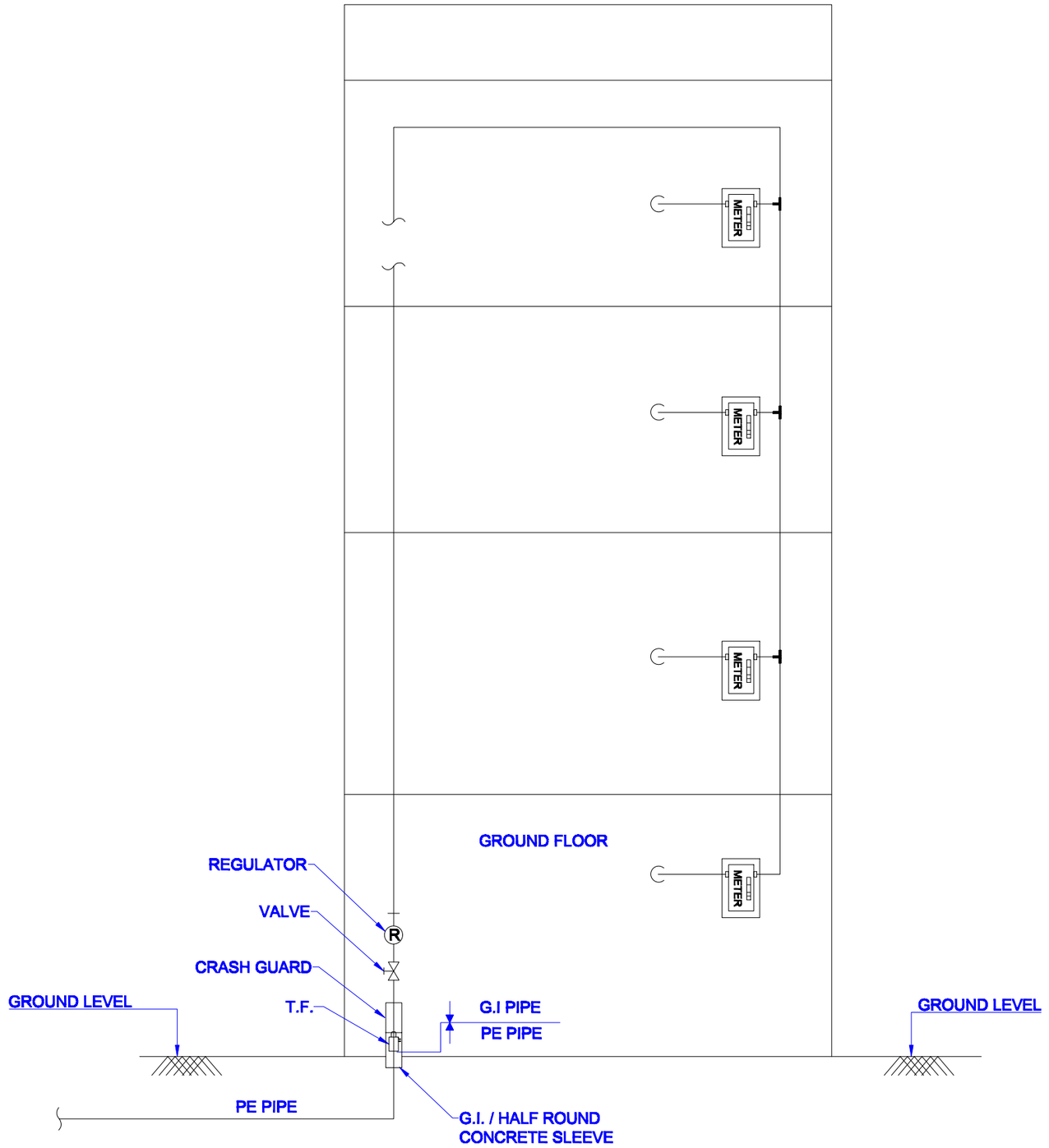
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	GC-STD-PP-2031 / 0



INDICATIVE RISER ARRANGEMENT IN BUILDING, IF METER IS INSTALLED AT EACH FLOOR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
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9. FROM TRANSITION FITTING TO THE ISOLATION VALVE, SHALL BE CONSIDERED IN THE OUTSIDE KITCHEN PIPING.
10. AT THE TIME OF MEASURING LENGTH OF G.I./COPPER PIPE, G.I./COPPER FITTINGS SHALL BE COUNTED IN THE PIPE LENGTH.

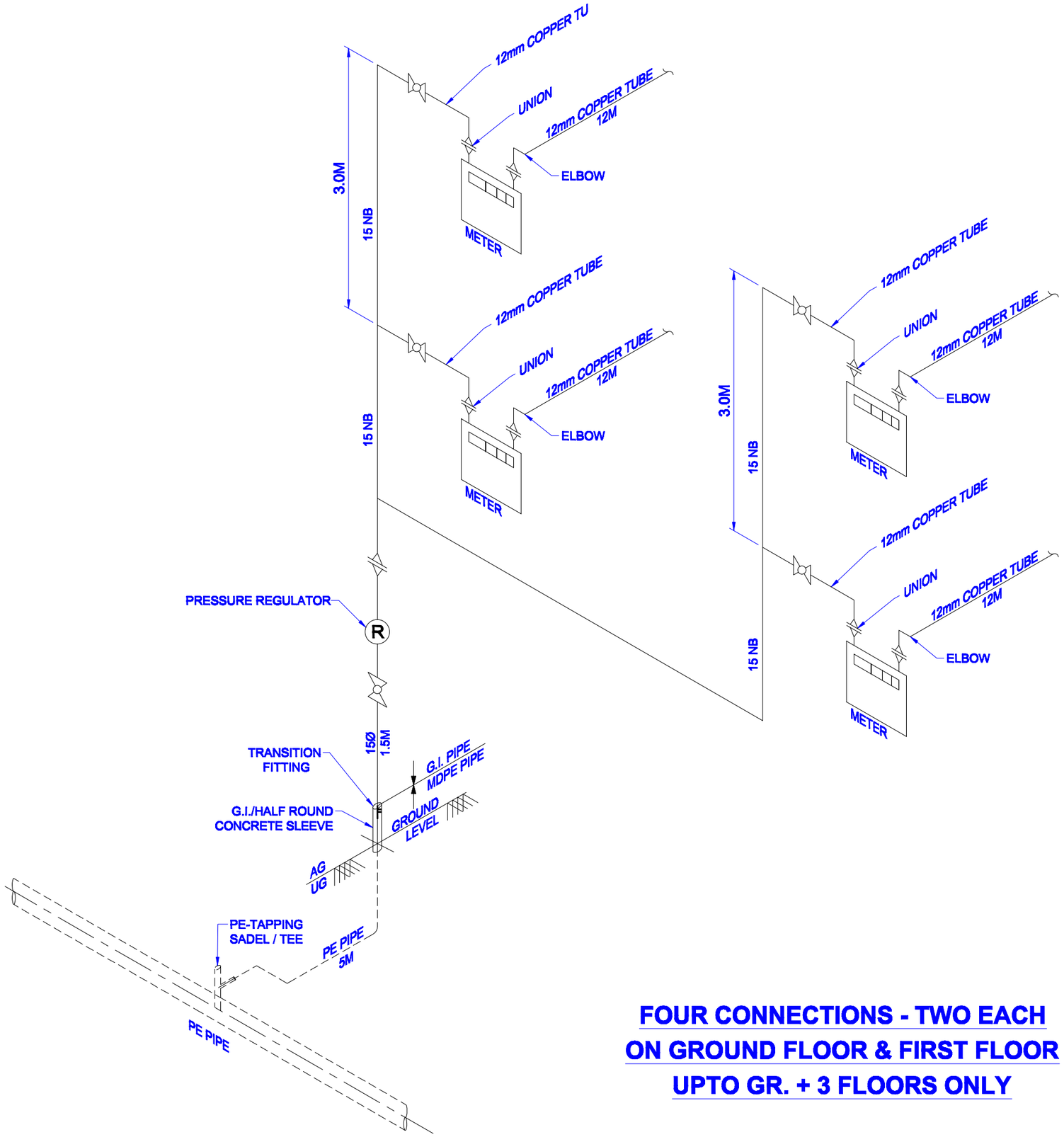
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	MGTD-BP-2032	0



FOUR CONNECTIONS - TWO EACH ON GROUND FLOOR & FIRST FLOOR UPTO GR. + 3 FLOORS ONLY

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

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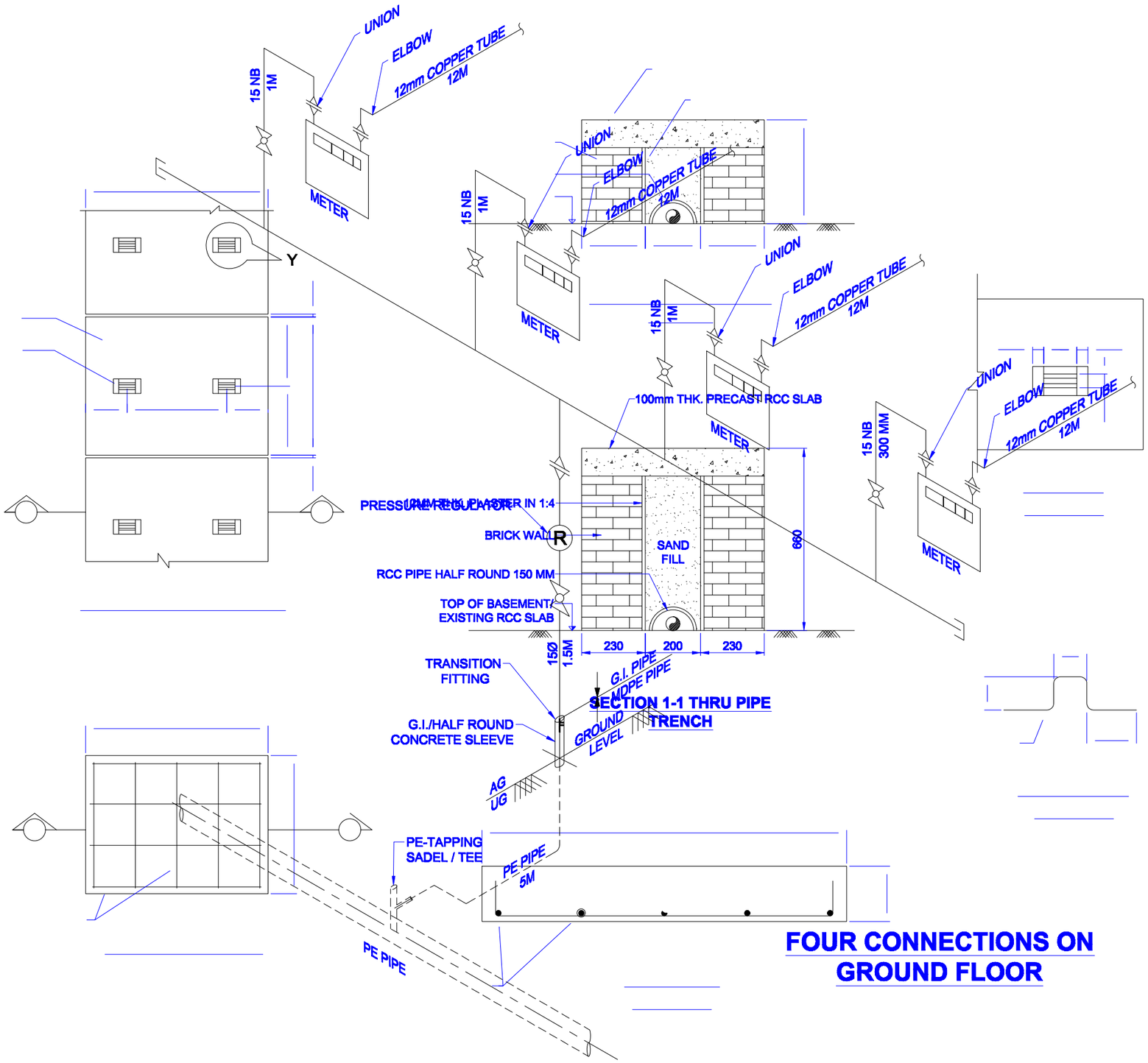
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	------	VBC-STD-PP-2033 / 0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

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REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

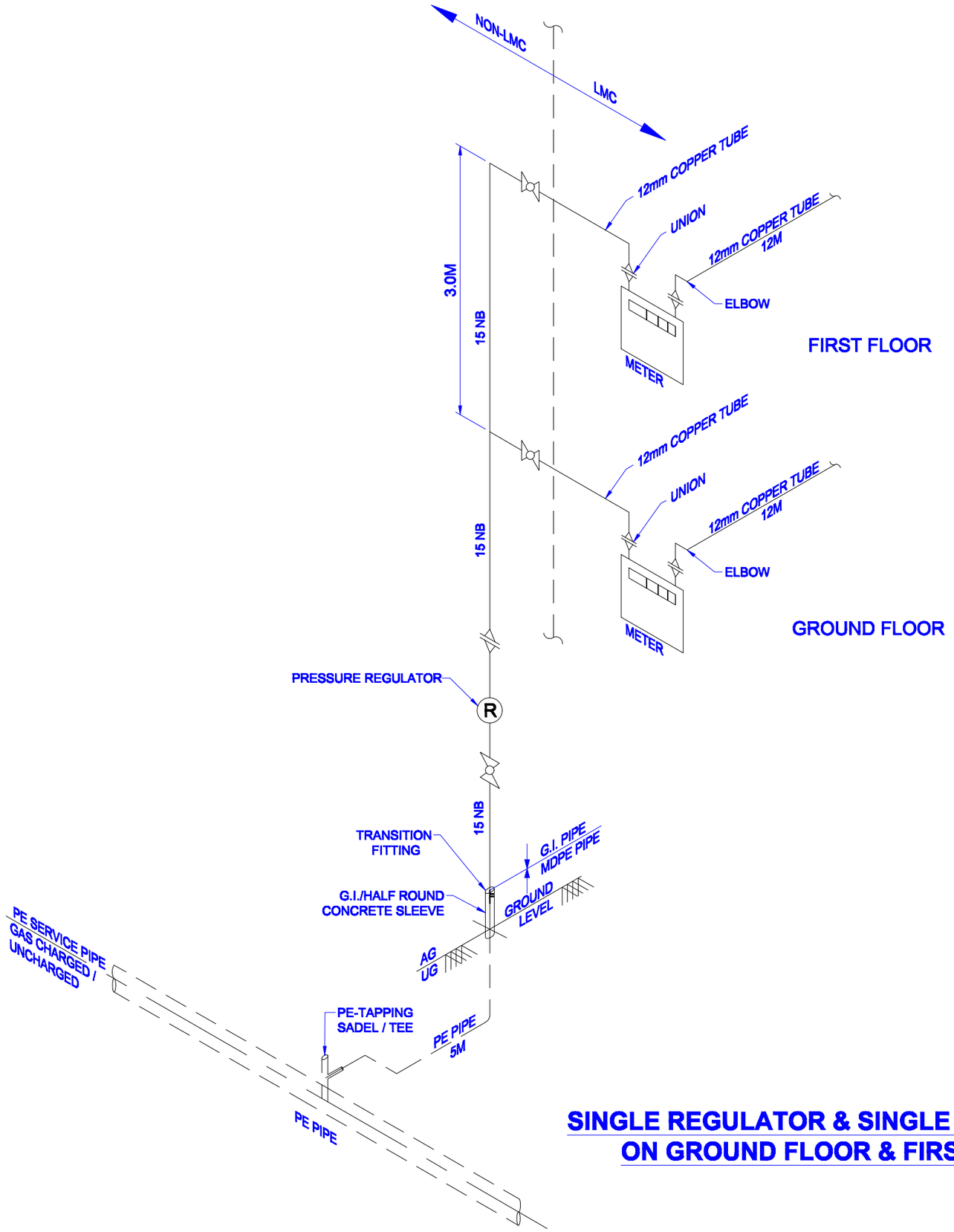
PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	VCSTD-PP-2034	0

Digitally signed by RACHNA SHUKLA
Date: 2025.03.13 12:58:27 IST



SINGLE REGULATOR & SINGLE CONNECTION ON GROUND FLOOR & FIRST FLOOR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
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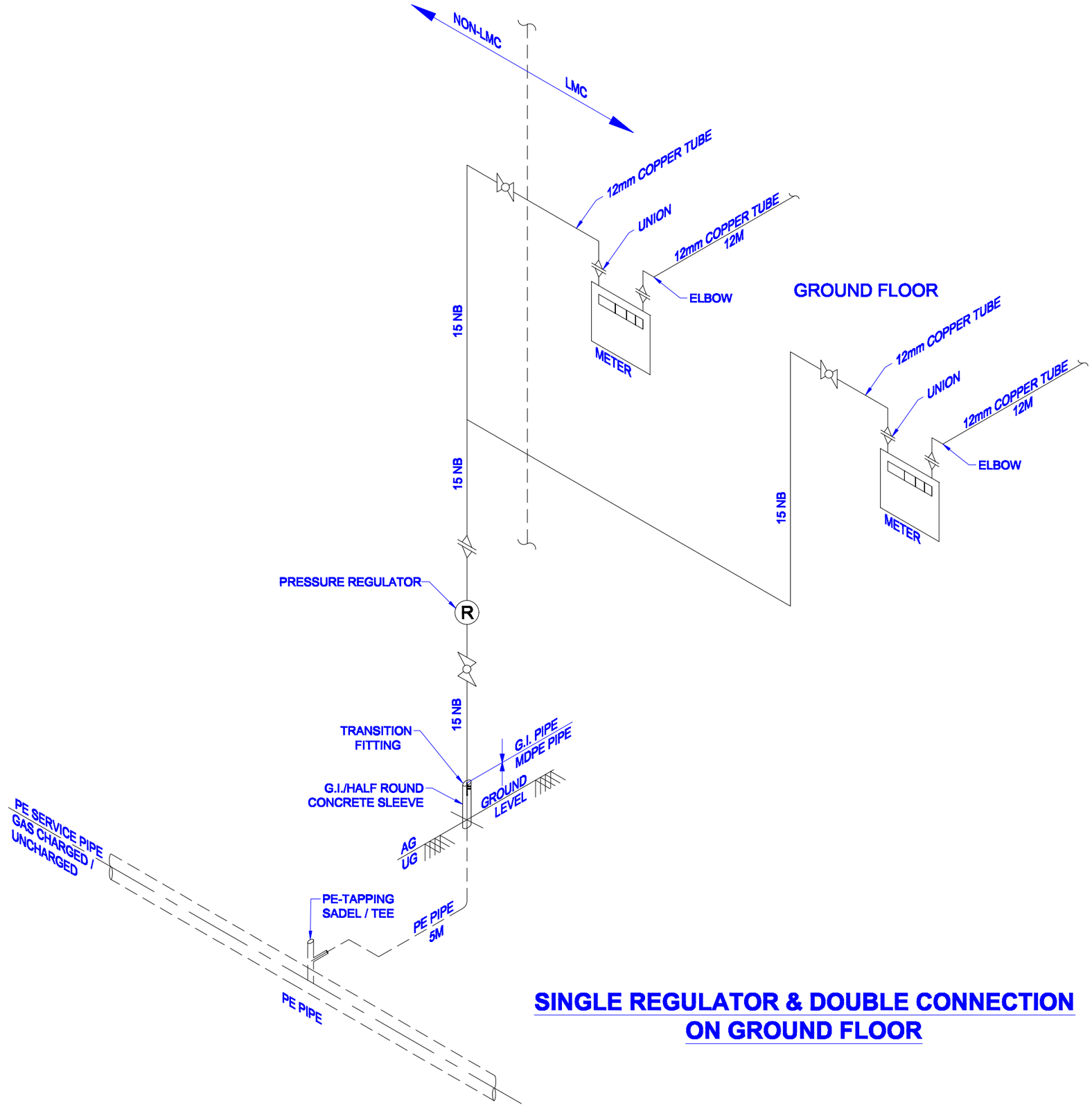
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG FOR FLAT

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	------	VBC-STD-RP-2035	0



SINGLE REGULATOR & DOUBLE CONNECTION ON GROUND FLOOR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

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6. IF COPPER PIPE GOES TO THE APPLIANCE VALVE THEN BRASS FITTING SHALL BE USED AT THE OUTLET OF METER OR IF G.I. PIPE GOES TO THE APPLIANCE VALVE THEN G.I. FITTING SHALL BE USED AT THE OUTLET OF THE METER.
7. MAXIMUM DISTANCE BETWEEN CLAMPS SHALL BE 1.5M WHEN PIPE GOES IN THE STRAIGHT LENGTH, IF ANY TEE OR ANY FITTING IS USED IN BETWEEN THE PIPE THEN CLAMP SHALL BE PLACED 150 MM AWAY FROM CENTER LINE OF THE FITTING AT EVERY SIDE. HOWEVER, THE SAME MAY BE CHANGED AS PER SITE CONDITIONS / AS DIRECTED BY EIC.

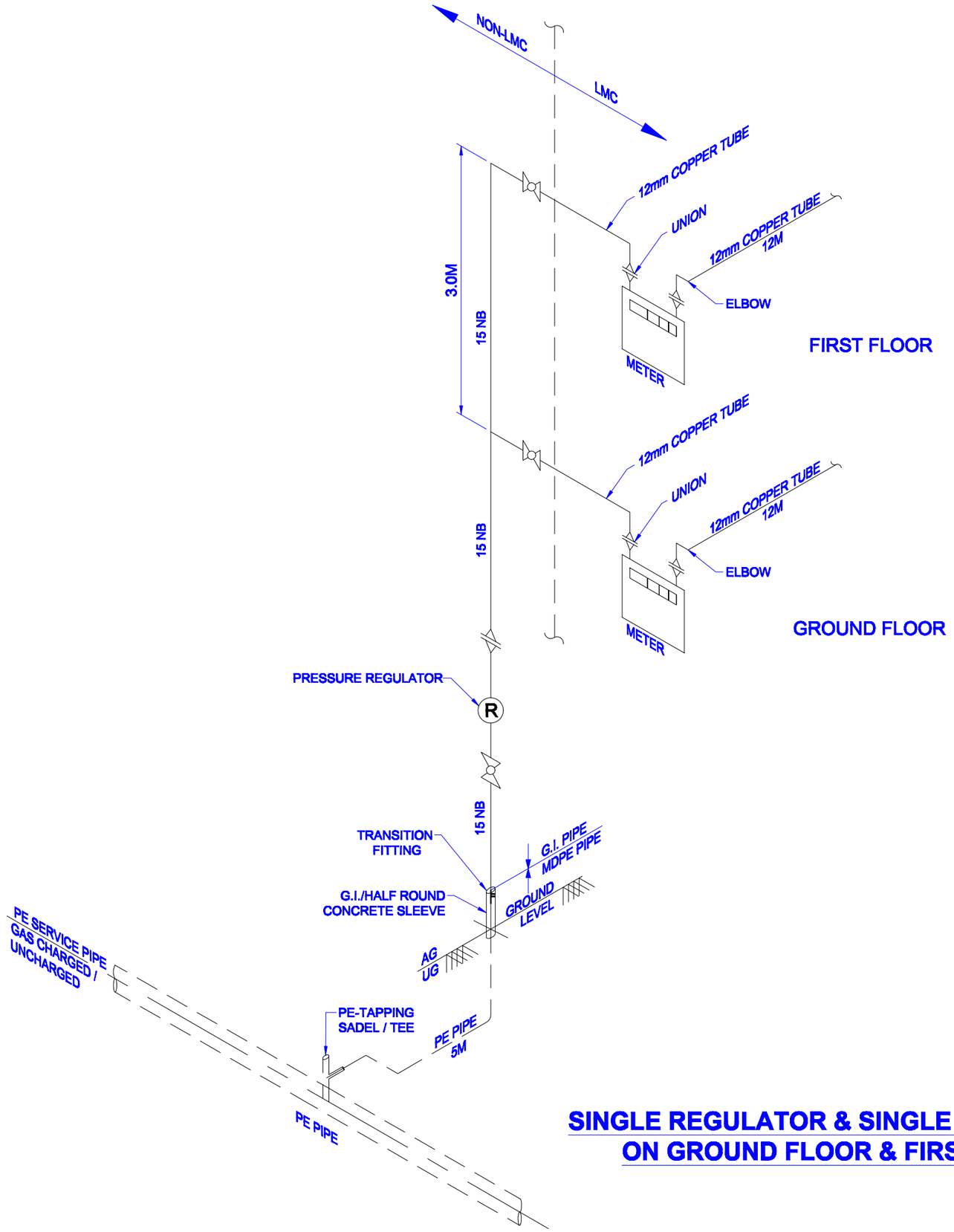
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	IGGSTP-2036	0



SINGLE REGULATOR & SINGLE CONNECTION ON GROUND FLOOR & FIRST FLOOR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
3. PIPING DOWNSTREAM METER SHALL BE COPPER IN CASE METER IS INSTALLED WITHIN THE KITCHEN.
4. TENTATIVE RISER LENGTH (FROM OUTLET OF TRANSITION FITTING TO INLET OF ISOLATION VALVE) SHALL BE 1.5M. ANY CHANGES IN RISER LENGTH SHALL BE AFTER APPROVAL FROM EIC.
5. G.I. INSTALLATION / METER INSTALLATION SHALL BE DECIDED BY OWNER / OWNER'S REPRESENTATIVE AS PER SITE CONDITIONS.
6. IF COPPER PIPE GOES TO THE APPLIANCE VALVE THEN BRASS FITTING SHALL BE USED AT THE OUTLET OF METER OR IF G.I. PIPE GOES TO THE APPLIANCE VALVE THEN G.I. FITTING SHALL BE USED AT THE OUTLET OF THE METER.
7. MAXIMUM DISTANCE BETWEEN CLAMPS SHALL BE 1.5M WHEN PIPE GOES IN THE STRAIGHT LENGTH, IF ANY TEE OR ANY FITTING IS USED IN BETWEEN THE PIPE THEN CLAMP SHALL BE PLACED 150 MM AWAY FROM CENTER LINE OF THE FITTING AT EVERY SIDE. HOWEVER, THE SAME MAY BE CHANGED AS PER SITE CONDITIONS / AS DIRECTED BY EIC.

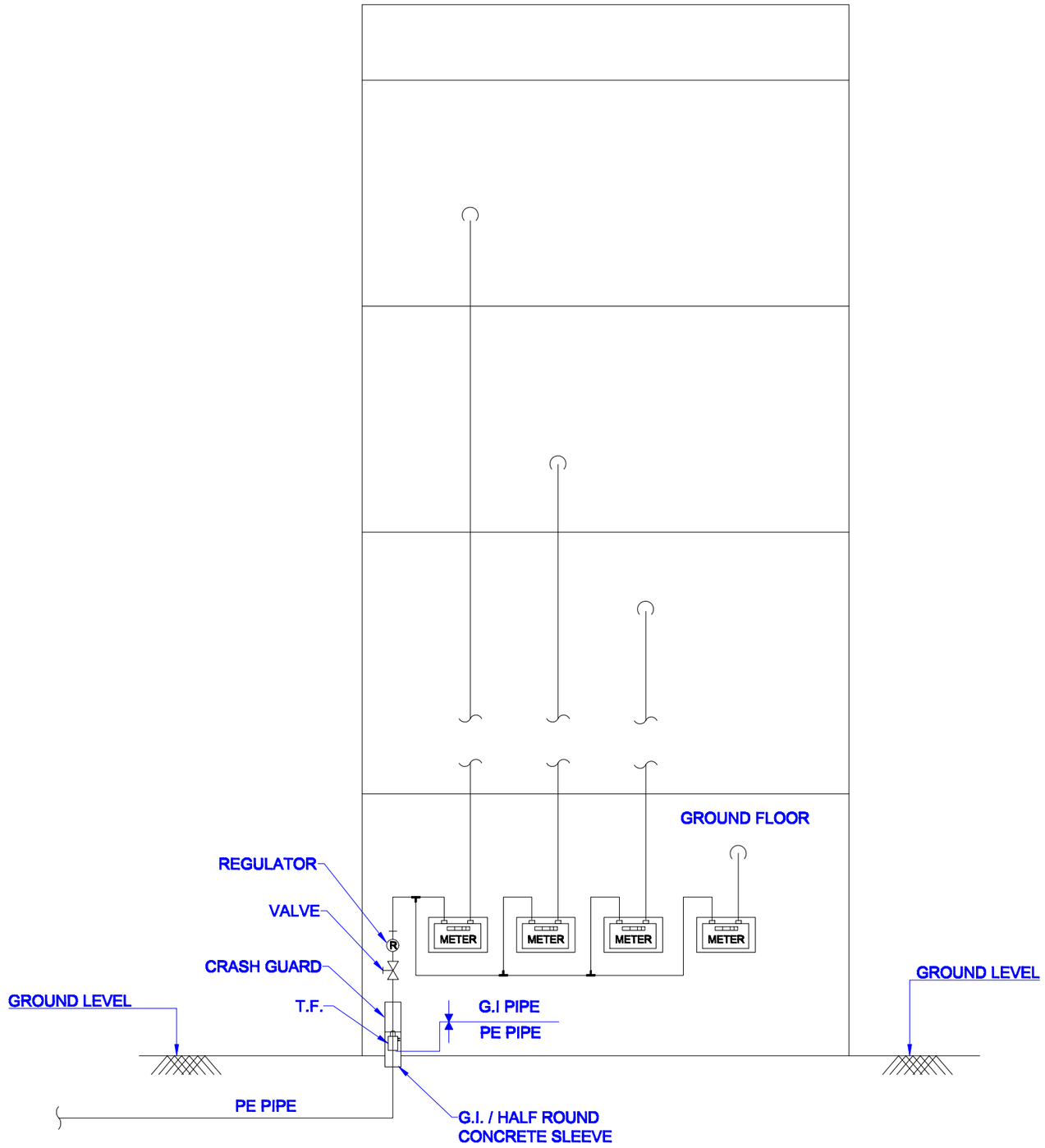
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG FOR KOTHI

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	------	IBC-STD-RP-2037	0



INDICATIVE RISER ARRANGEMENT IN BUILDING, IF METER INSTALLED AT GROUND FLOOR

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
3. PIPING DOWNSTREAM METER SHALL BE COPPER IN CASE METER IS INSTALLED WITHIN THE KITCHEN.
4. TENTATIVE RISER LENGTH (FROM OUTLET OF TRANSITION FITTING TO INLET OF ISOLATION VALVE) SHALL BE 1.5M. ANY CHANGES IN RISER LENGTH SHALL BE AFTER APPROVAL FROM EIC.
5. G.I. INSTALLATION / METER INSTALLATION SHALL BE DECIDED BY OWNER / OWNER'S REPRESENTATIVE AS PER SITE CONDITIONS.
6. IF COPPER PIPE GOES TO THE APPLIANCE VALVE THEN BRASS FITTING SHALL BE USED AT THE OUTLET OF METER OR IF G.I. PIPE GOES TO THE APPLIANCE VALVE THEN G.I. FITTING SHALL BE USED AT THE OUTLET OF THE METER.
7. MAXIMUM DISTANCE BETWEEN CLAMPS SHALL BE 1.5M WHEN PIPE GOES IN THE STRAIGHT LENGTH, IF ANY TEE OR ANY FITTING IS USED IN BETWEEN THE PIPE THEN CLAMP SHALL BE PLACED 150 MM AWAY FROM CENTER LINE OF THE FITTING AT EVERY SIDE. HOWEVER, THE SAME MAY BE CHANGED AS PER SITE CONDITIONS / AS DIRECTED BY EIC.
8. TAPPING SHALL BE LEFT NEAR OUTSIDE THE KITCHEN AS DIRECTED BY OWNER / OWNER'S REPRESENTATIVE.
9. FROM TRANSITION FITTING TO THE ISOLATION VALVE, SHALL BE CONSIDERED IN THE OUTSIDE KITCHEN PIPING.
10. AT THE TIME OF MEASURING LENGTH OF G.I./COPPER PIPE, G.I./COPPER FITTINGS SHALL BE COUNTED IN THE PIPE LENGTH.

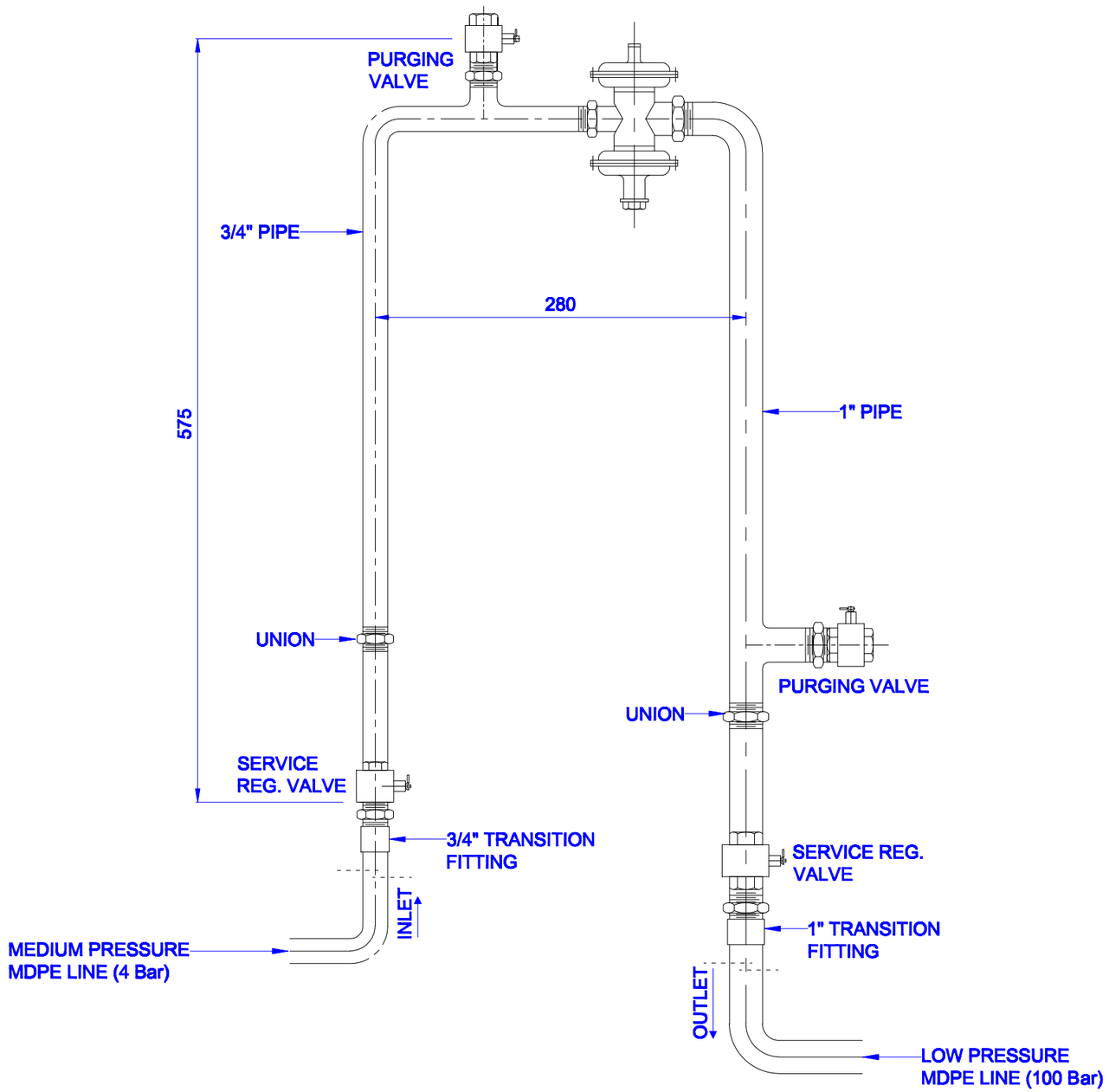
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	GA-STD-AP-2038 / 0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE THE DRAWING.

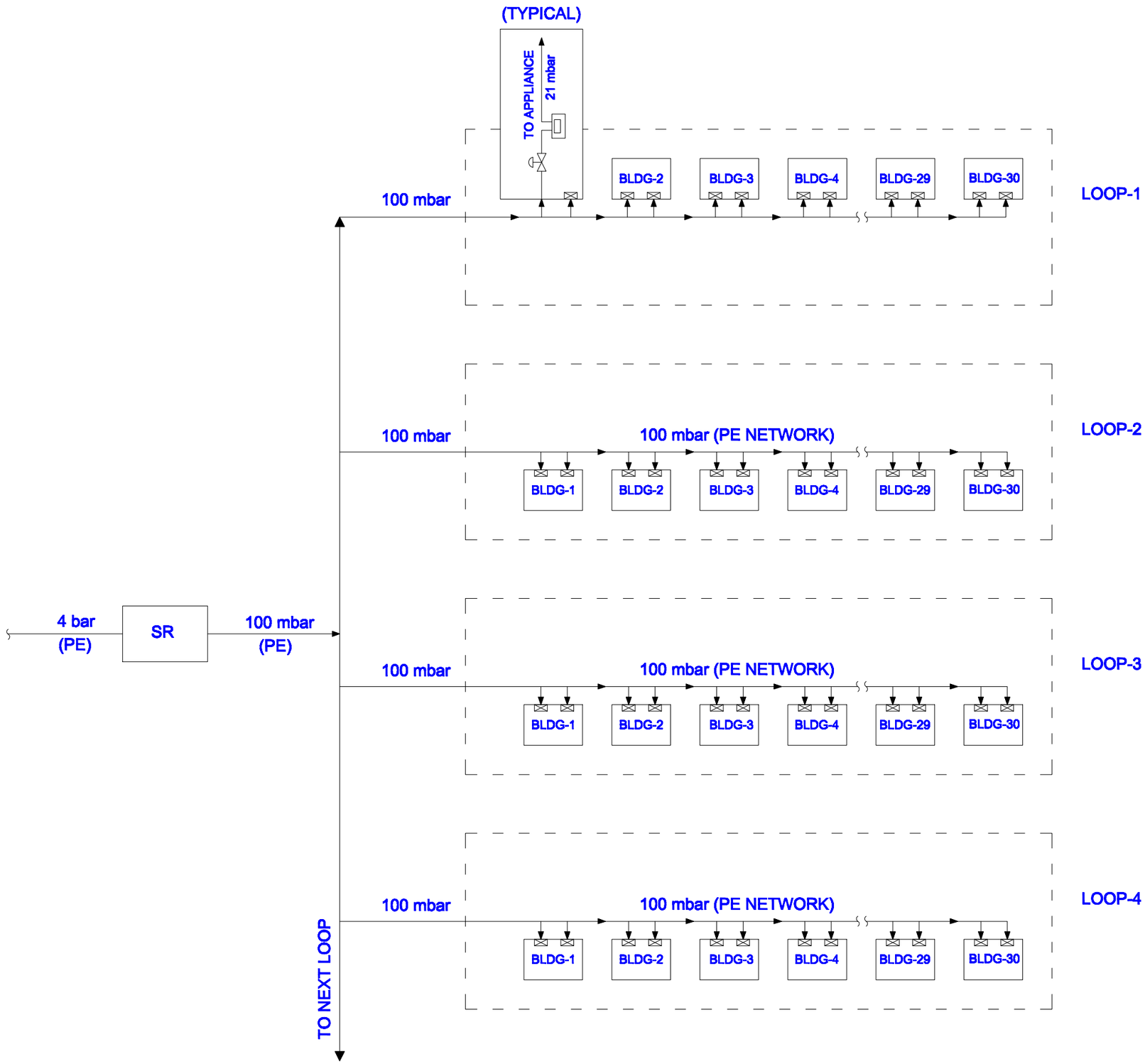
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM FOR SINGLE STREAM REGULATOR

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	MC-TD-AP-2039 / 0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE THE DRAWING.

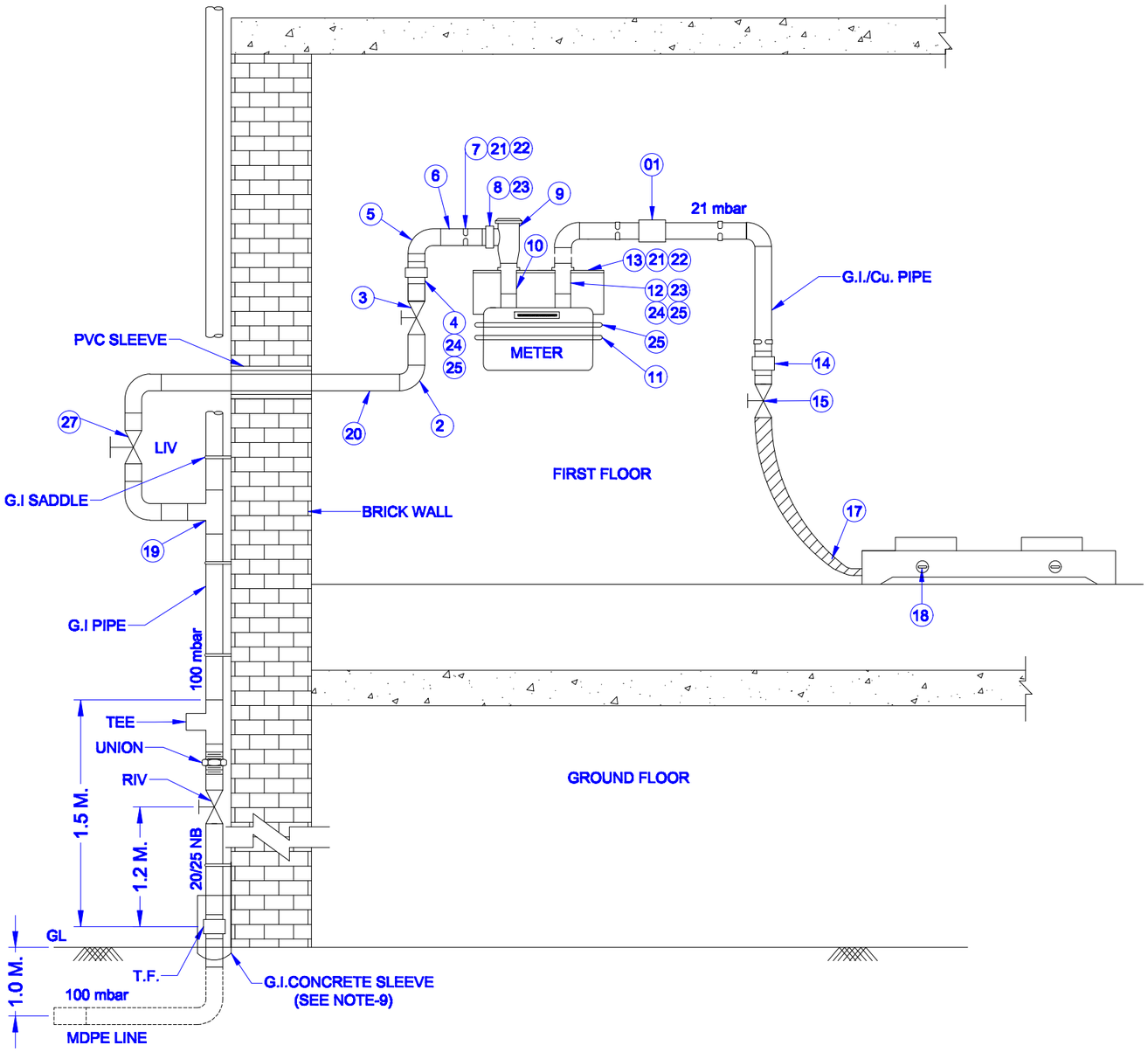
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM DESCRIBING DIFFERENT PRESSURE SYSTEM (SR TO APPLIANCE IN KITCHEN)

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	------	VBC-STD-PP-2040	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE SIZES SHOWN IN THE DRAWING ARE TENTATIVE AND SHALL BE DECIDED AT THE TIME OF DETAIL ENGINEERING.
3. PIPING DOWNSTREAM METER SHALL BE COPPER IN CASE METER IS INSTALLED WITHIN THE KITCHEN.
4. TENTATIVE RISER LENGTH (FROM OUTLET OF TRANSITION FITTING TO INLET OF ISOLATION VALVE) SHALL BE 1.5M. ANY CHANGES IN RISER LENGTH SHALL BE AFTER APPROVAL FROM EIC.
5. G.I. INSTALLATION / METER INSTALLATION SHALL BE DECIDED BY OWNER / OWNER'S REPRESENTATIVE AS PER SITE CONDITIONS.
6. IF COPPER PIPE GOES TO THE APPLIANCE VALVE THEN BRASS FITTING SHALL BE USED AT THE OUTLET OF METER OR IF G.I. PIPE GOES TO THE APPLIANCE VALVE THEN G.I. FITTING SHALL BE USED AT THE OUTLET OF THE METER.
7. MAXIMUM DISTANCE BETWEEN CLAMPS SHALL BE 1.5M WHEN PIPE GOES IN THE STRAIGHT LENGTH, IF ANY TEE OR ANY FITTING IS USED IN BETWEEN THE PIPE THEN CLAMP SHALL BE PLACED 150 MM AWAY FROM CENTER LINE OF THE FITTING AT EVERY SIDE. HOWEVER, THE SAME MAY BE CHANGED AS PER SITE CONDITIONS / AS DIRECTED BY EIC.
8. TAPPING SHALL BE LEFT NEAR OUTSIDE THE KITCHEN AS DIRECTED BY OWNER / OWNER'S REPRESENTATIVE.
9. G.I CONCRETE SLEEVE INSTALLATION SHALL BE DECIDED BY OWNER / OWNER'S REPRESENTATIVE AS PER SITE CONDITIONS.
10. REGULATOR TO BE FIXED NEAR THE METER AS PER INSTRUMENT AS PER INSTRUCTION OF EIC.

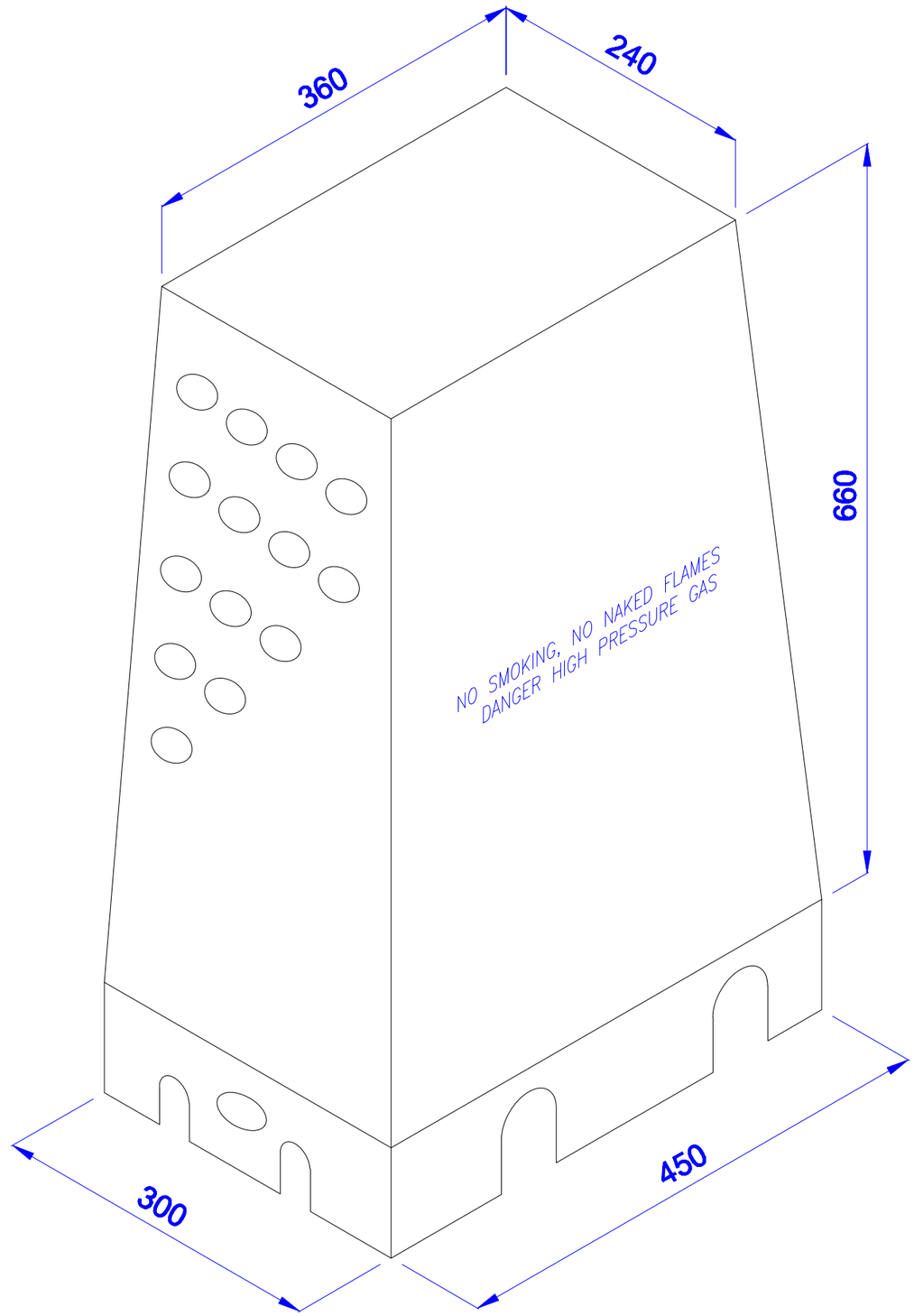
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: TYPICAL DOMESTIC CONNECTION LAYOUT OF NG DISTRIBUTION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	------	IGC-STD-RP-2041	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. THE HOUSING SHOULD BE OF FIBER REINFORCED PLASTIC (FRP).
3. 40mm GROUTING WITH NON SHRINKAGE COMPOUND SHALL BE PROVIDED AT BOTTOM OF SERVICE REGULATOR.

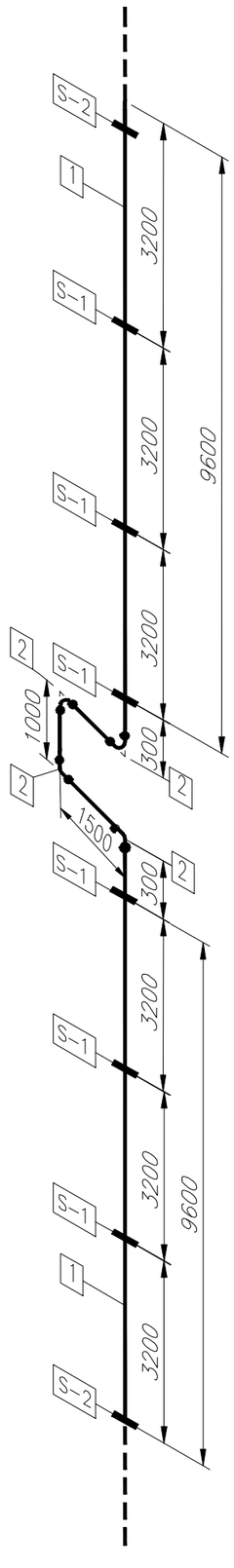
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

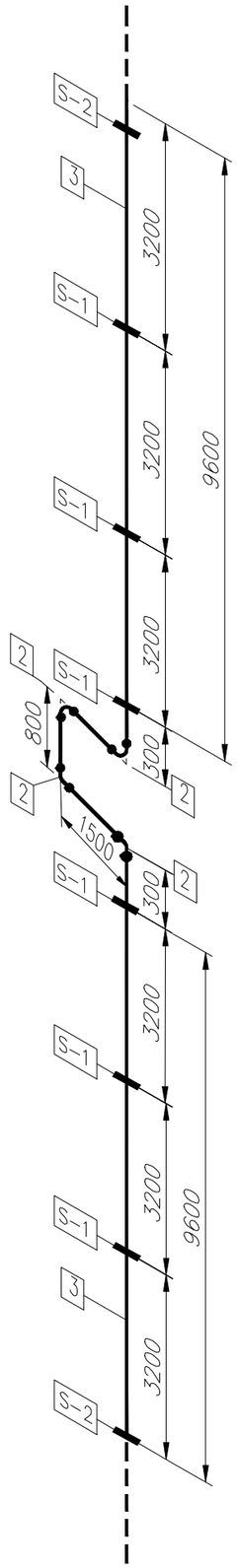
PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM OF HOUSING FOR SINGLE SERVICE REGULATOR

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	LBO/TP-2042 / 0

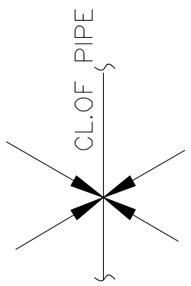


OPTION–A
(LOOP SIZE–1500X1000)

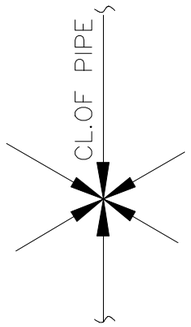


OPTION–B
(LOOP SIZE–1500X800)

SUPPORT SYMBOLS



(GUIDE S–1.)



(ANCHOR S–2)

BILL OF MATERIAL

S.NO.	SIZE (NB)	DESCRIPTION	QTY.	UNIT / CODE
1	50	GI PIPE –IS–1239 PART–1	20.8	M
2	50	ELBOW 90°,	04	Nos.
3	50	GI PIPE –IS–1239 PART–1	20.6	M

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.

REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

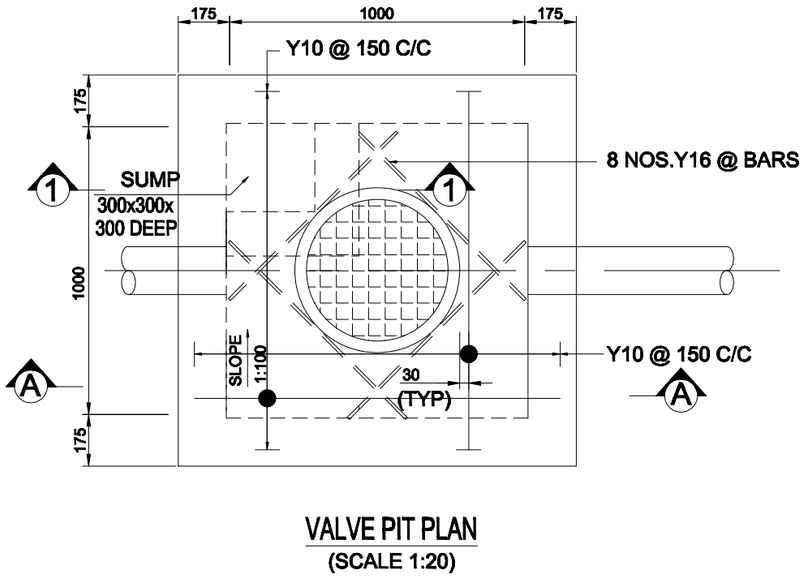
PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: EXPANSION LOOP FOR RISER IN HIGH RISE BUILDING

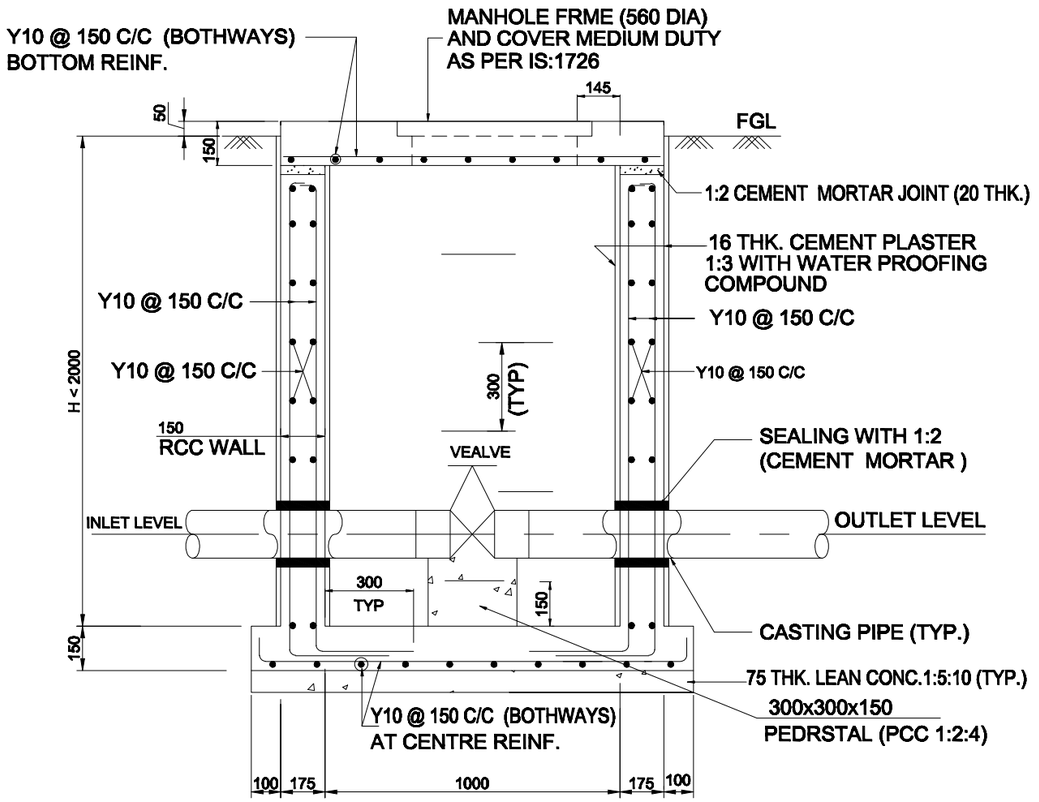
SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	VC-STD-PP-2043 / 0

Digitally signed by RACHNA SHUKLA
Date: 2025.03.13 12:58:27 IST

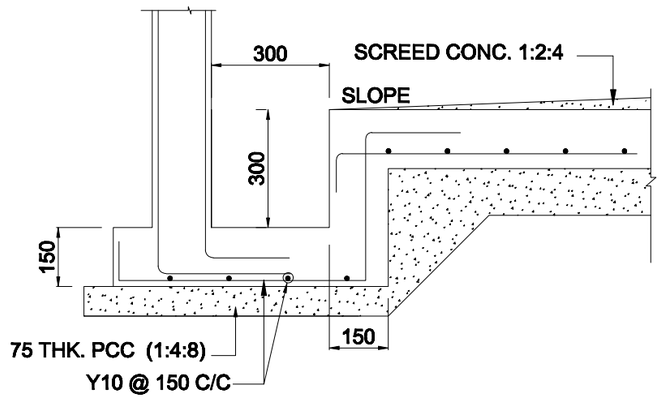
FORMAT NO C211050-FMT-005_00



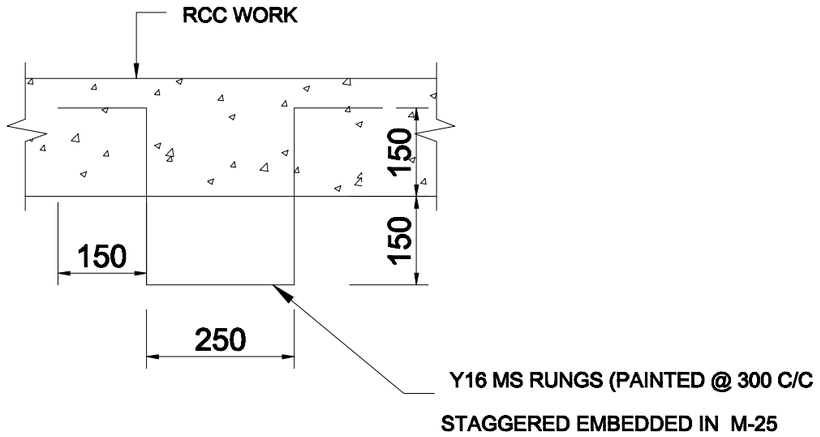
VALVE PIT PLAN
(SCALE 1:20)



SECTION A-A
(SCALE 1:20)



SECTION 1-1
(SCALE 1:15)



TYPICAL DETAILS OF MS RUNGS
(SCALE 1:10)

RCC VALVE CHAMBERS SIZES 1M x 1M

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES :

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE THE DRAWING
3. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE (a) SLAB 20mm
4. GRADE OF CONCRETE USED SHALL BE M-25 CONFORMING.
5. REINFORCEMENT SHALL BE HYSD BARS OF (GRADE Fe 415) CONFORMING TO IS:1786.

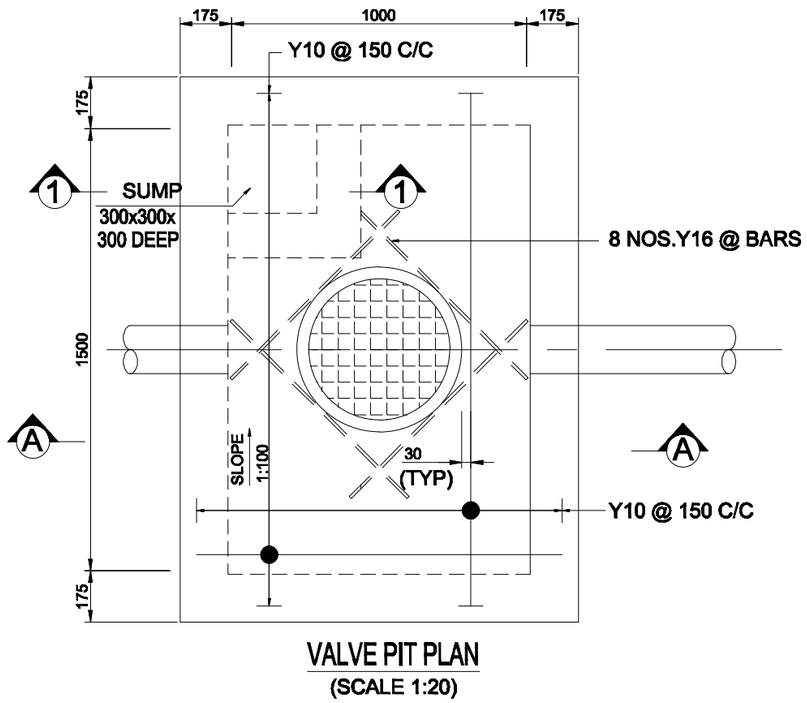
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

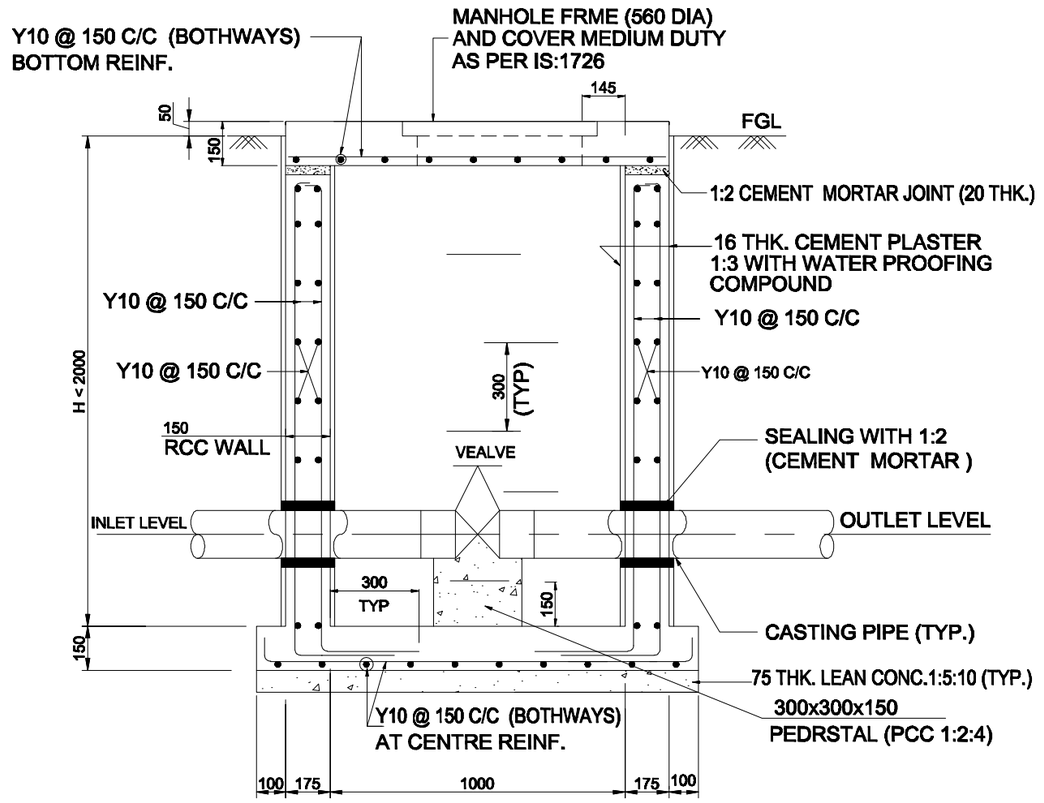
PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: STANDARD DETAIL OF RCC VALVE CHAMBER (1M x 1M)

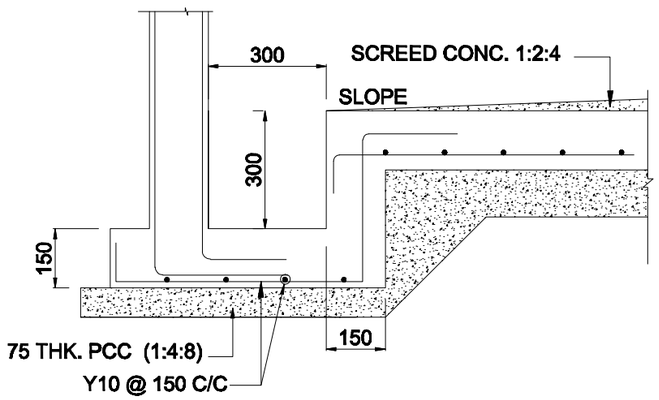
SCALE: SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE: A3	JOB NO.: -----	DRAWING NUMBER: VQS-STD-RP-2044
		REV.: 0



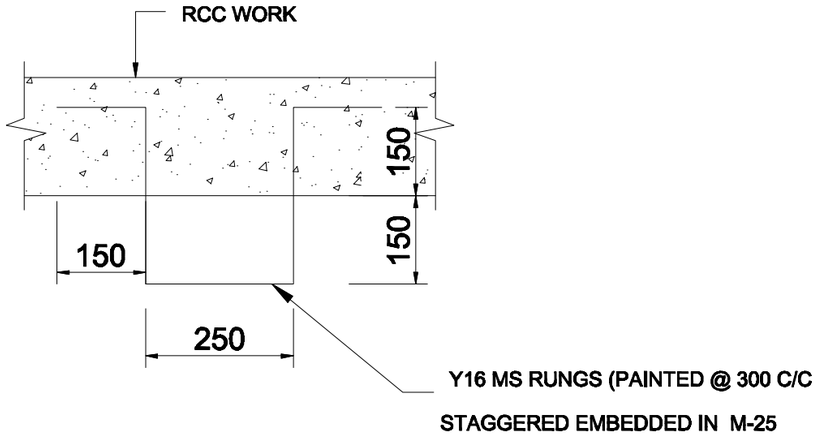
VALVE PIT PLAN
(SCALE 1:20)



SECTION A-A
(SCALE 1:20)



SECTION 1-1
(SCALE 1:15)



TYPICAL DETAILS OF MS RUNGS
(SCALE 1:10)

RCC VALVE CHAMBERS SIZES 1.5M x 1M

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES :

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. FOLLOW WRITTEN DIMENSIONS ONLY. DO NOT SCALE THE DRAWING
3. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE (a) SLAB 20mm
4. GRADE OF CONCRETE USED SHALL BE M-25 CONFORMING.
5. REINFORCEMENT SHALL BE HYSD BARS OF (GRADE Fe 415) CONFORMING TO IS:1786.

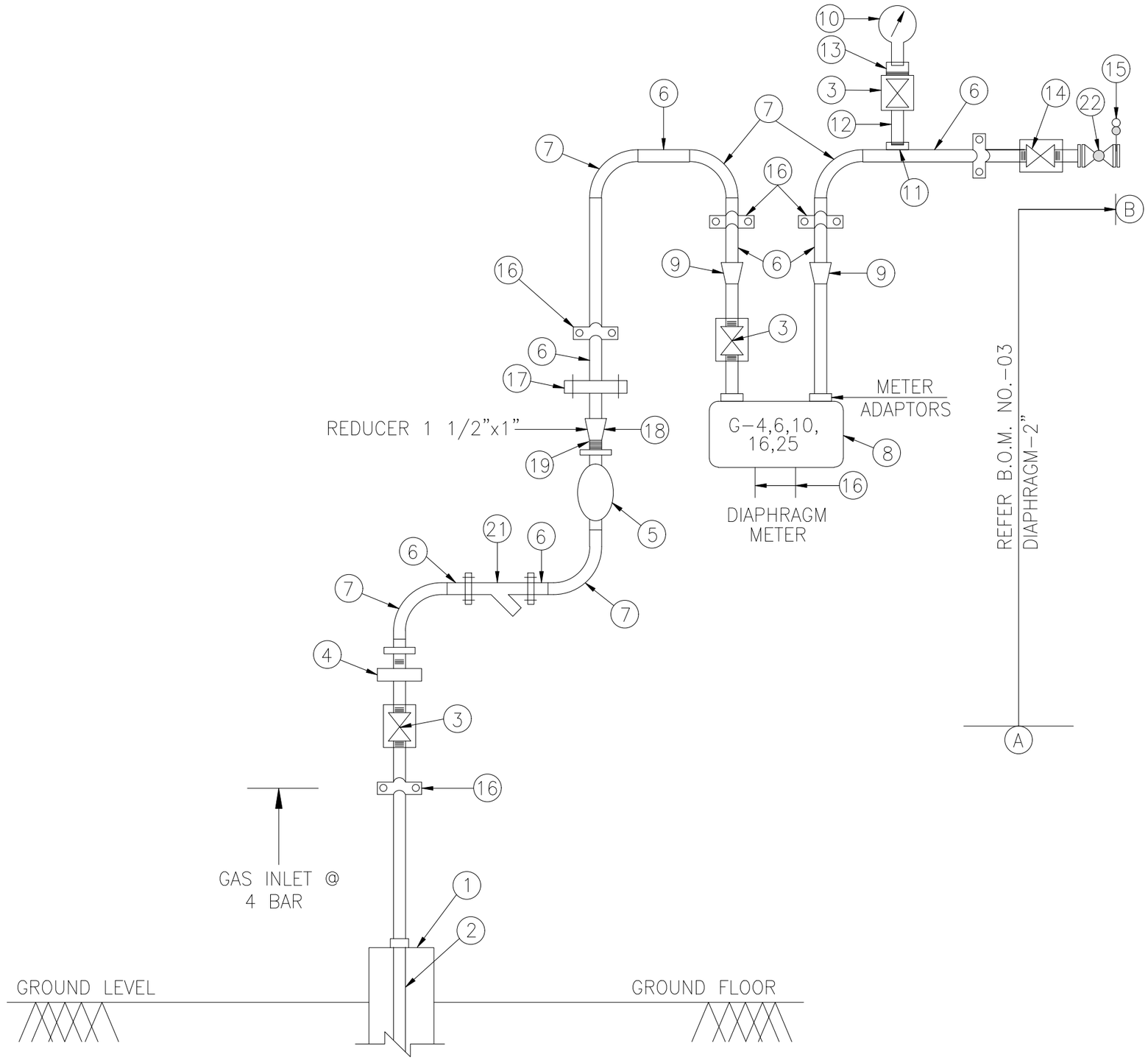
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: STANDARD DETAIL OF RCC VALVE CHAMBER (1.5M x 1M)

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	VPC-STD-RP-2045	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. CS PIPE SHALL CONFIRM TO ASTM A106 Gr B.
2. CS FITTINGS SHALL CONFIRM TO ASTM A105.
3. NPT THREADS SHALL CONFIRM TO ANSI B1.20.1
4. WELDING OF PIPES & FITTINGS SHALL BE CARRIED OUT AS PER API 1104.
5. ALL MATERIAL EXCEPT BELOW MENTIONED IS IN CONTRACTOR'S SCOPE.
6. ANY ADDITIONAL ITEM REQUIRED FOR COMPLETION OF WORK SHALL BE CONTRACTOR'S RESPONSIBILITY WITHOUT ANY COST/TIME IMPLICATION.
7. ANY ADDITIONAL SUPPORT/CLAMPS REQUIRED AT THE TIME OF INSTALLATION OF MRS SKID SHALL BE CONTRACTOR'S RESPONSIBILITY.
8. GIVIN BOM IS INDICATIVE ONLY. INDICATIVE ITEM MAY VERY DURING ACTUAL CONSTRUCTION ON SITE.
9. APART FROM FREE ISSUE MATERIAL BALANCE MATERIAL SHALL BE SUPPLIED BY CONTRACTOR.
10. CONTRACTOR TO ENSURE PROVISION FOR LOCKING/ SEALING ARRANGEMENT FOR METER/VALVE TO AVOID MISUSE.
11. IN CASE OF SPACE CONSTRAINT, FLANGE END Y-TYPE STRAINER MAY BE INSTALLED VERTICALLY.

MATERIAL SUPPLIED

1. METER
2. REGULATOR
3. ISOLATION VALVE

1. SUPPLY OF IF NOT IN CONTRACTOR SCOPE.
2. THE FITTING AS MARKED ALL DRAWING ARE TENTATIVE & MAY CHANGE DISCREPANCY UPON METER & REGULATOR'S OUTLET/INLET ENDS AS SUPPLIED BY VENDOR TO IGL.

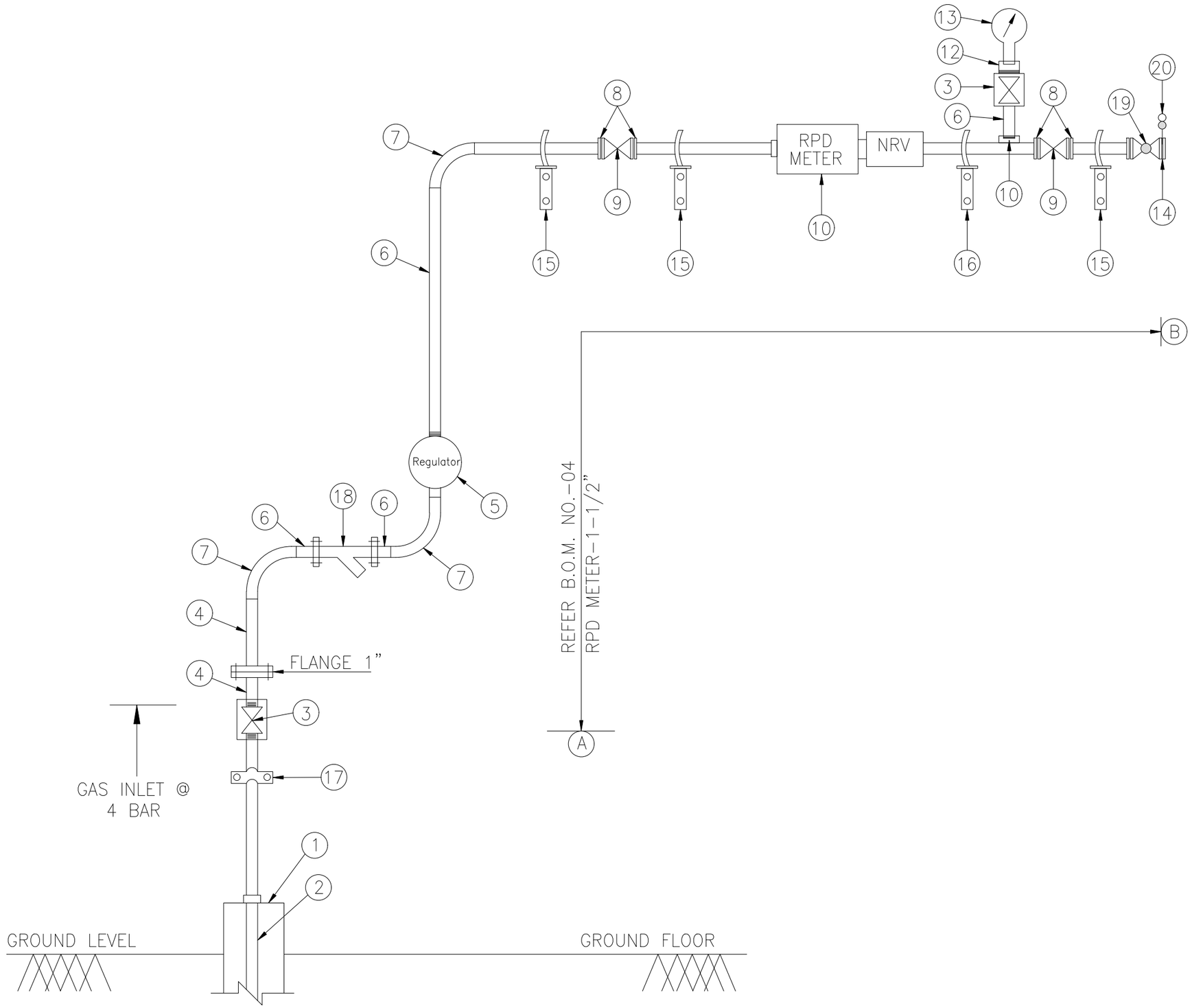
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM METERING & REGULATING STATION

SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	IGC-TP-2046 / 0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. CS PIPE SHALL CONFIRM TO ASTM A106 Gr B.
2. CS FITTINGS SHALL CONFIRM TO ASTM A105.
3. NPT THREADS SHALL CONFIRM TO ANSI B1.20.1
4. WELDING OF PIPES & FITTINGS SHALL BE CARRIED OUT AS PER API 1104.
5. ALL MATERIAL EXCEPT BELOW MENTIONED IS IN CONTRACTOR'S SCOPE.
6. ANY ADDITIONAL ITEM REQUIRED FOR COMPLETION OF WORK SHALL BE CONTRACTOR'S RESPONSIBILITY WITHOUT ANY COST/TIME IMPLICATION.
7. ANY ADDITIONAL SUPPORT/CLAMPS REQUIRED AT THE TIME OF INSTALLATION OF MRS SKID SHALL BE CONTRACTOR'S RESPONSIBILITY.
8. GIVIN BOM IS INDICATIVE ONLY. INDICATIVE ITEM MAY VERY DURING ACTUAL CONSTRUCTION ON SITE.
9. APART FROM FREE ISSUE MATERIAL BALANCE MATERIAL SHALL BE SUPPLIED BY CONTRACTOR.
10. CONTRACTOR TO ENSURE PROVISION FOR LOCKING/ SEALING ARRANGEMENT FOR METER/VALVE TO AVOID MISUSE.
11. IN CASE OF SPACE CONSTRAINT, FLANGE END Y-TYPE STRAINER MAY BE INSTALLED VERTICALLY.

MATERIAL SUPPLIED

1. METER
2. REGULATOR
3. ISOLATION VALVE

1. SUPPLY OF IF NOT IN CONTRACTOR SCOPE.
2. THE FITTING AS MARKED ALL DRAWING ARE TENTATIVE & MAY CHANGE DISCREPANCY UPON METER & REGULATOR'S OUTLET/INLET ENDS AS SUPPLIED BY VENDOR TO IGL.

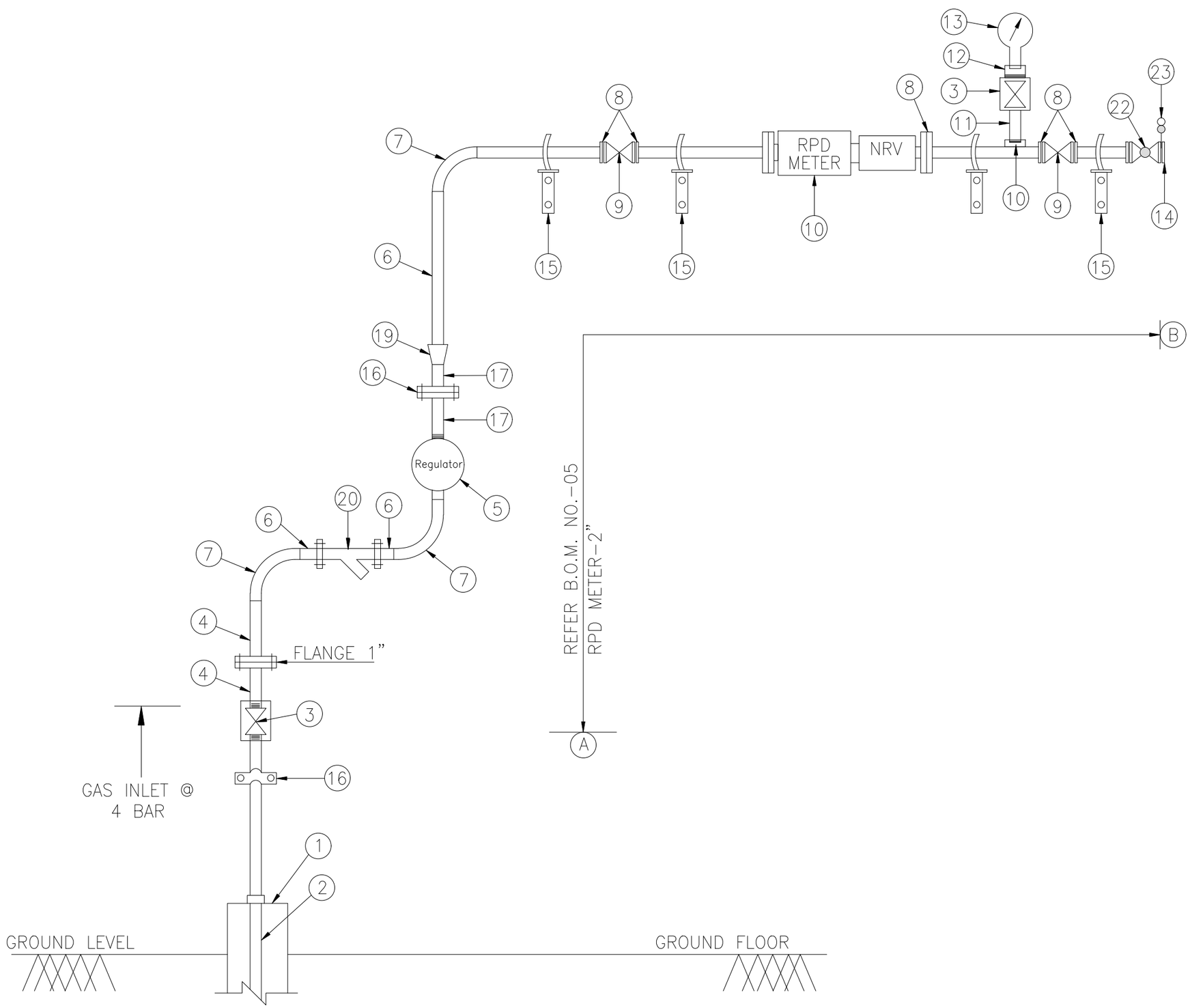
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM METERING & REGULATING STATION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	VBC-STD-RP-2047	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. CS PIPE SHALL CONFIRM TO ASTM A106 Gr B.
2. CS FITTINGS SHALL CONFIRM TO ASTM A105.
3. NPT THREADS SHALL CONFIRM TO ANSI B1.20.1
4. WELDING OF PIPES & FITTINGS SHALL BE CARRIED OUT AS PER API 1104.
5. ALL MATERIAL EXCEPT BELOW MENTIONED IS IN CONTRACTOR'S SCOPE.
6. ANY ADDITIONAL ITEM REQUIRED FOR COMPLETION OF WORK SHALL BE CONTRACTOR'S RESPONSIBILITY WITHOUT ANY COST/TIME IMPLICATION.
7. ANY ADDITIONAL SUPPORT/CLAMPS REQUIRED AT THE TIME OF INSTALLATION OF MRS SKID SHALL BE CONTRACTOR'S RESPONSIBILITY.
8. GIVIN BOM IS INDICATIVE ONLY. INDICATIVE ITEM MAY VERY DURING ACTUAL CONSTRUCTION ON SITE.
9. APART FROM FREE ISSUE MATERIAL BALANCE MATERIAL SHALL BE SUPPLIED BY CONTRACTOR.
10. CONTRACTOR TO ENSURE PROVISION FOR LOCKING/ SEALING ARRANGEMENT FOR METER/VALVE TO AVOID MISUSE.
11. IN CASE OF SPACE CONSTRAINT, FLANGE END Y-TYPE STRAINER MAY BE INSTALLED VERTICALLY.

MATERIAL SUPPLIED

1. METER
2. REGULATOR
3. ISOLATION VALVE

1. SUPPLY OF IF NOT IN CONTRACTOR SCOPE.
2. THE FITTING AS MARKED ALL DRAWING ARE TENTATIVE & MAY CHANGE DISCREPANCY UPON METER & REGULATOR'S OUTLET/INLET ENDS AS SUPPLIED BY VENDOR TO IGL.

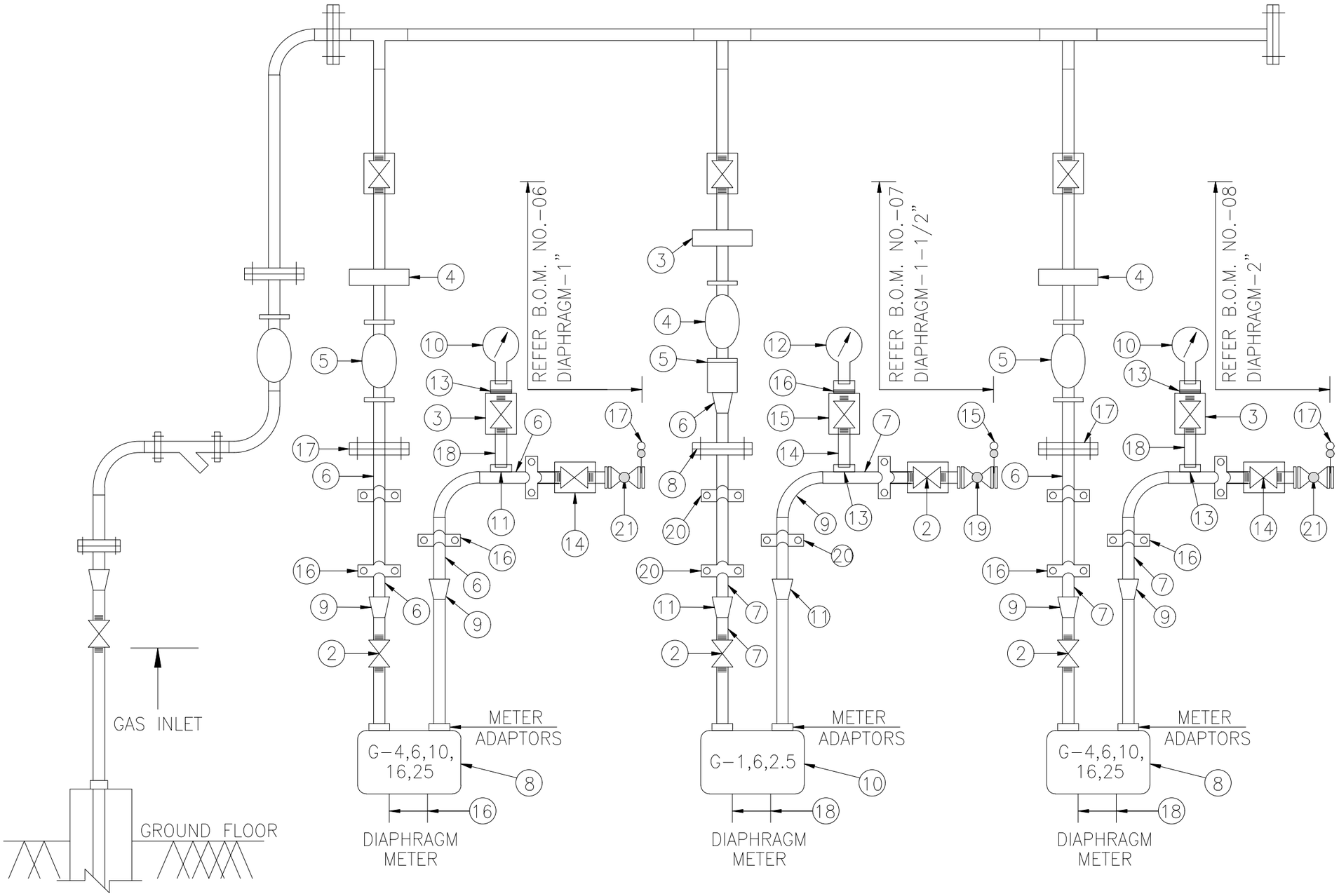
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM METERING & REGULATING STATION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	IGCTD-EP-2048	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. CS PIPE SHALL CONFIRM TO ASTM A106 Gr B.
2. CS FITTINGS SHALL CONFIRM TO ASTM A105.
3. NPT THREADS SHALL CONFIRM TO ANSI B1.20.1
4. WELDING OF PIPES & FITTINGS SHALL BE CARRIED OUT AS PER API 1104.
5. ALL MATERIAL EXCEPT BELOW MENTIONED IS IN CONTRACTOR'S SCOPE.
6. ANY ADDITIONAL ITEM REQUIRED FOR COMPLETION OF WORK SHALL BE CONTRACTOR'S RESPONSIBILITY WITHOUT ANY COST/TIME IMPLICATION.
7. ANY ADDITIONAL SUPPORT/CLAMPS REQUIRED AT THE TIME OF INSTALLATION OF MRS SKID SHALL BE CONTRACTOR'S RESPONSIBILITY.
8. GIVIN BOM IS INDICATIVE ONLY. INDICATIVE ITEM MAY VERY DURING ACTUAL CONSTRUCTION ON SITE.
9. APART FROM FREE ISSUE MATERIAL BALANCE MATERIAL SHALL BE SUPPLIED BY CONTRACTOR.
10. CONTRACTOR TO ENSURE PROVISION FOR LOCKING/ SEALING ARRANGEMENT FOR METER/VALVE TO AVOID MISUSE.
11. IN CASE OF SPACE CONSTRAINT, FLANGE END Y-TYPE STRAINER MAY BE INSTALLED VERTICALLY.

MATERIAL SUPPLIED

1. METER
2. REGULATOR
3. ISOLATION VALVE

1. SUPPLY OF IF NOT IN CONTRACTOR SCOPE.
2. THE FITTING AS MARKED ALL DRAWING ARE TENTATIVE & MAY CHANGE DISCREPANCY UPON METER & REGULATOR'S OUTLET/INLET ENDS AS SUPPLIED BY VENDOR TO IGL.

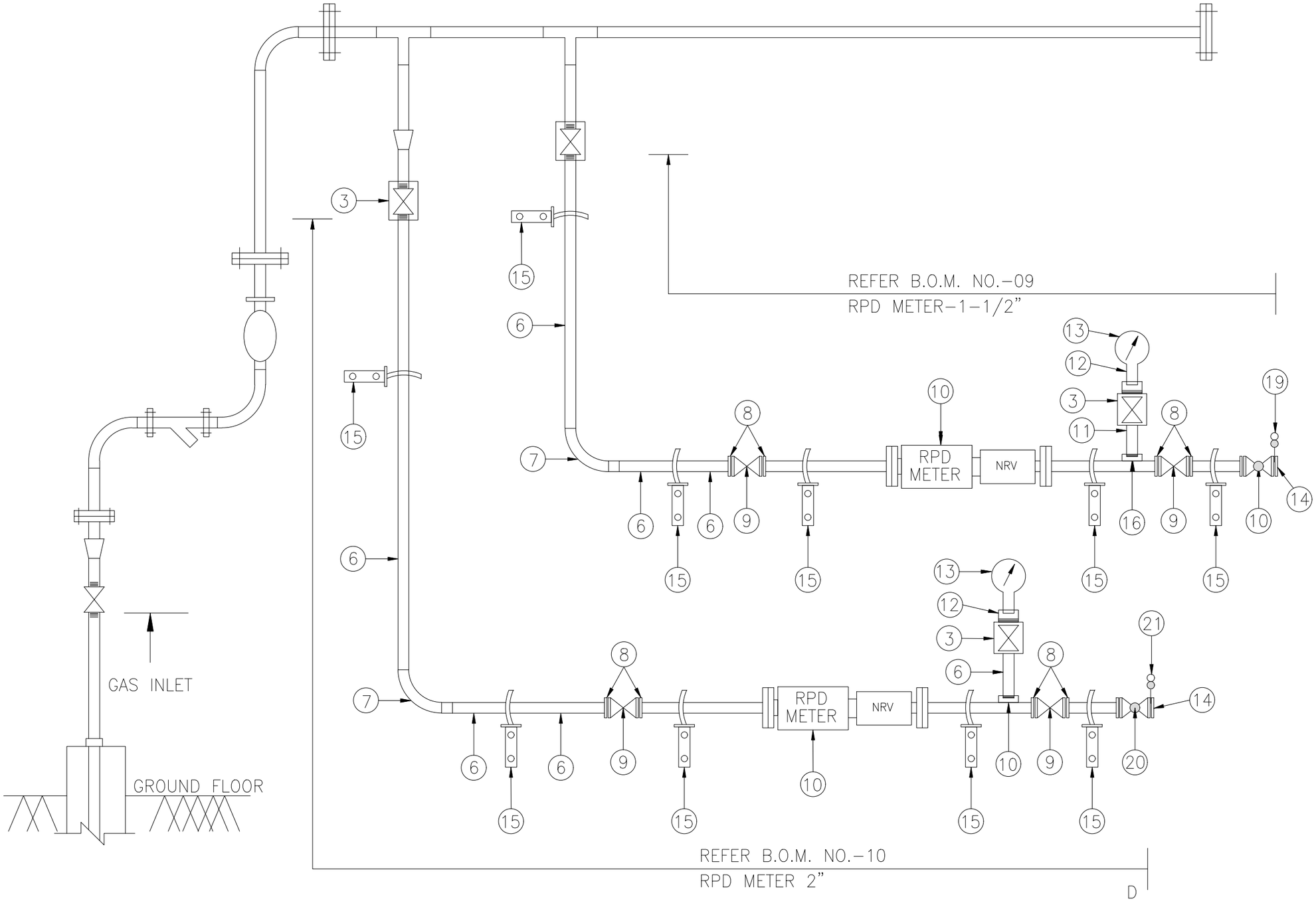
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SCHEMATIC DIAGRAM METERING & REGULATING STATION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	IGL/TP-2049	0



REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. CS PIPE SHALL CONFIRM TO ASTM A106 Gr B.
2. CS FITTINGS SHALL CONFIRM TO ASTM A105.
3. NPT THREADS SHALL CONFIRM TO ANSI B1.20.1
4. WELDING OF PIPES & FITTINGS SHALL BE CARRIED OUT AS PER API 1104.
5. ALL MATERIAL EXCEPT BELOW MENTIONED IS IN CONTRACTOR'S SCOPE.
6. ANY ADDITIONAL ITEM REQUIRED FOR COMPLETION OF WORK SHALL BE CONTRACTOR'S RESPONSIBILITY WITHOUT ANY COST/TIME IMPLICATION.
7. ANY ADDITIONAL SUPPORT/CLAMPS REQUIRED AT THE TIME OF INSTALLATION OF MRS SKID SHALL BE CONTRACTOR'S RESPONSIBILITY.
8. GIVIN BOM IS INDICATIVE ONLY. INDICATIVE ITEM MAY VERY DURING ACTUAL CONSTRUCTION ON SITE.
9. APART FROM FREE ISSUE MATERIAL BALANCE MATERIAL SHALL BE SUPPLIED BY CONTRACTOR.
10. CONTRACTOR TO ENSURE PROVISION FOR LOCKING/ SEALING ARRANGEMENT FOR METER/VALVE TO AVOID MISUSE.
11. IN CASE OF SPACE CONSTRAINT, FLANGE END Y–TYPE STRAINER MAY BE INSTALLED VERTICALLY.

MATERIAL SUPPLIED

1. METER
2. REGULATOR
3. ISOLATION VALVE

1. SUPPLY OF IF NOT IN CONTRACTOR SCOPE.
2. THE FITTING AS MARKED ALL DRAWING ARE TENTATIVE & MAY CHANGE DISCREPANCY UPON METER & REGULATOR'S OUTLET/INLET ENDS AS SUPPLIED BY VENDOR TO IGL.

REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

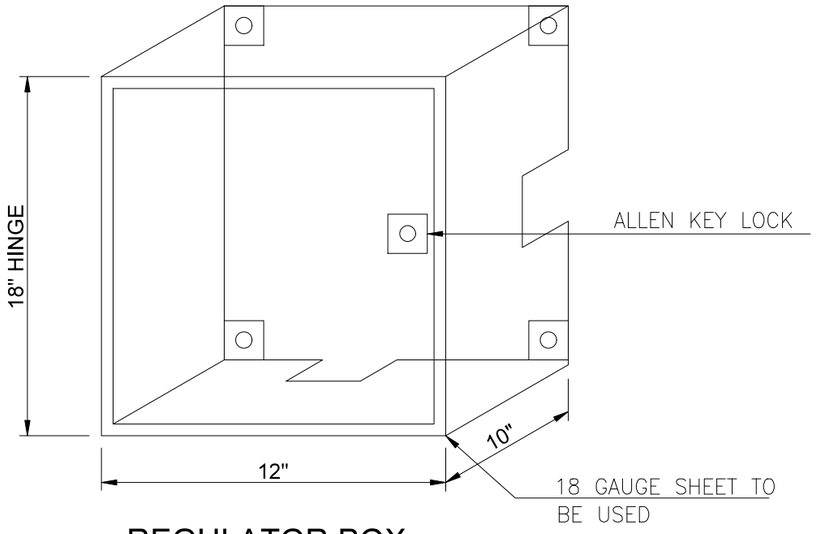
PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

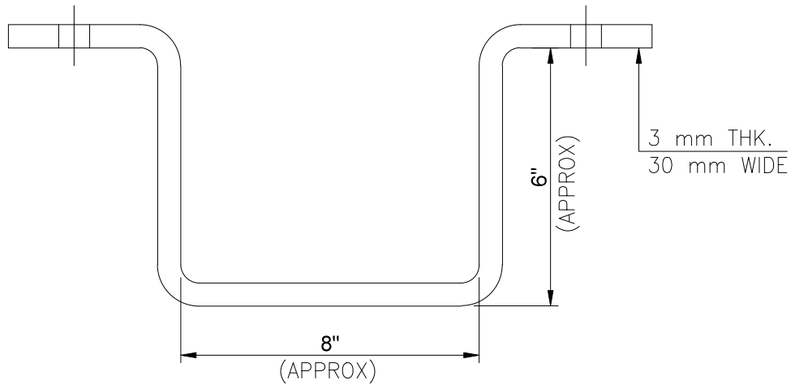
TITLE: SCHEMATIC DIAGRAM METERING & REGULATING STATION

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	IGL-STD-RP-2050	0

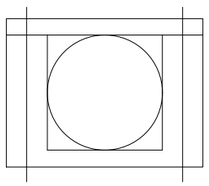
SKETCH OF REGULATOR BOX, BRACKETS & CLAMPS



REGULATOR BOX

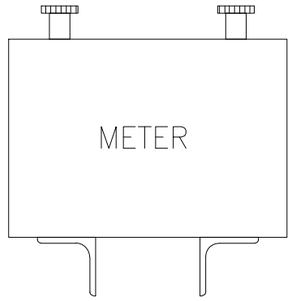


BRACKETS FOR METER (DOMESTIC)

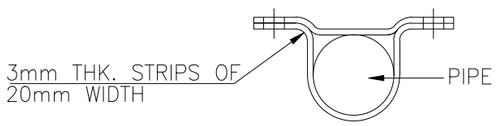


TYPE-1

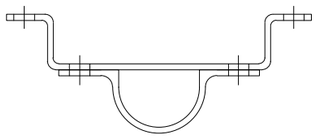
PE/PVC CLAMPS FOR COPPER PIPE



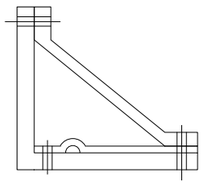
ANGLE BRACKETS 50x50mm
FOR NON DOMESTIC METERS



TYPE-1



TYPE-2



TYPE-3

MS CLAMPS FOR
3/4"& 1/2" GI PIPE

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. CLAMPS, REGULATOR BOX AND METER BRACKET ARE TO BE MADE AS PER DIRECTION AND APPROVAL OF EIC.
3. CLAMPS/BOXES BRACKETS TO BE TIGHTLY SECURED TO THE WALL WITH PROPER ROWEL PLUGS, SCREWS ETC WOODEN BLOCKS TO BEUSED IN CASE ROWEL PLUGS DO NOT HOLD PROPER THE AREA.
4. PAINTING WITH ONE COAT OF ZINC PRIMER AND THREE COATS OF SYNTHETIC ENAMEL PAINT OF REPUTED MAKE.
5. CLAMPS ON PIPE TO BE FIXED AT MINIMUM DISTANCE OF 1.5 METERS AND AT BENDS.

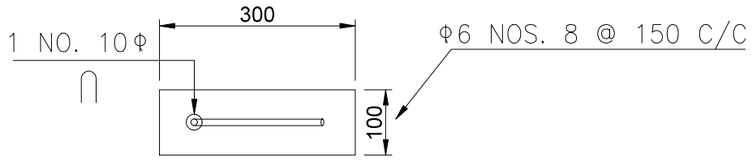
REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

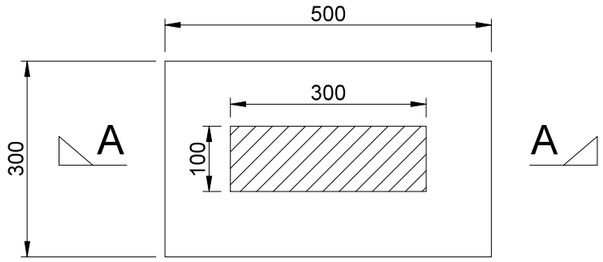
PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SKETCH OF REGULATOR BOX, BRACKETS & CLAMPS

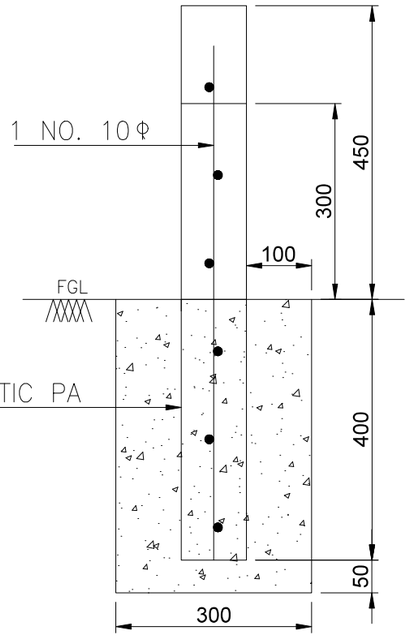
SCALE: SCALE	TOTAL NO. OF SHTS: 1 OF 1	
SIZE	JOB NO.	DRAWING NUMBER / REV.
A3	-----	MC-TD-DP-2051 / 0



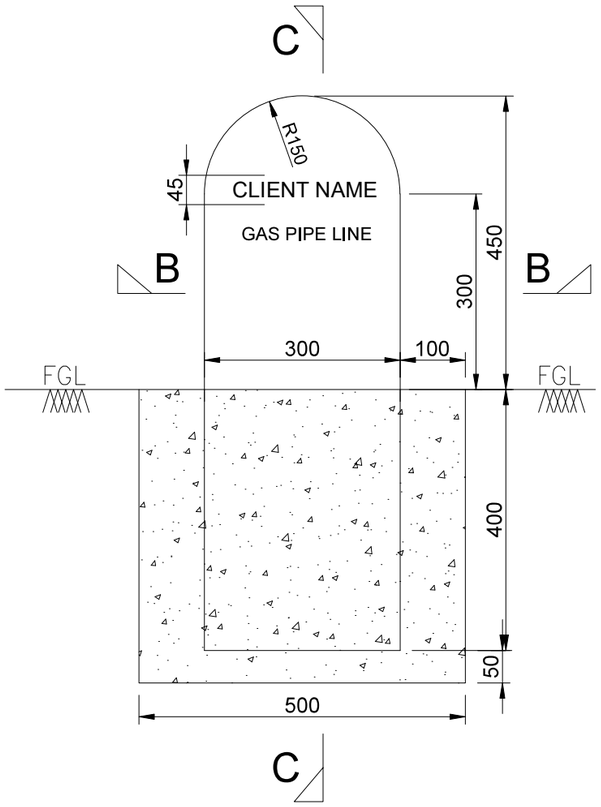
SECTION - B-B



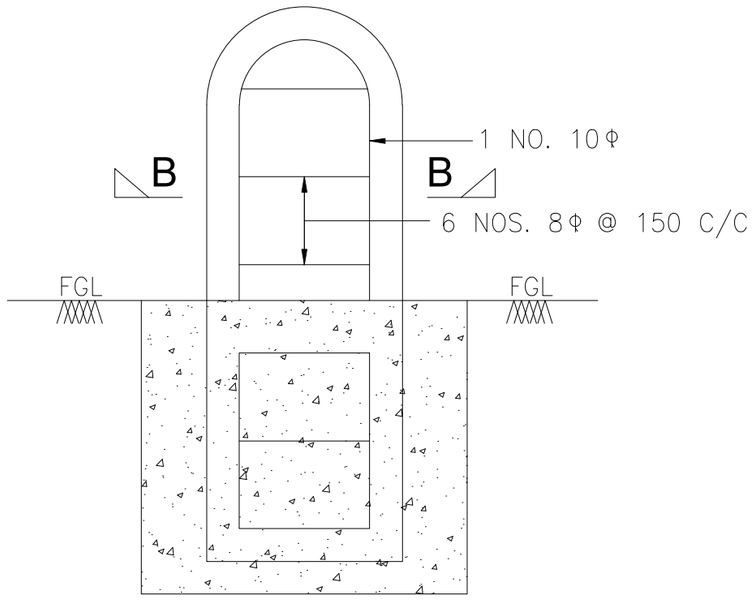
PLAN



SECTION - C-C



SECTION - A-A
(FOR DIMENSIONS)



SECTION - A-A
(FOR REINFORCEMENT)

REFERENCE DRAWINGS

DRAWING TITLE	DRAWING NUMBER

NOTES:-

1. DRAWING IS NOT SCALE.
2. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE.
3. MARKERS SHALL BE INSTALLED IN EVERY 50 METER INTERVAL AS PER INSTRUCTIONS OF ENGINEER-IN-CHARGE.
4. ALL BOUNDARY MARKERS SHALL BE PRESENT & INSCRIPTION SHALL BE ENGRAVED 5mm DEEP IN THE MOULD ON BOTH FACE.
5. CONCRETE FOR BOUNDARY MARKERS SHALL BE M-20.

REV.	DATE	DESCRIPTION	PREP.	CHKD.	APPD.
0	23.06.23	IFC / IFE / TENDER	P.S.S	D.G	S.K.N

PMC: VCS QUALITY SERVICES PVT. LTD.

PROJECT: LAYING OF MDPE NETWORK AND GI/COPPER INSTALLATION

TITLE: SKETCH FOR RCC ROUTE MARKER

SCALE:	SCALE	TOTAL NO. OF SHTS:	1 OF 1
SIZE	JOB NO.	DRAWING NUMBER	REV.
A3	-----	BGSTD-ZP-2052	0

Digitally signed by RACHNA SHUKLA
Date: 2025.03.13 12:58:27 IST

FORMAT NO C211050-FMT-005_00

APPROVED VENDOR LIST

	LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS		
		TOTAL SHEETS	60
DOCUMENT NO	VCS-00-00-VL-0001		

LIST OF RECOMMENDED VENDORS FOR BOUGHT OUT ITEMS

12	31.12.2024	Issued as Standard	Ramveer Singh	Safdar Ali	Rachna Shukla
REV	**DATE**	**DESCRIPTION**	**PREP**	**CHK**	**APPR**

TABLE OF CONTENT

A. MECHANICAL & PIPELINE

1.0 CARBON STEEL PIPES

1.1 PIPE CARBON STEEL TO INDIAN STANDARDS

a. A.S.T. Pipes Pvt. Ltd. (AST Group)
b. Advance Steel Tube Ltd.
c. Apl Apollo Tubes Ltd. (Er. Bihar Tubes Ltd.
d. Asian Mills Pvt. Ltd.
e. Asrani Tubes Limited
f. Dadu Pipes (P) Ltd.
g. Essar Steel Limited(Er Hazira Pipes Mill)
h. Gaurang Products Pvt Ltd. (Ast Group)
i. Goodluck Steel Tubes Ltd.
j. Hi-Tech Pipes Limited
k. Indus Tube Limited
l. Jindal Industries Ltd
m. Jindal Pipes Ltd.
n. Jindal Saw Ltd (Kosi Works)
o. Jotindra Steel & Tube Ltd
p. Lalit Pipes And Pipes Ltd.
q. Maharashtra Seamless Ltd.
r. Man Industries (India) Ltd. – Pithampur
s. Man Industries (India) Ltd. Anjar
t. Mukat Tanks & Vessels Ltd.
u. Nezone Tubes Limited
v. North Eastern Tubes Limited
w. Pratibha Industries Limited
x. Pratibha Pipes & Structural Ltd.
y. Psl Ltd (Chennai)
z. Psl Ltd (V1, V2 & NC)
aa. Rama Steel Tubes Ltd.
bb. Ratnamani Metals And Tubes Ltd.
cc. Ravindra Tubes Limited

dd. Samshi Pipe Industries Limited

ee. Surya Roshni Ltd.

ff. Swastik Pipes Ltd.

gg. Utkarsh Tubes & Pipes Ltd. (Formly Bmw)

hh. Welspun Corp. Limited (Dahej)

ii. Zenith Birla (India) Limited

1.2 PIPE & TUBULARS TO A.P.I. STANDARDS

a. Arcelormittal Tubular Products Roman Sa, Romania

b. Bhel (Trichy),India

c. Dalmine Spa (Enquiry To Tenaris),Uae

d. Eewkorea Co. Ltd (Germany), Korea

e. Eew Korea Co. Ltd. (Korea), Korea

f. Eisenbau Kramer Gmbh, Germany

g. Hyundai Rb Co. Ltd. South Korea

h. Ilva Lamiere E Tubi Srl (Enq To Ilva Spa, Italy

i. Inox Tech. Spa, Italy

j. ISMT Ltd. Ahmedngr, India

k. TATA Steel, India

l. PSL

m. Jindal Pipes Ltd., India

n. Jindal Saw Ltd. (Kosi Works), India

o. Jindal Saw Ltd. (Nashik Works), India

p. Lalit Pipes And Pipes Ltd. India

q. Maharashtra Seamless Ltd., India

r. Man Industries (I) Ltd. (Pithampur), India

s. Mukat Tanks & Vessels Ltd., India

t. Pratibha Industries Limited, India

u. Ratnamani Metals And Tubes Ltd., India

v. Siderca S.A.I.C (Enquiry Totenaris), Uae

w. Sumitomo Metal Ind. Ltd., India

x. Surya Roshni Ltd., India

y. Swastik Pipes Ltd, India

z. Tata Steel Uk Limited (Formerly C702)

aa. Tubos De Acero De Mexico Sa (Enq. Tenaris), Uae

bb. Tubos Reunidos Sa Spain

cc. Umran Steel Pipe Inc (Turkey), Turkey

dd. Valcovny Trub Chomutov, Czech Republic

ee. Vallourec And Mannesmann Tubes, France

ff. Welspun Corp Limited (Dahej), India

1.3 PIPE/TUBE CS (SEAMLESS) TO ASTM STANDARDS

a. Arcelormittal Tubular Products Roman Sa, Romania

b. Bhel (Trichy), India

c. Changshu Seamless Steel Tube Co. Ltd., China

d. Dalmine Spa (Enquiry To Tenaris, Uae

e. Heavy Metals & Tubes Limited (Mehsana), India

f. Ismt Ltd. Ahmedngr, India

g. Ismt Ltd. Baramati India

h. Jfe Steel Corporation, Uae

i. Jindal Sdaw Ltd (Nashik Works) India

j. Klt Automotive And Tubular Products Ltd., India

k. Mahalaxmi Seamless Limited, India

l. Maharashtra Seamless Ltd, India

m. Products Tubulares S.A.U, Spain

n. Ratnadeep Metal Tubes Ltd., India

o. Staineest Tubes Pvt Ltd., India

p. Sumitomo Metal Ind. Ltd., India

q. Tubos Reunidos Sa Spain

r. Valcovny Trub Chomutov, Czech Republic

s. Vallourec Andmannesmann Tubes France

t. Yangzhou Chengde Steel Pipe Co. Ltd Dubai (UAE)

u. Jindal SAW Ltd Kosi Kalan Mathura

1.4 PIPE CARBON STEEL (WELDED) TO ASTM STANDARDS

a. Eew Korea Co. Ltd. (Germany), Korea

b. Eew Korea Co. Ltd. (Korea), Korea

c. Eisenbau Kramer Gmbh, Germany

d. Hyundai Rb Co. Ltd., South Korea

e. Inox Tech. Spa, Italy

f. Jindal Saw Ltd (Kosi Works), India

g. Lalit Pipes and Pipes Ltd., India
h. Man Industeries (I) Ltd.(Pithampur), India
i. Man Industries (India) Ltd. Anjar, India
j. Mukat Tanks & Vessels Ltd., India
k. Ratnamani Metals And Tubes Ltd., India
l. Sumitomo Metal India Ltd., India
m. Tata Steel Uk Limited

2.0 VALVES

2.1 GLOBE VALVES

a. BDK (New Delhi)
b. Datre Corpn (Calcutta)
c. KSB Pumps (New Delhi)
d. L&T (New Delhi)
e. Neco Schuber & Salzer Ltd. (New Delhi)
f. Niton Valve (Mumbai)
g. Ornate Valves (Mumbai)
h. Panchavati Valves (Mumbai)
i. AV Valves Ltd.
j. BHEL (Trichy), India
k. Econo Valves Pvt Ltd, India
l. Fouress Engg (I) Ltd (Aurangabad)
m. Guru Industrial Valves Pvt Ltd
n. Leader Valves Ltd, India
o. NSSL Ltd. (Neco Schubert & Salzerltd)
p. Oswal Industries Ltd, India
q. Petrochemical Engineering Enterprises, India
r. Sakhi Engineers Pvt Ltd
s. Shalimar Valves Pvt Ltd
t. Steel Strong Valves India Pvt Ltd, India
u. Petro Valves Pvt. Limited, Ahmedabad
v. Hawa Engineers Limited, Ahmedabad

2.2 CHECK VALVES

a. Advance Valves Pvt. Ltd., Noida
b. Aksons & Mechanical Enterprises, Mumbai

c. Larsen & Toubro Limited (Audco India Limited, Chennai)
d. AV valves Ltd., Agra
e. BDK engineering India Ltd., Hubli
f. BHEL, OFE&OE Group, New Delhi
g. Datre Coroportion Limited, Calcutta
h. Leader Valves Ltd., Jalandhar
i. Neco schubert & Salzer Ltd., New Delhi
j. Niton Valves Industries (P) Ltd., Mumbai
k. Precision Engg. Co., Mumbai
l. Econo Valves Pvt Ltd, India
m. Fouress Engg (I) Ltd (Aurangabad)
n. KSB Pumps Ltd (Coimbatore), India
o. NSSL Ltd. (Neco Schubert & Salzer Ltd)
p. Oswal Industries Ltd, India
q. Panchvati Valves & Flanges Pvt Ltd, India
r. Petrochemical Engineering Enterprises, India
s. Sakhi Engineers Pvt Ltd
t. Shalimar Valves Pvt Ltd
u. Steel Strong Valves India Pvt Ltd, India
v. Shiv Shakti Engineering Works (Approved up to 06 inch)

2.3 PLUG VALVES

a. Breda Energia Sesto Industria Spa, Italy
b. Fisher Sanmar Ltd., Chennai
c. Larsen & Toubro Ltd., New Delhi
d. Nordstrom Valves, USA
e. Serck Audco Valves, UK
f. Sumitomo Corporation India Pvt. Ltd., New Delhi
g. Z Corporation, Korea
h. Hawa Valves (India) Pvt. Ltd., Mumbai
i. Steel Strong Valves India Pvt. Ltd., Navi Mumbai
j. Econo Valves
k. Flow-Serve PTE (Mfr. SERCK), India

2.4 BALL VALVES

a. Hawa Valves (India) Pvt. Ltd, Navi Mumbai

b. Larsen & Toubro, Delhi
c. Microfinish Valves Pvt. Ltd., Noida
d. Oswal Industries Ltd., Gandhi nagar
e. Virgo Engineers Ltd., Delhi
f. Boteli Valve Group Co. Ltd., China
g. Cameron (Malaysia) SDN BHD, Malaysia
h. Dafram S.P.A., Italy
i. Fangyuan Valve Group Co. Ltd., China
j. Franz Schuck GmbH, Germany
k. O.M.S. Saleri (Italy)
l. Pibi Viesse S.P.A (Italy)
m. Nuovo Pignone (Italy)
n. Perar S.P.A (Italy)
o. Pietro Fiorentini (Italy)
p. Cooper Cameron Valv Italy SRL-FRM, Itly
q. Petrol Valves SRL
r. Tormene Gas Technology S.P.A (VALVITALIA)
s. Petro Valves Pvt. Limited, Ahmedabad
t. Shiv Shakti Engineering Works (Approved up to 08 inch)

3.0 TEE

3.1 FLOW TEE

a. Coprosider SPA, Italy
b. GEA Energy System India Limited, Chennai
c. Multitex Filteration
d. Pipeline Engineering, UK
e. Scomark Engg. Limited (U.K.)
f. Skeltonhall Limited, Engaland(U.K.)
g. Technospecial SPA, Italy
h. Tectubi SPA, Italy
i. RMA Germany
j. Pipefit Engineers Pvt. Ltd.
k. Vee Kay Vikram & Co.

3.2 SPLIT TEE

a. IPSCO, Canda

b. TD Willamsons, USA
c. Plant-Tech Power Technical Services Pvt Ltd
d. Teemans, UK
e. Vee Kay Vikram & CO.

4.0 FLANGES

a. Aditya Forge Ltd., Vadodara
b. Amforge Industries Ltd., Mumbai
c. CD Engineering Co., Ghaziabad
d. Echjay Forgings Pvt. Ltd. (Bombay), Mumbai
e. Echjay Industries Ltd., Rajkot
f. Forge & Forge Pvt. Ltd., Rajkot
g. Golden Iron & Steel Works, New Delhi
h. JK Forgings, New Delhi
i. Metal Forgings Pvt. Ltd., Mumbai
j. Perfect Marketings Pvt. Ltd., New Delhi
k. Sky Forge, Faridabad
l. S&G, Faridabad
m. Chaudhry Hammer Works Ltd, India
n. JAV Forgings (P) Ltd, India
o. Kunj Forgings Pvt Ltd, India
p. MS Fittings
q. R.N. Gupta & Co. Ltd, India
r. R.P. Engineering Pvt Ltd, India
s. Sanghvi Forgings & Engineering Ltd
t. Shri Ganesh Forgings Ltd., India
u. Uma Shankar Khandelwal & Co., India
v. Sawan Engineers, Baroda
w. Stewarts & Lloyds of India Ltd., Kolkata
x. Engineering Services Enterprises
y. Pipefit Engineers Pvt. Ltd.
z. Jindal Forging
aa. Vivial Forges

5.0 FITTINGS

a. Commercial Supplying Agency, Mumbai

b. Dee Development Engineers Ltd.
c. Eby Industries, Mumbai
d. Flash Forge Pvt. Ltd., Vishakhapatnam
e. Gujarat Infra Pipes Pvt. Ltd., Vadodara
f. M.S. Fittings Mfg. Co. Pvt. Ltd., Kolkata
g. Stewarts & Lloyds of India Ltd., Kolkata
h. Teekay Tubes Pvt. Ltd., Mumbai
i. Pipe Fit, Baroda
j. Sky Forge, Faridabad
k. S&G, Faridabad
l. Sawan Engineers, Baroda
m. Eby Fasteners, India
n. Leader Valves Ltd, India
o. R.N. Gupta & Co. Ltd, India
p. Exten Engg Pvt Ltd
q. Sivananda Pipe & Fittings Ltd
r. Jindal Forging
s. Vivial Forges
t. PK Tubes Rajasthan
u. CSA Fitting
v. Gujarat Infrapipes pvt ltd, Vadodara
w. KS Pipes Fitting Pvt Ltd, Palwal
x. Tube Bend, Kolkata

6.0 PIG LAUNCHERS/ RECEIVERS/ PIG SIGNALERS

a. Bassi Luigi Fittings B.V., Holland
b. BRAUN STAHL PIPE TEC, GERMANY
c. FORAIN, ITALY
d. Fluidel SRL, ITALY
e. RMA Maschinen- und, GERMANY
f. Siiritec Nigi, Itlay
g. SCHUCK ARMATUREN, GERMANY
h. T.D. Williamson Inc., USA
i. Tectubi SPA, Italy

j. Taylor Forge Engineering System INC, USA
k. Tormene Americana S.A. (Argentina)
l. Tormene Gas Technology S.p.A., Italy
m. PIPELINE ENGINEERING, UNITED KINGDOM
n. Krohne, Oil & Gas BV, Drive Houston,
o. Multitex Filtration Engrs. Ltd, New Delhi
p. BGR ENERGY SYSTEMS LIMITED New Delhi
q. Glapwell Contracting Services Ltd. UK
r. FULGOSI GIOVANNI S.n.c di Corrado & C, ITALY
s. VEEKAY VIKRAM & CO, GUJRAT
t. GBM S.R.L, ITALY
u. Cardew Ltd., Alexeander
v. Forain S.R.L.
w. GD Engineering, India
x. Pipeline Engineering, UK
y. Siirtec Nigi SPA
z. Control Plus
aa. Oswal Infrastructure

7.0 LONG RADIUS BENDS

a. Jindal Saw Ltd. (Kosi Works), India
b. PSL Limited (Gandhidham – Mfrg), India
c. BHEL, Trichy, Tamilnadu
d. Welspun, Gujarat
e. Sawan
f. Gujarat Infra
g. P K Tubes
h. DEE Development
i. Pipefit Engineers Pvt. Ltd.

8.0 CLEAN AGENT SYSTEM

a. ADN Fire Safety Pvt Ltd (Vashi East, Thane)
b. Chetan Corporation (Ahmedabad)
c. Chetan Engineers (Ahmedabad)
d. Mx Systems International Pvt. Ltd. (Mumbai)
e. New Fire Engineers (P) Ltd (Sil Vassa)

f. Nitin Fire Protection Industries Ltd (New Bombay)

g. Nohmi Bosai (India) Private Limited

h. Tyco Fire & Security India Pvt. Ltd (Bangalore)

i. Vimal Fire Controls Pvt Ltd (Vadodara)

9.0 INSULATING JOINTS

a. IGP Engineers

b. V K Vikram

c. Advance Electronics

d. Nupros INC

10.0 GASKETS

a. IGP Engineers (P) Ltd., Madras

b. Madras Industrial Products, Madras

c. Dikson & Company, Bombay

d. Banco Products (P) Ltd., Vadodara

e. Goodrich Gaskets Pvt Ltd

f. Starflex Sealing India Pvt Ltd, India

g. Teekay Meta Flex Pvt Ltd

h. UNIKLINGER Ltd

i. HEM Engg. Corp.

j. Unique Industrial Packing Pvt. Ltd.

11.0 FASTENERS

a. Nireka Engg. Co. (P) Ltd., Calcutta

b. Precision Taps & Dies, Bombay

c. AEP Company, Vithal Udyoug Nagar

d. Fix Fit Fasteners, Calcutta

e. Precision Engg. Industries, Baroda

f. Echjay Forgings Pvt. Ltd., Bombay

g. Capital Industries, Bombay

h. Boltmaster India Pvt Ltd, India

i. Deepak Fasteners Limited, India

j. Fasteners & Allied Products Pvt Ltd, India

k. Hardwin Fasteners Pvt Ltd, India

l. J.J. Industries, India

m. Multi Fasteners Pvt Ltd, India

n. Nexo Industries, India

o. Pacific Forging & Fasteners Pvt Ltd, India

p. Pioneer Nuts & Bolts Pvt Ltd, India

q. Precision Auto Engineers, India

r. President Engineering Works, India

s. Sandeep Engineering Works, India

t. Syndicate Engineering Industries, India

12.0 WELDING ELECTRODES FOR PIPELINE/PIPING WORK

a. For Mainline – Lincoln/ Bohler make

b. For Terminal – For root pass –Lincoln/ Bohler make

For other passes – Lincoln, D&H or equivalent makeLincon

13.0 STRAINERS

a. Bombay Chemical Equipments

b. Gujarat Auto filed

c. Multitex Filtration Engineering Limited

d. Grand Prix Engineering Limited

14.0 COLD APPLIED TAPES

a. Denso GmbH

b. Raychem

15.0 HEAT SHRINKABLE SLEEVE/ FIBREGLAS REINFORCED SLEEVE

a. Covalence - Seal For Life India Pvt. Ltd. (Formerly Covalence Raychem- Berry Plastics Corporation)

b. Canussa-CPS

c. Rigil Techno India(Distributor for M/s CYG Changtong New Material Co Ltd,China)

d. M/s Shri Narayan lmpac-lndia LLP

16.0 STUD BOLTS WITH NUTS

a. Multi Thread Fasteners, Baroda

b. Darukhanwala

c. Precision Engineers, Baroda

d. Unbrako

e. TVC

17.0 WARNING MAT

a. Sparco Multiplast Pvt. Ltd., Ahmedabad
b. Singhal Industries , Ahemdabad
c. Puja Packing, Mumbai
d. Bina Enterprises, Mumbai
e. Shree Vijay Wire & Cable Industries

18.0 HDPE PIPES/DUCT

a. Climax Synthetics (P) Ltd., Vadodra
b. Indian Poly Pipes, Calcutta
c. Jain Irrigation Systems Ltd., Jalgaon
d. Kirti Industries (India) Ltd., Indore
e. Ori Plast Limited, Calcutta
f. Phoel Industries Limited, Delhi
g. Sangir Plastics (P) Ltd., Mumbai
h. Veekay Plast,Jaipur
i. Kisan Irrigation
j. Dutron Polymers Ltd.
k. Manikya Plastichem (P) Ltd
l. Himalyan Pipe Industries
m. NorthEast Polypipes LLP

19.0 DRY GAS FILTER & FILTER SEPERATOR

a. Grand Prix Fab (Pvt.) Ltd. (New Delhi)
b. Perry Equipment, USA
c. Faudi Filter, Germany
d. Forain S.r.l., Italy
e. ABB, Faridabad
f. Burgess Manning, USA
g. Multitex Filtration Engineers India
h. Triveni Plenty Engg. Ltd. (New Delhi)
i. Siirtec International Contractor S.P.A (Italy)
j. Flashpoint, Pune india
k. Filteration Engineers (I) Pvt Ltd, India
l. Gujarat Otofilt, India
m. Tormene Gas Technology

n. Ultrafilter (India) Pvt Ltd, India
o. Ravi Techno Systems Pvt Ltd, India
p. Siirtec Nigi S.P.A
q. Filtan Filter Anlagenbau Gmbh
r. Fairley Arlon BV
s. PECO Facet
t. EPE Epenstenner GMBH
u. Filtrex srl
v. Petromar Engineered Soln
w. Plenty Filter
x. Eurofiltec
y. PTI Technologies Inc

20.0 FILTER ELEMENT

a. Peco – Facet
b. Velcon
c. Pall – Filterite
d. Burgress Manning

21.0 NDT AGENCY

a. NDT Services, Ahmedabad
b. GEECY Industrial Services Pvt. Ltd., Mumbai
c. Corrosion Control Services, Mumbai
d. Perfect Metal Testing & Inspection Agency, Calcutta
e. Inter Ocean Shipping Co., New Delhi
f. RTD, Mumbai
g. Sievert, Mumbai
h. X-Tech, Vizag
i. Industrial X Ray and Allied Radiographers (I) Pvt. Ltd.
j. Inspection Technology
k. IXAR
l. Aditya NDT Services
m. Riya NDT Engineers
n. Star NDT Engineers
o. Technical testing & Inspection Services

22.0 Cold Applied Tapes

a. Denso GmBH
b. Polyken (Berry Plastics Corporation)

22.1 End Seal Tape-PVC

a. MAASH Industries

23.0 PUR Coating

a. Powercrete (Berry Plastics Corporation)

24.0 Casing End Closure

a. Raci, Italy
b. Raychem RPG Limited

25.0 Casing Insulators

a. Raci, Italy
b. Raychem RPG Limited
c. VeekayVikram

26.0 FIRE FIGHTING EQUIPMENT

26.1 FIRE EXTINGUISHERS

a. Avon Services (Production & Agencies) Pvt. Ltd., Bombay
b. Kooverji Devshi & Co., Bombay
c. Reliable (Fire Protection) India Ltd., Bombay
d. Zenith Fire Services, Bombay
e. Safex Fire Services, Bombay
f. Brij Basi Hi
g. tech Udyog
h. Bharat Engg Works, India
i. Gunnebo India Ltd
j. Nitin Fire Protection Industries Ltd, India
k. Supremex Equipments, India
l. Vimal Fire Controls Pvt Ltd., India

26.2 FIRE HYDRANTS, MONITORS, DELUGE VALVE, NOZZLES

a. Zenith
b. Minimax
c. Newage
d. HD Fire
e. Vijay Fire
f. Asco Strumech Pvt Ltd, India
g. Brij Basi Hi
h. tech Udyog
i. Gunnebo India Ltd
j. Nitin Fire Protection Pvt Ltd
k. Shah Bhogilal Jethamal & Brothers
l. Venus Pumps & Engineering Works

26.3 RRL Hose

a. Jayshree
b. Newage

26.4 HOSES

a. Ashit Sales Corporation, Bombay
b. Royal India Corporation, Bombay
c. Gayatri Industrial Corporation
d. Simplex Rubber Products Ltd., Ahmedabad
e. Zaverchand Marketing Pvt. Ltd., Baroda
f. Presidency Rubber Mill, Calcutta
g. The Cosmopolite, Calcutta
h. Simplex Rubber Products, Thane

NOTE:

1) For procuring bought out items from vendors other than those listed above, the same may be acceptable subject to the following: -

   a) The vendor/ supplier of bought out item(s) is a manufacturer/ supplier of said item(s) for intended services and the sizes being offered is in their regular manufacturing supply range.

   b) The vendor / supplier should not be in the Holiday list of CLIENT / VCS / other PSU.

   c) Should have supplied at least one single random length (i.e. 5.5 meters to 6.5 meters) for item assorted pipes / tubes and for other items, which are to be supplied in quantity on number-basis (other than assorted pipes / tubes)

minimum 01 (One) number of same or higher in terms of size and rating as required for intended services. The bidder should enclose documentary evidences i.e. PO copies, Inspection Certificate etc. for the above, along with their bids.

2) For any other item(s) for which the vendor list is not provided, bidders can supply those item(s) from vendors/ suppliers who have earlier supplied same item(s) for the intended services in earlier projects and the item(s) offered is in their regular manufacturing/ supply range. The bidder is not required to enclose documentary evidences (PO copies, Inspection Certificate etc.) along with their offer, however in case of successful bidder, these documents shall require to be submitted by them within 30 days from date of Placement of Order for approval to CLIENT / VCS.

3) The details of vendors indicated in this list are based on the information available with VCS, Contractor shall verify capabilities of each vendor for producing the required quantity with. PMC does not guarantee any responsibility on the performance of the vendor. It is the contractor's responsibility to verify the correct status of vendor and quality control of each parties and also to expedite the material in time.

B. CIVIL AND STRUCTURAL

Sr. No.	Items/ Name of Products	Make/ Brands/ Manufactures
1.	Reinforcement Steel	TATA, SAIL, RINL, JSW.
2.	Cement	Ambuja, ACC, JK, Grasim, Ultratech, Birla, L&T, Cement Corporation of India
3.	Structural Steel	TATA, SAIL, RINL, IISCO, ESSAR
4.	Structural Steel Tubes ISI Marked	TATA, JINDAL, SURYA
5.	Mineral wool for thermal insulation of ceilings (Under deck insulation)	Rock wool (india) Ltd. Minwool Rock Fibres Ltd., Lloyd Insulation.
6.	Synthetic Enamel Paint (1st quality only)	ICI Paint (Dulux), Asian Paint (Apcolite), Berger Paints (Luxol). Goodlass Nerolac Paints (Nerolac), Jenson & Nicholson Paints Ltd (Borolac)
7.	G.I SHEET	ESSAR, JSW, SAIL
8.	Sheeting Screw	Corroshield, Buildex,
9.	Chemical for Antitermite treatment	DE- NOCIL Bombay, Pest Control of India, Trishul
10.	Factory made Panelled Door shutter	Century; Godrej ; M/s Hindustan Housing factory Ltd., New Delhi ; M/s Delhi Construction Eqp, Sadar Bazar, Delhi ; M/s Joinery manufacturing Co., Calcutta;
11.	PVC Panel Door (Solid Core)	Rajshri Plastiwood Limited, Sintex, Hindopan, Marino

12.	Pressed steel door frames/ cupboard and window frames (manufacturers)	M/s SAIL, M/s TATA
13.	Pressed steel door frames/ cupboard and window frames (fabricators)	M/s Loyal safe works Mayapuri, N/Delhi M/s Multiwyn Industrial Corpn Calcutta M/s Metal Window Corpn N/Delhi M/s Chhabra Steel Udyog, 260 Sadar Bazar, Meerut Cantt. M/s Delite safe works, Rani Jhansi Road, N/Delhi
14.	Steel Windows, Ventilators (as per IS- 1038 of 1983) & frames pressed steel door/window	M/S Multiwyn Industrial Corpn, Calcutta ; M/S Metal Window Corp, N/ Delhi ; M/S Chhabra Steel Udyog 260, Sadar Bazar, Meerut Cantt ; Agent steel MFG Pvt Ltd, Ahmedabad ; Godrej ;
15.	AI Section for AI Door/ Window/ Partitions	Hindalco, Ajit India, Jindal
16.	AluminumI Door/ Window/ Glazing Fabricated and Anodized	M/s Alumilite Pvt Ltd, M/s Ajit India Pvt Ltd, M/s Ramniklal S Raste Agra, Argent Industries, M/s Aluminium Tech Industries, I-2249 DSIDC Narela, Delhi, M/s VR Associates, GH-14/242 Paschim Vihar, Delhi
17.	Aluminium door and windows Fittings	M/s Elite Enterprises C/6 Shalimar Hardware 133, Jarg Mahal, Dhobitalao Mumbai 400002. M/s Mohan Metal Industries 178/2-A, Bhole Nath Nagar, Shahadara, Delhi 110032. Mepro, Argent New Delhi, Classic, New Delhi. Jindal, Argent New Delhi,Golden Industries Pvt. Ltd. ECIE
18.	Aluminium Grill	Alu Grill, Arihant Aluminium Corporation, Decogrille
19.	Door Closer	Everite, Golden, Gandhi,
20.	Floor Spring	Prabhat, Everite
21.	Plywood for general purpose (IS-303)	National Plywood Inds Pvt Ltd, S Fancy lane, 8th floor, Calcutta-700001, Merino Plywood, Archid Ply, Ply, Swastik, Universal, Century, Greenply, National.
22.	Pre laminated Particle board	Kitply, Bhutan board, Ecoboard, Novapan, Archid ply, Merinova, Merino
23.	Laminated Sheets	Formica, Merino Lam, Greenlam, National,Century
24.	Modular Partitions	Godrej, Blowplast
25.	False Ceiling (Mineral Fibre Board)	Armstrong, Daiken, Luxalon, Llyods, Gypboard, Trac, Aerolite
26.	Aluminium False Ceiling	Lloyds, Armstrong, Luxlon,Trac
27.	Flooring Tiles (Mosaic / Terrazzo / PCC) (1st quality only)	Kajaria Ceramics, NITCO, Royal Tiles, Gem Tiles, Hindustan Tiles, M/S National Tiles & Industries, Ultra Tiles
28.	Glazed Ceramic Tiles, Non-Skid (Floor/Wall),	Kajaria, Somany, NITCO. Murudeshwar Ceramic Ltd (Navin Diamond tile), Johnson (Marbonite),

	(1st quality only)	
29.	Vitrified/ Designer Vitrified Tiles (1st quality only)	Asian, Marbonite (Johnson), Kerrogres (Kajaria), NITCO, Orient
30.	PVC Tiles/Flooring (IS 3461) (1st quality only)	Marblex Tiles, Krishna Tiles, Polyfin, Armstrong, Wonder floor.
31.	False Flooring	Godrej or equivalent
32.	Glass Mosaic Tiles (1st quality only)	Paladio, Coral, Accura, Bisazza, Italia, Mridul.
33.	Designer Paver Tiles/ Interlocking tiles ISI marked/ Grass-jointed Tiles. (1st quality only)	Pavit, Ultra, Hindustan, Eurocon, Vyara, National Tiles, Gem, Unistone, Konkrete, Unitile
34.	Wall care Putty for Base preparation (1st quality only)	Birla Wall care putty, Berger, Jenson & Nicholson, JK White
35.	White Cement (1st quality only)	Birla, JK
36.	Cement based Paints (1st quality only)	Super Snowcem, Duracem, Super Acrocem.
37.	Dry Distemper / Oil bound Distemper (1st quality only)	Goodlass Nerolac Paint, Shalimar Paint, Jenson & Nicholson, Asian Paint, Berger. ICI Dulux
38.	Acrylic Washable Distemper (1st quality only)	Asian, Berger, ICI Dulux, Jenson & Nicholson, Nerolac, Shalimar, Garware & Goodlass
39.	Plastic Emulsion Paint (1st quality only)	Asian, Berger, ICI, Nerolac, Jenson & Nicholson, Shalimar,Garware & Goodlass
40.	Exterior Acrylic Emulsion (1st quality only)	ICI (Weathercoat), Excel (Nerolac), Apex (Asian), Berger, Jenson & Nicholson, Shalimar,Garware & Goodlass
41.	Polymer based Paint	STP, CICO
42.	Textured Paint / Wall Tile (1st quality only)	Unitile, Heritage, Spectrum, Iokos, Acropaints, Asian
43.	Flexible board for Expansion joint	STP or equivalent
44.	Grout	Shrinkomp, Fosroc,Fairmate
45.	Integral water proofing compound	STP, Pidilite, Fosroc, CICO, Sika.
46.	Concrete Admixture	Pidilite, Fosroc, CICO, Sika.
47.	Water proofing for cementations surface IS-2645	Acrocrete & Acrocote, CICO, Fosroc, STP
48.	Bituminous Product	M/s Faridabad Spinning & Woolen Mills Pvt Ltd, 837, SP Mukherjee Marg Delhi,

		M/s STP Ltd (Formerly Shalimar Tar Products) M/s Bitufelt Pvt Ltd 123/377 Fazalm Ganj Kanpur 208012, Texas, Texas India Ltd, Multiplas
49.	Hardeners	Ironite, Ferrok, Hardonate
50.	Construction Chemicals	Choksey, CICO, Forsroc, Sika
51.	Stainless Steel Cladding	Jindal
52.	Punch Tape Concertina Coil	Global Technocrat, S.G. Engineers Delhi
53.	Stainless Steel Railing	Jindal
54.	FRP/ HDPE Garbage Bins	Sintex, Swift, Nutech, Sheetal
55.	Sanitary ware	Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Parryware (superfine), Cera (Ist quality), Classica (Ist / standard)
56.	WC seat cover ISI Marked	Parryware, Neycer Kermag (standard), Hindustan Sanitary Ware (Ist quality), Cera (Ist quality), Classica (Ist / standard)
57.	PVC Flushing Cistern IS: 774-1984 (ISI Certified)	Parryware, Hindustan Sanitary Wares, Cera.
58.	Faucets & Taps, Stop Valves & Pillar Taps, Surgical basin mixer, Shower rose etc.	Gem, Parko, Parryware, HSW, Jaquar
59.	Kitchen Stainless Steel Sink	Diamond, Nirali, Neel Kanth, Jayna
60.	Looking Mirror	Saint Gobain, Modi Float, Triveni Float Glass, Crown, Atul.
61.	Readymade Bathroom Cabinets	Commander Gratings (I) Pvt Ltd, Gratolite Cabinet, A- 4 Sector Viii Noida-202701, Alpina, Cera.
62.	Float Valve	Leader, Bombay Metal & Alloy Co, Bombay superflow.
63.	SGSW Pipes (IS-651) ISI Marked	Perfect Agra, Devraj Ind Gaziabad, Buran, RK, Prince,
64.	CI (Centrifugally Cast) Pipes for sewage disposal ISI marked	NICCO, SRIF, A-1 Singhal Casting Co Agra, Jindal Saw, Kesoram, NECO
65.	PVC rain water/sewage pipes (IS-4985)	Reliance, Finolex, Supreme, Kisan, Prince, Hindustan Plastic & machine corporation, Polypack industries (P) Ltd.
66.	HDPE Water storage tanks (Rotational Moulded)	Sintex, Swift, Nutech, Sheetal
67.	Cast Iron Pipes and Fittings	Hindustan Engineering Products Company Calcutta, S.L.C., Standard approved manufacturers of any other brand of fittings having ISI marking, RIF, BIS
68.	RCC Pipes	Indian Hume Pipe Company, Delhi / Allahabad / Chandigarh / Lucknow; Hindustan Pressure Pipes, Kolhapur; Dhere Concrete Products, Pune or any

		other approved manufacturer conforming B.I.S. Standard
69.	Brass Fittings	Leader Engineering Works, Jalandhar; L & K Mathura; Luster Sanitary, Jalandhar; Annapurna Metal Works, Calcutta; Neta Metal Works, Jalandhar
70.	C.P. Fittings	Ego Metal Works, Ballabhgarh; Jaquar Industries, Delhi; Soma Plumbing Fixtures Limited, Calcutta; Gem Sanitary Appliances Pvt. Ltd., Delhi; Essco Sanitations, Delhi.
71.	Stone Ware (Salt-Glazed) Pipes	Hind Ceramics Limited, Orissa; Ceramic Industries Limited, Sambalpur; Shrikamakshi Agencies, Madras; Binary Udyog Pvt. Limited, Howrah; Tirumati Moulds Limited, Nagpur.
72.	Asbestos Cement Pipes and Fittings	Ganga Asbestos Limited, U.P.; Hyderabad Asbestos Cement Products Limited; J.K. Super Pipe Industries, Nanded; Konark Cement and Asbestos Limited, Orissa; Maharashtra Asbestos Limited, Bombay.

List of Recommended Vender/Suppliers of Major Bought-Out Items: Unless otherwise specifically mentioned in the Schedule of Items, Contractor has to use materials as listed below, of only these brand names/Company's names, which are mentioned in the RECOMMENDED list for structural items thereon.

Sl. No.	Items/Name of Products	Makes/Brands/Manufactures
1	Structural Steel	SAIL / TATA / RINL / IISCO / ESSAR / ISPAT
2	Structural Steel Tubes ISI Marked	TATA / JINDAL / SURYA / SWASTIK
3	Synthetic Enamel Paint 1st Quality only	ICI Paint (Deluxe), Asian Paint (Apcolite), Shalimar Paint (Superlac), Goodlass,Nerolac Paint (Nerolac), Berger Paints

Any materials not fully specified in these specifications and which may be offered for use in the works shall be subject to approval of Engineer, without which it shall not be used anywhere in the construction works.

C. ELECTRICAL

LIST OF SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

1.0 AIR CONDITIONER

a. Blue Star
b. O General.
c. Daikin.
d. Carrier
e. Hitachi.
f. LG.
g. Lloyds
h. Mitsubishi
i. Panasonic
j. Sharp
k. Samsung.
l. Blue star.
m. Haier.
n. Voltas.
o. Videocon.

2.0 BATTERIES (LEAD ACID)

a. Amco Batteries Ltd.
b. Exide Industries Ltd.
c. HBL Power System Ltd.
d. Amara Raja Batteries Ltd.
e. Su-Kam Power Systems Ltd.
f. Base Corporation Ltd.
g. Okaya Power Ltd.
h. Southern Batteries Pvt Ltd.
i. True Power International Ltd.
j. Evolute Solutions Pvt Ltd.
k. Greenvision Technologies Pvt Ltd.
l. Artheon Electronics Ltd.

3.0 BATTERIES (NICKEL CADMIUM)

a. Amco Saft Batteries Ltd.

b. HBL Power Systems Ltd.

4.0 BATTERY CHARGER/DC-DC CONVERTER

a. Amara Raja Power System(P)Ltd.

b. BCH.

c. Chhabi Electricals Pvt. Ltd..

d. Caldyne Automatics Limited.

e. HBL Nife Power Systems Ltd..

f. Universal Instrument Mfg. Co Pvt Ltd.

g. Hitachi HI-REL Power Electronics P. Ltd

h. Mass-Tech Controls Pvt Ltd

i. Dubas Engineering Pvt Ltd

j. Chloride Power Systems & Solutions Ltd

k. Synergee

l. Enertech

m. Vertiv

5.0 CABLE – FIRE ALARM & COMMUNICATION CABLES

a. Cords Cable Industries Ltd.

b. CMI.

c. Delton cables Ltd.

d. ELKAY Telelinks.

e. KEI Industries Ltd.

f. Elkay Telelinks

6.0 CABLE – HT(XLPE)

a. Universal Cable Ltd.

b. KEI Industries Ltd.

c. Industrial Cables.

d. NICCO Corporation Ltd.

e. Uniflex.

f. Polycab.

g. Torrent cables Ltd.

7.0 CABLE – LT / MV POWER AND CONTROL

a. Cords Cable Industries Ltd.

b. Universal Cable Ltd.

c. KEI Industries Ltd.

d. Havells.

e. Delton.

f. Elkay Telelinks.

g. Evershine Electricals.

h. Ecko.

i. Ravin.

j. Rallison.

k. Suyog.

l. Netco.

m. Uniflex.

n. Paramount.

o. Gloster.

p. Associated cables Pvt Ltd.

q. CMI.

r. Gemscab.

s. Industrial cables.

t. NICCO.

u. Polycab.

v. Torrent.

8.0 CABLE – GLAND

a. Baliga.

b. Comet.

c. Flexpro.

d. Flameproof.

e. FCG.

f. Electro Werke.

g. Dowels.

h. CCI.

i. Sudhir Switchigear

j. Keyson Techno Equipments,

9.0 CABLE – LUGS & TERMINAL BLOCKS

a. Dowels.

b. Jainson.

c. Sharma Electrical

d. Punitam

e. Yamuna Powers

f. Rapid Manufacturer

g. Varun Controls.

10.0 CABLE – TRAY

a. Ercon Composites.

b. Yamuna Power & Infrastructure Ltd.

c. MEM

d. Bharti

e. Profab.

f. Ratan.

g. Slotco.

11.0 CABLE TERMINATION AND JOINTING KIT

a. CCI.

b. Raychem.

c. M-Seal.

12.0 CEILING/EXHAUST/PEDESTAL FANS & CIRCULATORS

a. Bajaj Electricals Ltd.

b. Crompton Greaves Ltd.

c. Khaitan Electricals Ltd.

d. Havell's.

e. Philips

f. Usha

g. Orient

13.0 CONTRACTORS – AC POWER

a. Andrew Yule.

b. ABB.

c. BHEL.

d. C&S.

e. Havell's.

f. L&T.

g. Schneider.

h. Siemens Ltd.

i. Telemechanique.

j. GE India Industrial

14.0 CONTROL TRANSFORMER

a. AE.

b. Indushree.

c. Intra Vidyut.

d. Kalpa Electricals.

e. Transpower Industries Ltd.

f. Siemens.

15.0 GAS GENERATOR/DIESEL GENERATOR SET

a. Sterling and Wilson.

b. Jackson Limited.

c. Sudhir Gensets.

d. Power Engineering (India) Pvt Ltd.

e. Prasha Technologies Limited.

f. Kumar Generator house.

g. Ashok Leyland Ltd.

h. Powerica Limited.

i. Supernova Engineers Limited.
j. Bhaskar Power Products (P) Ltd.
k. Caterpillar India (P) Ltd.
l. Cummins India Ltd.
m. Escorts Ltd.
n. Greaves Cotton Ltd.
o. Kirloskar ltd.
p. Mahindra & Mahindra Ltd.
q. Honda.
r. Perkins.
s. Eicher.
t. Tata Motors.
u. Ashok Leyland.

16.0 FLAME PROOF LDB'S/ JB'S/CONTROL STATION/ SWITCHES

a. FCG.
b. Sudhir switchgears.
c. Prompt Engineering Works
d. Flame Proof equipments pvt. Ltd.
e. Baliga Lighting Equipments Pvt. Ltd.
f. Flexpro Electricals Pvt. Ltd.
g. Exprotecta, Beroda.
h. FFLP Control Gears.
i. Sterling.
j. Kaysons Techno Equipment
k. Bajaj
l. Phoenix Contact

17.0 HIGH MAST

a. Bajaj Electricals Limited.
b. Crompton Greaves Limited.
c. Philips India Limited.
d. Surya Roshani.
e. Transrail

18.0 HIGH VOLTAGE PCC/ MCC PANELS

a. BHEL.
b. Control and Switchgear.
c. Siemens.
d. ~~Tricolite Electrical Industries~~.
e. Schneider.
f. CGL.
g. L&T.
h. ABB.

19.0 INDICATING LAMPS

a. Alstom Ltd.
b. BCH.
c. L&T Ltd.
d. Siemens Ltd.
e. Vaishno Electricals.
f. Tecknik
g. ABB

20.0 INDICATING METERS

a. L&T
b. ABB.
c. AMCO.
d. AE
e. Alstom Ltd. (EE).
f. Conzerv/Schneider
g. Elecon Measurement Pvt. Ltd.
h. HPL Electric & Power Pvt. Ltd.
i. MECO Instruments Ltd.
j. Minilec.
k. Rishabh Instruments Pvt. Ltd.
l. Trinity energy system.

m. Kaycee.

n. Salzer.

o. Trinity

p. Secure Meters Limited

21.0 LIGHTING FIXTURES

a. GE Lighting Pvt. Ltd.

b. Bajaj Electricals Ltd.

c. Crompton Greaves Ltd.

d. Philips India Ltd.

e. Havells

f. Wipro

g. Osram

h. Siska

i. Halonix

j. Surya

k. Polycab

l. Kawlity Photonix

22.0 LIGHTING FIXTURES – FLAMEPROOF

a. Bajaj Electricals Ltd.

b. Baliga Lighting Equipment Pvt. Ltd.

c. Crompton Greaves Ltd.

d. CEAG Flameproof Controlgear Pvt. Ltd.

e. Flexpro Electricals Pvt. Ltd.

f. Philips India Ltd.

g. Sudhir Switchgears Pvt. Ltd.

h. FCG.

23.0 MINIATURE CIRCUIT BREAKERS (MCBS) AND LIGHTING DB

a. ABB.

b. Hagger.

c. Havell's India Ltd.

d. Indo Asian Fusegear Ltd.

e. Legrand.

f. MDS Switchgear Ltd.

g. Schneider.

h. Siemens Ltd..

i. HPL.

j. L & T

k. Siemens

24.0 MOULDED CASE CIRCUIT BREAKER (MCCBS)

l. ABB.

m. Andrew Yule.

n. Larsen & Toubro.

o. Schneider.

p. Siemens.

q. Control and Switchgear.

r. Indo Asian,

s. Hager.

t. Merlin Gerin.

u. Havell's India Ltd

v. General Electric

25.0 PROTECTION RELAYS

a. BCH.

b. L&T Ltd.

c. Siemens Ltd.

d. Tele-menchanique & Controls (India) Ltd.

e. Eaton

f. Alsthom

g. ABB

h. Ashida

i. Novatek Electronics

j. Cantronics

k. Control & Switchgear

l. Frick Electronics

m. Indian Technologies

n. Rao Electromechanical

o. Kudam Corporation

26.0 LOW/MEDIUM VOLTAGE POWER CONTROL CENTER (PCC)/ MCC/ PDB/ MLDB/ LDB

a. ABB.

b. BCH.

c. BHEL.

d. C & S.

e. Elecmech Switchgear & Instrumentation.

f. KMG ATOZ.

g. L&T.

h. Pyrotech Electronics Pvt. Ltd.

i. Risha Control Engineers Pvt. Ltd.

j. UDKAM PROCESS EQUIPMENT INDIA PVT. LTD

k. Tricolite Electrical Industries.

l. Unilec Engineers ltd.

m. Vidyut Control India Pvt. Ltd.

n. Control and Schematic.

o. Zenith Engineering.

p. Schneider Electric,

q. AEG,

r. HAVELL'S,

s. MDS

t. Synergy System

u. Expert Engineers

27.0 PUSH BUTTONS

a. BCH.

b. Alstom Ltd.

c. L&T.

d. Siemens Ltd.

e. Tele-Menchanique & Controls (India) Ltd.

f. Vaishno Electricals.

28.0 SWITCHES-CONTROL

a. BCH.
b. Easum Reyrolle Relays & Devices Ltd.
c. Alstom.
d. Kaycee Industries Ltd..
e. L&T.
f. Siemens Ltd.

29.0 SWITCHES – 5/15A PIANO/ PLATE, SWITCH SOCKET

a. Anchor Electronics & Electricals Pvt. Ltd.
b. Kingal Electricals Pvt. Ltd.
c. North-West Switchgear Ltd.
d. Schneider
e. Havells
f. Cona
g. Orient
h. Panasonic

30.0 SWITCH SOCKET OUTLETS (INDUSTRIAL)

a. Alstom Ltd.
b. Best & Cromption Engineering Ltd.
c. BCH.
d. Crompton Greaves Ltd.
e. Essen Engineering Company Pvt. Ltd.

31.0 SOLAR POWER SYSTEM MODULES

a. Tata Power Solar Systems Ltd
b. REIL,
c. CEIL,
d. HBL Power.
e. Vikram Solar.
f. Waaree Solar.
g. Solar Semiconductor.
h. Sonali.

i. Mundra Solar
j. Vikram Solar
k. Bharat Electronics Limited
l. Waaree
m. Lumipex
n. Independent Qualitative Accessories
o. Statcon Energy
p. Volks Energy
q. Green Engineering

32.0 SOLAR PCU/CHARGE CONTROLLER

a. Statcon Energy
b. Enertech UPS Pvt Ltd
c. Consul Nowatt
d. OPS India
e. Schneider
f. Delta Electronics
g. ABB Ltd
h. KACO
i. SMA
j. HBP Power
k. Universal Instrument

33.0 TERMINALS BLOCKS

a. Connectwell.
b. Controls & Switchgear Co. Ltd.
c. Elmex Controls Pvt. Ltd.
d. Essen Engineering Co. Pvt. Ltd.
e. Phoenix Contact

34.0 DISTRIBUTION TRANSFORMERS

a. ABB.
b. Andrew Yule.
c. Areva.
d. BHEL.

e. Bharat Bijlee
f. Crompton Greaves.
g. EMCO Ltd.
h. Intra Vidyut.
i. Indushree.
j. Indcoil
k. Kirloskar.
l. Skippers Electricals.
m. Transformers & Rectifiers (I) Ltd.
n. Voltamp.

35.0 UPS SYSTEM AND INVERTER

a. DB Power.
b. Keltron.
c. Hi-Rel/HITACHI.
d. Dubas.
e. Toshiba Corporation.
f. Fuzi Electric Co Ltd.
g. Emerson.
h. Synergy System.
i. Eaton.
j. Enertech

36.0 GI-OCTAGONAL POLE

a. Bajaj.
b. Transrail.
c. Wipro.
d. K.L. Industries.

37.0 ELECTRICAL MOTORS

a. Siemens.
b. Crompton Greaves.
c. Kirloskar.
d. BHEL.
e. Bharat Bijlee.
f. Hindustan motors.

g. Alstom.

h. Texmo.

i. GE India.

j. National Motors.

k. ABB.

38.0 ELECTRICAL PROCESS HEATER

a. Escorts Limited, Faridabad, Haryana.

b. Spherehot / Kanti Lal Chuni Lal & Sons Appliances Pvt Ltd.Surat.

c. Kerone, Bhayander(E), Thane – 401105.

d. Excel Heaters, Andheri (West), Mumbai - 400 053, India.

e. Nirmal Industrial Controls Pvt. Ltd., Mulund(W), Mumbai - 400 080.

39.0 CATHODIC PROTECTION AGENCIES/CONTRACTOR/ VENDERS

a. CALTECH Engineering Service.

b. Universal Corrosion Prevention India.

c. Cathodic Technology Limited.

d. Cathodic Control Company Pvt. Ltd.

e. CORRTECH International Pvt Ltd.

f. MITCORR Cathodic Protection Pvt Ltd.

g. Underground Pipeline & NDTS Pvt. Ltd.

h. JG Corrosion Solution.

i. Mercury Cathodic Protection Service.

j. UNDTS Corrosion Service.

k. SARK EPC Projects Pvt. Ltd.

40.0 BACKUP AGENCY FOR INTERFERENCE SURVEY & MITIGATION

a. PLE Germany

b. Vendor Velde

c. Nippon Japan

d. SSS India CIPL / interference survey.

e. Balslev Denmark, .

f. SSS Germany

g. Jef Techno Slutions Pvt. Ltd.

h. SARK EPC Projects Pvt. Ltd.

41.0 PERMANENT REFERENCE CELL

a. PERMACELL/ HARCO (USA)

b. CORRTECH (ZULU), INDIA

c. TINKER RASOR, USA

d. SILVION, UK

42.0 CP CABLES

a. Brooks Cables.

b. Nicco Corporation Ltd.

c. CCI Ltd.

d. Delton Cables Ltd.

e. KEI Industries.

f. Torrent Cables.

g. Universal cables.

h. Victor Cables.

i. Associated Flexible & Wires Pvt Ltd.

j. Asain Cables (RPG Cables).

k. Fort Gloster (Gloster Cables Ltd).

l. Finolex Cable.

m. Rediant Cables.

n. NETCO Cables Pvt Ltd.

o. Havells Ltd.

43.0 CP SACRIFICIAL ANODES

a. Scientific Metals Engineers Pvt. Ltd., Karaikudi

b. PSL Holding Pvt. Ltd., Mumbai.

c. Cathodic Controls, Bangalore.

d. BHEL, Bhopal.

e. Nippon Corrosion, Japan.

f. AFIC, KSA.

g. Platt Bros. and Company, USA

h. Wilson Walton International.

i. Impalloy International.

j. Corrpro International.

k. HOCKWAY, UK

l. NAKABOHTEC, Japan .

m. Cortech International

n. Titanor Component

o. Shakti Metals, Ahmedabad

p. Shaktianodes Private Limited, Ahmedabad

44.0 CP PORTABLE /PERMANENT REFERENCE CELL

a. M/S PERMACELL/HARCO, USA

b. M/S BORIN MANUFACTURER, USA

c. M/S M.C.MILLER, USA

d. M/S TINKER RASOR

45.0 CPTR (AC OPERATED)

a. Canara Electric

b. CATHODIC CONTROL COMPANY PVT LTD.

c. Kriston Systems

46.0 PIN BRAZING / THERMITWELD

a. SAFETRACK, SWEDEN

b. CadWeld

c. BAC, UK

d. ERICO, USA

e. THERMOWELD, USA

f. ERICO, EUROPE

47.0 CP SURGE DIVERTER/SPARK GAP ARRESTOR (EX-D)

a. Dhen,

b. OBO

c. Corrpro system

d. Sohne

e. Dairyland

48.0 CP SOLID STATE POLARISATION CELL.

a. Dairyland

b. Metricorr

c. Rustol

d. Dhen

e. Kriston Systems

49.0 PETROLEUM COKE BREEZE:

a. M/S LORESCO, USA

b. M/S ASBURY, USA

c. M/S GOA CARBON, GOA

d. M/S INDIA CARBON, CALCUTTA

e. M/S PETROCARBON & CHEMICAL COMPANY, HALDIA

50.0 CP ANODE (MMO TYPE):

a. Corrtech

b. Scientific Metal Engineers Karaikudi

c. Titanor Component Ltd., Goa, India.

d. Denora Permelic S.P.A (Italy). .

e. Oronzio De Nora S.A. Ingano Switzerland

f. CER Anode Technologies International USA

g. ACTEL, UK

h. ELTECH System Corporation, Texas

i. MAGNETO-CHEMIE, Netherlands

j. MATCOR (USA)

51.0 HEAT SHRINK CAP FOR CP ANODE

a. MATCOR (USA) To Cable Joint

b. Seal For Life

52.0 ER- PROBE (EXTERNAL CORROSION) ER- PROBE & CORROSION COUPON ASSEMBLY

a. Rose Corrosion Services UK

b. Metal Samples, USA. .

c. Roharbak Cosasco USA

d. Caproco UK

e. Emetricorr, Denmark

53.0 HEAT SHRINK CAP FOR ANODE TO CABLE JOINT

a. Raychem, USA

b. Matcor (USA)

54.0 MMO WIRE ANODES (WITH FACTORY PRE-PACKED COKE BREEZE)

a. Matcor (USA)

b. Covalence (USA)

c. Berry Plastics (USA) – (Seal for Life Industries)

55.0 MMO WIRE ANODES (WITHOUT FACTORY PRE-PACKED COKE BREEZE)

a. GROUPPO DENORA, GOA, INDIA

b. CERANODE TECHNOLOGIES, USA

c. TELPRO, USA

56.0 MMO TUBULAR/ STRIP/ RIBBON ANODES

a. GROUPPO DENORA, GOA, INDIA

b. ORANZIO DE NORA, ITALY

c. MAGNETOCHEMIE, HOLLAND

d. ACTEL LTD., U.K.

e. ELTECH SYSTEMS CORPORATION, USA

f. CERANODE TECHNOLOGIES, USA

g. MATCOR (USA)

Note: -

For any other brought out item(s) for which the vendor list is not provided in the tender , bidders can supply those item(s) from vendors/ suppliers who have earlier supplied similar item(s) for the intended services in earlier Oil and Gas projects and the item(s) offered is in their regular manufacturing/ supply range.

1) The vendor/supplier should not be in the Holiday list of OWNER/ ONSULTANT/other PSU

2) The bidder is not required to enclose documentary evidences (PO copies, Inspection & Completion with satisfactory working certificates etc.) along with their offer, however in case of successful bidder, these documents shall required to be submitted by them within 30 days from date of Placement of Order for approval to OWNER / CONSULTANT.

D. INSTRUMENTATION

LIST OF RECOMMENDED VENDER/SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

1.0 PRESSURE GAUGES

a. AN Instruments Pvt Ltd
b. Badotherm Process Instruments B.V.
c. Baumer Bourdon Haenni S.A.S
d. British Rototherm Co Ltd
e. Budenberg Gauge Co Ltd
f. Dresser Inc
g. Forbes Marshall (Hyd) Pvt Ltd
h. General Instrument Consortium
i. H. Guru Instruments (South India) Pvt Ltd
j. Manometer (India) Pvt Ltd
k. Nagano Keiki Seisakusho Ltd
l. Hirlekar Precision, India
m. Waaree Instruments Ltd
n. Walchandnagar Industries Ltd (Tiwac Divn)
o. Wika Alexander Wiegand & Co GmbH
p. Wika Instruments India Pvt Ltd
q. Ashcroft India Pvt Ltd.

2.0 TEMPERATURE GAUGES

a. AN Instruments Pvt Ltd.
b. Badotherm Process Instruments B.V.
c. Bourdon Haenni S.A.
d. Dresser Inc.
e. General Instruments Consortium
f. H. Guru Instruments (South India) Pvt Ltd
g. Nagano Keiki Seisakusho Ltd

h. Solartron ISA
i. Walchandnagar Industries Ltd (Tiwac Divn)
j. Wika Alexander Wiegand & Co GmbH
k. Wika Instruments India Pvt Ltd
l. Pyro Electric, Goa
m. Ashcroft India Pvt Ltd.

3.0 TEMPERATURE ELEMENTS INCLUDING SKIN TYPE

a. ABB Automation Ltd
b. Altop Industries Ltd
c. Bourdon Haenni S.A.
d. Detriv Instrumentation & Electronics Ltd
e. General Instruments Consortium
f. Japan Thermowell Co Ltd
g. Tecnomatic S.P.A
h. Tempsen Instrument India Ltd
i. Thermo Electric Co. Inc.
j. Thermo-Couple Products Co
k. Thermo-Electra B.V.
l. Wika Alexander Wiegand & Co GmbH
m. Altop Industries Ltd., Baroda
n. Nagman Sensors (Pvt.) Ltd.
o. Pyro Electric, Goa

4.0 POSITIVE DISPLACEMENT FLOW METERS

a. RMG (Germany)
b. Elster Instromet
c. Romet
d. Dresser
e. Itron
f. FMG
g. Common
h. Metreg
i. Raychem RPG
j. Vemmtec

5.0 TURBINE FLOW METER

a. Daniel
b. Elster Instromet
c. Itron
d. RMG
e. Rockwin

6.0 ELECTRONIC VOLUME CORRECTOR

a. Elgas
b. Itron
c. Plum
d. Pietro Fiorentini

7.0 ORIFICES (METER RUN, FLOW CONDITIONER, ORIFICE PLATE AND ASSEMBLY)

a. Emerson
b. FMC, USA
c. Pietro Fiorentini S.P.A (Italy)
d. Canalta Controls, Canada

8.0 ULTRASONIC FLOW METERS

a. Daniel (USA)
b. RMG (Germany)
c. Instromet International (Belgium)
d. Sick Maihak, Germany
e. FMC, Germany

9.0 MASS FLOW METERS

a. Daniel Measurement & Control Asia Pacific
b. Endress + Hauser Instruments International
c. FMC Measurements Solutions
d. Heinrichs Messtechnik GMBH
e. Rheonik MessGerate GMBH

10.0 FIELD INSTRUMENTS (P, DP, F, L, T)

a. ABB Ltd
b. Honeywell
c. Fuji Electric Instruments Co Ltd
d. Yokogawa
e. Invensys India Pvt.Ltd

11.0 LEVEL GAUGES/ LEVEL INSTRUMENTS

a. Bliss Anand
b. Chemtrols
c. V-Automat
d. Levcon
e. Nivo Controls
f. Sbeletro Mechanicals
g. TRAC

12.0 PRESSURE REGULATOR AND SLAM SHUT VALVE

a. Pietro Fiorentini S.P.A. (Italy)
b. Emerson
c. RMG-Regel Messtechnik (Germany
d. Mokveld Valves BV (Netherlands)
e. Schlumberger (USA)
f. Gorter Controls B V (Netherlands)
g. Instromet International NV
h. Nirmal Industrial Controls Pvt Ltd. (up to 6" size only)
i. ESME Valves Ltd
j. Kaye & Macdonald Inc.
k. Nuovo Pignone S.P.A (Italy) (GE Oil Co.)
l. Richards Industries (Formerly Treloar)
m. Samson AG Mess-und Regeltechnik

n. Tormene Gas Technology

o. Dresser Inc, USA (upto 8" size, 300# class only)

13.0 PRESSURE SAFETY VALVES

a. Keystone Valves (India) Pvt. Ltd.

b. Larson & Toubro Ltd.

c. Lesser GmbH & Co KG

d. Mekaster Engg Ltd..

e. Tyco Sanmar Ltd. (New Delhi)

f. Anderson Greenwood Crosby

g. BHEL (Trichy)

h. Curtiss Wright Flow Control Corporation

i. Dresser Inc.

j. Fukui Seisakusho Co. Ltd

k. Nakakita Seisakusho Co Ltd

l. Nuovo Pignone S.P.A (Italy) (GE Oil co)

m. Parcol S.P.A

n. Safety Systems UK Ltd

o. Tai Milano S.P.A

p. Weir Valves & Controls France

q. Bliss Anand Pvt Ltd.

14.0 CONTROL PANEL & ACCESSORIES

a. Keltron Controls Ltd., Kerala

b. Elechmec Corporation Ltd., Mumbai

c. Industrial Controls & Appliances Pvt. Ltd.,

d. Alstom System Ltd., Noida

e. Emerson Process Management (I) Pvt. Ltd.

f. ABB Instruments Ltd., New Delhi

g. Larsen & Toubro Ltd.

h. Control & Automation, New Delhi

i. GE Fanuc Systems Pvt. Ltd., New Delhi

j. Rockwell Automation (I) Ltd., Ghaziabad

k. Honeywell Automation Ltd.

l. Rittal

m. Pyrotech Elcronics Pvt Ltd.

n. Positronics Pvt Ltd.

o. Electronics Corporation of India Ltd.

15.0 JUNCTION BOXES AND CABLES GLANDS

a. Ex-Protecta

b. Flameproof Control Gears

c. Baliga

d. Flexpro Electricals

16.0 CONTROL AND SIGNAL CABLES

a. Associated Cables

b. Brook

c. Associated Flexibles & Wires (Pvt) Ltd

d. Universal Cables Ltd,India

e. Delton Cables Ltd, India

f. KEI Industries Ltd INDIA

g. CMI Limited

h. Cords Cable Industries Ltd, India

i. Elkay Telelinks (P) Ltd., India

j. Udey Pyrocables Pvt Ltd, India

k. Goyolene Fibres (I) Pvt Ltd, India

l. Netco Cable Industries Pvt Ltd, India

m. Nicco Corporation Ltd, India

n. Paramount Communications Ltd, India

o. Polycab Wires Pvt Ltd, India

p. Radiant Cables Pvt Ltd, India

q. Reliance Engineers Ltd., India

r. Suyog Electricals Ltd, India

s. Thermo Cables Ltd

17.0 GAS DETECTION SYSTEM

a. Crowcon Detection Instruments Ltd

b. Detection Instruments (I) Pvt Ltd

c. Detector Electronics Corporation

d. Drager Safety AG & Co. KGAA

e. General Monitors Ireland Ltd
f. Mine Safety Appliances Company
g. MSA – Mines Safety Appliances(India) Ltd
h. Industrial Scientific Oldham France S.A.
i. Riken Keiki Co Ltd
j. Simrad Optronics Icare
k. Honeywell Analytics
l. Net Safety Monitoring Inc.
m. Simtronics SAS

18.0 MOV ACTUATOR:

a. Rotork- UK, USA & INDIA
b. Limitorque
c. Auma- India
d. Biffi- Italy

19.0 PNEUMATIC ACTUATOR (SOLENOID OPERATED ON-OFF TYPE)

a. Metso Automation
b. Tyco
c. Samson Controls
d. L&T
e. Emerson
f. Fisher
g. Masoneilan Process Control
h. Instrumentation Limited (IL)-Palghat
i. Micro Finish
j. Rotex

20.0 SOLENOID VALVES

a. Avcon
b. Festo

21.0 ELECTRO – HYDRAULIC ACTUATOR

a. Avcon Rotork controls (Deutchland Gmbh)
b. Biffi Italia Srl
c. Ledeen (Italy)

d. Virgo Valves and Controls ltd.-India
e. Limittorque
f. Reineke
g. Voith
h. Bettis
i. Rotork- UK, USA & INDIA
j. Rotex
k. Schuck Group

22.0 GAS OVER OIL ACTUATOR

a. Biffi Italia Srl,
b. Ledeen(Italy)
c. Virgo Valves & Control ltd.-India,
d. Voith,
e. Bettis,
f. Rotork-UK, USA, India,
g. Rotex,
h. Schuck Group,
i. Valve Italia.

23.0 OFC

Manufacture/ Procurement, Testing and supply of suitable OFC Joint closures including all necessary accessories of any of the following make:

a. Raychem
b. 3M
c. Siemens
d. Any other make from the approved vendor list of client with supporting paper.

24.0 FLOW CONTROL VALVES

a. Fouress Engg. (New Delhi)
b. Fisher Xomox (New Delhi)
c. MIL Control Ltd. (Noida)
d. KOSO India Pvt ltd
e. Samson Control (Thane)
f. Dresser Valves India Pvt Ltd.

g. Fisher Controls
h. Valvitalia Italy
i. CCI Valve technology
j. Flowserve Pvt Ltd.
k. Metso Singapore Pvt Ltd.
l. Instrumentation Ltd Palghat
m. Dresser Inc. USA

25.0 FLOW COMPUTERS

a. Emerson
b. Instromet International (Belgium)
c. FMC Measurement Solutions (UK)
d. RMG (Germany)
e. OMNI Flow Computers Inc.
f. Thermo Fisher, USA

26.0 INDICATORS & CONTROLLERS

a. Yokogawa
b. Eurotherm Chessel
c. Honeywell
d. Emerson

27.0 BARRIERS

a. MTL
b. STHAL
c. P&F
d. Phoenix

28.0 GAS CHROMATOGRAPH

a. ABB
b. Emerson
c. Instromet International, NV
d. RMG Regal+Messtechnik GmbH
e. Yokogawa

29.0 I/P CONVERTERS

a. ABB
b. Emerson

c. IMI Watson Smith Ltd.

d. Moore Controls Ltd

e. Shreyas Instruments Pvt Ltd, India

f. Thermo Brandt Instruments

30.0 SS FITTINGS, INSTRUMENT VALVES & MANIFOLDS

30.1 FOR CNG WORK:

a. DK-LOK

b. Swagelok Co.

c. Parker

d. Dawsons Tech Components LLP

e. ASTEC Valves & Fittings Pvt Ltd

30.2 EXCEPT CNG WORK:

a. Swagelok Co.

b. Parker

c. Aura INC.

d. HOKE

e. Excelsior Engineering works

f. Swastik Engineering works India

g. Comfit and valves pvt ltd

h. Arya craft and engineering Pvt ltd

i. DK lok

j. ASTEC Valves & Fittings Pvt Ltd

k. Dawsons Tech Components LLP

31.0 SS TUBES

31.1 FOR CNG WORK:

a. Swagelok Co.

b. Parker

c. Sandvik

d. Jindal Saw

31.2 EXCEPT CNG WORK:

a. Swagelok Co.

b. Parker

c. Sandvik

d. Heavy metal and tube limited

e. Nuclear fuel complex India

f. Scorodite

g. Ratnamani Metals and Tubes

h. Jindal Saw

E. SHOP & FIELD PAINTING

LIST OF RECOMMENDED VENDER/SUPPLIERS OF MAJOR BOUGHT-OUT ITEMS

1.0 INDIAN VENDORS

a. Asian Paints (I) Ltd.

b. Berger Paints Ltd.

c. Goodlass Nerlolac Paints Ltd.

d. Jenson And Nicholson Paint Ltd & chokuGu Jenson & Nicholson Ltd.

e. Shalimar Paints Ltd.

f. Sigma Coating, Mumabai

g. CDC Carboline Ltd.

h. Premier Products Ltd.

i. Coromandel Paints & Chemicals Ltd.

j. Anupam Enterprises

k. Grand Polycoats

l. Bombay Paints Ltd.

m. Vanaprabha Esters & Glycer, Mumbai

n. Sunil Paints and Varnishes Pvt. Ltd.

o. Courtaulds Coating & Sealants India (Pvt.) Ltd.

p. Mark-chem Incorporated, Mumbai (for phosphating chemicals only)

q. VCM Polyurethane Paint (for polyurethane Paint only)

2.0 FOREIGN VENDORS FOR OVERSEAS PRODUCTS

a. Sigma Coating, Singapore

b. Ameron, USA

c. Kansai Paint, Japan

d. Hempel Paint, USA

e. Valspar Corporation, USA

f. Courtaulds Coating, UK.

Notes:

1. Bidder can select equipment of two different makes, selected from this VENDOR LIST and mention the same in the checklist for technical evaluation attached with the tender. The offered bid must include filled datasheet indicating make, model, size, rating of offered instrument/ equipment duly supported by sizing calculation of offered equipment (wherever applicable).

2. Vendors who have already supplied above equipment in other terminals of client, shall also be considered qualified for this tender provided the supplied equipment are commissioned and running successfully and they have not been put on holiday.

3. Equipment / Instruments of any make which is offered by one bidder and acceptable to client shall be accepted for other bidder also. After placement of order, on request of the successful bidder list of other qualified makes for a particular item (for which successful bidder wants to change the vendor) shall be provided.

4. Bidder shall take prior approval of the make / model no of the offered item and it shall be from the list given above. However additional vendors will be considered in exceptional cases, provided they have supplied for similar application to reputed gas transmission/distribution companies, in quantities at least half the numbers being supplied for this tender, and working satisfactorily for minimum 6 months. Documentary evidence substantiating above shall be submitted for taking approval.

F. FOR PE & LMC WORK (GI/CU)

1.0 MDPE FITTINGS & MDPE VALVES

a. Aliaxis,
b. George Fischer,
c. Al-Aziz,
d. Kimplas,
e. Banides,
f. Agru,
g. Friatech,
h. Plasson

2.0 GI PIPE

a. Swastik Pipe Ltd.
b. Jindal Industries Ltd.
c. Vishal Pipes Ltd.
d. Indus Tubes Ltd
e. Advance steel Tubes Ltd.
f. Good Luck Tubes Ltd.
g. Surya Roshni Limited
h. APL Apollo Tubes Limited
i. Jindal Pipes Limited
j. RK Steel Manufacturing Company Private Limited
k. PSL Tubes Limited

3.0 CASTING GI FITTINGS

a. Sarin Industries Ltd.
b. Jupiter Metal Industries Ltd.
c. Jainsons Industries Ltd.
d. Jinan Meide Casting Co. Ltd.
e. Green Malleable Pvt. Ltd.

4.0 FORGED GI FITTING (FOR HIGH RISE SEGMENT)

a. Jainsons Industries
b. B.M. Meters Pvt. Ltd.
c. Unique Pipe Fitting Co

5.0 COPPER TUBES & FITTINGS

a. Jay Banas Mehta Tubes Limited- Trade Mark "MEXFLOW"

b. Rajco metal (Tubes & Fittings)

c. Paras Industries

d. MERCURE METAL & ALLOYS PVT LTD

6.0 BRASS FITTINGS

a. Chandan Enterprises

b. Paras Industries Ltd.

7.0 BRASS VALVES

a. Universal srl, Italy

b. Tiemme Raccorderie Sede, Italy

c. Enolgas Bonimu s.a.s., Italy

d. Fratelli Fortis s.r.l, Italy

e. Giacomo Climbrio, Italy

f. Parker Hannifin S.P.A., USA

g. Singapore Valve & Amp; Fittings Pte Limited, Singapore /Bengaluru

h. Rubinetterie Utensilerie Bonomi (RUB), Italy

i. Zhegiang Valogin Technology Co. Ltd., China,

j. Ningbo Zhiqing Industrial Co. Ltd., China,

k. Zhegiang Dunan Valve Co. Ltd.,

l. Ningbo Huaping, China.

8.0 BRASS FITTINGS

a. Chandan Enterprises

b. Paras Industries Ltd.

c. Chokhawala Distributors – Brass Adaptor.

9.0 STEEL RE-INFORCED RUBBER HOSE (TYPE-4)

a. Super Seal Flexible Hose Ltd.

b. Suraksha Products Pvt. Ltd.

c. Vansh Industries

d. T & L Gases

10.0 CORRUGATED FLEXIBLE METAL HOSES (ANACONDA)

a. KPC Flex Tubes

b. Vestas Hose Division

c. Alpha Flexi Tubes

d. Chandan Enterprises

Note:

1. Vendor may procure material from any of approved vendors listed.
2. For equipment/components other than the above, vendor shall submit past track record for the proposed sub-vendors and obtain written approval from Owner / Consultant before placing order.
3. In case of exigencies like long delivery periods from approved vendors, the contractor shall list down the proposed suppliers/vendors for such items and submit the same for owner review/approval along with necessary documents/PTR.
4. Non-acceptance of a particular proposed vendor due to any reasons whatsoever shall not be a cause of schedule and cost implication. If equipment is sourced from outside India, vendor shall obtain prior approval for make of equipment before placement of order.

Above mentioned vendor list is tentative and further addition/deletion may be done as per discretion of Owner/VCS.

AUTHORISED TPIA LIST

Energising Quality	**LIST OF AUTHORIZED THIRD-PARTY INSPECTION AGENCY (TPIA)**	**DOC. NO.- VCS-C&P-TPIA-001**

SL. NO.	NAME OF TPIA
1	Det Norske Veritas (DNV)
2	Germanischer Lloyd Industrial Services GmbH
3	Bureau Veritas (India) Pvt. Ltd.
4	Moody International (India) Pvt. Ltd. (Industry Services Division)
5	SGS India Pvt. Ltd.
6	Certification Engineer International Limited (CEIL)
7	TÜV SÜD South Asia Pvt. Ltd.
8	ABS Industrial Verification (India) Pvt. Ltd.
9	Lloyd Register of Industrial Services
10	IRCLASS Systems and Solutions Private Limited
11	Tata Projects Limited
12	International Certification Services Pvt. Ltd.
13	TUV India Pvt. Ltd., Industrial Services Division
14	Intertek India Pvt. Ltd. (Industry Services Division)
15	Quality Austria Central Asia Pvt. Ltd.
16	Edlipse Engineering Global Pvt. Ltd.
17	TUV-Rheinland

VOLUME – B (TCP)

	CITY GAS DISTRIBUTION PROJECT	

TCP DESIGN BASIS			Total Sheets		7
DOCUMENT NO.	C251151	00	CP	DB	4001

BHAGYANAGAR GAS LIMITED

CITY GAS DISTRIBUTION PROJECT

TEMPORARY CATHODIC PROTECTION DESIGN BASIS

REV	DATE	DESCRIPTION	PREP	CHKD	APPR
C1	04-03-2025	ISSUED FOR REVIEW	FJ	AA	AA

CONTENTS

1. GENERAL

This design basis defines the design requirements for this project in addition to the applicable specifications for:-

- Temporary cathodic protection (TCP)
- Sacrificial anode cathodic protection system
- Impressed current cathodic protection system.
- NACE requirements
- OISD requirements and
- PNGRB regulations

In case of conflict the requirements mentioned in the stringent requirements mentioned in this document **or stringent** shall prevail.

2. Temporary Cathodic protection	
2.1. Type	*Sacrificial Zinc/Magnesium anode*
2.2. Design life	2 Year or till commissioning of PCP whichever is later
2.3. Pipeline coating	Three Layer Polyethylene
2.4. Casing for carier pipe	HDD is the preferred obstacle crossing method. Bare casing will be used where required.
2.5. Protective current density at 30° C	As per standard specification
2.6. Current drainage and coating resistance measurement survey	Shall be carried out
2.7. Corrosion Survey	Shall be carried out
2.8. Anode material (for sacrificial CP System)	Magnesium (1.55 V)
2.9. Minimum number of anodes (TCP)	At least 1 anode must be provided for each km of pipeline even if calculations show a lower requirement.
2.10. Polarization coupons (Factory manufactured)	Shall be provided at every 10 kms and additional coupons as required as per specification for TCP
2.11. Size of exposed area of coupon	10mm x 10mm
2.12. No. & Location of coupons	To be decided during detail engineering subject to 1.7 above
2.13. No. of magnet devices for operation of magnetic reed switch	As per SOR/SOW
2.14. Electrical resistance probes	Shall be provided. Location to be decided during detail engineering.
2.15. Polarization cell	Solid state type shall be provided at every HT Line Crossings of 66 KV & Above.

2.16. Surge Diverters	Solid state type surge diverter shall be provided at every insulating joint. *Lightning impulse current (10/350 µs) (Iimp) 100 kA*
2.17. Additional tests to evaluate the coating defects	Shall be conducted after connecting to PCP system.
2.18. Test Stations	Test stations shall be provided at an average spacing of 1 kM along the pipeline ROW
2.19. Test station locations	• At places where TCP anodes are installed • Both sides of cased crossings (Road or railway) • One side of the crossing if it is not cased • All insulating joints • At location of reference cells, surge diverters, polarization coupons, polarization cells, ER Probes • Both sides of canal crossings of width >50 m • Both sides of major river crossings • At EHV/ HV AC/ HV DC overhead line crossings and where these overhead lines are in parallel. • Near DC networks or grounding systems and HV DC grounding suystems • Where interference problems are suspected • At crossings of pipelines and other structures • At SV/IP/DT/RT stations • At any other location considered necessary by the owner/consultant.
2.20. Cable type	• High conductivity, annealed Tinned copper conductor, 650/1100 volt grade, HMWPE insulated, aluminum backed by Mylar tape/polyester tape shielded, armoured/unarmoured and HMWPE sheathed cables shall be used.
2.21. Cable sizes	• Ref Cell 1x10mm^2 • Potential measurement 1x6mm^2 • Polarization coupon 1x6 mm^2 & 1x10 mm^2 • Current measurement 1x10mm^2 • Pipe bonding 25mm^2 • Cathode connection 35 mm^2 • Anode Header connection 35 mm^2 • Surge diverter 25 mm^2 • Anode connection (HT Crossing) 25 mm^2 • Anode connection Cased crossing 10 mm^2 • Anode connection TCP 06 mm^2
2.22. Bonding with foreign pipelines	• Will be done.

NOTE:

Withing 60 days of lowering each continuous segment of pipe it should be protected at a minimum -850 mV potential by Mg anodes as part of the TCP. *Where soil resistivity is 150 ohm.M or more, achievement of -850 mV potential level should not be mandatory*. However minimum acceptable shift of potential at such locations (w*here soil resistivity is 150 ohm.M or more) shall be decided by the owner/consultant, on a case to case basis.*

3. Additional requirements:

a) For protection of the carrier pipe inside casing pipe, if any, zinc ribbon anode shall be used with below mentioned installation method after consultation with PMC/owner:

- Zinc ribbon anodes to be installed for protection of carrier pipe inside the casing pipe along with Bentonite filling at the annular space between casing and carrier. Discrete Mg anode (quantity as required to achieve -850mV potential level), shall be connected to casing pipe at the cased crossings in case casing and carrier pipe is shorted (i.e become in mechanical contact with each other) and the short is not cleared after filling of Bentonite.

b) The pipeline shall be grounded through polarization cell with Zinc galvanic anode/zinc ribbon anode or braided copper mitigator, wherever the pipeline is either crossing or running in parallel with overhead EHV/ HV transmission lines of voltage grade 66 KV and above.

c) Current measurement test station needs to be installed at all the intermediate CP Station for measurement of the upstream and downstream pipeline current as well as coating resistance.

d) In case anode ground bed for foreign pipeline is existing within 100m of the proposed pipeline ROW and cause interference to proposed pipeline, CP CONTRACTOR need to relocate the anode bed with the consent of the OWNER of the foreign pipeline without any extra cost to BGL.

e) Necessary measures shall be adopted to mitigate the stray current interference due to crossings of high tension line, electrified railway track, existing pipeline in the close vicinity etc. by providing sacrificial anodes, grounding cells, diodes etc.

f) Surge diverter across insulation joints shall be solid state type. Unprotected side of Surge diverter shall be grounded with GI Earth Electrode and resistance of Earth electrode should be maintained less than 3 Ohms.

4. Codes and Standards:

1. NACE SP0169	Control Of External Corrosion On Underground Or Submerged Metallic Piping Systems
2. NACE 10A190	Measurement Techniques Related To Criteria For Cathodic Protectionof Underground Or Submerged Steel Piping Systems
3. NACE SP0177-2014	Mitigation Of Alternating Current And Lightning Effects On Metallic Structures And Corrosion Control Systems
4. NACE SP0286-2007	Electrical Isolation Of Cathodically Protected Pipelines
5. NACE Pub 54276	CP Monitoring For Buried Pipelines
6. NACE SP0572	Standard Recommended Practice - Design, Installation, Operation, And Maintenance Of Impressed Current Deep Anode Beds
7. IS 8062:2006	Code Of Practice For Cathodic Protection Of Buried Pipielines/Structure For Transportation Of Oil, Natural Gas And Liquids
8. BS 7361-1:1991	Cathodic Protection. Code Of Practice For Land And Marine Applications
9. VDE 0150	Protection Against Corrosion Due To Stray Currents Of D.C. Installation
10.BIS 7098 Part I	Cross-linked Polythylene Insulated Thermoplastic Sheathed Cables For Working Voltages Up to And Including 1100 Volts
11.IS 1554-1	PVC Insulated (Heavy Duty) Electric Cables, Part 1: For Working Voltages Up To And Including 1 100 V
12.NACE Standard SP0207	Performing Close-Interval Potential Surveys and DC Surface Potential Gradient Surveys on Buried or Submerged Metallic Pipelines
13.IS 8062	Code of Practice for Cathodic Protection of Buried Pipeline/ Structure for Transportation of Natural Gas, Oil and Liquids
14.IS 1554, Part I	PVC Insulated (Heavy Duty) Electric Cables: For Working Voltages up to and Including 1100V
15.IS/ IEC: 60079	Electrical Apparatus for Explosive Gas Atmosphere
16.IS/ IEC: 60529	Classification of Degree of Protection Provided by Enclosures

Energising Quality	PROJECT NO. C251151	

TCP SCOPE OF WORK			TOTAL SHEETS		12
DOCUMENT NO.	C251151	00	CP	SOW	4002

BHAGYANAGAR GAS LIMITED

CITY GAS DISTRIBUTION PROJECT

TCP SCOPE OF WORK

C1	04-03-2025	ISSUED FOR REVIEW	FJ	AA	AA
REV	**DATE**	**DESCRIPTION**	**PREP**	**CHKD**	**APPR**

ABBREVIATION

PNGRB	Petroleum and Natural Gas Regulatory Board
OISD	Oil Industry Safety Directorate
CEA	Central Electricity Authority
SEA	State Electricity Authority
BS	British Standards
ICCP	Impressed Current Cathodic Protection
TCP	Temporary Cathodic Protection
MEDB	Main Electrical Distribution Board
HDD	Horizontal directional drilling
MLV	Main Line valve
CPPSM	Cathodic Protection Power Supply Module
3LPE	3-Layer Polyethylene
NACE	National Association of Corrosion Engineers
ASTM	American Society for Testing and Materials
CIPL	Close Interval Potential Logging
CPTRU	Cathodic Protection Transformer Unit
DCVG	Direct Current Voltage Gradient
IJ	Insulation Joint

TABLE OF CONTENTS

1.0 SCOPE OF WORK

Corrosion survey, design, detail engineering, fabrication, supply, installation, testing and commissioning of the temporary cathodic protection system using Mg/ Zn galvanic anodes to protect the external surface of 3LPE coated pipeline from Katedhan to DRDO in segment-1, DRDO to LB Nagar in segment -2, MLV 13 to Patancheruvu in segment-3 and Beerumguda to Patancheruvu in segment-4 against corrosion for design life of minimum 2 years.

Part	Dia (Inch)	Length (M)
Segment-1	12″	7800
	6″	400
	4″	1650
Segment-2	12″	6700
	6″	400
	4″	3600
Segment-3	12″	7050
	6″	3460
	4″	1500
Segment-4	10″	5720
	6″	3660
	4″	1500

Maintaining and keeping of PSP value as specified and monitoring at monthly basis of PSP voltage & AC voltage of the temporary cathodic protection system till the handover of the pipeline to the owner as per Annexure-A. All work shall be carried out conforming to the Scope of work, Design Basis, Data Sheets, National & International standard & as per standard specification No- VCS-SS-EL-4018A for Temporary Cathodic Protection system. Scope shall also include but not limited to the following for completion of jobs:-

(i) Measurement of soil resistivity along the ROW (At 1000 mtr. Interval) & collection of soil & water samples along ROW at depth of 1M, 2M & 3M at every 10km interval (Min 03 sample at each location) for its chemical & microbial

analysis as per specification for corrosion survey **VCS-SS-EL-4017 & NACE Standard TM0106-2006** for detection of SRB, ARB, TDS, pH, Rx, Moisture & total dissolved H_2S etc.

Collection of additional data elements along the ROW of pipeline related to AC, DC interference including details of all like foreign pipeline, overhead power transmission lines crossings & parallelism, power cables, river crossing, road crossing locations, railway traction (electrified/non-electrified), Substations (HVAC/HVDC),existing CP facilities (such as transformer rectifiers, anode ground beds, test facilities etc.) along with GPS coordinates. Site survey report submitted in design document shall have all these details included.

(ii) Design, Detailed Engineering, Preparation of Design Document, Preparation of Test station schedule & Bill of Material as per the corrosion survey & Chemical analysis of Soil/Water samples for Temporary Cathodic Protection system. Catalogues, vendor drawings, installation procedures, operation and maintenance manuals etc. for all equipment/materials shall be the part of design document.

(iii) Total number of anode shall be calculated as per total anode weight requirement & total protection current required. Localized soil resistivity at 1 Mtr. depth shall be considered for calculation of number of Anodes. However, minimum one anode shall be installed at every 1 KM with test station.

(iv) Supply, installation, testing & commissioning of Mg (3 Kg) galvanic anodes with backfill as per the standard specification- **VCS-SS-EL-4018A**.The weight of the Mg Anode & the total nos. of anodes shall be calculated as per the corrosion survey, soil chemical analysis, total weight and current requirement of the pipeline section.

(v) Supply, Installation, Testing & commissioning of Test stations (Big Size & Normal Size) weatherproof (IP-55) including cement concrete foundation as per specification & enclosed drawings. Selection of TLP size will be as per the nos. of cables terminating at the station. TLP shall be sealed at both ends by means of foam sealing/solid sealing. Termination plate inside the TLP should have high insulation level (FRP or higher grade) to avoid drainage of CP current due to insulation leakage. All the test-stations and junction boxes shall be provided with shrouded Allen screws to avoid vandalism. Connection scheme shall be permanently fixed inside the TLP.

(vi) Cable laying and Cable to pipe connection by Thermit welding and Pin brazing (for charged pipeline) for 35 mm2, 25 mm2, 10 mm2, 6 mm2 of 600/1100 V grade copper cables XLP insulated /PVC sheath including excavation and

exposing piping, recoating with epoxy, testing etc. Colour code identification for the various CP System cables used in the system shall be included in design document.

(vii) Contractor to note that the exact cable routing and exact cable quantities shall be decided at site based on actual site conditions. Contractor shall ensure that there is no surplus or shortage of cables at site and procure cables accordingly.

(viii) GI Earthing of aboveground cathodically unprotected pipeline at all locations. The earth electrode shall be per IS 3043. Earth electrode resistance shall be limited to 2Ω max.

(ix) Supply, installation, testing & commissioning of one set of Explosion proof type spark gap arrestor (100 kA) across each insulating joint as per P&ID/specification. Surge diverter cable needs to be terminated without any joints across the IJ.

(x) For CP at cased crossings, **Bare Casing shall be considered** as far as possible. At cased crossing, if the casing pipe is coated then it shall be protected additionally by (Independent from carrier pipe protection system) sacrificial Zn anodes installation. Carrier pipeline at cased crossings shall be protected by providing Sacrificial Ribbon anodes. The TCP contractor shall check and confirm the isolation between carrier pipe and casing after installation and before welding the section with mainline. Any re-work requires for establishing isolation shall be in the scope of pipeline Contractor without any extra time and cost to OWNER.

(xi) Supply, installation, testing & commissioning of solid state polarization cells and Grounding through zinc anodes at HT line crossings/ running parallel (66 KV and above). Rating of polarization cell shall be 3.7 KA @ 30 Cycle & number of 20 kg net weight zinc anode shall not be less than two. The resistance of grounding shall be limited to 5Ω max.

If any proposed additional line of voltage rating 66kV & above is envisaged during construction, the same shall also be considered in the design document. Contractor shall supply polarization cell along with necessary grounding system for the same.

If it is observed during the monthly monitoring that the source of the AC interference is due to the power lines less than 66kV, Contractor shall provide grounding of the pipeline through SSD to mitigate AC interference on the pipeline.

(xii) Supply, installation, testing & commissioning of external electrical resistance

Probe along the pipeline at marshy/vulnerable locations to monitor the external corrosion activity on the pipeline. Location of external ER probe shall be decided during detail engineering.

(xiii) Supply, installation, testing & commissioning of Polarization coupons having total exposed area of 10mm x 10mm on one side. The coupon shall be installed along the pipeline at additional vulnerable locations (River crossings, Marshy locations, Interference prone area, stray current source locations, foreign pipeline crossings/parallel).Location of external Polarization coupons & magnetic reed switch shall be decided during detail engineering in consultation with BGL/VCS.

Exposed side of polarization coupon shall be opposite to pipe & polarization coupon shall not be installed between TLP & Pipeline.

The works related to collection of approximately 2-5 m of pipeline material (In pieces of 300 to 1000 mm length) for fabrication of polarization coupons is in the scope of the Contractor and shall be supplied by the Owner.

(xiv) Bonding in between pipelines running parallel or crossing as required including taking of permission from the owner of the foreign pipeline (Permission shall be taken by the Pipeline Owner and any fee required for the same shall be paid by the Owner, however contractor shall assist in all respect to get such permissions from foreign pipeline owner).

(xv) PSP Monitoring on monthly basis of the TCP system till commissioning of the permanent cathodic protection system including the coupon OFF PSP. Till the construction of the pipeline is in progress and or till handover of the pipeline system to the owner.

(xvi) All civil/ structural & other miscellaneous works related to TCP system including supply of bricks, cement etc. required for completion of the system.

(xvii) Coating Integrity test of HDD section of the pipeline shall be conducted immediately after the completion of the HDD of each HDD section by separate temporary power source and anode bed. Bidder shall submit the procedure as per the NACE requirements for approval along with the design document.

(xviii) Temporary CP system shall be installed immediately of the any lowered section but not later than 15 days from the time of lowering of pipeline segments. To achieve this the TCP design document must be submitted and approved before the construction of the pipeline begins.

(xix) All civil work related to the CP works like Preparation of buried cable trenches,

excavation, back filling, compacting, providing of brick protection by second-class bricks, spreading of fine river sand including supply of bricks, cements steel etc. The job includes repairing of all civil works damaged during installation of electrical and other facilities.

(xx) The scope of work under this contract shall be inclusive of breaking of walls and floors, and chipping of concrete foundations necessary for the installation of equipment, materials. Minor modifications wherever required to be done in the owner free supplied equipment or devices to enable cable entry, termination, etc.

(xxi) Supply and installation of all other accessories not specifically mentioned herein but necessary for completion of job.

(xxii) Co-ordination with other Contractors/Pipeline contractor.

2.0 SCOPE OF SUPPLY

2.1 **Owner's scope of Supply: NIL**

2.2 **Bidder's scope of Supply:**

Supply, testing, Packing, Forwarding, Delivery, Installation and commissioning of all items required to accomplish all jobs/activities listed under clause "scope of work" are included in the scope of the contractor**. No equipment will be free issued by the owner**.

(i) All commissioning & start up spares are in bidder's scope (Included in this package). Any commissioning & startup spare consumed during the startup & commissioning is included in the supply of this package, for which no extra payment is made.

(ii) All The necessary permissions required for the bonding, interference mitigation (from SEB's, water works departments/ boards, railways & other pipeline owners) are in the scope of contractor and shall be obtained before taking mitigation measures.

3.0 INSPECTION AND TESTING

All the equipment supplied by the contractor shall be inspected by the approved inspection agency (TPI) at the manufacturer's works prior to dispatch. Contractor shall furnish necessary certificates, test reports etc. for Review /Approval to Owner/ Inspection agency. Contractor to get DCN prior to supply of equipment/ material from VCS. The TPI shall be from approved TPI

list attached with the tender. TPI shall be arranged by the CP contractor for the testing of the material/equipment at the vendor works.

The issue of DCN for any equipment or component thereof does not absolve the contractor from his contractual obligations towards subsequent satisfactory performance of the equipment at site. If any equipment be found defective, in whole or part thereof after receipt at site or during erection/commissioning and testing, the same shall be Rectified/Changed by contractor free of cost.

4.0 TESTING & COMMISSIONING

The successful tenderer shall provide adequate supervisory/ skilled personnel and all tools and tackles, testing equipment and instruments required for complete checking of installations and testing and commissioning of all equipment and accessories. The testing and commissioning of all equipment is in the scope of bidder & shall be carried out in accordance with the latest edition of relevant Indian / International Standard and NACE standards.

Any defects noticed during the testing and commissioning relating to the equipment supplied and work carried out by the Contractor, will be rectified by the contractor at his own cost. Any work not conforming to the execution drawings, specifications or codes shall be rejected forthwith and the contractor shall carry out the rectification at his own cost.

5.0 DRAWINGS, STANDARD SPECIFICATION AND INSTALLATION STANDARDS

5.1 The equipment/ materials to be supplied and their installation by the contractor shall conform to the requirements of the applicable standard specifications. Also of various material/ equipment shall also conform to the standard specification.

Construction shall be as per drawings/ specifications issued/ approved by the Owner/ Consultant during the course of execution of work.

A)	**SPECIFICATION**	
	Specification for TCP system	VCS-SS-EL-4018A
	Specification for Corrosion Survey	VCS-SS-EL-4017
B)	**DATASHEETS & QAP**	
	Quality Assurance Plan	VCS/QAP/TCP/001
C)	**STANDARD DRAWINGS**	
1.0	Prepacked Zinc Anode	VCS-STD-EL-4511
2.0	Prepacked Mg Anode	VCS-STD-EL-4510
3.0	Details of Test Station for TCP	VCS-STD-EL-4510
4.0	Test Station Connection Schemes	VCS-STD-EL-4514

5.0	Galvanic Anode Installation	VCS-STD-EL-4502
6.0	Zinc Ribbon Anode for Cased Crossings with Coated Casings	VCS-STD-EL-4506
7.0	Pipeline Grounding Through Polarisation Cell and Galvanic Anodes	VCS-STD-EL-4507
8.0	Details of Zinc Grounding Cell	VCS-STD-EL-4508
9.0	Permanent Copper – Copper Sulphate Reference Cell & Installation Details	VCS-STD-EL-4509
10.0	Details of thermit weld for cable to pipe joint	VCS-STD-EL-4504

Note:

Pipeline Schematic Route Diagram attached with tender is indicative of the nature of work and issued for tendering purposes only. The bidders, however, shall visit the site before bidding for proper information of site conditions.

6.0 In case of an irreconcilable conflict between Indian or other applicable standards, general conditions of contract, special conditions of contract, specifications, drawings or schedule of rates, the following shall prevail to the extent of such irreconcilable conflict in order of precedence:

1. Contract Agreement
2. Detailed Letter of Acceptance along with Statement of Agreed Variations.
3. Fax / Letter of Intent / Fax of Acceptance.
4. Schedule of Rates as enclosures to Letter of Acceptance.
5. Job / Particular Specifications.
6. Drawings
7. Technical / Material Specifications.
8. Special Conditions of Contract.
9. Instruction to Bidders
10. General Conditions of Contract.
11. Indian Standards
12. Other applicable Standards

6.1 It will be the contractor's responsibility to bring to the notice of engineer-in-charge any irreconcilable conflict in the contract documents before starting the work (s) or making the supply with reference which the conflict exists.

6.2 In the absence of any specifications covering any material, design of work (s) the same shall be performed / supplies / executed in accordance with standard engineering practice as per the instructions / directions of the engineer-in-charge, which will be binding on the contractor.

6.3 In case of any conflict in technical requirements among PJS, TS, SCC, SOR etc. of tender document and international / national codes / standards, more stringent requirement shall govern or as per the decision of EIC.

Annexure-A

Format for TCP system Commissioning

Sr. No	TS No	Chainage	TS Type	Natural PSP	Instant PSP	Polarised PSP (24 Hrs.)	Anode Voltage (V)	Anode Current (mA)	AC Voltage (V)	Other Readings (If Any)	Remarks

Format for Monthly Monitoring Report of TCP system

Sr. No	TS No	Chainage	TS Type	PSP (-) Voltage			Anode Voltage (V)	Anode current (mA)	AC Voltage (mV)	Other Readings (If Any)	Remarks
				Carrier		Casing(If Protected)					
				Without Bonding	Bonding						

	CONTRACTOR		**QUALITY ASSURANCE**	CLIENT:	M/S BHAGYANAGAR GAS LIMITED
	ORDER NO. & DATE		**PLAN FOR TCP WORKS**	PROJECT	CITY GAS DISTRIBUTION PROJECT
	SUB-CONTRACTOR			PACKAGE NAME	TCP SYSTEM
	ORDER NO. & DATE				

INSTRUCTIONS FOR FILLING UP :

1. QAP shall be submitted for each of the equipment separately with breakup of assembly/sub-assembly & part/component or for group of equipment having same specification.
2. Use numerical codes as indicated for extent of inspection & tests and submission of test certificates & documents. Additional codes & description for extent of inspection & tests may be added as applicable for the plant and equipment
3. Separate identification number with quantity for equipment shall be indicated wherever equipment having same specifications belonging to different facilities are grouped together.
4. Weight in tonnes (T) must be indicated under column 5 for each item. Estimated weights may be indicated wherever actual weights are not available.

ABBREVIATIONS USED :

CONTR-CONTRACTOR

MFR-MANUFACTURER

CODES FOR EXTENT OF INSPECTION, TESTS, TEST CERTIFICATES & DOCUMENTS:

Code	Description	Code	Description	Code	Description
1.	Visual	12.	Routine test as per relevant IS other standard	23.	Short time rating
2.	Dimensional	13.	Type test as per relevant IS/ other standard	24.	Operational & functional check
3.	Fitment & Alignment			25.	Over Speed Test
4.	Physical Test (Sample)				
5.	Chemical Test (Sample) (Review of test report only)	14.	Impulse Test	26.	Flame Proof Test
6.	Ultrasonic Test	15.	Partial Discharge Test	27.	Clearance and creepage Distance
7.	Magnetic Particle Test (MPT)	16.	Heat run risc test\tempr.		
8.	Radiography Test	17.	Enclosure Protection Test	28.	Acceptance Test
9.	Dye Penetration Test	18.	Calibration	29.	Material test
10.	Measurement of IR Value a) Before HV Test b) After HV Test	19.	Noise & Vibration	30.	Coating Thickness (MMO Anode), Resistivity (MMO Anode) & comsumption rate (For Mg, Zn & Zn Ribbon Anode only review of Test report)
		20.	Test certificates for bought out components		
11.	High Voltage test/Dielectric test	21.	Tank Pressure Test / Pressure Test	31.	Contact Resistance anode to cable Joint
		22.	Paint shade verification & Thichness check	32.	Destructive testing
				33.	Test Station Connection Scheme check, Name plate and terminal check
				34.	Chemical Composition & Open Circuit Potential (For Zn Ribbon Anode, Review of Test report only)

DOCUMENTS:	
D1.	Approved GA drawings
D2.	Approved single line/ schematic diagram
D3.	Approved data sheet
D4.	Approved bill of materials
D5.	Unpriced P.O. copy
D6.	Calibration Certificate of all measuring instruments and gauges

EQUIPMENT DETA							INSPECTION AND TESTS								
Sl. No	Description (With equipment heading, place of use, and Breif Specifications)	Indentification No.	Quantity		Manufacturer's Name and Address	Expected schedule of Final Inspection	Raw Material and in process stage			Final Inspection/Test by			Test Certificates & documents to be submitted to VCS	Acceptance Criteria Standards /IS/ BS/ASME/ Norms and Documents	REMARKS / SAMPLING PLAN
			No/M	T			MFR	CONTR	VCS// TPI	MFR	CONTR/ TPIA	CLIENT /VCS			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1.	CP Cables (1Cx6Sqmm, 1Cx10 Sqmm, 1Cx25Sqmm & 1Cx35Sqmm)		Meters				1,2,28	-	-	1,2,28	1,2,28	R	D1, D2, D3, D4, D5, D6, 20, 13	I.S., Approved Data Sheet & Specifications	
2.	Test Stations (Big & Small Type)		Nos.				1,2,3,4,22, 29	-	-	1,2,3,4, 22,33	1,2,3,4, 22,33	R	D1, D2, D3, D4, D5, D6, 20, 13	I.S., Approved Data Sheet & Specifications	
3.	Sacrificial Mg & Zn Anodes		Nos.				1,2,5	-	-	1,2,4, 5, 30, 32*	1,2,4, 5, 30, 32*	R	D1, D2, D3, D4, D5, D6, 20, 13	I.S., Approved Data Sheet & Specifications	* on 1% of total nos. of anodes
4.	Spark Gap Arrestor (100 kA)		Nos.				-	-	-	-	-	R	Manufacturer test certificates & Compliance Report	Approved Data Sheet & Specifications	

5.	Polarisation Cell (Solid State)		Nos.				-	-	-	-	-	R	Manufacturer test certificates & Compliance Report	Approved Data Sheet & Specifications	
6.	External ER Probe		Set				1,2,3,5, 13,29		-	1,2,3,5, 13*,17*, 21*,24, 29	1,2,3,5, 13*,17*, 21*,24, 29	R	D1, D3, D4, D5, D6, 20,12,13	Approved Data Sheet & Specifications	*on one no. of each type
7.	CTSU (Computerised Test Station Unit) & CTSU Reader		Nos.				1,2,3	-	-	1,2,3, 22,24,33	1,2,3, 22,24,33	R	D1, D3, D4, D5, D6, 20,12,13	Approved Data Sheet & Specifications	
8.	Permanent Reference Cell		Nos.				-	-	-	-	-	R	Manufacturer test certificates & Compliance Report	Approved Data Sheet & Specifications	
9.	Mg/Zinc Ribbon Anode		Mtr				-	-	-	1,2,30,34	1,2,30,34	R	D1, D3, D4, D5, D6, 20,12,13	Approved Data Sheet & Specifications	

For Manufacturer (Stamp & Signature)	For CONTR (Stamp & Signature)	For V C S (Stamp & Signature)	**Q.A.P. NO.** **VCS/EL/TCP/ QAP** SHEET 2 OF 2	REV. **0**

ENERGISING QUALITY

VCS QUALITY SERVICES PVT. LTD.

STANDARD SPECIFICATION

FOR

SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM FOR PIPELINES

VCS – SS – EL – 018A

00	06.11.2017	ISSUED AS STANDARD	MG	RD	AD	SK
Rev. No	Date	Purpose	Prepared By	Checked By	Approved By	Approved By

CONTENTS

ABBREVIATION

LPE	Three Layer Polyethylene
AC	Alternating Current
Ag / AgCl	Silver / Silver chloride reference electrode
CSE/Cu/$CuSO_4$	Copper Sulphate Electrode
DC	Direct Current
HDD	Horizontal Directional Drilling
HT	High Tension Line
ICCP	Impressed current Cathodic Protection
MIJ	Monolithic Insulation Joint
PCP	Permanent Cathodic Protection
PSP	Pipe to Soil Potential
ROU	Right of Use
ROW	Right of Way
SV Station	Sectionalized Valve Station
TCP	Temporary Cathodic Protection
TLP	Test Lead Point

1.0 SCOPE

This specification defines the requirements of design, engineering, installation, testing and commissioning of sacrificial anode cathodic protection system (SACP) for external surface of city gas distribution buried 3LPE coated pipelines with associated high build liquid epoxy valves/fitting. The SACP system shall be used for protecting city gas distribution pipelines during the TCP construction phase.

This specification defines the basic guidelines to develop a suitable sacrificial cathodic protection system for city gas distribution pipelines.

All data required in this regard shall be taken into consideration to develop an acceptable design and for proper engineering of the system.

Compliance with this specification and/or approval of any of the contractor's documents shall in no case relieve the contractor of his contractual obligations.

2.0 LATEST CODES & STANDARDS

ISO 15589-1: 2015	Petroleum and natural gas industries-CP of pipe line transportation systems- on land pipelines
NACE SP-0169-2013	Recommended practice control of external corrosion on underground or submerged metallic piping system
IS 8062 part-2: 2006	Code of Practice for Cathodic Protection of Steel Structures, Part II: Underground Pipelines
OISD-RP-226- 2013	Natural gas transmission pipelines and city gas distribution networks
NACE SP-0286-2007	Recommended Practice- the electrical isolation of cathodically protected pipe lines
NACE SP-0200-2014	Cathodic Protection for metallic cased crossings
BS EN 50162:2004	Protection against corrosion by stray current from direct current systems
BS EN 15280:2013	Evaluation of AC corrosion likelihood of buried pipelines applicable to cathodically protected pipelines
NACE SP-0177-2014	Recommended Practice- Mitigation of AC and lighting effects on metallic structures and corrosion control systems
NACE-SP-21424-2018	Alternating Current Corrosion on Cathodically Protected Pipelines: Risk Assessment, Mitigation, and Monitoring
NACE SP0104-2014	The Use of Coupons for Cathodic Protection Monitoring Applications
NACE TM0497-2012	Measurement techniques related to criteria for cathodic protection on submerged metallic piping system
ASTM G57-2012	Field measurement of soil resistivity using Wenner four pin electrode method
ASTM B418-2016	Cast and Wrought Galvanic Zinc Anodes
ASTM B843-2018	Magnesium Alloy anodes for cathodic protection
API 1102	Recommended practice for Steel Pipelines Crossing Railroads and Highways
IS 1554 PART-1	PVC Insulated heavy duty cables
IS 3043: 2007	Code of practice for Earthing
ISO 13847:2013	Petroleum and natural gas industries — Pipeline transportation systems — Welding of pipelines

OISD RP-113-2013	Classification of area for electrical installations at hydrocarbon processing and handling facilities
OISD-RP-188-2019	Corrosion monitoring of offshore and onshore pipelines
PNGRB-G.S.R. Infra/ T4S/ P&PPL/01 /2014	Technical Standards and Specifications including Safety Standards for Petroleum and Petroleum Products Pipelines
PESO Petroleum rules 2002	CHAPTER III: PART V- Transport by Pipelines

The equipment shall also confirm to the provisions of Indian Electricity rules and other statutory regulations currently in force in the country.

In case of any contradiction between various referred standards/ specifications /data sheet and statutory regulations the following order of priority shall govern:

a. Statutory regulations
b. Material datasheet
c. Particular specification (if applicable)
d. This specification (standard specification)
e. Codes and standards

3.0 DESIGN

The design and engineering of the SACP system shall be carried out by the contractor as per procedures and design parameters specified below:

3.1 SYSTEM IMPLEMENTATION

a. Corrosion survey of the ROW as per VCS tender specification
b. Design basis of SACP system
c. Design and engineering package of SACP (Including calculation for SACP system)
d. Field testing and commissioning procedure
e. As built documentation

3.2 CORROSION SURVEY

3.2.1 The details of corrosion survey including soil resistivity data along ROW and other data required for CP design if available with the Owner shall be included as part of project specification. However, verification of its veracity and adequacy shall be the entire responsibility of the contractor. Contractor shall also carry out soil resistivity survey at sacrificial anode ground bed locations for proper design of ground. Wenner's 4-pin method or approved equal shall be used for such measurements. Survey instruments shall have maximum AC and DC ground current rejection feature.

Soil/water samples shall be collected along the ROU for analysis. Samples shall be collected on an average at one location for every 10 km along ROU with minimum at two locations. Exact locations shall be decided at site depending on the type of soil, soil resistivity and in consultation with OWNER or his representative. At each location the soil samples shall be collected at 1 M, 2 M depth and at expected depth of pipeline if it is more than 2 m at the location.

3.2.2 Care shall be taken to ensure that the resistivity observations are not influenced by the presence of foreign pipelines/structures, and earth currents in the vicinity of HT lines and installations using earth return in their power system etc.

3.3 ADDITIONAL DATA TO BE COLLECTED

The following data shall be collected to generate design data for evaluation of interaction/interference possibilities due to presence of other services in ROW/in vicinity. Owner shall provide assistance for liaison work to the extent possible.

- Route and types of foreign service/pipeline in and around or crossing the right of way (including those existing and those which are likely-.to come up during contract execution)
- Diameter, wall thickness, pressure, soil-cover, and type of external coating, type of cathodic protection system provided, if any and year of laying/commissioning in case of foreign pipelines.
- Details of the existing cathodic protection systems protecting the services i.e., type of protection, location, rating of anode beds, test station locations and their connection schemes. Present output current and voltage readings of the CP power supply units.
- Remedial measures existing on foreign pipelines/services to prevent interaction.
- Graphical representation of existing structure/ pipe to soil potential records.
- Possibility of integration/isolation of CP systems, which may involve negotiations with owners of other services
- Information on existing and proposed DC/AC power sources and systems using earth return path such as HVDC substations/ earthing stations, fabrication yards with electric welding etc. in the vicinity of the entire pipeline route.
- Crossing and parallel running of electrified and non-electrified traction (along with information regarding operating voltage; AC/DC type etc.) as well as abandoned tracks near ROW having electrical continuity with the tracks in use.
- Crossing or parallel running of any existing or proposed 11 kV and above AC/DC overhead power lines along with details of voltage, AC/DC type etc.
- Voltage rating phases sheathing details of-underground power cables running along ROW or in its vicinity.
- Any other relevant information that may be needed in designing and implementing proper protection.
- Contractor shall conduct necessary potential gradient surveys for any existing anode ground beds that may interfere with the CP system of the pipelines covered under this project.

3.4 REPORT

- On completion of all field work, a report incorporating all the results generated from surveys and details of additional data, collected shall be prepared.

- The report shall also contain detailed interpretation of:
  - Survey results and resistivity data
  - List of Foreign pipeline crossings and other DC interference prone areas
  - List of HT line (≥ 66kV) crossings and other AC interference prone areas
  - Various drawings prepared in connection with the above work.
  - Soil resistivity values plotted on semi-log graph sheets.

3.5 CATHODIC PROTECTION DESIGN PARAMETERS

Unless otherwise specified, following parameters shall be used for design of cathodic protection system.

Where the cathodic protection system is specified for temporary protection, those parts of sacrificial anode cathodic protection system, which will be integrated, with the permanent CP system shall be designed based on permanent CP parameters.

3.5.1 DESIGN LIFE

- TCP shall be designed for 2 years

3.5.2 PROTECTION CURRENT DENSITY

Pipelines directly buried and having three-layer polyethylene (3LPE) coating

Pipeline surrounding	Temporary CP (μ A/m^2)
Soil resistivity more than 100 ohm-m	10
Soil resistivity 10 ohm-m to 100 ohm-m	25
Soil resistivity less than 10 ohm-m	50

Pipelines laid through HDD and having three-layer polyethylene (3LPE) coating

Pipeline surrounding	Temporary CP (μ A/m^2)
Soil resistivity for HDD	50

Note:

I. Safety factor for current density: 1.3

II. Anode utilization factor: 0.85

III. Pipeline Natural Potential: (-) 0.45 V w.r.t CSE

IV. Steel Resistivity: 2.2 x 10^{-7} ohm-M

The above current density values for temporary CP system are applicable for CP system design life.

Actual current density to be adopted shall be decided based upon soil and other environmental conditions, current drainage survey data (where included in Contractor's scope) at HDD locations, proximity of foreign pipe lines/structures and other interference areas affecting the installation. Where considered necessary for satisfactory protection of pipeline the current density shall be suitably increased by contractor.

The pipe protection current density indicated as above shall be applicable where the temperature of the fluid transported by the pipeline/ the surface temperature of the buried portion of the pipeline does not exceed 30° C, the protection current density shall be increased suitably in consultation with the Owner/Company.

3.5.3 CATHODIC PROTECTION DESIGN CRITERIA

Cathodic protection system shall be designed to meet the following criteria:

The pipe to soil potential measurements shall be between (-) 0.95 V (ON) and (-) 1.5 V (ON) for polyethylene coated pipe lines with respect to a copper/copper sulphate reference electrode.

At locations of polarization coupons, the coupon to soil potential measurement shall be between -0.850 V (Instant OFF) to -1.18 V (Instant OFF) with respect to stable permanent copper / copper sulfate reference electrode installed close to the coupon.

A positive potential swing of 50 milli volts or more shall be considered sufficient to indicate the presence of an interaction/interference situation requiring investigation and incorporation of mitigation measures by the Contractor.

4.0 MATERIAL

The system shall include the following major equipment/sub-systems unless otherwise specified in project specifications.

a. Sacrificial anodes (Magnesium/Zinc, as per soil resistivity)
b. Sacrificial (Mg) anodes only at coated cased crossings
c. Sacrificial (Mg) anodes at HDD locations
d. Test stations
e. Surge diverter at MIJ and zinc grounding anode at unprotected side of MIJ
f. DC decoupling device with earthing system
g. Interconnecting cables
h. Cables to pipe connections
i. Polarization coupons for measurement of "Instant OFF" potentials with permanent reference cell

All equipment shall be new and procured from approved manufacturers. Equipment offered shall be field proven. Equipment requiring specialized maintenance or operation shall be avoided as far as possible. Prototype equipment shall not be accepted.

Equipment shall conform to the relevant specifications enclosed with the tender document. All equipment including test stations shall be located in safe non-hazardous areas.

Where it is essential to install the equipment in hazardous area, such equipment shall be flame-proof type and shall meet the requirement of IS: 2148 or equivalent international Standard and shall be suitable for gas group IIB, temperature class T3 (200°C). Indigenous equipment shall be certified by CMRI or any other recognized testing body and shall be approved by the concerned statutory authority. All flameproof equipment shall carry the BIS license marking as per the requirement of statutory authorities. All imported equipment for hazardous area may be tested and certified by an independent certifying agency of country of equipment origin and shall be approved by the concerned statutory authority in India.

4.1 SACRIFICIAL ANODE GROUND BEDS

4.1.1 Along ROW where soil resistivity predominantly remains low, ranges from 0-10 ohm-m and pH value is within 9, zinc anodes shall be provided. Anodes of type I as per ASTM-B 418 standard shall be used for seawater, brackish water or saline electrolyte application and anode of type II as per ASTM-B 418 standard shall be used for fresh water, back fill and soil applications.

4.1.2 Along ROW where soil resistivity is predominantly in the range of 10 ohm-m to 30 ohm-m, low potential (1.55V) magnesium anodes, as per ASTM-B 843 shall be provided.

4.1.3 Along ROW where soil resistivity is predominantly in the range of 30 ohm-m to 50 ohm-m high potential (1.75V) magnesium anodes, as per ASTM-B 843 shall be provided.

4.1.4 At high resistivity area where resistivity is of the order of 50 ohm-m and above magnesium ribbon anodes may be provided.

4.1.5 In case the soil resistivity varies from 5 ohm-m to 50 ohm-m, then low potential (-1.55V_{CSE}) magnesium anode shall be used for the entire length of the pipeline.

4.1.6 Average separation distance between each consecutive sacrificial anode location along the pipeline route for temporary cathodic protection shall be 1 km.

4.1.7 The minimum weight of the sacrificial anode for temporary cathodic protection for design life of 2 years shall be min. 2.5kg net pre-packed or whichever is higher, as per detailed design calculations.

4.1.8 Suitability of the selected sacrificial anodes for the soil conditions with particular attention to carbonates, bicarbonates, phosphates and nitrates, shall be checked for proper operation by the Contractor.

4.1.9 The anodes shall be laid in proper type of back fill consisting of a 20 % bentonite, 75 % gypsum and 5 % of sodium sulfate to improve the local conductivity around the anodes, such that the effect of soil is minimum on the anode effectiveness and life.

4.1.10 The leads of all the anodes shall be brought up to the test station and shall be terminated individually.

4.1.11 The number of anodes at each ground bed shall be sufficient for providing the specified pipe protection current density taking into consideration the ground bed resistance, cable resistance, etc. The number of anodes for ground bed, spacing of ground beds based on the applicable soil resistivity, size of pipeline, type of coating for the pipeline shall be chosen from the table after necessary verification by the CP contractor.

4.1.12 Any deficiency in the protection system if noticed during commissioning or during monitoring shall be corrected by the CP contractor by suitably augmenting the system with additional anodes without any cost / schedule implications.

4.1.13 For the portion of the pipeline for which the CP system has been specified based on the permanent CP system parameters – cased crossing, HDD, HT line locations, the contractor shall ascertain the requirement of the cathodic protection current density indicated above, and the anodes installed at these locations, shall be suitable for PCP system design life.

4.2 TEST STATIONS

4.2.1 Test stations shall be provided along the pipeline ROW for monitoring the performance of the cathodic protection system at the following locations. Test stations shall be provided at additional locations, if required, so that distance between any two adjacent test stations does not exceed 1000 meters in inhabited areas and 2000 meters in uninhabited areas like forest/deserts.

- At the location of anode ground beds
- At one sides of metalled road crossings
- At all insulating joints
- At tap-off station
- At HT (≥ 66kV) AC/DC overhead line crossings and location of HT line parallelism within 50M of the pipeline.
- At vulnerable location with drastic change in soil resistivity.
- At both sides of major river crossings and HDD.
- At location of DC decoupler
- In the vicinity of DC networks or grounding system where interference problems are suspected.
- At crossings of other pipelines/structures.
- At both sides of cased crossings.
- At any other locations considered vulnerable/locations where AC/DC interference is expected
- At railway line crossings and at selected location along railway lines running parallel to the pipeline.
- At the location of Sectionalizing Valve (SV) Station.
- At any other locations considered necessary by owner/owner's representative

4.2.2 The types of TLP to be used shall be as follow:

i. Type A- Potential measurement
ii. Type B- Current measurement
iii. Type C- At the locations of cased crossing- Bare casing
iv. Type D- At the locations of cased crossing – coated casing
v. Type E- At locations of foreign pipeline crossings
vi. Type F- At MIJ locations
vii. Type H- At HV locations and SV stations
viii. Type A+HDD- At HDD crossing locations
ix. Type A + PC- At locations of polarization coupon installations

4.2.3 Test stations used for sacrificial anodes shall have shunt for measurement of anode current, provision for resistance insertion to limit the anode current output and anode disconnecting link.

4.2.4 Test stations for bonding shall be provided with shunt and resistor as a means to monitor and control current flow between the pipeline and foreign pipelines or structures that may exist in common ROW.

4.2.5 Test station with current measuring facility shall be provided at interference prone areas, on both sides of major river crossings, HDD locations, near marshy areas and minimum one for every 10 km max. along the pipeline.

4.2.6 The test stations shall be installed with the face of the test station facing the pipeline. The nameplate of test stations shall carry the following minimum information

a. Chainage in km.
b. Test station connection scheme
c. Distance from pipeline in meters.
d. Direction of product flow.

4.2.7 Terminals and different schemes of wiring shall be provided as per the test station connection scheme. Minimum twenty percent spare terminals shall be provided in each test.

4.2.8 Minimum two cables shall be provided from the pipeline at any test station

4.2.9 The location of all the test stations shall be marked with their connection schemes and other relevant information on alignment sheets. A detailed test station schedule shall be prepared.

4.3 SURGE DIVERTER & GROUNIDNG OF PIPELINE AT UNPROTECTED SIDE OF MIJ

Explosion proof type spark gap surge diverter shall be connected across each monolithic insulating joint (MIJ) to protect it from high voltage surges.

The surge diverter shall be rated for discharging lightening current (10/350 µs) & AC fault currents picked by the pipeline across the MIJ without causing excessive voltage build up which would damage the MIJ or cause an electric arc or flashover across the MIJ.

Surge diverters shall be directly mounted on MIJ to prevent the breakdown of MIJ which is 5 kV. The length of the surge diverter leads connecting across the MIJ shall be suitable to connect to the MIJ cleats without any joint/copper clamp.

The above ground portion of the pipeline at the unprotected side of the MIJ shall be grounded by GI plant earthing or zinc anodes of 20 kg net weight.

4.4 GROUNDING OF PIPELINE

4.4.1 AT LOCATION OF HT TRANSMISSION LINE CROSSING (≥ 66kV)

In TCP scope at all HT crossings (66 kV and above), H-Type TLP's shall be provided, for grounding 3LPE coated pipeline through a suitably rated DC decoupler and suitably designed grounding system.

a) DC Decoupler: The DC Decoupler through which the pipeline shall be grounded shall be solid state type and shall be capable of blocking DC voltages ± 2 V and provide an effective and continuous conductive path to suitably design the grounding system for AC induced voltages, lightning currents, surge currents and AC fault currents.

b) Grounding System: The grounding system resistance shall be less than 5 ohms to meet the following requirement of AC interference mitigation:

- AC induced voltage: < 15 V RMS AC
- AC current density: a) < 30 A/m^2, if DC current density exceeds 1 A/m^2
  b) < 100A/m^2, if DC current density is less than 1 A/m^2

  The AC-DC current density to be measured at coupon locations and the current densities mentioned above will be time weighted average of 24 hrs.

To achieve required grounding resistance, following type of grounding system shall be designed and installed:

Soil resistivity Range (in ohm-cm)	Type of Grounding System
< 2500 ohm-cm	Minimum two (2) nos. of zinc grounding anodes, in a chemical backfill. Each zinc grounding cell shall have net weight of 20kg.
> 2500 ohm-cm	- Zinc ribbon anode of minimum dimension 12/14 mm, with trench backfilled with chemical backfill. - Copper conductor of size 16 mm^2, with factory pre-packed adequate backfill.

Note: The length of zinc ribbon anode/copper conductor shall be decided by the contractor after having performed grounding calculations.

4.4.2 AT LOCATION OF HT TRANSMISSION LINE RUNNING PARALLEL

Where transmission lines run parallel within 50 M of either side of the pipeline, the pipeline shall be grounded at a maximum interval of 1 km, at suitable locations, where AC induced voltages are the highest. The grounding shall be done through DC decoupler using grounding system to meet the AC interference criteria as specified above under Clause 4.6.1

4.5 CP AT CASED CROSSING

4.5.1 Casing should be avoided as far as possible. If cased crossing is unavoidable, bare casing to be provided, with selecting higher thickness allowance as per API 1102

4.5.2 No sacrificial anodes (ribbon anodes) shall be used inside casing & carrier annular space.

4.6 REFERENCE CELL ACCESS POINTS

4.6.1 Reference cell access points shall be provided at all test station locations, at insulating joint locations, where the ground is paved, for measurement of pipe to soil potentials. A perforated 2" PVC pipe of 1.5- 2-meter length so as to reach the pipeline depth filled with native soil and buried at the location shall be provided for the purpose. The length of the PVC pipe shall be adequate to reach the native soil below the paving.

4.7 CABLES

4.7.1 Cables shall be with annealed high conductivity stranded copper conductor, PVC insulated, 650/1100V grade, PVC sheathed conforming to IS: 1554 Part –I. The size of the copper conductor shall be:

- For anode tail cable to test station: 10 mm^2 unarmored
- From test station to pipeline: 10 mm2 armored
- For bonding, DC decoupler, grounding anodes and surge diverter: 25 mm2 armored
- For reference cells and pipeline potential measurements: 6 mm2 armored

CABLE LAYING

Cables shall be laid in accordance with the layout drawings to be prepared by the Contractor. No straight through joint shall be permitted. Cable route shall be carefully measured and cables cut to required length. Minimum half meter cable slack shall be provided near anodes, pipeline and test stations to account for any settling

All cables inside station/plant area shall be laid at a depth of 0.75 M Cables outside station/plant area shall be laid at a depth of minimum 1.5 M Cables shall be laid in sand under brick cover and backfilled with normal soil. For cables laid outsider the station/plant area, polyethylene warning mats shall be placed at a depth of 0.9 m. from the finished grade to mark the route

PVC pipes of proper size shall be provided for all underground cables for road crossings

Cables shall be neatly arranged in trenches in such a manner that crisscrossing is avoided and final take off to equipment is facilitated.

4.8 POLARIZATION COUPON

4.8.1 Coupon shall have one side exposed area of 1 cm^2. The coupon shall be made from the material of the pipeline. Minimum one polarization coupon shall be installed every

5 kms for measurement of "Instant OFF" or polarized potential of the 3LPE coated buried pipeline, which otherwise cannot be measured in a TCP based cathodic protection system.

4.8.2 The location of polarization coupon TLP shall preferably be between two Types-A TLP's to check the mid-point pipeline polarization.

4.8.3 Cable connection of $10mm^2$ and $6mm^2$ shall be provided to the coupon for connecting it to the pipeline for cathodic protection and potential protection measurements respectively.

4.8.4 Polarization coupon TLP will not have any sacrificial anode connected.

4.8.5 Polarization coupon shall be provided with a permanent copper / copper sulfate reference electrode installed close to the polarization coupon.

4.8.6 Connection of coupon to pipeline shall be through a vacuum sealed magnetic reed switch housed inside the test station. The magnetic reed switch shall be rated to carry and break minimum 10 mA at 50 V DC.

4.8.7 Coupons shall be installed at bottom $1/3^{rd}$ portion of the pipeline and 250 mm away from the pipe surface.

4.8.8 The bare area of coupon shall be placed opposite to the pipeline.

4.8.9 The permanent reference electrode shall be placed 150 mm from the pipeline.

4.8.10 Coupons shall be provided as per the requirement of NACE SP104:2014

4.8.11 Selection of other locations of Polarization coupons shall be decided by PMC / Engineer-In-Charge

4.9 PERMANENT REFERENCE CELLS

4.9.1 High purity copper-copper sulphate reference cells with proven high reliability shall be provided for stable coupon to soil potential measurement at the locations of polarization coupons.

4.9.2 The reference cells shall be of silver/silver chloride type in place of copper/copper sulphate cells, at marshy area locations, where water table is high and chloride ion concentration is more than 300 ppm for marshy area in saline soils high purity zinc may be considered as an alternative to silver/silver chloride.

4.9.3 The life of reference cells shall be minimum 10 years under burial-conditions.

4.9.4 The test station connection scheme inside the test station shall clearly indicate the type of reference cell (Cu $CuSO_4$ /Ag AgCl).

4.10 CABLE TO PIPE CONNECTIONS

4.10.1 All cable connections to the new pipeline shall be made by an approved exothermic process or by pin brazing. However, cable connection to charged pipelines shall be made by pin brazing. Exothermic welding shall be adopted for water pipelines. The resistance of the cable to pipe at the connection point shall not exceed 0.1 ohm.

Coating shall be repaired after connection of cable conductor to pipeline. The coating repair material shall be compatible with the original coating and shall prevent ingress of water along the cable, surface and at the interface of coating repair with the original pipe coating

5.0 INSPECTION, TESTING AND COMMISSIONING

5.1 SYSTEM TESTING AT SITE

5.1.1 Field tests as per the reviewed field testing and commissioning procedures prepared by the Contractor shall be carried out on the equipment/systems before these are put into service. Acceptance of the complete installation shall be contingent upon inspection and test results

5.1.2 Before the CP system facilities are put into operation, necessary tests shall be carried out to establish that all equipment, devices, wiring and connection have been correctly installed, connected and are in good working condition as required for the intended operation. Owner/Owner's representative may witness all tests. Intimation shall be given at least one week before commencing the tests.

5.1.3 All tools, equipment and instruments required for testing shall be provided by Contractor. Generally, the following minimum tests must be carried out and recorded.

a. Cables

i. Cable No.
ii. Voltage grade
iii. Conductor cross section
iv. Continuity check
v. Voltage test
vi. Insulation resistance values between each core & earth, between cores. All cables shall be tested by 500 V megger

b. Insulating Joint

i. Location
ii. Pipe to soil potential of both protected and non-protected sides of the insulating joint before and after energization of CP system

c. Surge Diverter

i. Location/Identification number rating
ii. Type
iii. Explosion proof enclosure check for healthiness
iv. Check for proper connection

d. DC Decoupler

i. Location/Identification number
ii. Ratings
iii. Check for wiring

iv. Details of grounding provided

e. Sacrificial Anode

I. Location
II. Type
III. Open circuit potential

f. Permanent Reference Cell

I. Location
II. Type of cell
III. Potential reading
IV. Installed on near coupon location
V. Distance and depth from pipeline

g. Grounding Anodes

I. Location
II. Type of anode
III. Potential reading
IV. Grounding Resistance

h. Coupon

I. Location
II. Exposed area of coupon
III. Potential reading
IV. Distance and depth from pipeline
V. Distance of permanent reference electrode from coupon

5.2 COMMISSIONING

5.2.1 Natural potential of pipe to soil for the complete pipeline and casing pipeline at the locations of cased crossings shall be measured at all the test station locations, recorded prior to connecting anodes to pipe line and casing pipeline respectively.

5.2.2 The anode shall be connected to pipeline in the test station and the pipe to soil potential observation shall be made after allowing 48 to 72 hours for polarization.

5.2.3 The current output of each anode at temporary CP anode ground bed shall also be measured. In case the anode output current exceeds the rated capacity, it shall be controlled by insertion of resistance element in the anode circuit inside test station and the pipe to soil potential shall be rechecked for adequacy of protection.

5.2.4 At locations of polarization coupon, the coupon 'Instant OFF' potential shall be measured by switching off the reed switch.

5.2.5 Additional anodes shall be provided where required to achieve desired level of protection and to keep the anode output current within the rated value. In case pipe to soil potential exceeds the specified value, suitable resistance shall be inserted in the anode circuit to limit the potential.

5.2.6 The PSP of casing and carrier pipe shall be recorded and in case the difference in the ON PSP of casing (with anodes disconnected) and carrier pipe is less than 200 mV, the same shall be reported to the Owner/Owner's representative.

5.2.7 AC induced voltage measurements shall also be made on the pipeline at all TLP locations to find out continuous induction of voltage.

5.2.8 Potential on the protected and unprotected side of the MIJ to be recorded to confirm the integrity of MIJ.

5.2.9 At foreign pipeline locations, potential of both the pipelines- owners and foreign shall be recorded and the locations of foreign pipeline anode bed have to be identified to avoid any anodic interference in future. At locations of foreign pipeline crossing Zinc anodes– 20 kg can also be installed as a mitigation measure shall be sized for the design life specified for permanent CP.

5.2.10 Resistance of the grounding anode shall be recorded at MIJ (unprotected side) and HT line crossing (location shall be recorded it should be less than 5 ohm or as per design requirement.

5.2.11 After connecting all the anode ground beds to pipe line, measurement of pipe to soil potentials shall be taken at each test station to ensure conformity to protection criteria.

5.2.12 In case of insufficient protection as per the CP design criteria on any portion of the pipeline/ casing pipeline (at cased crossings where casing is cathodically protected) Contractor shall carry out necessary additions/modifications to the provided protection in consultation with the Owner/Owner's representative.

6.0 SYSTEM MONITORING

6.1 Where the CP provided is temporary, the CP system shall be monitored at all test stations once in a month for healthiness/adequacy of protection of installed TCP system. If any deficiency/interference in protection system is noticed, the same shall be rectified/augmented by providing additional anodes as required. The monitoring report shall be submitted regularly to owner for his review/information.

ANNEXURE – I
TCP MATERIALS DATASHEET

1.1 MAGNESIUM ANODE

MAGNESIUM ANODE		
Standard	**ASTM-B-843**	
Composition	**Weight Content (Low Potential)**	**Weight Content (High Potential)**
Manganese	0.15 %	0.5 – 1.3%
Aluminum	5.3-6.7 % max.	0.01 % max.
Copper	0.02 % max.	0.02 % max.
Nickel	0.002% max.	0.001% max.
Iron	0.003 % max.	0.03 % max.
Zinc	2.5-3.5 %	-
Silicon	0.1% max.	0.05% max.
Other	0.30 % max. (Total)	0.30 % max. (Total)
Magnesium	Balance	
Anode Circuit Open Potential	1.55 volts (CSE)	1.75 volts (CSE)
Anode Consumption Rate	7.9 Kg/ (A. Yr) max.	7.9 Kg/ (A. Yr) max.
Anode tail cable	1C X 10 mm2 (un-armored)	
Backfill Material	Gypsum – 75% Bentonite – 20% Sodium Sulphate – 5%	
Make	As per approved vendor list	

1.2 ZINC ANODE

ZINC ANODE		
Standard	ASTM-B-418	
Composition	**Weight: Type-I** (Used for seawater, brackish water or saline electrolyte application)	**Weight: Type-II** (Used for fresh water, back fill and soil applications)
Aluminum	0.1% to 0.5% max.	0.005 % max.
Cadmium	0.025% to 0.07%	0.003 % max.
Copper	0.005 % max.	0.002 % max.
Iron	0.005 % max.	0.0014 % max.
Lead	0.006 % max.	0.003 % max.
Others	0.01% max.	-
Zinc	Balance	Balance
Anode Open Circuit Potential	(-) 1.1 Volts w.r.t CSE	(-) 1.1 Volts w.r.t CSE
Anode Consumption rate	11.24 Kg/(A. Yr) max.	11.24 Kg/ (A. Yr) max.

ZINC ANODE	
Anode tail cable	1C X 25 mm^2 (armored)
Backfill Material	Gypsum –50% Bentonite – 50%
Make	As per approved vendor list

1.3 ZINC RIBBON ANODE

ZINC RIBBON ANODE	
Standard	ASTM-B-418
Dimension	12/14 mm
Length	As required
Composition	*Weight: Type-II* *(Used for fresh water, back fill and soil applications)*
Aluminum	0.005 % max.
Cadmium	0.003 % max.
Copper	0.002 % max.
Iron	0.0014 % max.
Lead	0.003 % max.
Others	-
Zinc	Balance
Anode Open Circuit Potential	(-) 1.1 Volts w.r.t CSE
Anode Consumption rate	11.24 Kg/ (A. Yr) max.
Anode tail cable	1C X 25 mm2 (armored)
Backfill Material	Gypsum –50% Bentonite – 50%
Remarks	Trench to be backfilled with chemical backfill
Make	As per approved vendor list

1.4 COPPER CONDUCTOR (AC MITIGATOR)

COPPER CONDUCTOR	
Diameter	38mm
Wire Size	6 AWG (16 mm^2)
Length	As required
Backfill	Special backfill with corrosion inhibitors
Fabric	Integrated woven synthetic acid resistant
Braid	Tough, porous, protective braid enhancing the abrasion and damage resistance of the fabric jacket
Make	As per approved vendor list

1.5 SURGE DIVERTER

SURGE DIVERTER	
Type	Spark gap, explosion proof Ex d IIC T6, Solid State
Lightning Impulse Current (10/350 µs)	50 kA
Nominal Discharge Current (8/20 µs)	100 kA
Spark Over AC Voltage (50 Hz)	≤ 1.2 kV
Power Frequency Sparkover Voltage (50 z)	≤ 0.5kV
Power Frequency Withstand Voltage (50 z)	≤ 250V
Degree of protection	IP-67
Make	As per approved vendor list

1.6 DC DECOUPLER/POLARIZATION CELL

DC DECOUPLER	
Type	Solid state type
Blocking DC Voltage	- 2 V DC
Leakage Current at -1.2V at 20℃	< 20 µA
Steady state AC discharge current	45 Arms @ 50 Hz
Power fault current (40 milli sec) 2 cycle @ 50 Hz	5 kA
Power fault current (200 milli sec) 10 cycle @ 50 Hz	3.7 kA
Power fault current (600 milli sec) 30 cycle @ 50 Hz	3.7 kA
Lightning Impulse Current (10/350 µs)	75 kA
Lightning Impulse Current (8/20 µs)	100 kA
Max. permissible voltage DC	- 2 V
Degree of protection	IP-68
Make	As per approved vendor list

1.7 CABLES

All the cables shall be annealed high conductivity, tinned, stranded copper conductor, XLPE insulated, 1100V grade, FRLS, PVC sheathed

CABLES	
Anode Tail cable for Magnesium anodes	Conductor Size - 10 Sq mm No of Cores - Single Protection – Un armored
Potential Measurement	Conductor Size – 6 Sq mm No of Cores - Single Protection – Armored
Current Measurement cable	Conductor Size – 10 Sq mm No of Cores - Single Protection – Armored
Bonding, Surge Diverter connection Cable	Conductor Size – 25 Sq mm No of Cores - Single Protection – Armored
Make	As per approved vendor list

1.8 TEST STATION

TEST STATION	
Type	Normal Type / Big Type (to house DC Decoupler)
Dimension	As per manufacturer's detailed drawings
Terminal Plate dimension	As per manufacturer's detailed drawings
Height of the Test station from ground level	1200 mm (min.) Bakelite Sheet with 20% spares.
No. of Terminals	12 Nos. (min.) M-8 (SS)
Test station Material	Mild Steel (MS, 3 mm thick)
Protection Level	IP 55 (Weather Proof), IP – 55 Certificate shall be enclosed with MTC
Cable Entry	Bottom entry through pipe bend
Support Pipe	M.S. Pipe of 100 mm Dia (4"), SCH -40, 90" Elbow, R=5D
Length of Support Pipe	1000 mm.
Base Plate	As per manufacturer's detailed drawings
Thickness of pipe	4.5 mm.
Shutter of the test station	Hinged type with concealed lock (With castle lock key) + Two Nos. of Allen Key lock
Test station for Sacrificial anode	Shall have a shunt (0.10Ohm, 0.5 A, 50 mV) & provision for variable resistance insertion (Rating: 0-0.1 Ohm) at Mg anode locations
Name plate	As per design document (Anodized aluminum name plate, White letter with black back ground) (0.9 thick x 120 x 160mm)
Painting	The sheet steel used for fabrication of test lead point 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 surfaces shall be prepared by applying a coat of phosphate paint and a coat of blue/grey zinc chromate primer. The

TEST STATION	
	under surfaces shall be free from all imperfections before undertaking the finished coat. After preparation of the under surface, spray painting with two coats of final paint shall be done. The finished panel is dried in oven in dust free atmosphere. Panel finish shall be free from imperfections like pin holes, orange peels, run off paint etc.
Cable Entry Sealing	With Foam / Solid Sealing
Gas Kit	6 mm – Neoprene
PCC Details	1:5:10
RCC Details	M20
PCC over foundation base Plate	150 mm PCC over foundation
Stencil block letter marking	40 mm marking on Test station by black color, showing arrow of direction of flow, Test Station No., Chainage, "Test station connection scheme type with name of the pipeline", Distance from pipeline in meters
Make	As per approved vendor list

Note: - Variable Power Resistor shall be provided in circuit to limit PSP to -1.5 V (ON).

1.9 PIN BRAZING KIT

PIN BRAZING KIT	
Pin Brazing Pin + Ferrule	Safe track Make or Equivalent
Insulating Resin Material	Epoxy Dobo fill 60 + Hardener 758
Enclosure	Funnel

1.10 THERMIT WELD CONNECTION KIT

THERMIT WELD CONNECTION KIT	
Thermit Cartridge	M/s Erico Europa Make or Equivalent
	CA-15: For 6 to 16 Sq. mm. CA-25: For 25 sq. mm. and above
Insulating Resin Material	Epoxy Dobo fill 60 + Hardener 758
Enclosure	Funnel

Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION

FOR

CORROSION SURVEY

VCS – SS – EL - 4017

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
02	05.03.2022	SP	RD	AA	HK
01	16.10.2019	MG	VV	AD	SK
00	05.07.2017	MG	RD	AD	SK

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	05.03.2022	SP	RD	AA	HK	New revision system updated

ABBREVIATION

ROU	Right of Use
EHC	Extra High Voltage
HV	High Voltage

CONTENTS

1.0 SCOPE

1.1 The Specification covers the requirements for corrosion survey including measurement of soil resistivity, chemical analysis of soil/water and collection of other cathodic protection related data along ROU of the pipelines.

2.0 REFERENCE DOCUMENTS

2.1 Equipment and measurement techniques shall unless otherwise specified, conform to the requirement of latest revisions of following applicable Standards:

- BIS Specifications
- BS Specifications and codes of practice
- NACE publications

2.2 The work shall be carried out in compliance with all applicable local laws and regulations.

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

- Statutory regulations
- Data Sheets
- Job Specification
- This Specification
- Codes and Standards.

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 GENERAL

4.1 This Specification defines the basic guidelines for carrying out the corrosion survey. Contractor shall be responsible for providing necessary data interpretation based on corrosion survey measurements, which is intended to form a basis for design of cathodic protection system for the pipeline.

5.0 SOIL RESISTIVITY SURVEY

5.1 Unless otherwise specified the soil resistivity measurements shall be carried out at intervals of approximately 500 m along the ROU. Where soil resistivity is less than 100 ohm.m and two successive readings differ by more than 2:1 then additional soil resistivity readings in between the two locations shall be taken.

5.2 To carry out the soil resistivity measurement Wenner's 4 pin method or approved equal shall be used. The depth of resistivity measurement at each location shall be at around 1 m and at the burial depth of the pipeline accounting for the cuttings /fillings or 2 m approximately whichever is higher. At locations where multi-layer soil with large variation in resistivity/ corrosiveness is expected and /or locations specifically advised by Owner or his representative resistivity measurements at additional depth of up to 3 m (approx.) or more shall be taken. In general the resistivity of soil, which shall be surrounding the pipe, shall be measured. Hence the depth of measurement / electrode spacing may vary depending on topography and strata at the area.

5.3 At places where ROU has not yet been cleared, measurements shall be made right over the center line of pipeline route surveyed accounting for the cuttings /fillings also.

5.4 Observations shall be made enclosing the soils adjoining the trench wherever pipeline trenching has already been done.

5.5 The observations shall be made enclosing the soil immediately surrounding the pipeline route where ROU has been cleared but trenching has not been done.

5.6 All measurements shall be taken at right angles to the ROU unless otherwise asked by Owner or his representative at site.

5.7 At places in ROU where other pipelines are already existing care shall be taken to precisely locate such pipes line and take such precautions that observations are not adversely affected by presence of such pipelines.

5.8 Care shall also be taken that the observations are not influenced by presence of other earth currents in the area especially in the vicinity of EHV/HV lines and plants using earth return in their source of power etc.

5.9 Wherever possible / advised by Owner or his representative, depth of water table shall be determined by resistivity observations.

5.10 All measurements shall be made and recorded in metric units. While recording the data reference to the nearest intersecting point shall be made. To provide visual representation of variations in the resistivity along ROU, values shall be plotted on semi log graph sheets. The resistivity graph shall also indicate the resistivity at additional depths measured at various locations and depth of water table.

6.0 TESTS ON SOIL SAMPLES

6.1 Soil/water samples shall be collected along the ROU for analysis. Samples shall be collected on an average at one location for every 10 km along ROU with minimum at two locations. Exact locations shall be decided at site depending on the type of soil, soil

resistivity and in consultation with Owner or his representative. At each location the soil samples shall be collected at 1 m, 2 m depth and at expected depth of pipeline if it is more than 2 in at the location.

6.2 The collected soil/water shall be analyzed to determine presence and percentage of corrosive compounds including carbonates, bicarbonates, nitrates, chlorides, oxygen activity, moisture content and pH value.

7.0 ADDITIONAL DATA COLLECTION

7.1 The following data shall be collected with a view to generate design data for evaluation of cathodic protection interaction possibilities due to presence of other services in ROU and its vicinity:

7.2 Following information regarding foreign service/pipeline in or around the ROU (for existing and those, which are likely to come up during contract execution).

7.2.1 Types of service / pipelines and year of laying.

7.2.2 Diameter and pipeline coating in case of pipeline.

7.2.3 Parallel running / crossing.

7.2.4 Year of laying / commissioning.

7.2.5 Depth of laying.

7.2.6 Type of existing cathodic protection systems (impressed-current / sacrificial).

7.2.7 Location and type (Deep well / surface) of anode ground bed.

7.2.8 Rating of impressed current type of anode ground bed.

7.2.9 Location of existing CP power supply units and their output voltage, current, pipe to soil potential readings.

7.2.10 Location of existing test stations.

7.2.11 Remedial measures existing on foreign service/pipeline to prevent interactions.

7.2.12 Graphical representation of existing structure / pipe to soil potential records.

7.2.13 Possibility of integration/isolation of CP system of the foreign service/pipeline with that of the proposed pipeline, which may involve negotiations with owners of foreign services.

7.2.14 Where, pipeline is likely to "pass close to any existing ground bed (within 100 m approx.), anode-bed potential gradient survey shall .be carried out, to verify possible interference with the CP system of the pipeline covered under this project.,

7.3 Voltage rating, phases and sheathing details of cables running parallel or crossing the ROU.

7.4 Existing .and proposed DC/AC power sources and systems using earth return path such as HVDC substations/ earthing stations fabrication yards with electric welding etc. in the vicinity of the entire pipeline route

7.5 Crossing and parallel running of electrified and non-electrified traction (along with information regarding, operating voltage, AC/DC type etc.) as well as abandoned tracks near ROU having electrical continuity with the tracks in use.

7.6 Crossing or parallel running of any existing or proposed EHV/HV AC/DC overhead power lines along with details of voltage, AC/DC type etc.

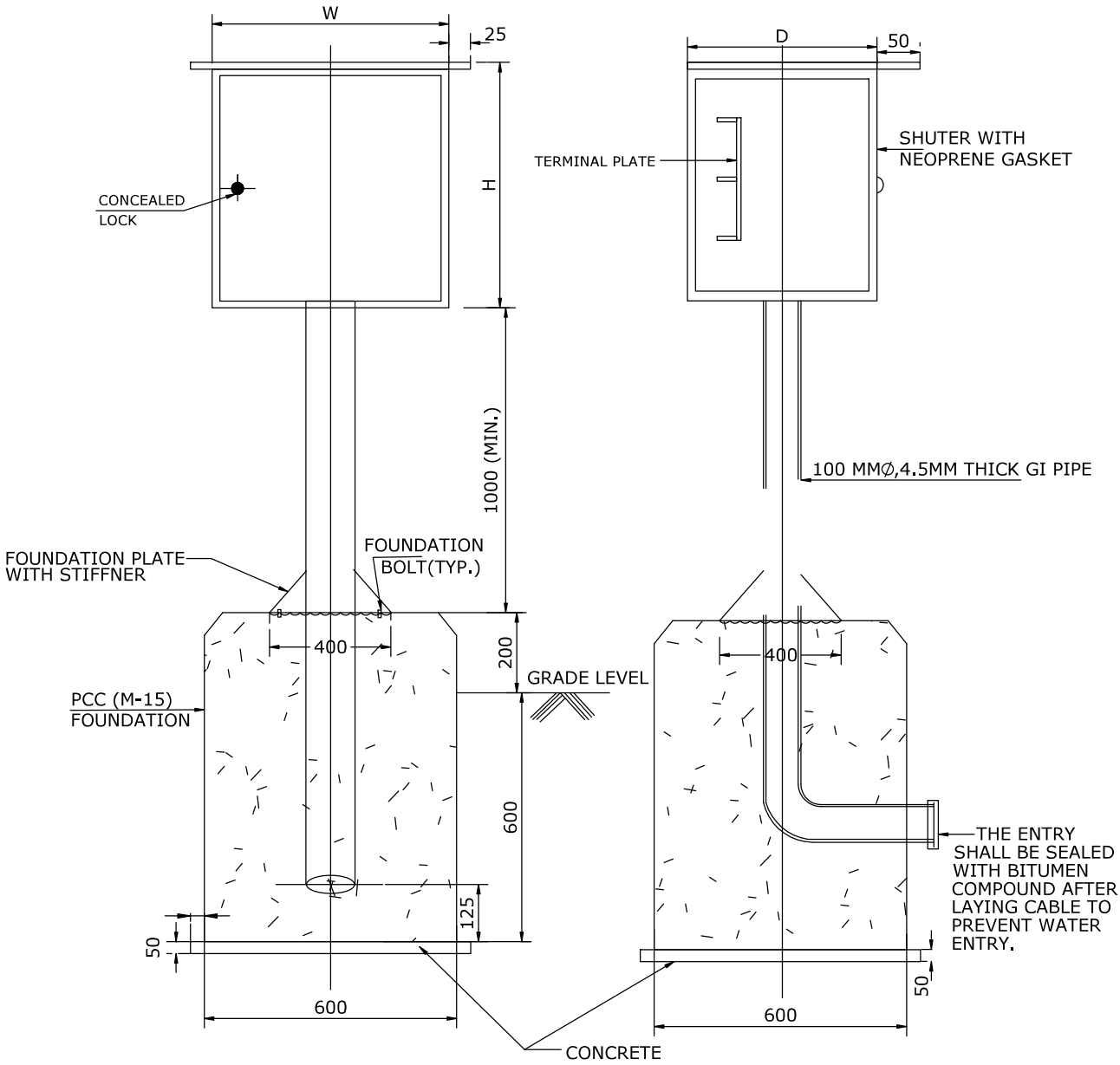
7.7 Voltage rating, phases, sheathing details of underground power cables, along ROU or in its vicinity.

7.8 Any-other relevant information that may be needed in designing and implementing of proper cathodic protection scheme for the proposed pipeline.

8.0 REPORT

8.1 On completion of all the field and laboratory work an interim report incorporating results generated from surveys, additional data collected, results of test carried out, etc., shall be submitted for comments / approval. The report shall also highlight any adverse impact on performance of sacrificial anodes due to the percentage of corrosive compounds including carbonates, bicarbonates, nitrates, chlorides present in the soil and pH value of the soil noticed during the survey. The final report incorporating comments/missing data shall be furnished for records. The report along with various drawings, graphs etc. prepared in connection with the work shall be submitted along with six prints by the Contractor.

VCS QUALITY SERVICES PRIVATE LIMITED	TEST STATION WITH FOUNDATION DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4501		02	A4
		SHEET NO.	1 OF 1		



NOTES:

1. THE SHUTTER SHALL BE HINGED TYPE WITH CONCEALED LOCK & SHALL HAVE DOOR GASKET TO MAKE THE TEST STATION WEATHER PROOF (IP:55).
2. THE INNER & OUTER SURFACE OF THE TEST STATION SHALL BE EPOXY PAINTED.
3. THE NAME PLATE SHALL BE OF ANODISED ALUMINIUM WITH BLACK BACKGROUND & WHITE LETTERS & SHALL BE FIXED TO THE INNER SIDE OF SHUTTER.
4. TEST STATION SHALL BE ERECTED WITH THEIR SHUTTERS PARALLEL TO THE LINE OF AXIS & FACING THE PIPELINE.
5. THE CHAINAGE OF TEST STATION SHALL BE WRITTEN WITH BLACK PAINT ON THE OUTER SIDE OF THE FRONT SHUTTER.
6. HEIGHT OF THE TEST STATION SHOWN ABOVE GROUND LEVEL IS MINIMUM ONLY. THE ACTUAL HEIGHT SHALL BE DECIDED BASED ON LOCAL FLOOD LEVELS TO BE ASCERTAINED .
7. CONTACTORS SHALL FURNISH ALL THE DIMENSIONS OF THE TEST STATION.
8. ALL DIMENSIONS ARE IN MM.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	GALVANIC ANODE INSTALLATION	STANDARD DRAWING NO.		REV.	SIZE
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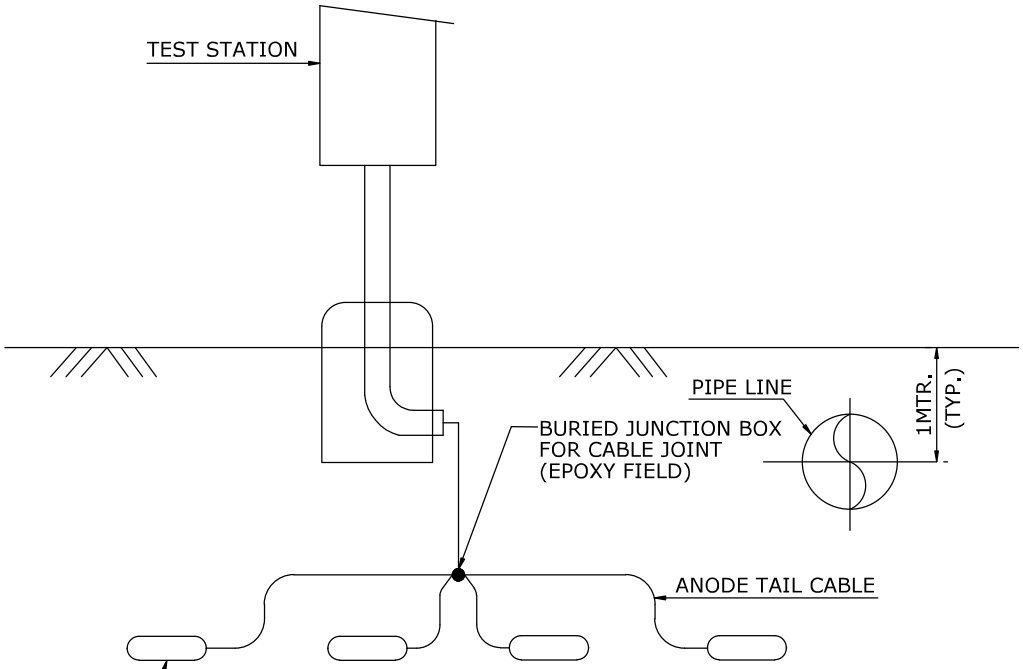
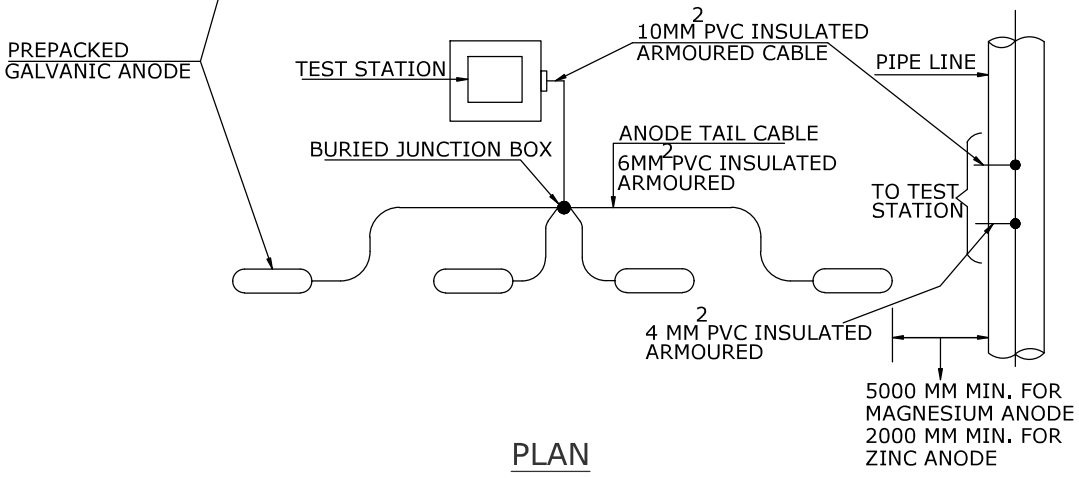
		SHEET NO.	1 OF 1		



ELEVATION



PLAN

GALVANIC ANODE INSTALLATION

NOTES:

1. THE PREPACKED GALVANIC ANODE SHALL BE INSTALLED AT A MINIMUM DEPTH, EQUAL TO BOTTOM LEVEL OF THE PIPELINE.
2. THE ANODES ARE SHOWN HORIZONTALLY LAID. ALTERNATIVELY THE ANODES MAY BE VERTICALLY INSTALLED WITH
3. NUMBER OF TERMINALS FOR TEST STATION FOR GALVANIC ANODES FOR PERMANENT CP SYSTEM SHALL BE DECIDED BASED ON NUMBER OF ANODES.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	SHALLOW ANODE GROUND BED (PCP)	STANDARD DRAWING NO.		REV.	SIZE
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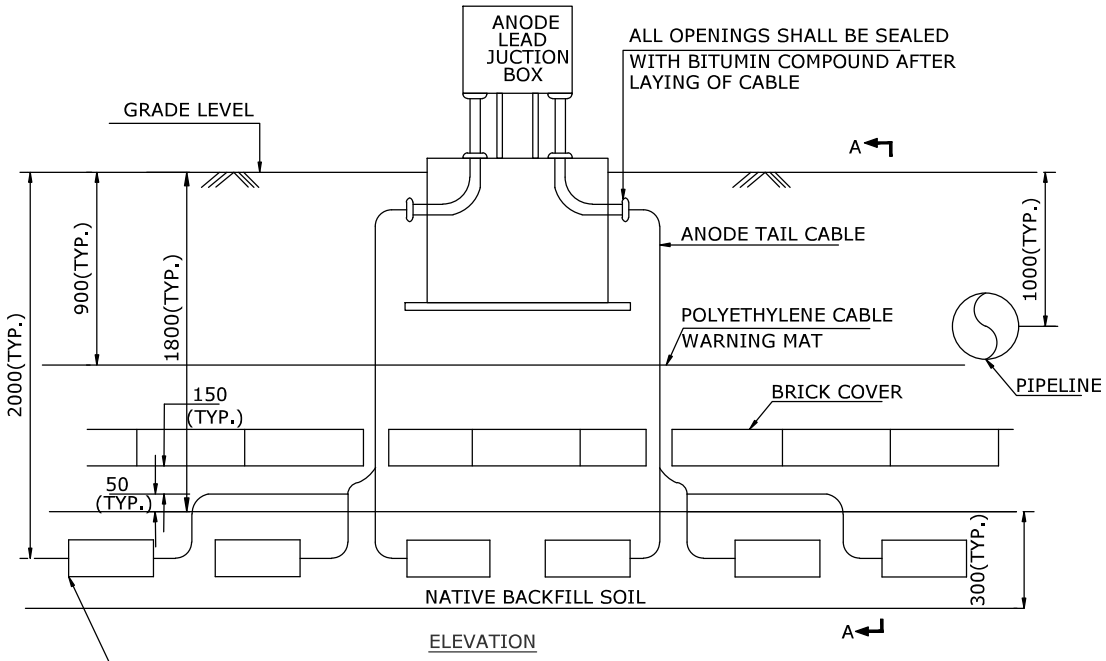
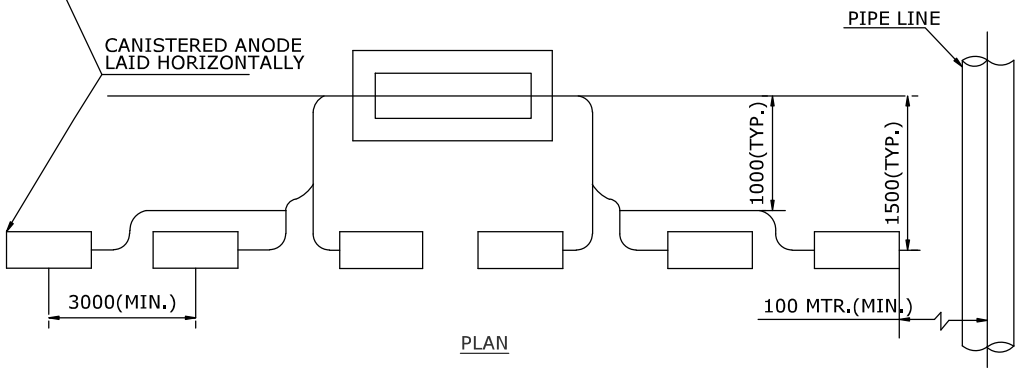
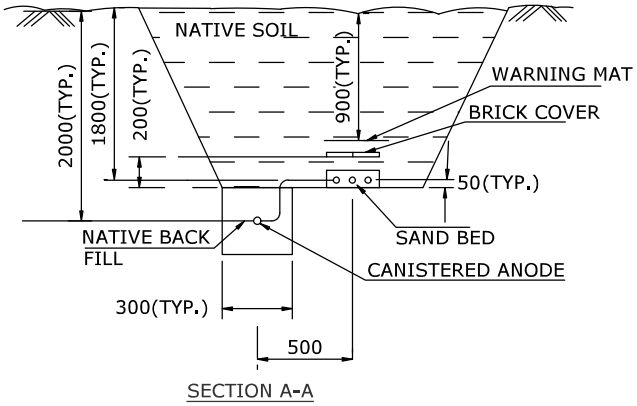
		SHEET NO.	1 OF 1		



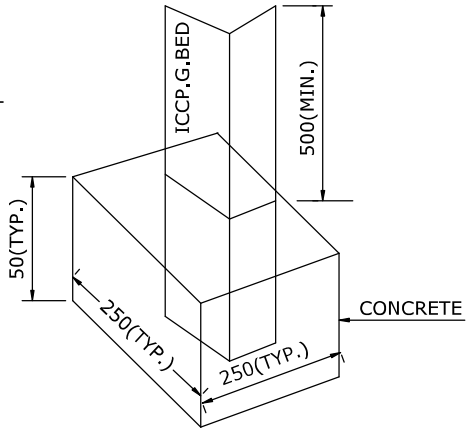
ELEVATION



PLAN



SECTION A-A



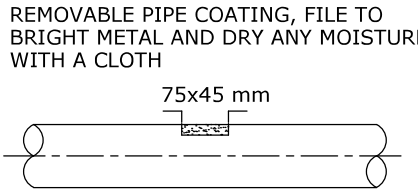
ANODE BED MARKER POST

NOTES:

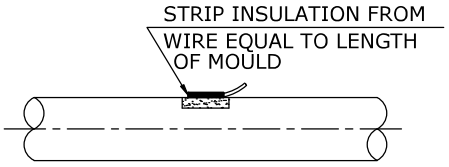
1. THE ANODE GROUND BED SHALL BE LOCATED ELECTRICALLY REMOTE FROM THE PIPELINE WITH MINIMUM 100 MTR. AWAY FROM THE NEAREST POINT ON THE PIPELINE.
2. NO. SPLICING SHALL BE ALLOWED FOR THE CABLES.
3. CONTACTOR SHALL FURNISH THE DIMENSIONED DRAWING SHOWING ACTUAL QUANTITY OF ANODES FOR EACH GROUND BED.
4. ALL UNARMOURED CABLES SHALL BE RUN THROUGH PE SLEEVES.
5. ANODE BED MARKER SHALL BE RUN THROUGH PE SLEEVES.
6. NATIVE BACKFILL SOIL SHALL BE FREE OF ROCKS, GARBAGE, PAPERS, PLASTICS ETC.
7. ANODES MAY BE LAID VERTICALLY IN CASE OF VERTICALLY SHALLOW ANODE GROUND BED DESIGN.
8. ALL THE DIMENSIONS ARE IN MM.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	THERMITE WELD CONNECTION DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4504		02	A4
		SHEET NO.	1 OF 1		



STEP-1



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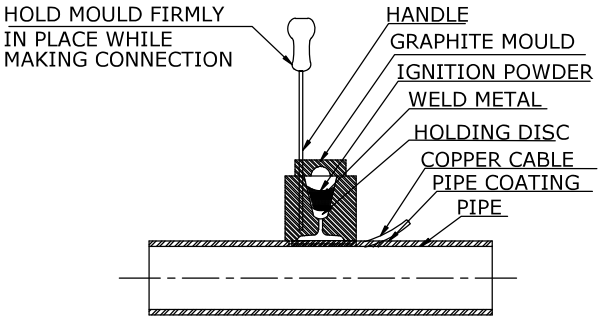
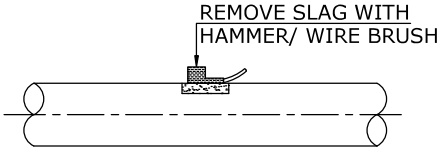
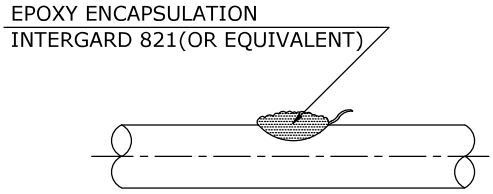


STEP-3



STEP-4



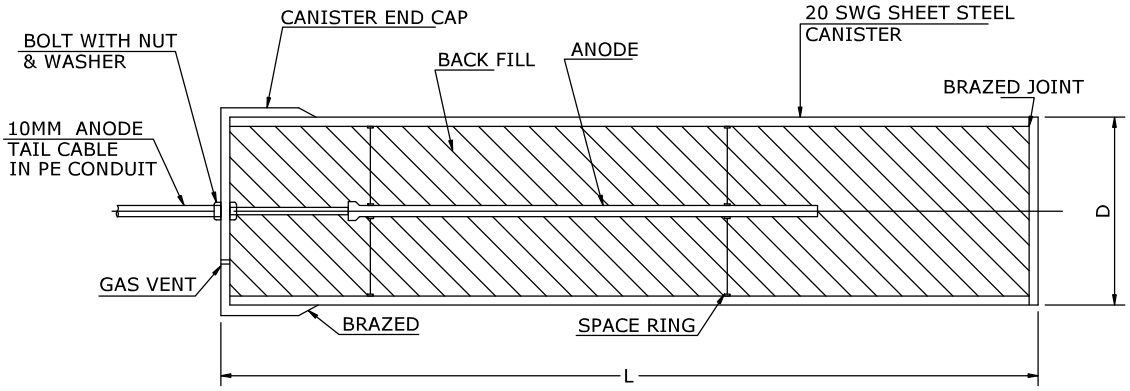
STEP-5

NOTES: GENERAL THERMITE WELDING PROCEDURE

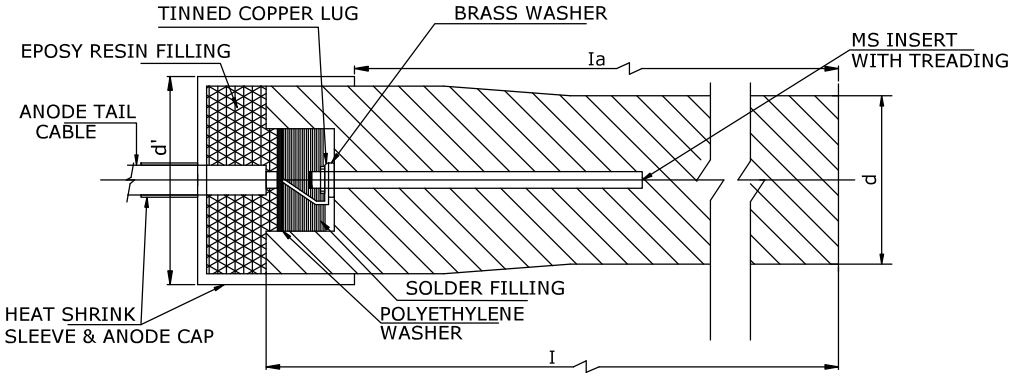
1. REMOVABLE PIPE COATING FILE TO BRIGHT METAL AND DRY ANY MOISTURE WITH A CLOTH.
2. STRIP INSULATION FROM WIRE EQUAL TO LENGTH OF MOULD.
3. INSERT THE CONDUCTOR INTO MOULD.
4. INSERT STEEL DISC IN BOTTOM OF MOULD CAVITY INSIDE MOULD _ DUMP THE METAL INTO MOULD BEING CAREFUL NOT TO UPSET THE STEEL DISC. TAP THE BOTTOM OF THE TUBE TO LOOSEN ALL THE IGNITION POWDER AND SPREAD IT EVENLY OVER THE WELD METAL. PLACE A SMALL MOUNT OF STARTING POWDER ON THE TOP EDGE OF THE MOULD UNDER COVER OPENING FOR EASY IGNITION.
5. CLOSE COVER AND IGNITE WITH THE FLINT GUN MOVE GUN AWAY QUICKLY TO PREVENT FOULING . IF FLINT GUN SHOULD BECOME FOULED , SOAK IT IN HOUSEHOLD AMMONIA.
6. AFTER IGNITION, HOLD THE MOULD IN PLACE FOR 5 SECONDS TO ALLOW THE WELD TO SOLIDIFY, AFTER THE WELD HAS COOLED, REMOVE THE SLAG WITH A CHIPPING HAMMER OR WIRE BRUSH.
7. ENCAPSULATE THE CONNECTION AND ENTIRE PREPARED SURFACE WITH TWO PART EPOXY COMPOUND.
8. REMOVE ALL SLAG'S FROM THE WELDER BEFORE MAKING THE NEXT WELD CLEAN THE COVER EVERY 6 TO 10 WELDS.
9. WET OR DAMP MOULDS WILL PRODUCE POROUS WELDS. MOULDS MUST BE DRIED OUT BEFORE ATTEMPTING TO WELD.
10. CONNECTIONS ARE TO BE PLACED A MINIMUM OF 100mm APART, UNSUCCESSFUL WELDS ARE ABANDONED AND MOVED TO ANOTHER PREPARED SURFACE NOT LESS THAN 100mm AWAY.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	TYPICAL CONSTRUCTION DETAILS OF HIGH SILICON CAST IRON ANODE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4505		02	A4
		SHEET NO.	1 OF 1		



PREPACKED CANISTERED ANODE



ANODE DETAILS

CHEMICAL COMPOSITION OF ANODE (% WEIGHT):-

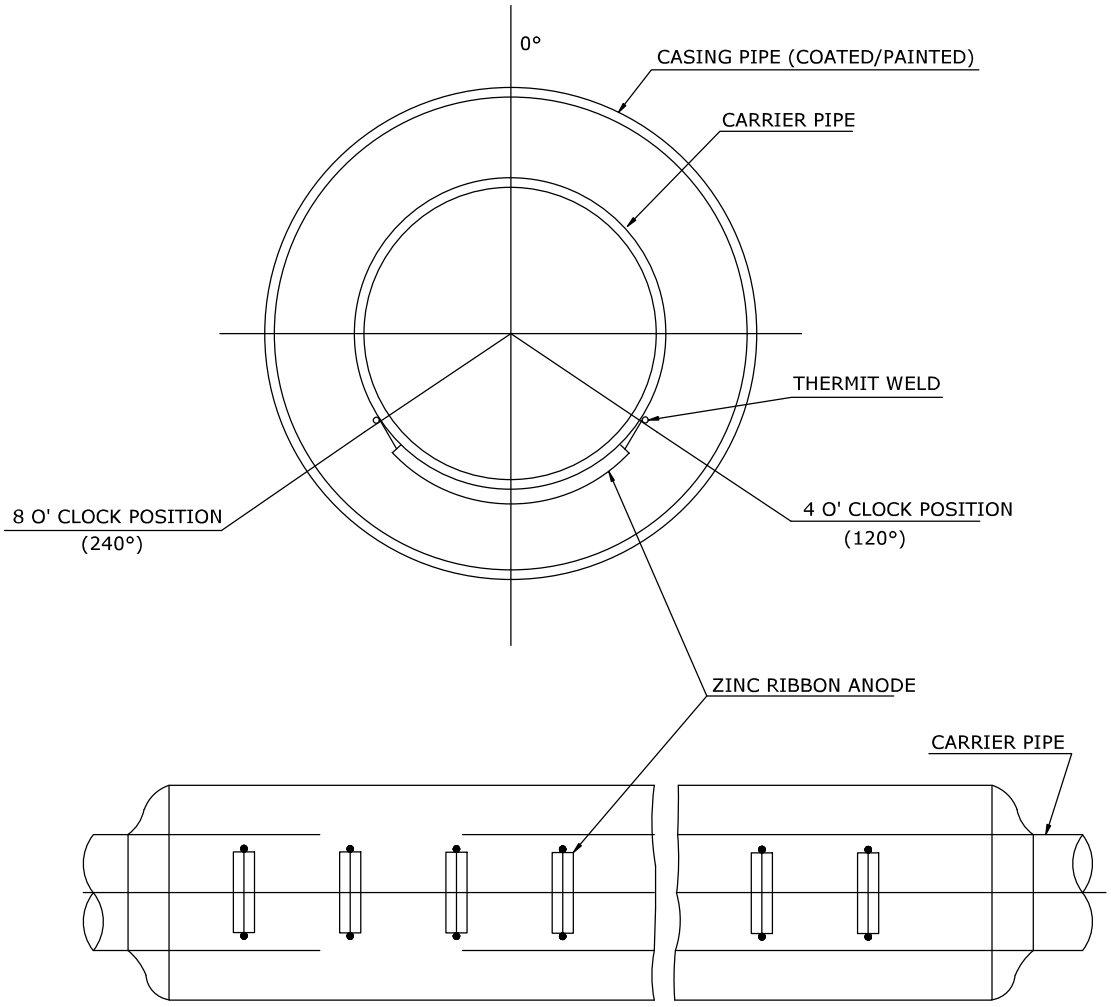
CARBON	: 0.7%-1.1%
MANGANESE	: 1.5% max.
SILICON	: 14.2%-14.75%
CHROMIUM	: 3.25%-5%
MOLYBDYNUM	: 0.2%max.
COPPER	: 0.5% max
IRON	: REMAINDER

NOTES:

1. ANODE FOR SURFACE AND DEEP GROUND BED APPLICATION SHALL BE IDENTICAL EXCEPT FOR BACK FILL PREPACKING.
2. SHEET STEEL ANODE CANISTERS SHALL BE FILLED WITH METALLURGICAL GRADE COKE BREEZE.
3. FLUID PETROLEUM COKE BREEZE BACKFILL SHALL BE PROVIDED IN THE WELL, SURROUNDING ANODES IN DEEP WELL GROUND BEDS.
4. ANODE TAIL CABLE SHALL BE 10 Sq.mm HIGH CONDUCTIVITY, STRANDED COPPER CONDUCTOR, 650V GRADE, PE INSULATED, PVC SHEATHED & UNARMOURED.
5. ALL THE DIMENSIONS, NET WEIGHT & GROSS WEIGHT OF THE ANODE SHALL BE FURNISHED BY CONTACTOR.
6. THE ACTIVE LENGTH 'Ia' OF ANODE SHALL BE CONSIDERED FOR CALCULATING THE SIZE / WEIGHT.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	ZINC RIBBON ANODE FOR CASED CROSSINGS WITH COATED/PAINTED CASING	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4506		02	A4
		SHEET NO.	1 OF 1		



BOTTOM VIEW

CHEMICAL COMPOSITION OF ANODE (% WEIGHT):-

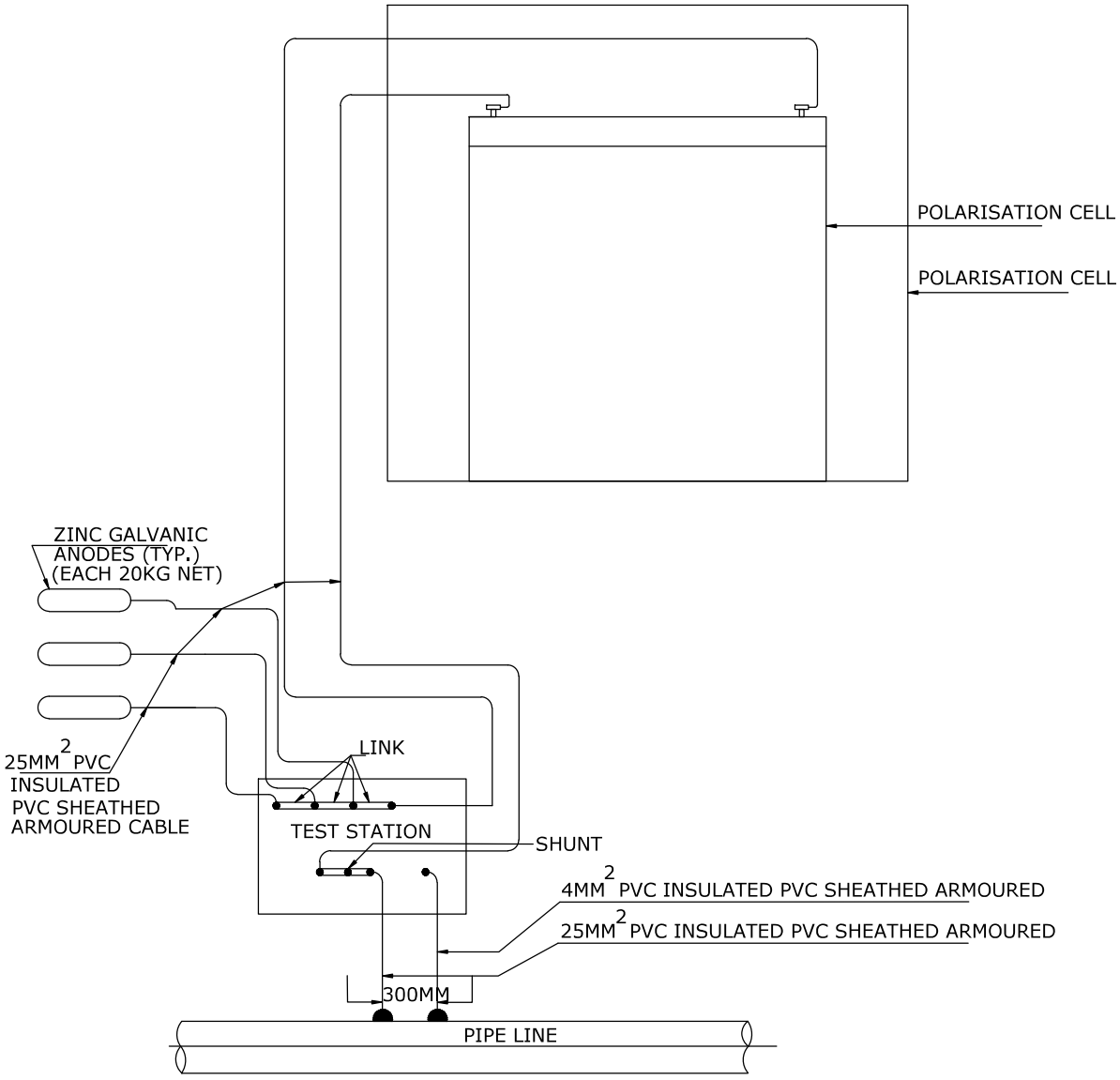
A1 ---------- : 0.005% max.
Cd ---------- : 0.003% max.
Cu ---------- : 0.002% max.
Fe ---------- : 0.0014% max.
Pb ---------- : 0.003%max.
Zn ---------- : REMAINDER

NOTES:

1. STEEL CORE TO BE THERMIT WELDED DIRECTLY TO CARRIER PIPE WITHIN CASINGS AT 4 & 8 '0' CLOCK POSITIONS FOR CARRIER PIPE OF LESS THAN 4 INCH DIA. ANODES MAY BE PROVIDED ALONG THE LENGTH OF THE CARRIER PIPE LINE AT THE BOTTOM LEVEL.
2. SIZE OF ANODE & SPACING BETWEEN ANODES SHALL BE DECIDED BASED ON DESIGN CRITERIA. HOWEVER MINIMUM ONE NUMBER ANODE SHALL BE PROVIDED BETWEEN TWO PIPE SPACERS/CENTRALISERS PROVIDED BETWEEN CARRIER AND CASING PIPES.
3. PIPE SPACERS/CENTRALISERS ARE NOT SHOWN.
4. ANODE COMPOSITION, DIMENSION, NET & GROSS WEIGHT PER UNIT LENGTH SHALL BE FURNISHED BY THE CONTACTOR.
5. CASING PIPE WHERE COATED AGAINST CORROSION OF EXTERNAL SURFACE SHALL BE PROTECTED BY GALVANIC ANODES INSTALLED AT BOTH THE ENDS OF THE CASING PIPE.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	PIPELINE GROUNDING THROUGH POLARIZATION CELL AND GALVANIC ANODE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4507		02	A4
		SHEET NO.	1 OF 1		

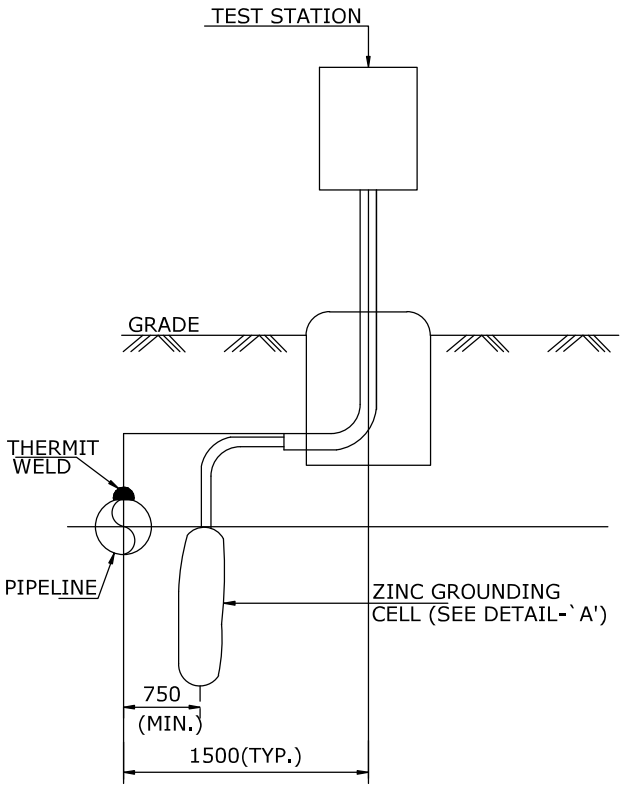


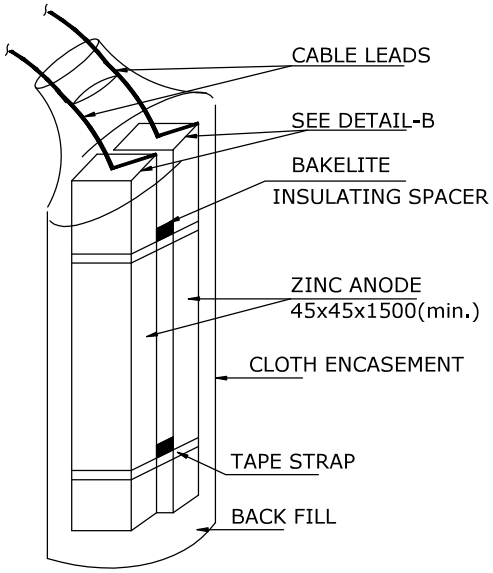
NOTES:

1. THE POLARISATION CELL, ANODES AND ASSOCIATED CABLES, CABLE JOINT ETC. SHALL BE MINIMUM BE RATED FOR THE EXPECTED FAULT CURRENT AT THE LOCATION OF THE INSTALLATION & SIZED FOR DESIGN LIFE OF PERMANENT C.P SYSTEM.
2. THE POLARISATION CELL SHALL BE HOUSED IN A VANDALLISM PROOF HOUSING.
3. CELL SHALL HAVE GOOD VENTILATION TO ATMOSPHERE & SHALL BE PROTECTED AGANIST DIRECT SUN LIGHT & RAIN / WATER.
4. ANODE TAIL CABLES OF EACH ANODE SHALL BE TERMINATED INDIVIDUALLY IN TESTSTATION.
5. CONTACTOR SHALL FURNISH DRAWING WITH ACTUAL DIMENSIONS & RATINGS.
6. EASY ACCESS TO POLARISATION CELL SHALL BE AS PER STANDARD 7-51-0601 (PREPACKED ZINC ANODE).

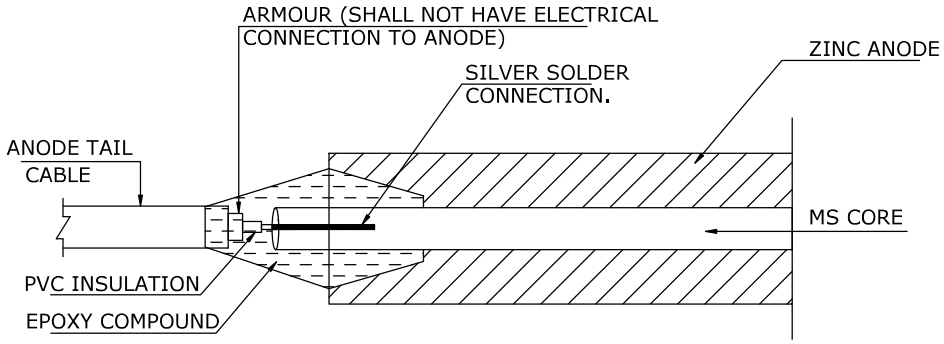
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	ZINC GROUNDING CELL TWO PLATE TYPE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4508		02	A4
		SHEET NO.	1 OF 1		





DETAIL-A



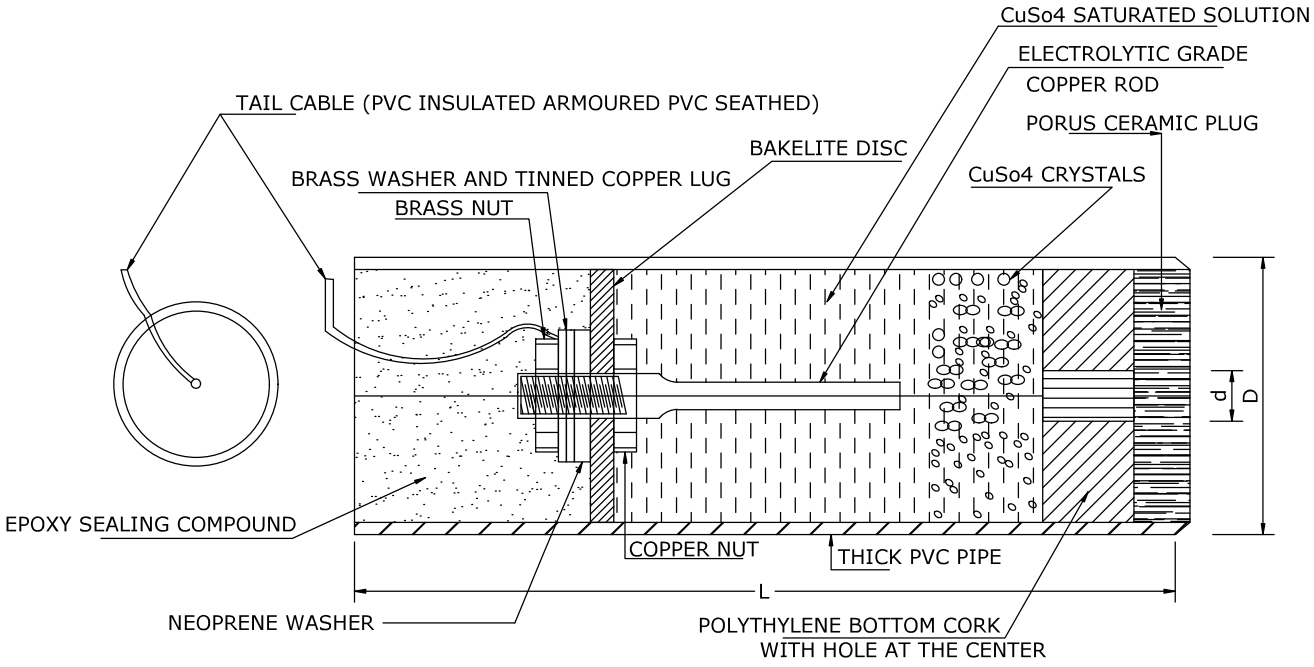
DETAIL-B

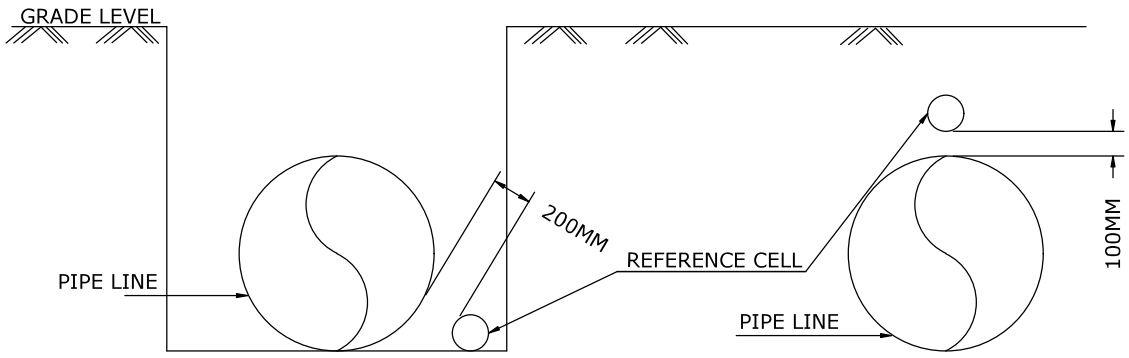
NOTES:

1. CONTACTOR SHALL FURNISH ANODE COMPOSITION, NET WEIGHT, GROSS WEIGHT AND ALL THE DIMENSIONS OF THE GROUNDING CELL.
2. ZINC GROUNDING CELLS SHALL BE INSTALLED VERTICALLY SUCH THAT THE TOP OF THE CELL IS APPROXIMATELY AT THE SAME ELEVATION AS PIPE CENTRE LINE.
3. NET WEIGHT OF ZINC FOR EACH PLATE OF THE GROUNDING CELL SHALL BE MINIMUM 20KG.
4. ALL CABLE LEADS FOR ZINC GROUNDING CELL SHALL BE KEPT AS SHORT & DIRECT AS POSSIBLE.
5. GROUNDING CELL CABLE LEAD SHALL BE 25 Sqmm HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR 650V GRADE, PVC INSULTED, ARMOURED & PVC SHEATHED.
6. CABLE JOINT TO ANODE CORE SHALL BE SUITABLE TO DISCHARGE MINIMUM 10 KA FAULT CURRENT.
7. ALL DIMENSIONS ARE IN MM.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	PERMANENT COPPER-COPPER SULPHATE REFERENCE CELL AND INSTALLATION DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4509		02	A4
		SHEET NO.	1 OF 1		





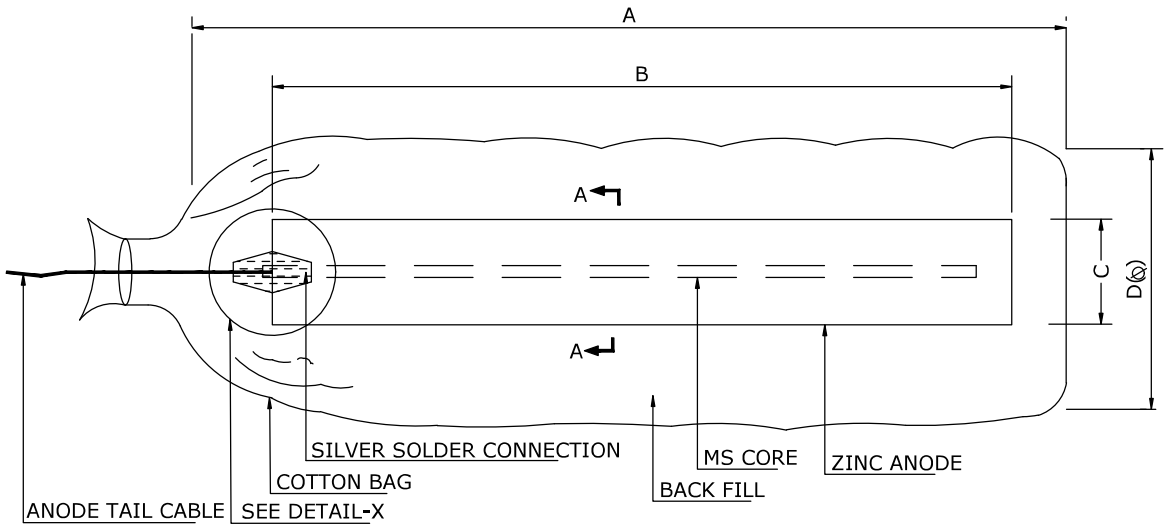
REFERENCE CELL INSTALLATION

NOTES:

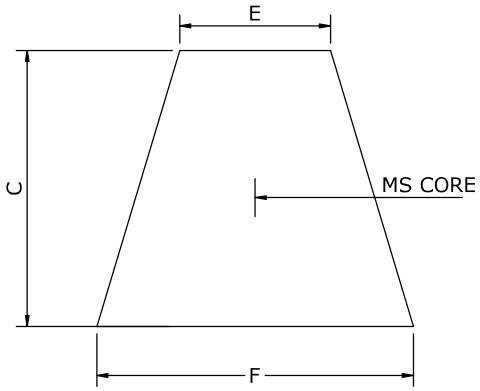
1. REFERENCE CELL SHALL BE BACK FILLED WITH CARBONACEOUS BACK FILL MATERIAL SPECIFIED.
2. FOR NEW PIPELINES REFERENCE ELECTRODE SHALL BE INSTALLED APPROXIMATELY AT THE BOTTOM LEVEL OF THE PIPE LINE, 200MM AWAY FROM SURFACE OF THE PIPELINE.
3. REFERENCE ELECTRODES MAY BE INSTALLED AT THE TOP OF THE PIPELINE. APPROXIMATELY 100MM ABOVE THE PIPELINE WHERE THE PIPELINE HAS ALREADY BEEN LAID.
4. REFERENCE CELL CABLE SHALL BE ROUTED ALONG THE BOTTOM LEVEL OF THE PIPELINE. AND 250MM APPROX. AWAY FROM THE SURFACE OF THE PIPE.
5. BACKFILLED REFERENCE ELECTRODES SHALL BE SOAKED IN 20 LTRS. OF CLEAN FRESH WATER FOR 24 HOURS IMMEDIATELY PRIOR TO INSTALLATION.
6. CONTACTOR SHALL FURNISH REFERENCE CELL DRAWING WITH ALL DIMENSIONS.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

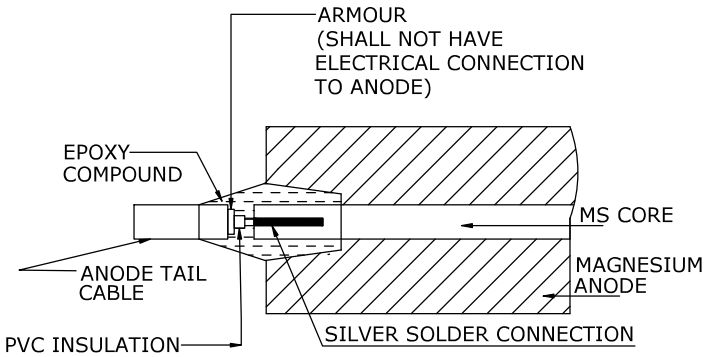
VCS QUALITY SERVICES PRIVATE LIMITED	PREPACKED MAGNESIUM ANODE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4510		02	A4
		SHEET NO.	1 OF 1		



ELEVATION



SECTION-AA



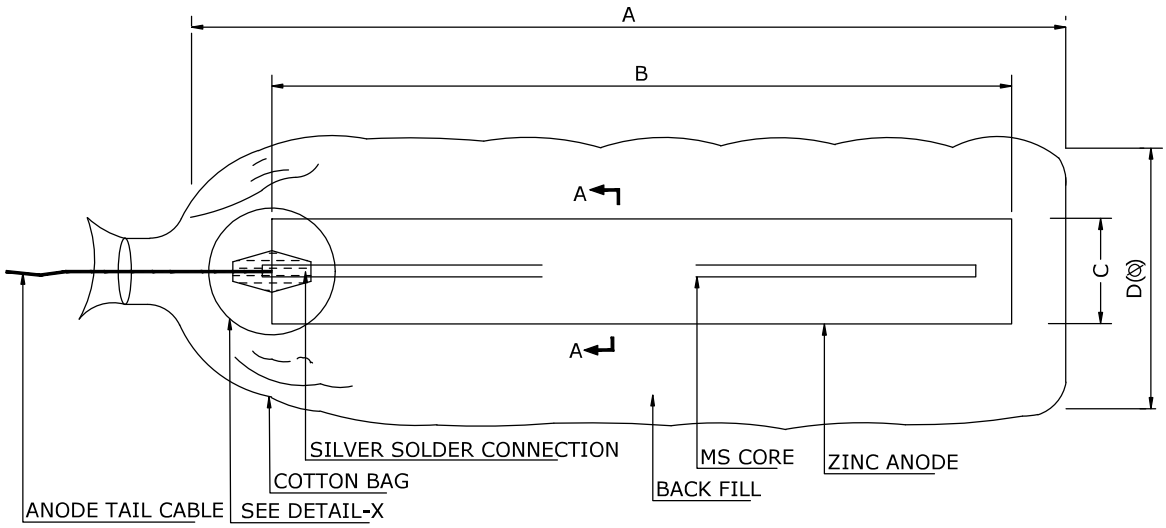
DETAIL-X

NOTES:

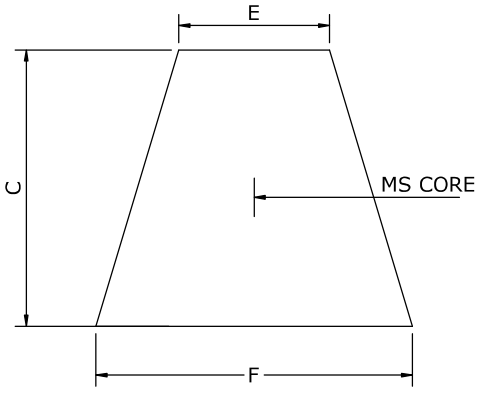
1. ANODE COMPOSTION, NET WEIGHT, GROSS WEIGHT AND DIMENSIONS SHALL BE FURNISHED BY CONTACTOR.
2. ANODE TAIL CABLE SHALL BE HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR, 650V GRADE, PVC INSULATED, PVC SHEATHED & ARMOURED.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	05.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

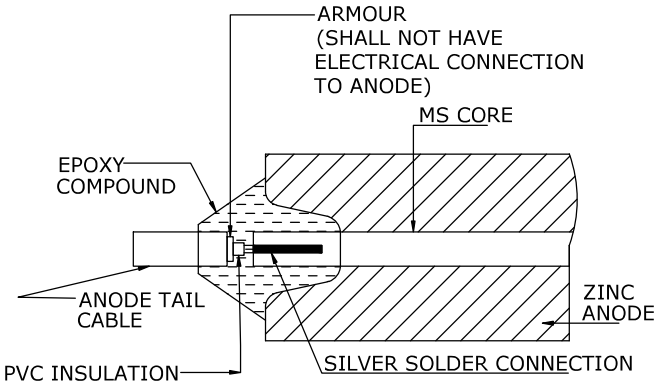
VCS QUALITY SERVICES PRIVATE LIMITED	PREPACKED ZINC ANODE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4511		02	A4
		SHEET NO.	1 OF 1		



ELEVATION



SECTION-AA



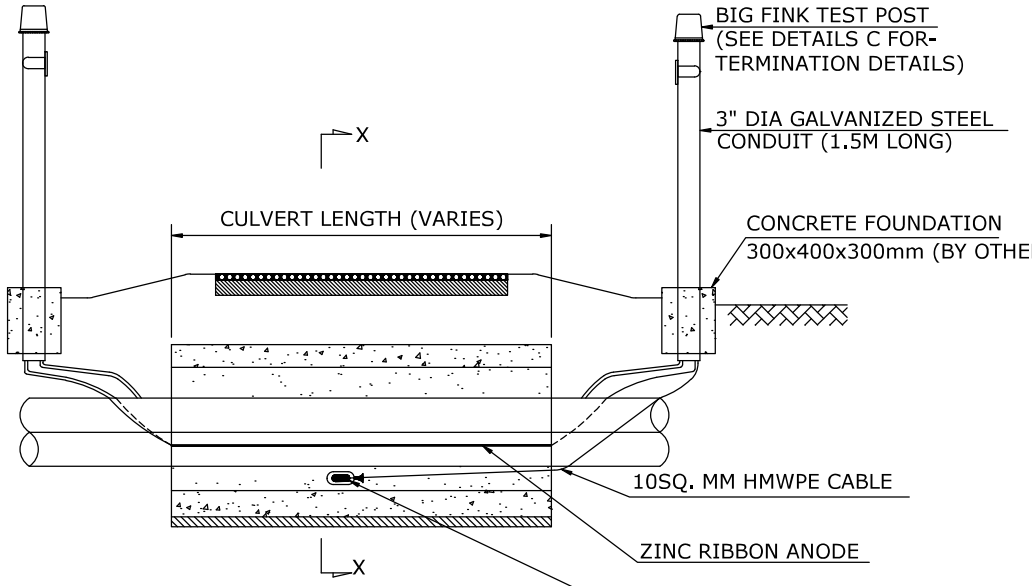
DETAIL-X

NOTES:

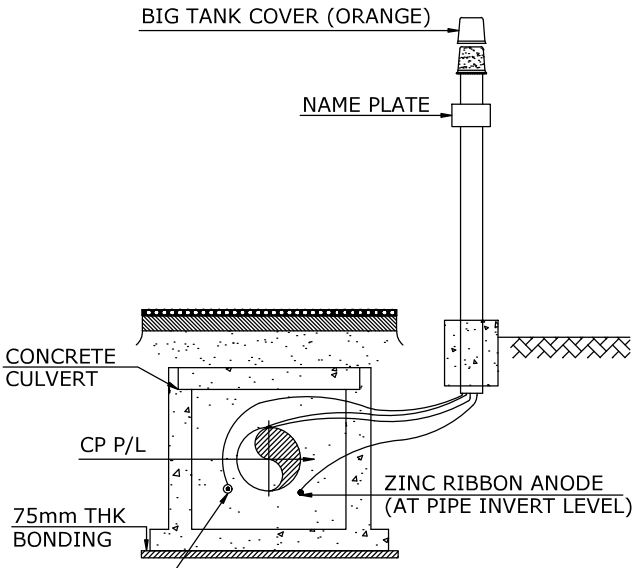
1. ANODE COMPOSTION, NET WEIGHT, GROSS WEIGHT AND DIMENSIONS (A,B,C,D,E & F) SHALL BE FURNISHED BY CONTACTOR.
2. ANODE TAIL CABLE SHALL BE HIGH CONDUCTIVITY, STRANDED, COPPER CONDUCTOR, 650V GRADE, PVC INSULATED, PVC SHEATHED & ARMOURED.
3. ANODE TYPE-I SHALL BE USED FOR SEA WATER, BRACKISH WATER OR SALINE ELECTROLYTE AND ANODE-II SHALL BE USED FOR WATER, BACK FILLS & SOIL APPLICATION.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

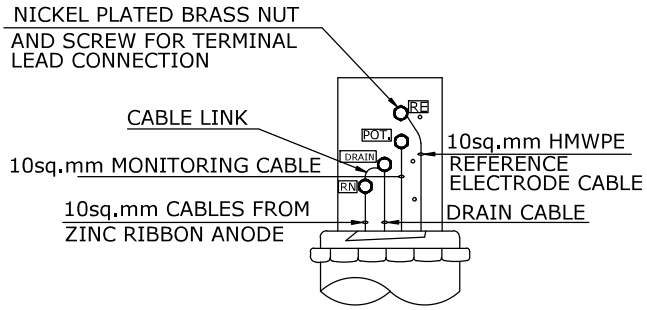
VCS QUALITY SERVICES PRIVATE LIMITED	CATHODIC PROTECTION SYSTEM TEST POST INSTALLATION AT ROAD CROSSING (RX)	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4512		02	A4
		SHEET NO.	1 OF 1		



ELEVATION



SECTION X-X



DETAIL-C
TERMINATION DETAILS

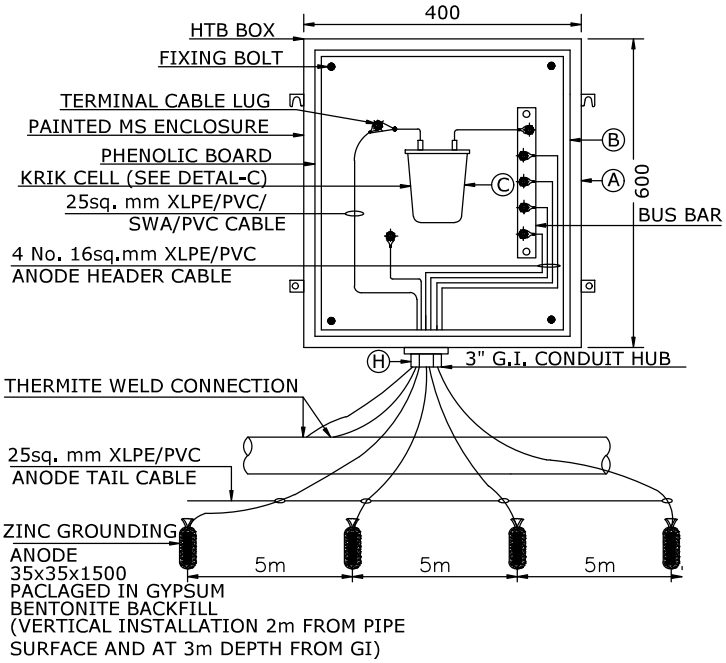
TEST POST INSTALLATION DETAILS AT ROAD CROSSING WITH CONCRETE CULVERT

NOTES:

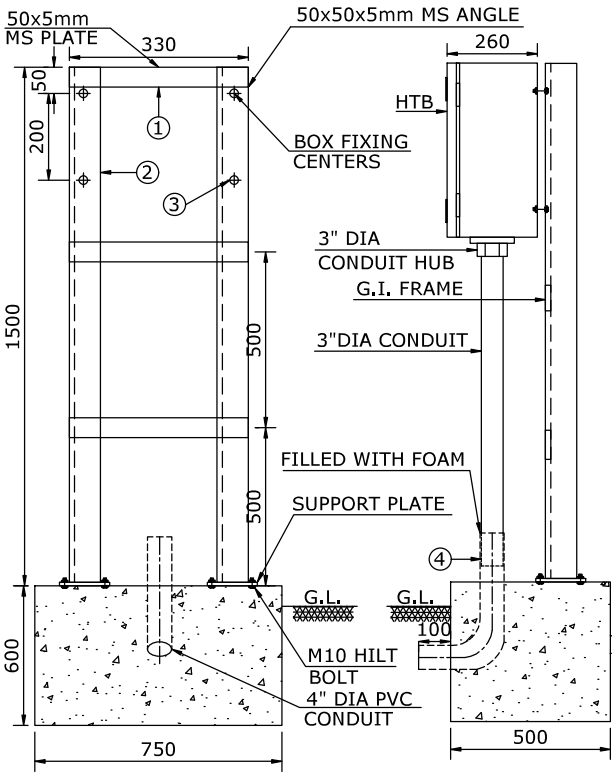
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ANODE RIBBONS SHALL BE INSTALLED AT ROAD CROSSING WHERE THE PIPE IS CASED IN CONCRETE CULVERT.
3. EACH TEST POST SHALL BE HAVE ONE MONITORING AND ONE DRAIN CABLE CONNECTED TO THE PIPE PIPE STRUCTURE.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

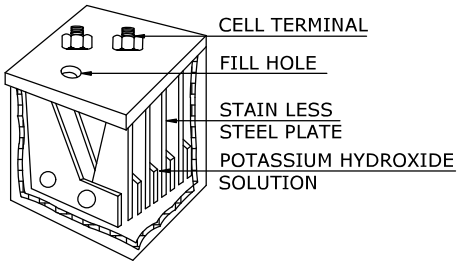
VCS QUALITY SERVICES PRIVATE LIMITED	CATHODIC PROTECTION SYSTEM HIGH TENSION LINE CROSSING JUNCTION BOX (HTB)INSTALLATION DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4513		02	A4
		SHEET NO.	1 OF 1		



ZINC GROUNDING CELL



HTB MOUNTING DETAILS (BY OTHERS)



DETAIL-C

KRIK CELL (5kA RATING) DETAILS

ITEM NO.	MATERIALS SCHEDULE	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	2 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	2 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

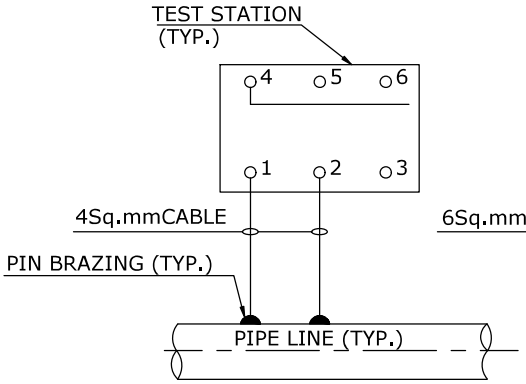
ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES,11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	CONDUIT LENGTH TO SUIT.	NO	1
5.	2" DIA PVC CONDUIT LENGTH TO SUIT.	NO	1

NOTES:

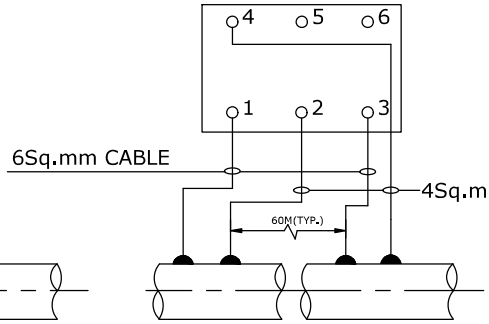
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. THE ZINC GROUNDING ANODE INSTALLATION CAN BE DONE ON ANY ONE SIDE OF THE OVERHEAD POWER LINE CROSSING TO SUIT THE DRILLING AUGERING MACHINE ACCESSIBILITY AT SITE.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

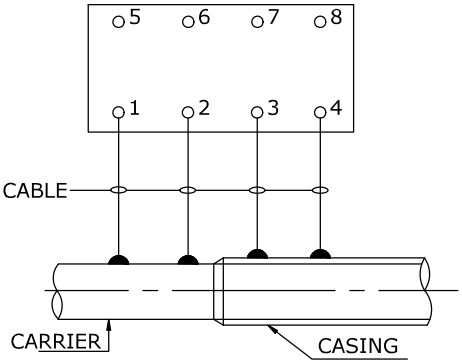
VCS QUALITY SERVICES PRIVATE LIMITED	TEST STATION CONNECTION SCHEMES	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4514		02	A4
		SHEET NO.	1 OF 3		



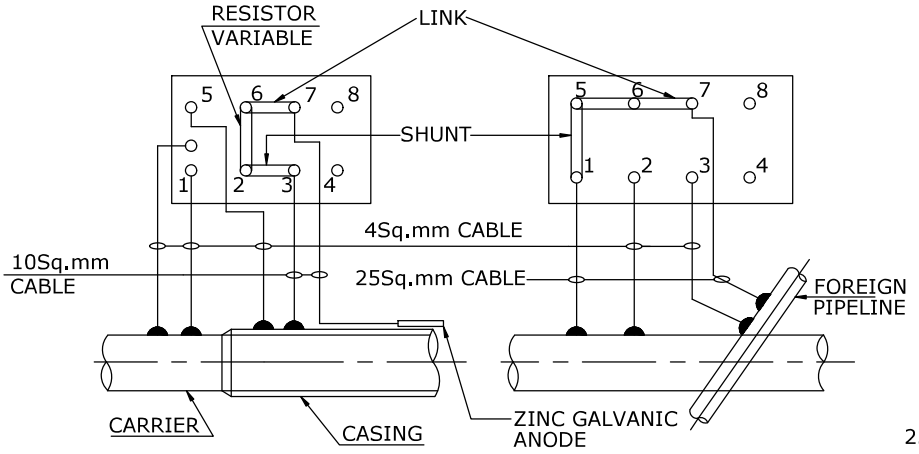
POTENTIAL MEASUREMENT CONNECTION SCHEME-A



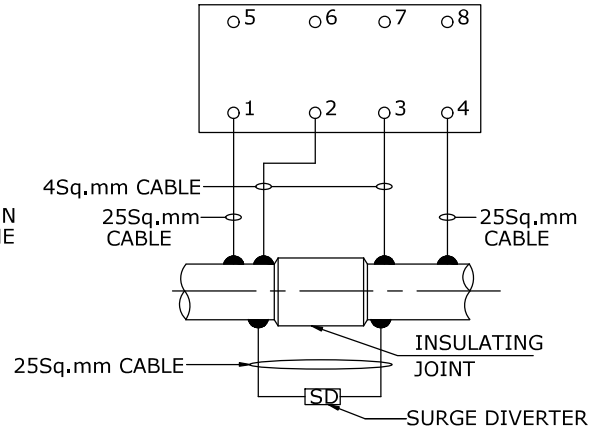
CURRENT MEASUREMENT CONNECTION SCHEME-B



CASED CROSSING WITH UNCOATED/UNPAINTED CASING CONNECTION SCHEME-C



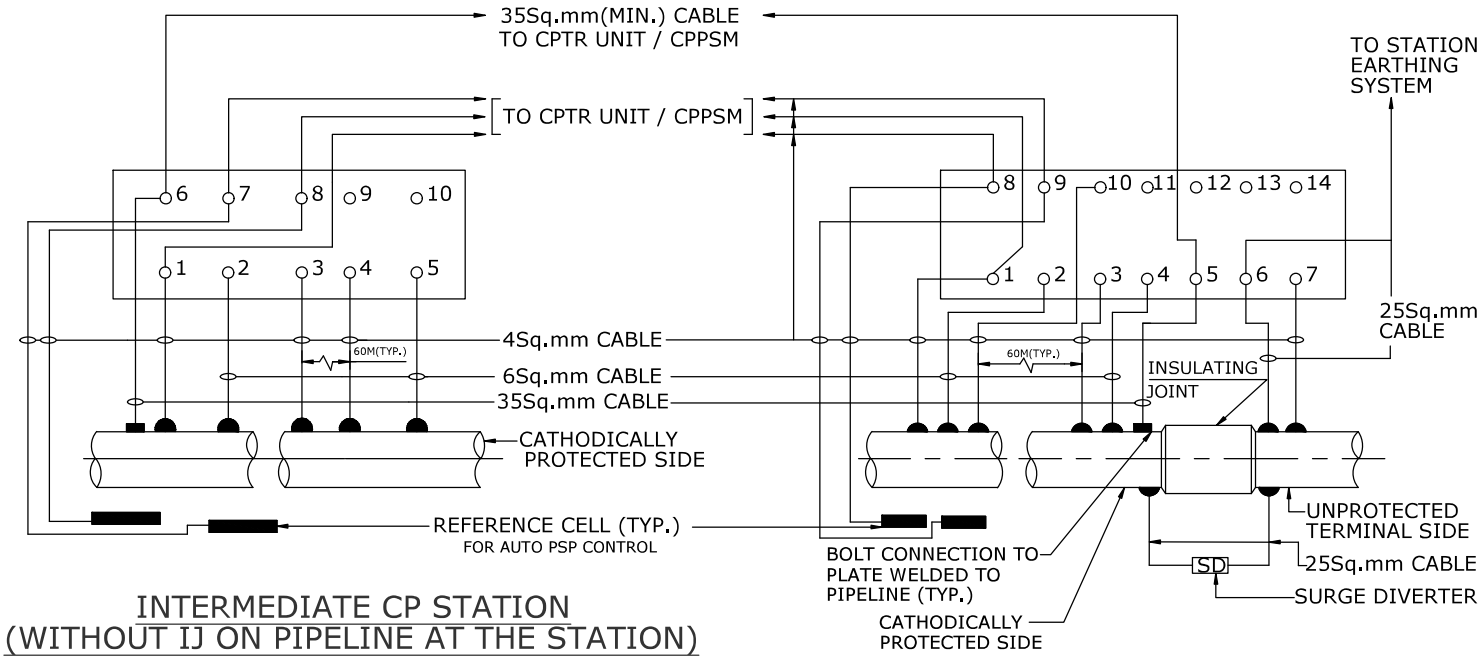
CASED CROSSING WITH COATED/PAINTED CASING (CONNECTION SCHEME-D)



FOREIGN PIPELINE CROSSING (CONNECTION SCHEME-E)

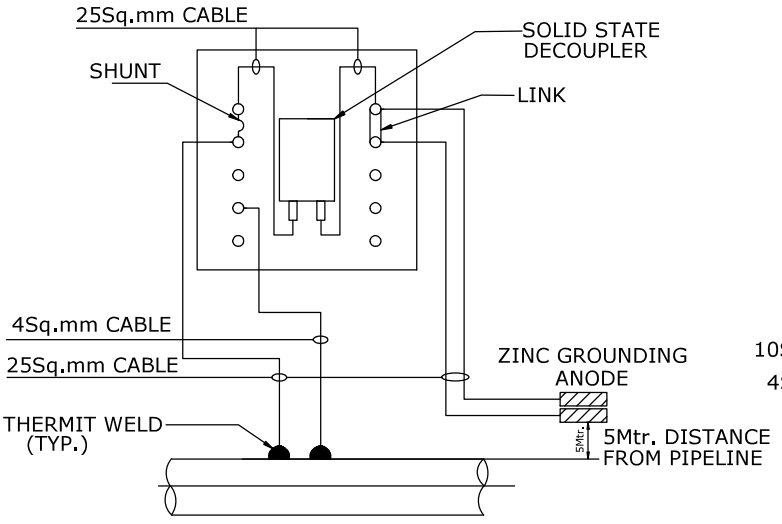
INSULATING JOINT CONNECTION (CONNECTION SCHEME-F)

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

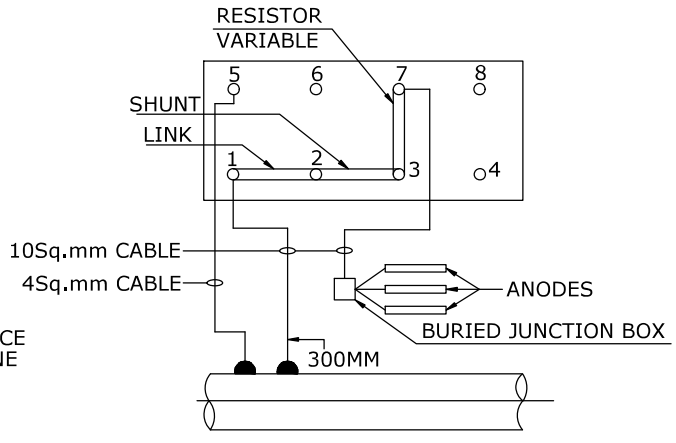


INTERMEDIATE CP STATION (WITHOUT IJ ON PIPELINE AT THE STATION) IMPRESSED CURRENT DRAINAGE POINT (CONNECTION SCHEME-G)

TERMINAL STATION IMPRESSED CURRENT DRAINAGE POINT (CONNECTION SCHEME-H)



PIPELINE GROUNDING THROUGH POLARIZATION CELL AND GALVANIC ANODE (CONNECTION SCHEME-M)

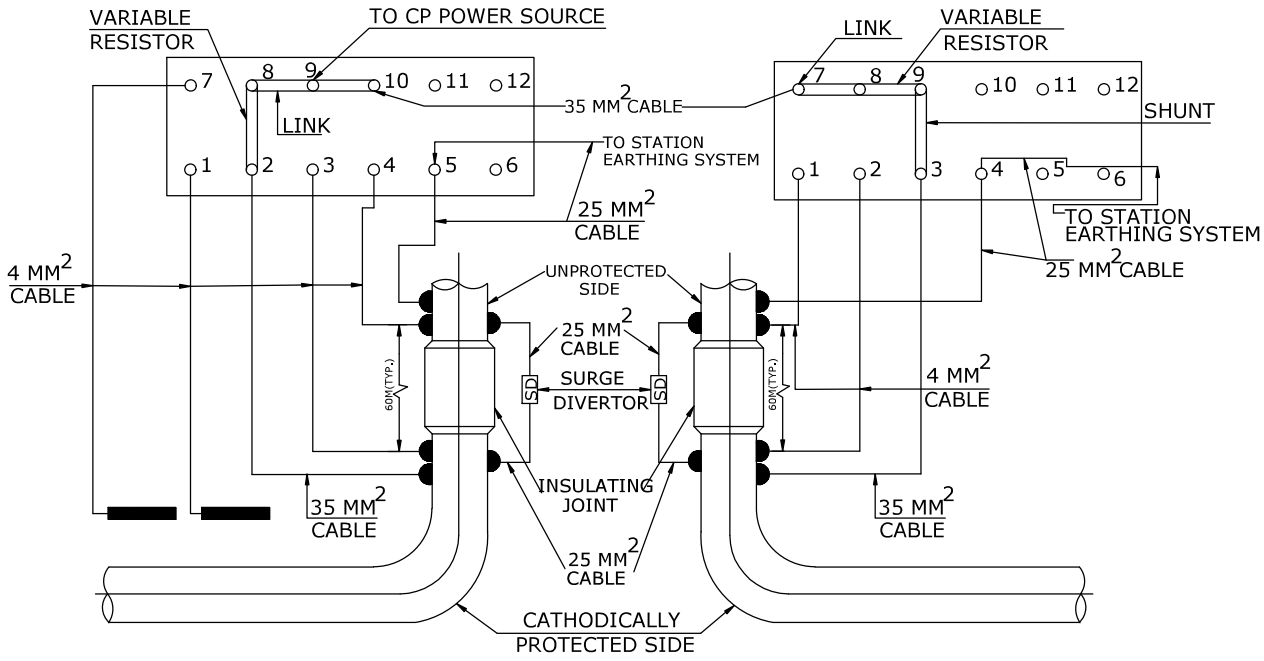


TCP GALVANIC ANODE INSTALLATION (CONNECTION SCHEME-L)

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

TEST STATION I-1

TEST STATION I-2



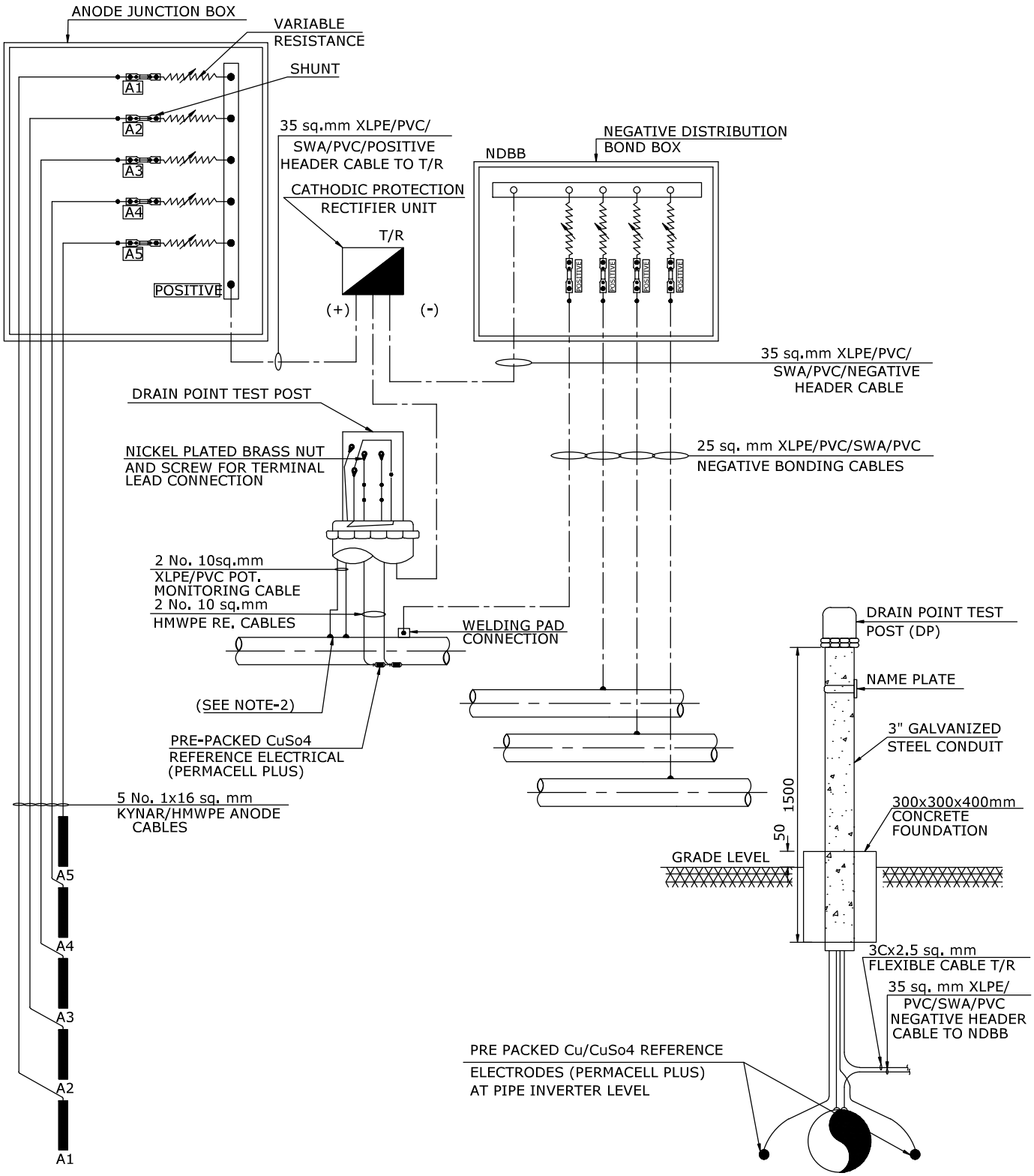
INTERMEDIATE PIGGING STATION
IMPRESSED CURRENT DRAINAGE POINT
CONNECTION SCHEME -I

NOTES:

1. NUMBER OF TERMINALS FOR TEST STATION OF DIFFERENT CONNECTION SCHEME SHALL BE AS SHOWN ON THE RESPECTIVE SCHEME DRAWING, TEST STATION FOR ANY OTHER SCHEME DRAWING. TEST STATION FOR ANY OTHER SCHEME SHALL PREFERABLY BE SIMILAR TO ANY OF THE ABOVE TYPES.
2. ELECTRICAL CONNECTIONS SHALL BE CLEANED TO BRIGHT SURFACE & TIGHTENED WITH NON-OXIDE GREASE APPLIED ON MECHANICALLY MATED SURFACE.
3. NUMBER OF TERMINALS FOR TEST STATION FOR GALVANIC ANODES FOR PERMANENT CP SYSTEM SHALL BE DECIDED BASED ON NUMBER OF ANODES.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	CATHODIC PROTECTION SCHEMATIC DIAGRAM	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4515		02	A4
		SHEET NO.	1 OF 1		



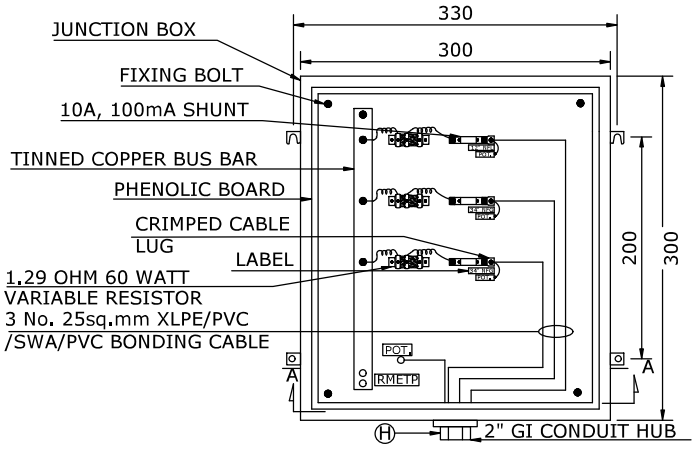
MMO ANODES GROUNDED

NOTES:

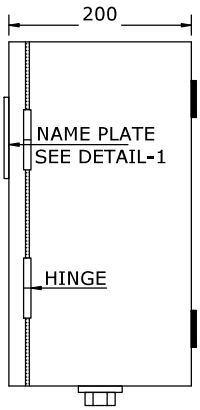
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ALL CABLES-TO-PIPE CONNECTIONS (EXCEPT DRAIN CONNECTION ON RMETP) FOR UNDERGROUND PIPELINE SHALL BE MADE VIA THERMITE WELDING AS PER DWG. STD.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

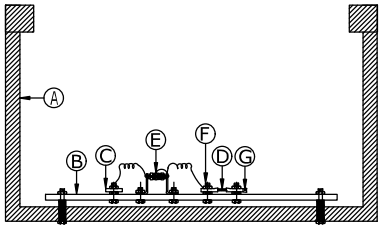
VCS QUALITY SERVICES PRIVATE LIMITED	CATHODIC PROTECTION SYSTEM EQUIPOTENTIAL BOND BOX (EBB) DETAILS FOR RMETP	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4516		02	A4
		SHEET NO.	1 OF 1		



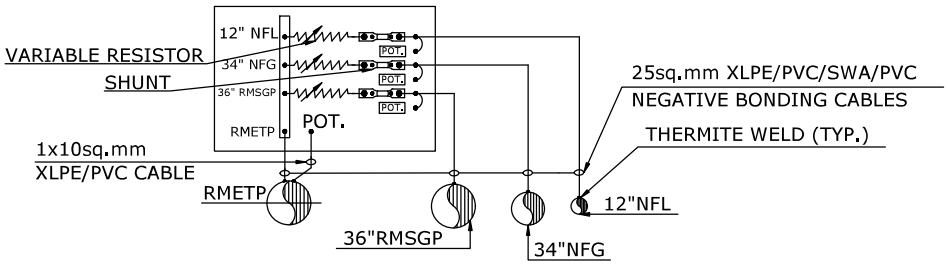
EQUIPOTENTIAL BOND BOX



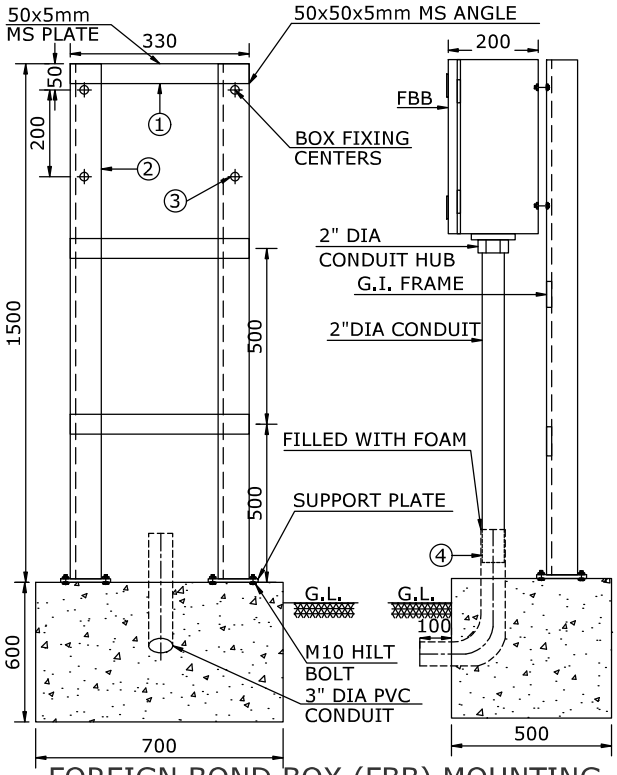
DETAIL-1
NAME PLATE DETAILS



SECTION A-A



TERMINATION DETAILS



FOREIGN BOND BOX (FBB) MOUNTING DETAILS (BY OTHERS)

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	3 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	3 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

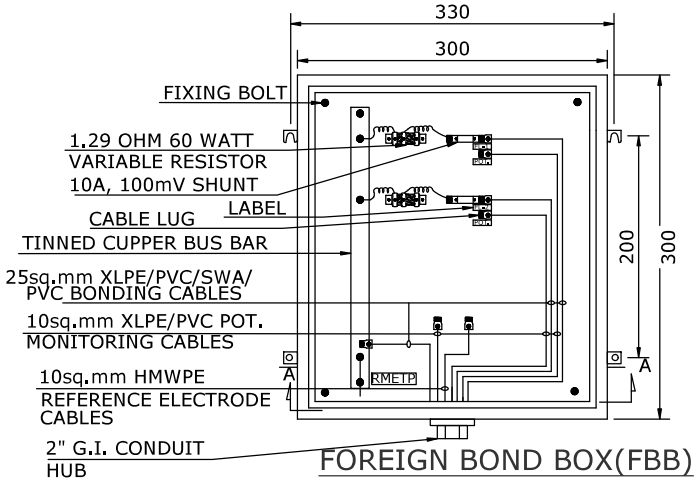
ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES,11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	3: PVC CONDUIT LENGTH TO SUIT.	NO	1
5.	2" G.I. CONDUIT LENGTH TO SUIT.	NO	1

NOTES:

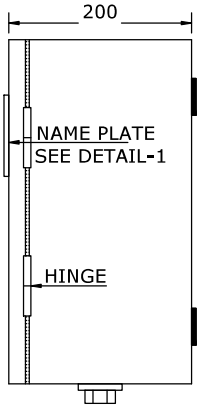
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	CATHODIC PROTECTION SYSTEM FOREIGN BOND BOX (FBB) DETAILS (2CIRCUITS)	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4517		02	A4
		SHEET NO.	1 OF 1		

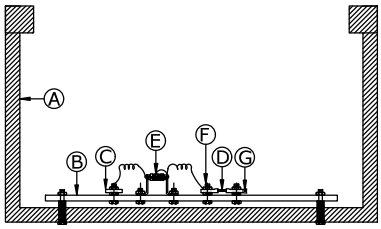


FOREIGN BOND BOX(FBB)

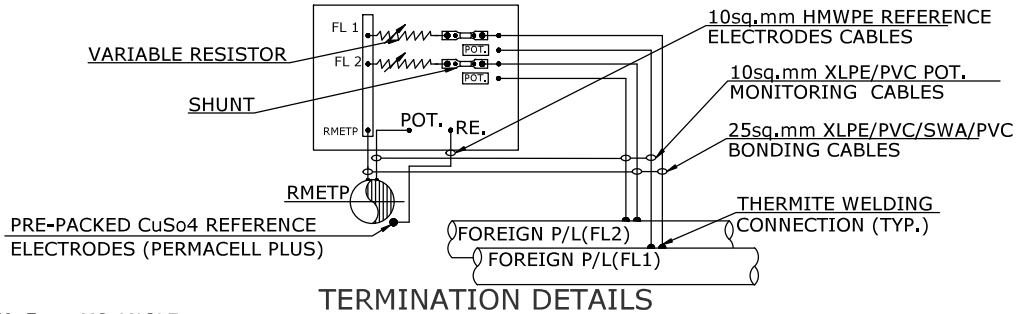


SIDE VIEW

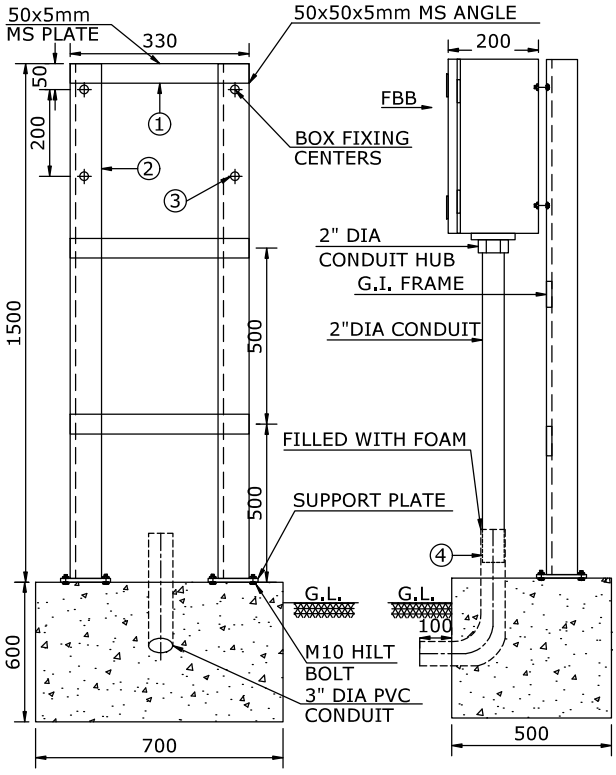
DETAIL-1
NAME PLATE DETAILS



SECTION A-A



TERMINATION DETAILS



FOREIGN BOND BOX (FBB) MOUNTING DETAILS (BY OTHERS)

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	2 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	2 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

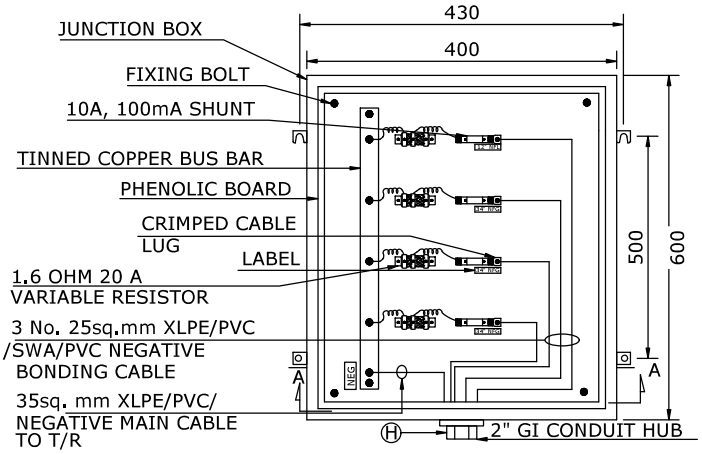
ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES,11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	CONDUIT LENGTH TO SUIT.	NO	1
5.	2" DIA PVC CONDUIT LENGTH TO SUIT.	NO	1

NOTES:

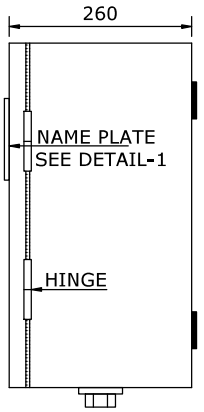
1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

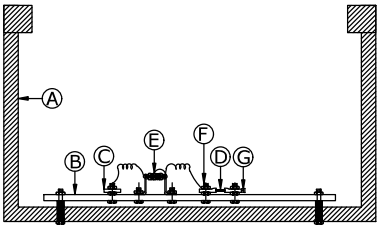
VCS QUALITY SERVICES PRIVATE LIMITED	NEGATIVE DISTRIBUTION BOND BOX (NDBB) DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4518		02	A4
		SHEET NO.	1 OF 1		



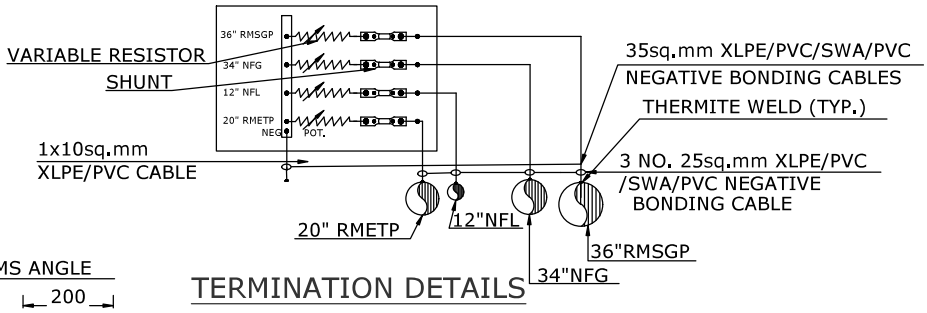
EQUIPOTENTIAL BOND BOX



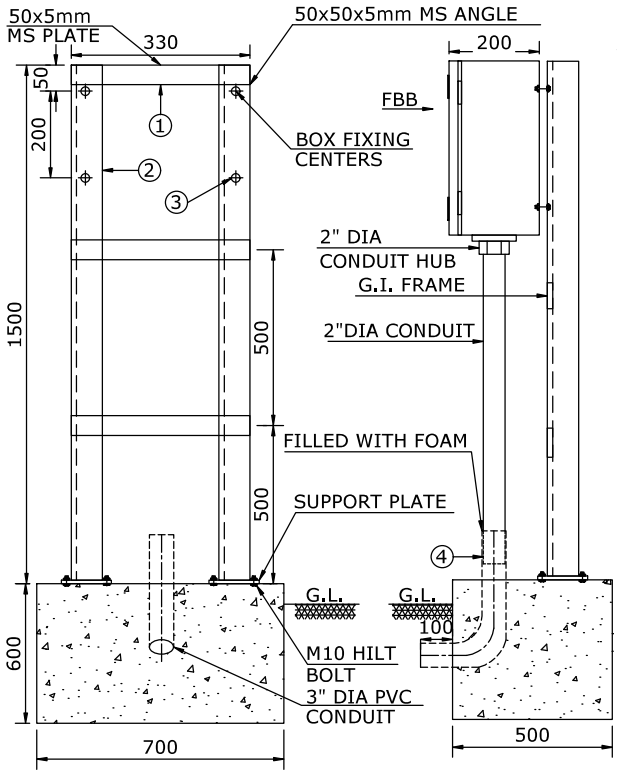
DETAIL-1
NAME PLATE DETAILS



SECTION A-A



TERMINATION DETAILS



NEGATIVE DISTRIBUTION BOND BOX MOUNTING DETAILS (BY OTHERS)

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 1.6mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	4 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	4 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	CRIMPED CABLE LUG	AS REQ.
H.	2" DIA G.I. CONDUIT HUB	1 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

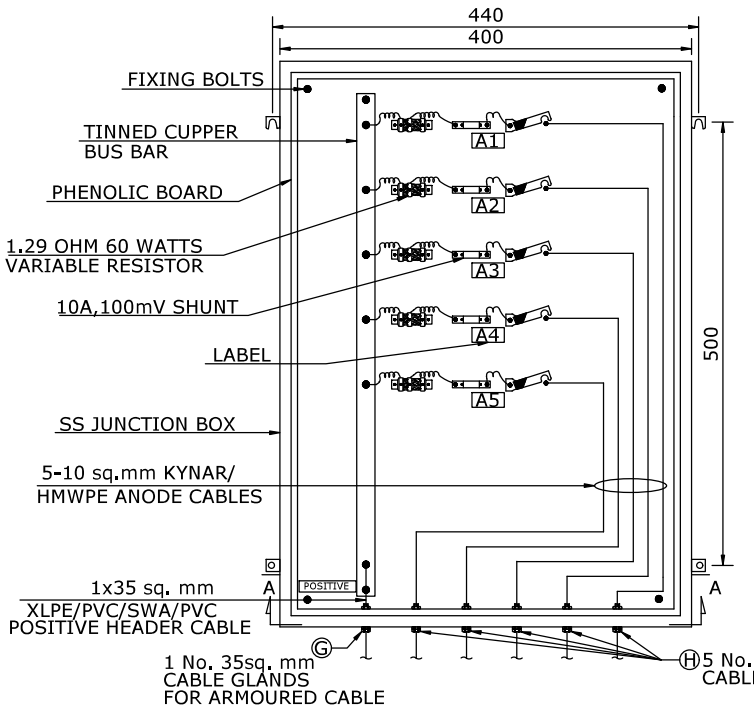
ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES,11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	3" PVC CONDUIT LENGTH TO SUIT.	NO	1
5.	2" G.I. CONDUIT LENGTH TO SUIT.	NO	1

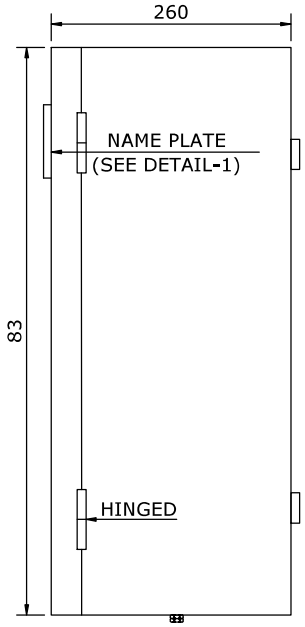
NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

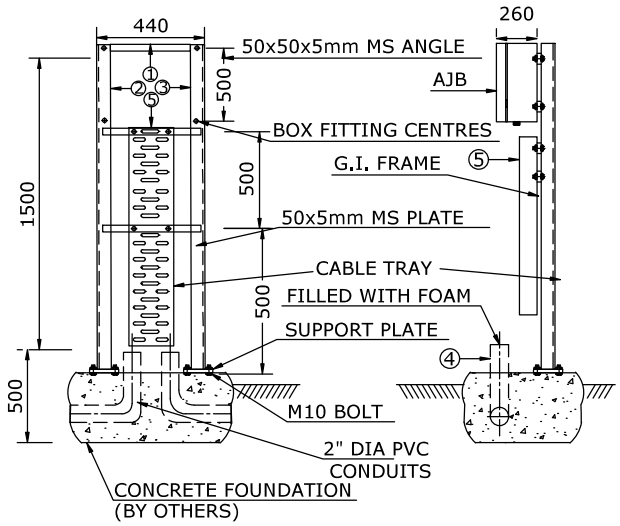
VCS QUALITY SERVICES PRIVATE LIMITED	CATHODIC PROTECTION SYSTEM ANODE JUNCTION BOX(AJB) DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4519		02	A4
		SHEET NO.	1 OF 1		



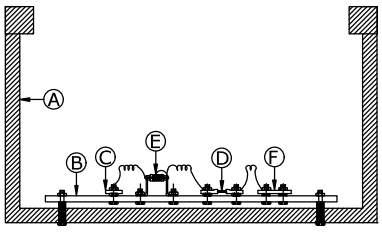


DETAIL-1
NAME PLATE DETAILS

ANODE JUNCTION BOX



ANODE JUNCTION BOX (AJB) MOUNTING DETAILS (BY OTHERS)



SECTION A-A

MATERIALS SCHEDULE

ITEM NO.	DESCRIPTION	QTY.
A.	PAINTED STEEL ENCLOSURE LOCKABLE TYPE RATED FOR IP 55 PROTECTION MIN. 3mm THICK.	1 No.
B.	PHENOLIC BOARD-6mm THICK	1 No.
C.	TINNED CUPPER BUS BAR 25x5mm PLATE	1 No.
D.	SHUNT 10A, 100mV	5 No.
E.	VARIABLE RESISTOR 1.29 OHM 60 WATTS.	5 No.
F.	BRASS TERMINAL C/W WASHER, LOCK WASHER & NUTS	AS REQ.
G.	BRASS CABLE GLAND (35 sq. mm)	1 No.
H.	BRASS CABLE GLAND (10 sq. mm)	5 No.
I.	COPPER CABLE LINK	5 No.

MOUNTING FRAME MATERIAL SCHEDULE (BY OTHERS)

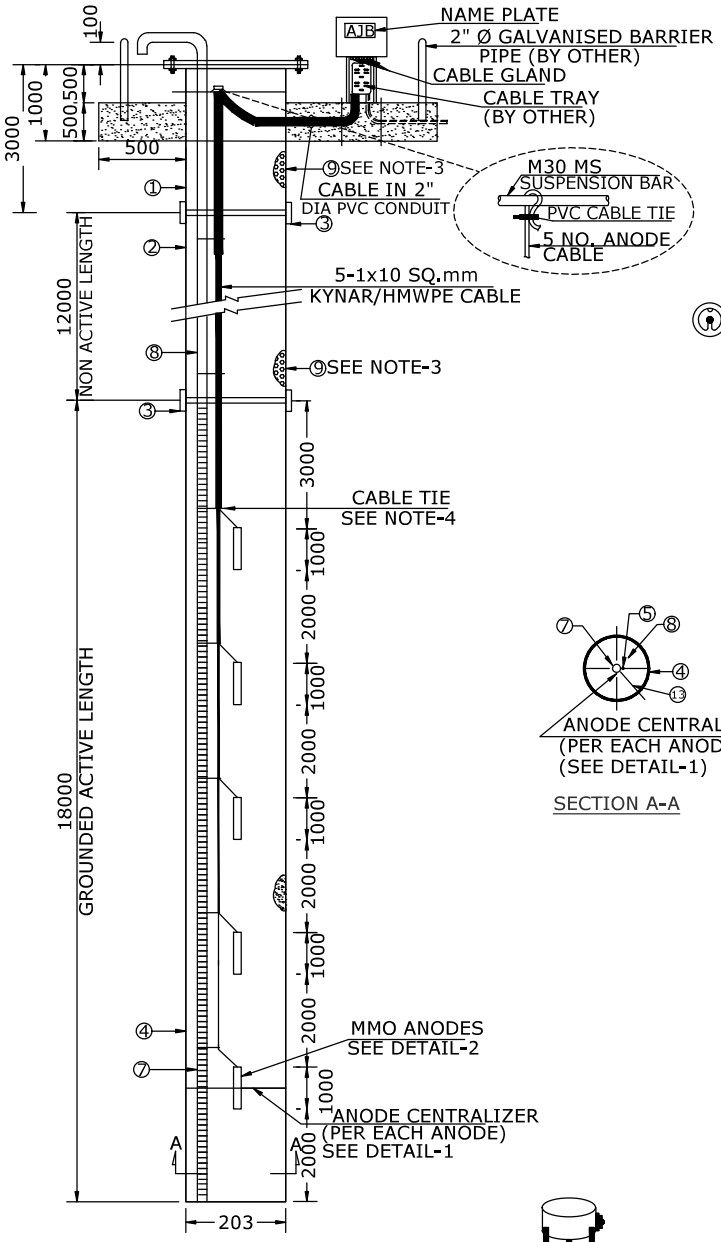
ITEM NO.	DESCRIPTION	UNIT	QTY.
1.	MS FLAT SIZE 50x5mm, LENGTH TO SUIT	NO	3
2.	MS ANGLES SIZE 50x50x5mm, OVERALL LENGTH 1500mm	NO	2
3.	FRAME AND BOX FIXING HOLES,11mm DIAMETER AND STAINLESS STEEL SET SCREWS, NUTS AND WASHERS	NO	4
4.	2" DIA PVC CONDUIT LENGTH TO SUIT.	NO	2
5.	CABLE TRAY LENGTH TO SUIT (APPROX. 800mm)	NO	1

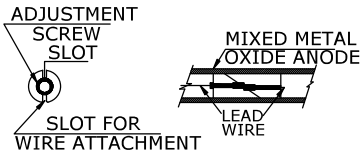
NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.

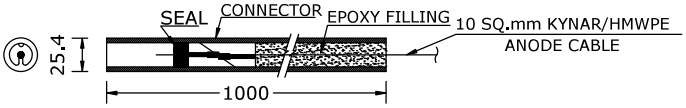
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	19.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VCS QUALITY SERVICES PRIVATE LIMITED	DEEP WELL GROUNDED INSTALLATION DETAILS	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4520		02	A4
		SHEET NO.	1 OF 1		



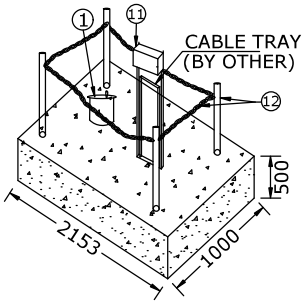


CONNECTOR INSTALLATION

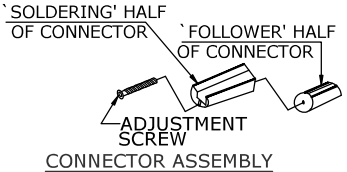


DETAIL-2
MMO TUBULAR ANODE DETAILS

SECTION A-A



CONCRETE FOUNDATION DETAILS (BY OTHERS)



CONNECTOR ASSEMBLY

DETAIL-1
ANODE CENTRALIZER

MATERIAL TAKE-OFF

ITEM NO.	DESCRIPTION	QTY.
1.	HEAD WORKS INCLUDING BLIND FLANGE VENT AND CABLE ROPE HANGER	1M
2.	PVC CASING, 203 MM Ø	6M
3.	STEEL THREADED COLLAR	2 No.
4.	STEEL CASING 203mm DIA WITH END SEALED (BY OTHER)	18M
5.	MIXED METAL OXIDE TUBULAR ANODES WITH 16 SQ. mm KYNAR/HMWPE CABLE	5 No.
6.	CALCULATED PETROLEUM COKE BREEZE	800kG
7.	PERFORATED PVC VENT PIPE (25mm Ø)	16M
8.	UNPERFORATED PVC VENT PIPE (25mm Ø)	16M
9.	CLEAN SHINGLE 12mm Ø (BY OTHER)	AS REQ.
10.	M30 M.S. SUSPENSION BAR	1 No.
11.	ANODE JUNCTION BOX (450x450x260)	1 No.
12.	CRASH GUARD (BY OTHER)	AS REQ.
13.	ANODE CENTRALIZER	5 No.

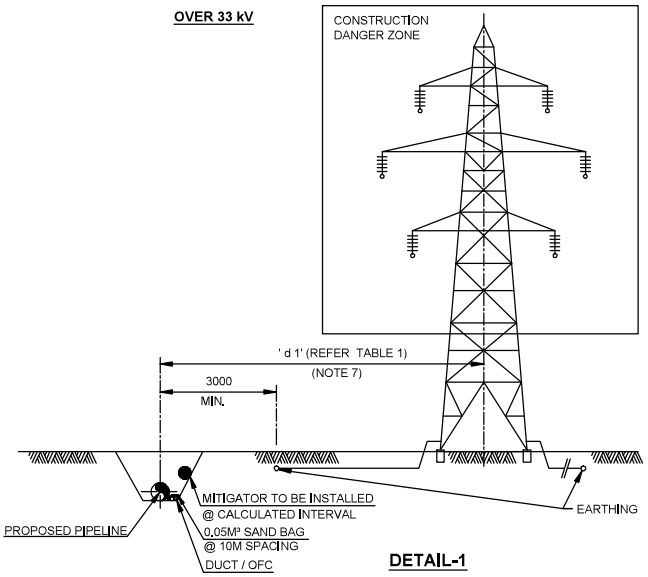
NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. ACTIVE LENGTH (16mm) SHALL BE FIELD WITH CALCINED PETROLEUM COKE BREEZE.
3. ONCE THE COKE BREEZE COLUMN BECOMES HARD, INACTIVE LENGTH TO BE FIELD WITH CLEAN SHINGLE 12mm DIA (BY OTHER)
4. CABLES TO BE TIED TO THE VENT PIPE USING PVC CABLE TIE.
5. CABLES TO BE TIED TO THE SUSPENSION ROC USING PVC CABLE TIES.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

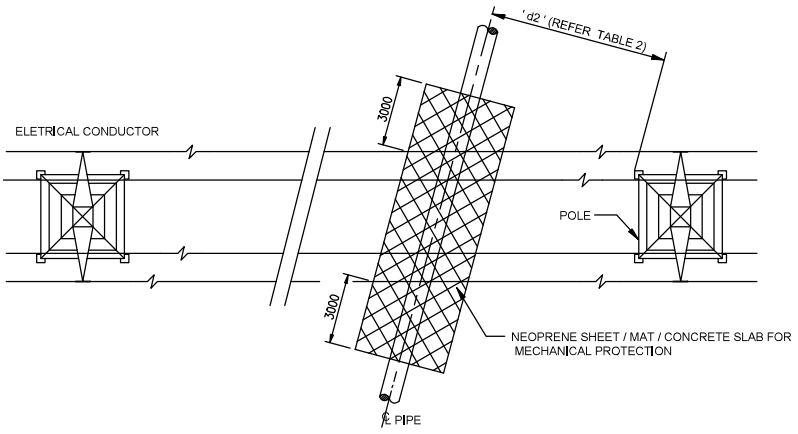
VCS QUALITY SERVICES PRIVATE LIMITED	TYPICAL DRAWING FOR OVERHEAD POWER LINE FOR PIPE LINES	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-EL-4521		02	A4
		SHEET NO.	1 OF 1		

PARALLELISM TO HIGH VOLTAGE TRANSMISSION LINES

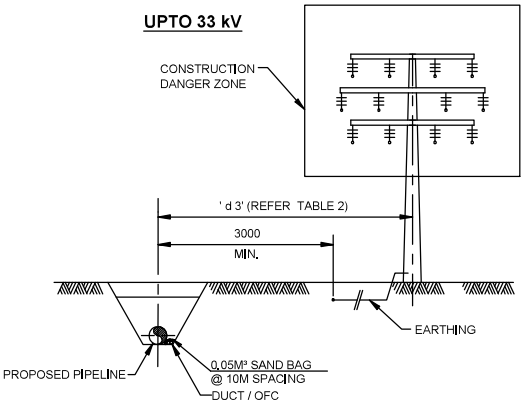


DETAIL-1

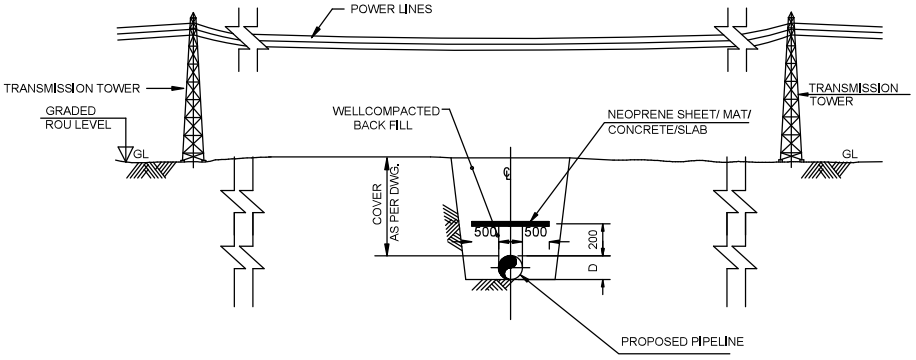
CROSSING OF HIGH VOLTAGE TRANSMISSION LINES



DETAIL-2



DETAIL-3



DETAIL-4

NOTES:

1. ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
2. IN CASE THE MINIMUM DISTANCE IS NOT MET, THE LOCAL ELECTRICAL COMPANY HAS TO BE CONTACTED FOR APPROVAL.
3. CONSIDERATION SHOULD BE GIVEN TO LIGHTNING FAULT, CURRENT PROTECTION OF PIPELINE & SAFETY OF PERSONNEL.
4. IN CASE OF CROSSING OF HIGH VOLTAGE TRANSMISSION LINES, MIN. DISTANCE SHALL BE MAINTAINED AS PER TABLE-1.
5. SUITABLE MEASURE SHALL BE TAKEN FOR THE PROTECTION OF THE LINE AS PER TABLE-2.
6. CONCRETE SLAB/ NEOPRENE / MAT SHALL BE PROVIDED FOR OHL CROSSINGS FOR 11 KV AND ABOVE AS PER REQUIREMENTS.
7. AS PER NOTE-4 MIN. DISTANCE IS NOT FEASIBLE THEN PLEASE REFER THE DETAILS-A

TABLE 1

IF THE OHL IS RUNNING PARALLEL TO THE PIPE LINE MORE THEN 100mtrs. MAINTAIN THE MINIMUM DISTANCE FROM CENTERLINE OF PIPELINE TO POWER TRANSMISSION STRUCTURES / LINE

Right of Way Clearance (As per Standard)

KV	Min ROW
66 KV	18 Meter
132 KV	27 Meter
220 KV	35 Meter
400KV	52 Meter (Single Circuit)
400 KV	48 Meter (Double Circuit)

TABLE 2

Minimum Clearance Between Power Lines to other metal / human safety distance at Nominal System Voltage of line.

KV	METER
11 KV	2.44 Meter
33 KV	2.44 Meter
66 KV	2.44 Meter
132KV	3.05 Meter
220KV	4.58 Meter
400KV	6.10 Meter

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
02	06.05.22	RE-ISSUED AS STANDARD DRAWING	SY	RD	AA	HK
01	18.12.19	RE-ISSUED AS STANDARD DRAWING	SY	VV	AD	SK
0	15.05.17	ISSUED AS STANDARD	SY	RD	AD	SK

VOLUME C
(CIVIL)

Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
EARTHWORK IN SITE GRADING

VCS-SS-CS-6002

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
03	31.01.2022	NV	GDS	HK	GW
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01	16.10.2019	MA	MO	AD	SK
00	05.07.2017	MA	MO	AD	SK

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REVISION RECORD						
Rev.	**Revision Date**	**Prepared by**	**Checked by**	**Approved by**	**Authorized by**	**Revision Description**
00	**05.07.2017**	**MA**	**MO**	**RKB**	**AD**	**Issued for use as Standard**
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02	**14.02.2020**	**NV**	**GDS**	**RKB**	**SK**	**New revision system updated**
03	**31.01.2022**	**NV**	**GDS**	**HK**	**GW**	**VCS QMS Integration**

ABBREVIATION

m	Metre
Mm	Millimetre
IS	Indian Standard
m2	Square metre
GPS	Global Positioning System
VCS	VCS Quality Services Pvt Ltd

CONTENTS

1.0 SCOPE

This specification and the method of measurements described thereon are applicable for earthwork involved in Site Grading & Rock Cutting

2.0 REFERENCES

2.1 BIS CODES

IS: 2720 Part IV - Methods of tests for soils, Part-V- Grain size Analysis

IS: 2720 Part V - Methods of tests for soils, Part 5- Determination of liquid & plastic limit.

IS: 2720 Part VI - Methods of tests for soils, Part 6- Determination of shrinkage factors.

IS: 2720 Part VII - Methods of tests for soils, Part 7- Determination of water content dry density relation using light compaction.

2.2 VCS SPECIFICATIONS

VCS-SS-CS-6003 Earthwork for underground piping

VCS-SS-CS-6022 Earthwork in Foundations

NOTE: - Latest Edition of all Codes and Standards shall be followed.

3.0 GENERAL

3.1 CONTRACTOR shall maintain adequate drainage facilities at SITE at all times during the execution of work. Additional ditches, drains & such other temporary means to achieve this, over and above what is shown in the drawings, shall be provided and maintained by CONTRACTOR at his own cost.

3.2 Adequate dewatering facilities like dewatering pumps and piping etc. shall also be provided by the CONTRACTOR for this work, including dewatering during excavation etc. as required, at his own cost.

4.0 MATERIAL FOR EARTHWORK

4.1 Only soil considered suitable by the Engineer-in-charge shall be deployed for the construction and that considered unsuitable shall be disposed off, as directed by Engineer-in-charge, at his own cost and no claim for compensation will be entertained.

4.2 The CONTRACTOR shall give the samples of soil he proposes to use for filling, along with the following characteristics of the samples, to Engineer-in-charge for approval, prior to collection and use. The tests for these characteristics shall be done in a laboratory / test house as approved by Engineer-in-charge.

a. Mechanical analysis or grain size analysis as per IS: 2720 Part IV.

b. Liquid limit as per IS: 2720 Part V.

c. Plastic limit as per IS: 2720 Part V.

d. Determination of Shrinkage limit factors as per IS: 2720 Part VI.

e. Determination of water content dry density relation using light compaction as per IS: 2720 Part VII.

4.3 The soil used for filling shall be free from boulders, lumps, tree roots, rubbish or any organic deleterious matter.

4.4 Soil having plasticity index less than 20 shall be used for filling purpose.

4.5 Soil having laboratory maximum dry density of less than 1.5 gm/cc shall not be used.

4.6 Care shall be taken to see that unsuitable waste material is disposed off in such a manner that there is no likelihood of its getting mixed with the material, proposed to be used, for filling.

4.7 The work shall be so planned and executed that the best available soil is reserved for the top portion of Embankments.

5.0 CUTTING TREES

5.1 All trees having girth above 30 cms, which are not marked for preservation, shall be cut down and their roots dug up to a depth of 1 metre from the existing ground level.

5.2 All holes or hollows produced by digging up roots shall be carefully filled with approved soil, including all leads and lifts, rammed and compacted to obtain 90% of maximum laboratory dry density of soil and levelled as directed.

5.3 All uprooted trees shall be stacked or disposed off as directed by Engineer-in-charge.

5.4 PAYMENT

This clause shall apply to item rate tenders only.

Cutting of trees above 30 cms girth shall be paid per number. The rate quoted shall include cutting, uprooting removing the trees within plant boundary as directed, including filling holes or hollows produced by removal of roots etc. as per specifications.

6.0 CLEANING AND STRIPPING

6.1 All the areas, including depressions, where filling or cutting is to be carried out shall be cleared and stripped completely of bushes, roots, vegetation, plantation trees, shrubs, trees up to 30 cms girth, organic and other objectionable materials. All these shall be completely uprooted and virgin soil exposed and not merely scrapped at the surface. The roots of trees of girth up to 30 cms shall be removed to a minimum depth of 1m below existing ground level and holes, hollows filled up with selected approved available soil within all leads and lifts and compacted to obtain 90% of

laboratory dry density of soil as per IS: 2720, Part VII and leveled as directed by Engineer-in-charge. All soft patches must be worked out to remove soft soil and selected approved earth must be filled back and the areas (areas coming under filling) compacted to obtain 90% of maximum laboratory dry density of soil, as per IS: 2720 Part VII. The depth of stripping shall be generally 50 to 150 mm as decided by Engineer-in-Charge.

6.2 Material obtained from clearing shall be stacked or disposed off as directed by Engineer-in-charge within a lead as per directions of Engineer-in-Charge.

6.3 PAYMENT

This clause shall apply to item rate tenders only.

No separate payment shall be made for clearing, stripping and disposal of materials obtained from clearing. This shall be considered as part of cutting work in areas of cutting and filling work in areas of filling and the rates quoted under the respective items of

a. Earthwork in Excavation/ Cutting

b. Earthwork in filling (both with available earth & earth obtained from approved borrow areas), shall be inclusive of clearing and stripping with all operations described above in clause no.6.0 in respective areas of cutting and filling.

No separate payment shall be made for clearing, stripping and disposal of materials obtained from clearing of borrow areas for earth. This shall be considered as part of filling work in area of filling and the rate quoted under the respective items.

7.0 EARTHWORK IN EXCAVATION/CUTTING

7.1 After clearing and stripping of areas as specified above in clause No.6.0, spot levels at intervals and pattern as decided by the Engineer-in-charge, shall be taken jointly by CONTRACTOR and Engineer-in-charge. Excavation / cutting shall commence only after the levels are signed by the contractor as a token of his acceptance.

7.2 Excavation/ cutting shall be carried out strictly as per the instruction of Engineer-in-charge.

7.3 If the contractor excavates/ cuts beyond the required level, additional quantity of earthwork shall not be paid for. The excavation taken below the specified level shall be made good by filling with approved material, to the required compaction, at Contractor's cost.

7.4 The final bed and sides of excavation must be levelled, dressed and compacted. In case of areas under excavation for site grading, the final surface shall be levelled, dressed and consolidated by means of sheep foot / power driven rollers to obtain maximum compaction. However, no test control is required in such areas.

7.5 Shoring and strutting shall be adopted only with the permission of Engineer-in-charge in writing. Such shoring and strutting shall follow the necessary specification.

7.6 Provisions for dewatering shall be governed by the relevant clauses.

7.7 Payment

This clause shall apply to item rate tenders only.

Payment for Excavation shall be on the basis of volume of excavation calculated on the basis of joint level taken as per clause 7.1 and the final finished grade levels, the volume being calculated by the Trapezoidal rule including dewatering, if required. Intermediate payment will be on the basis of volume calculated based on spot levels taken during the time of the billing. Reference is also invited to clause 7.3.

8.0 EARTHWORK IN FILLING

8.1 After clearing, stripping and consolidation of areas as specified in clause 6.0, spot levels at intervals and pattern as decided by Engineer-in-charge shall be taken jointly by the CONTRACTOR and Engineer-in-Charge and filling shall commence only after the levels are signed by the CONTRACTOR as a token of his acceptance. Approved fill Material shall be spread in uniform layers not exceeding 30 cms in loose depth.

The contractor has to make his own approach and access roads from the borrow area to the demarcated filling areas. While the CONTRACTOR may make use of such short cuts as may be available to him for earth movement from borrow areas to the filling areas, the OWNER does not guarantee any passage way or right of way for the CONTRACTOR'S work other than available at site. No claim shall also be admissible to the CONTRACTOR on account of his having to take longer leads or routes for earth movement, than envisaged by him, either due to any road cuttings, non-availability of routes, or any other grounds whatsoever.

In case total filling required in any area consists of soil both from borrow areas and available approved excavated material from within plant area, then joint levels, shall be taken before commencing filling with earth from borrow area.

However, earth available from borrow areas required for filling can be used only after the available earth from excavation within demarcated area has been utilized and clearance to this effect obtained from the Engineer-in-charge.

8.2 All clods, lumps etc, shall be broken before compaction.

8.3 Successive layers of filling shall not be placed until the layer below has been thoroughly compacted and tested to satisfy the requirements laid down in this specification.

8.4 Prior to rolling, the moisture content of material shall be brought to within plus or minus 2% of the Optimum Moisture Content as described in IS: 2720 Part VII. The moisture content shall preferably be on the wet side for potentially expansive soil.

8.5 After adjusting the Moisture Content as described in clause 8.4, the layers shall be thoroughly compacted by either sheep foot roller or power driven roller or vibratory roller, as approved by Engineer-in-charge, till the specified maximum laboratory dry density is obtained.

8.6 Each layer shall be tested in field for density and accepted by Engineer-in-charge, subject to achieving the required density, before laying the next layer. A minimum of one test per 500m2 for each layer shall be conducted.

8.7 If the layer fails to meet the required density, it shall be reworked or the material shall be replaced and method of construction altered as directed by Engineer-in-charge to obtain the required density.

8.8 The filling shall be finished in conformity with the alignment, levels, cross-section and dimensions as shown in the drawing.

Earthen embankment shall be filled 300mm more on both sides, where height is more than 1M and this extra filling shall be dressed, after compaction, in conformity with alignment, level, cross-section and dimension as shown in the drawing, to achieve proper compaction in the slope. No extra payment shall be made in this regard.

8.9 Extra material shall be removed and disposed off as directed by the Engineer-in-charge.

8.10 Tolerances

8.11 General site grading, including cutting and filling in depressions, shall be carried out to within up down tolerance of +5 cms of final lines, grades and slopes.

Earth Work In Filling In Open Lined/Unlined Wells

For earth work in filling in open lined/unlined wells, only locally available coarse sand shall be used, in layers of 500 mm thickness. Each layer shall be thoroughly wetted by sprinkling water, before next layer is filled up. Filling shall be done upto lm depth below NGL as above. Layers from a depth of lm below NGL, upto NGL, shall also comprise of locally available coarse sand and compacted with suitable Mechanical / manual means,

to obtain same level of compaction as required for filling above NGL. Filling above NGL shall be done as per CI. 8.1 to 8.10 above.

8.12 Payment

This clause shall apply to item rate tenders only.

a. Payment for filling shall be made on cubic metre of volume calculated on the basis of cross section plotted from the levels of ground, where filling is to be carried out and the levels reached after filling is duly consolidated, volume being calculated by Trapezoidal method.

b. In case of simultaneous cut and fill operation, wherever specified, payment shall be made on the basis of one composite rate for cutting and filling. All other details about measurement etc. remaining same as above.

c. Payment for filling in open wells, lined or unlined, shall be made on the basis of volume calculated on the basis of average area multiplied with depth of open well

d. No extra payment shall be made towards testing.

9.0 REMOVAL OF SURPLUS EARTH

9.1 Surplus earth and soil from excavation and general site grading shall be removed from the construction areas to the area demarcated by the Engineer-in-charge.

9.2 Payment

This clause shall apply to item rate tenders only.

Payment shall be made only for lead beyond initial lead from construction area. Rate shall include loading, transportation, dumping, stacking the surplus earth and soil in the area demarcated by the Engineer-in-charge.

Payment shall be made on cubic metre basis of the difference of measurements of the volumes of the excavation and the measurement of the filling with the excavated earth. However, the contractor's entitlement to payment shall be restricted to the actual quantity of earth removed. Quantity generated due to void in back filled volume of earth shall also be removed by the contractor at no extra cost and this disposal of earth shall not be measured and paid under any item.

10.0 EXCAVATION IN ROCK

Blasting operations for site grading shall be carried out as per specification No. VCS-SS- CS-6022.

Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
EARTHWORK FOR UNDERGROUND PIPING

VCS-SS-CS-6003

Rev. No	Date	Prepared By	Checked By	Approved By	Authorized By
03	31.01.2022	NV	GDS	HK	GW
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Rev.	**Revision Date**	**Prepared by**	**Checked by**	**Approved by**	**Authorized by**	**Revision Description**
00	**05.05.2017**	**MA**	**MO**	**RKB**	**AD**	**Issued for use as Standard**
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ABBREVIATION

m	Metre
Cm	Centimetre
Mm	Millimetre
Km	Kilometre
U/G	Underground

CONTENTS

1.0 SCOPE

This specification deals with earthwork in trenches and pits (for valves, manholes, catch pits etc.) for underground piping.

2.0 REFERENCES

BIS CODES

IS: 783	Code of practice for laying of RCC pipes.
IS: 1200 (Part-I)	Method of measurement of building and civil engineering works.
IS: 3764	Excavation work - code of safety.

2.2 SPECIFICATIONS

VCS-SS-CS-6002	Earthwork in Site Grading
VCS-SS-CS -6022	Earthwork in Foundations

NOTE: - Latest Edition of all Codes and Standards shall be followed.

3.0 MATERIAL

All workmanship and materials shall conform to the provisions of IS: 1200 (Part-1) and IS: 3764.

4.0 EARTHWORK IN EXCAVATION FOR TRENCHES / PITS FOR PIPELINES

4.1 Excavation

Plant, machinery and equipment's for excavation shall be selected and deployed to provide optimum mechanization in excavation of trenches and pits. The selection for excavation and earth movement machinery etc. shall take into account type of materials to be excavated, method of excavation, prevailing weather conditions and type of transport to be used.

The excavation of area of cut shall be so timed that the bottom level is not exposed to the deteriorating influence of the weather for longer duration.

Excavation and earth moving equipment shall be deployed such that minimum damage is caused to the natural sub-soil structure of exposed formations.

The monitoring of soil deformations, ground water levels during and possibly after construction work shall be taken into consideration.

In the event, when excavation works are carried out in the vicinity of structures of any importance, the above monitoring shall be carried out within a distance, from the edge of the excavation of 5 to 15 times the excavation depth, depending upon the subsoil conditions and the stability of the neighboring structures.

4.2 Trenching work shall be carried out in all classes of soil including soft rock and excluding hard rock and shall be for all depths.

4.3 The trench shall be cut true to the line and level as per drawings.

4.4 If the trench is excavated below the required level than that indicated in the drawing, the extra depth shall be filled with concrete 1:5:10 or approved equivalent materials, as directed by the Engineer-in-Charge, at no extra cost to the owner.

4.5 In case of pressure piping, the trench shall be excavated generally as to provide a cover of 1000 mm or dia of pipe whichever is more. In case of gravity sewers/ pipes, the trench shall be excavated to conform to invert levels as per drawings. However in certain cases, the pipes may run at shallower levels or at deeper levels depending upon drawing, site condition etc. No rebate for lesser excavations, nor extra payment due to deeper excavations, shall be admissible in those cases where pipeline laying rates are inclusive of earthwork items. The rates quoted shall be deemed to cover all works connected with trenching, whether trenches are with single pipeline or have multiple pipelines in common trenches including road cutting and making good the same.

4.6 The width of the trench shall be sufficient to give free working space of personnel, equipment, supports and ancillaries on each side of the pipe. The free working space shall conform to IS: 783.Generally it shall not be less than 150 mm on either side or 1/3 dia of outer diameter of the pipe, whichever is greater.

4.7 When pipelines are running parallel, whether the trenching shall be individual or common, shall be decided by the Engineer-in-Charge and such decision shall be final and binding on the contractor. No extra shall be payable for common excavations.

4.8 All earthwork involved in excavations of all types of manholes, catch pits, valve chambers, inspection chambers, chambers for instrumentation tapping etc., which are coming on the alignment of U/G piping or as defined by drawing as a part of U/G piping work, shall be paid extra under Earth work in excavation, back filling and removal of surplus earth etc. under relevant clauses of the SOR.

4.9 Aspects such as variations in the soil conditions and the geological structure, depth of excavation, the existence of ground water and surface water, the type and extent of excavation, the topography of site, the proximity of items such as roads, buildings and buried services, construction traffic and activities near the excavation eg. stock piling shall be taken into account when determining whether the sides of excavation should be free standing, sloping or temporary supported.

Suitable drainage and / or dewatering system like Well Point method / Bore well method etc. shall be provided to prevent or limit ingress of surface or sub surface water into excavation.

Serviceable materials intended for reuse should be used as soon as possible after excavation otherwise they should be stock piled at a location beyond 1.5m from the top edge of the excavation or beyond a distance equal to the depth of the excavation whichever is higher at a location approved by the Engineer-in-charge. If excavated serviceable material is not possible to be stacked within the limits specified above, due to some constraint, it shall be stacked away at a location approved by Engineer-in-Charge and paid separately under relevant item.

Areas used for temporary stockpiling of excavated material shall be kept clean and orderly, with excavated material kept by the side of road to avoid traffic movement. Excavated areas shall be restored to their original condition before completion of works.

types of shoring and strutting, wherever necessary, shall be adopted to with hold the face of earth or cutting in slope, as per site requirements and direction of Engineer-in-Charge. Supports shall be maintained such that the integrity of the sides of the excavation is not impaired.

4.10 Any obstacle encountered during excavation shall be reported immediately to the Engineer-in-Charge and shall be dealt with as instructed.

4.11 The contractor shall maintain all excavated trenches and pits, in a dry and trim condition.

4.12 Necessary barricading and protection of slopes against slips due to traffic movement shall be provided to the satisfaction of Engineer-in-Charge. Necessary warning flags and lights shall be provided to caution traffic in the areas where trenches and/ or pits are provided.

4.13 In case of road cutting, all road material i.e. metal etc., shall be taken out carefully and kept separately for reuse and road work shall be redone up to the original level, as it was prior to cutting the road, with the excavated road materials after laying and testing of the pipeline, within 10 days from the date of starting this work, at the cost of the contractor. The contractor shall provide suitable warning signs and barricades to prevent accidents.

Contractor shall also provide reasonable bye pass at his own cost when a road is cut for Laying pipeline. Tankage dykes cut due to laying of the pipes, shall be redone conforming to the original specifications, by the Contractor at his own cost. Secondary dykes, to take care of any eventuality during construction, shall be provided by the Contractor at his own cost.

4.14 Dewatering shall be done in advance of the installation of the pipe to allow adequate inspection of padding of the bottom, if required. Dewatering shall be continued throughout during installation and backfilling.

The trench shall follow the gradient of pipeline as specified in the drawing. The contractor shall keep the trench in good condition, until the pipe is laid and tested. No extra claim shall be entertained due to its caving or setting down, either before or after the pipe is laid.

In case, pipe is lowered in caved trench and backfilled before being inspected by the Engineer-in-Charge, the Contractor shall re-excavate the trench for inspection and backfill it at his own cost.

5.0 BACKFILLING AND COMPACTION IN TRENCHES AND AROUND VALVE PITS, MANHOLES ETC.

BACKFILLING

Trenches shall be back filled with suitable materials which should be compacted to the same degree or better as the surrounding soils.

5.1 The soil used should be selected and approved by Engineer-in-Charge. Suitable material can be extracted from available excavated material. The soil should be free from rubbish, grass, organic matter, stones, building waste and Black Cotton Soil etc. It should be free from clods and hard lumps. In case good soil is not available from excavated material for back filling, trench shall be filled back with locally available coarse sand up to 30 cm. thick above the pipe and rest of trench shall be filled back with excavated soil up to required level.'

5.2 The filling should commence only after approval of Engineer-in-Charge is obtained and after the structures or pipes to be buried are tested and approved. Otherwise, if required, contractor shall uncover buried portion and refill at his own cost.

Temporary excavation supports should be removed as back filling and compaction proceeds, such that unacceptable movement of the supported ground does not occur.

Voids caused by extracted supports should be filled and compacted.

5.3 Filling should be done in layers. Each layer should be not more than 15 cm thick when loose and should be well rammed, with necessary watering, to obtain at least 90% of maximum laboratory dry density.

Compaction trials should be carried out on each soil type to be placed in backfill, in order to confirm the type of machine and number of passes required to obtain optimum compaction for given soil moisture contents. These trials should also be used to determine the variability of the proposed fill material for different weather conditions.

5.4 Care must be exercised to protect cables, pipes, joints, and other features from damage due to backfilling and consolidation.

5.5 Filling should extend up to the level of original ground surface or as per drawing or as directed by Engineer-in-Charge. The finished surface should be properly trimmed and dressed. The adjoining area should be cleaned and no heaps of surplus earth should be left out.

6.0 TRANSPORTATION OF SURPLUS EARTH

Unserviceable materials and serviceable materials not intended for re-use shall be removed from the work site and disposed off at a location as approved by Engineer-in-charge.

The surplus earth is generated due to pipe laying, valve chambers, and manhole construction etc. Surplus earth is also generated due to voids in the back filled volume of earth. The removal of surplus earth shall include excavation, loading, transportation, dumping, stacking or spreading, as per the directions of Engineer-in-charge.

7.0 PAYMENT

This clause shall be applicable for item tender rate only.

7.1 Unless specifically stated in the schedule of rates, no separate payment for earthwork in excavation, backfilling, transportation, dewatering etc. shall be admissible and the payment for the same is deemed to have been included in the relevant items of the contract.

7.2 In case payment for earthwork is specified separately in the Schedule of Rates, the payment shall be based on the actual quantity of excavation, backfilling and transportation done, taking into consideration the slopes authorized by the Engineer-in-Charge for excavation, volume of backfilling calculated on the basis of excavation reduced by the volume of pipes.

7.3 In cases where hard rock excavation is involved, the matter shall be referred to Engineer-in-Charge, before proceeding with the work.

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STANDARD SPECIFICATION
FOR
RCC PIPE CULVERTS & ERC CROSSING

VCS-SS-CS-6008

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ABBREVIATION

m	Metre
mm	Millimetre
IS	Indian Standard
IRC	Instrumentation Road Crossings
ERC	Electrical Road Crossings
PVC	Poly Vinyl Chloride
RCC	Reinforcement Cement Concrete

CONTENTS

1.0 SCOPE

The scope of this specification covers R.C.C pipe culverts and ERC/ IRC crossings with RCC or PVC pipes.

2.0 REFERENCES

2.1 BIS CODES

IS: 458	:	Precast Concrete Pipes (with and without reinforcement)
IS: 783	:	Code of practice for laying of RCC pipes
IS: 4985	:	Un-plasticized PVC pipes for potable water supplies

NOTE:- Latest Edition of all Codes and Standards shall be followed.

2.2 SPECIFICATIONS

VCS-SS-CS-6002	Earthwork for Site Grading
VCS-SS-CS-6003	Earthwork for underground piping
VCS-SS-CS-6022	Earthwork in Foundations

3.0 MATERIALS

3.1 All pipes must be new and perfectly sound, free from cracks, cylindrically straight and of standard nominal diameter and length, with even texture. RCC Pipes shall be of collar type only and each pipe shall have one collar with it. PVC Pipes shall be Class-I as per IS: 4985.

For pipe culverts, class of RCC pipe shall be NP3 / NP4 or as mentioned in the drawings.

3.2 The Contractor shall submit manufacturer's test certificate for acceptance of RCC/PVC pipes.

3.3 Spun yarn for pipe joints shall be of best quality. It shall be free from dust etc.

4.0 TRANSPORTATION AND STACKING

4.1 The transportation of materials to the worksite and stacking shall be done in a manner to cause minimum inconvenience to the traffic and other construction work.

4.2 The pipe shall be protected during handling against impact, shocks and free fall to avoid cracks and damage.

4.3 The Contractor shall be fully responsible for the safety and security of materials transported and stacked in the field.

4.4 EARTHWORK

Refer standard VCS-SS-CS-6002, VCS-SS-CS-6022 for earthwork.

5.0 LOWERING AND LAYING OF RCC PIPES

5.1 GENERAL

The laying and jointing of RCC pipes shall confirm to IS: 783. Pipes shall be jointed by collar joints.

The trench shall be checked for proper level, grade and alignment before lowering the pipes.

5.2 LOWERING

The RCC pipe shall be lowered cautiously to prevent disturbance to the bed and sides of the trench. The heavy RCC pipes shall be lowered by means of proper tripods, chain pulley blocks or as directed by Engineer-in-charge. Great care should be taken to prevent sand etc. from entering the pipes.

5.3 LAYING

5.3.1 Laying of RCC pipes shall proceed upgrade of slopes.

5.3.2 The error of grade shall not be rectified by packing up earth underneath the pipe. If required, concrete shall be used for packing.

5.3.3 The end of RCC pipes shall be kept closed to keep dirt, mud and foreign materials out. Adequate provision shall be made to prevent floating of pipes in the event of flooding of trenches.

The body of RCC pipe, for its entire length, shall rest on an even bed in the trench and places shall be excavated to receive the collar for the purpose of jointing.

5.4 JOINTING OF RCC PIPES

5.4.1 A few skeins of spun yarn, soaked in neat cement wash shall be inserted in the groove at the end of the pipe and the two adjoining pipes butted against each other. The collar shall then be slipped over the joint covering equally both the pipes. Spun yarn soaked in neat cement wash shall be passed round the pipes and inserted in the joint by means of caulking tools from both ends of the collar. More skeins of yarn shall be added and well rammed home. The object of the yarn is to center the two ends of the pipes within the collar and to prevent the cement mortar of the joint penetrating into the pipes.

5.4.2 Cement mortar 1:2 (1 cement: 2 sand) shall be slightly moistened and must on no account be soft or sloppy and shall be carefully inserted by hand into the joint. The mortar shall than be punched and caulked into the joint and more cement mortar added until the space of the joint has been filled completely with tightly caulked mortar. The joint shall be finished off neatly outside the collar on both side at an angle 45°

5.4.3 Any surplus mortar projecting inside the joint is to be removed and guarded against any damage. Sack or gunny bags shall be drawn past each joint after completion.

5.5 CURING

The Cement mortar joints in RCC pipes shall be cured at least for seven days.

5.6 TESTING

All joints in culvert pipelines shall be tested to a head of 1.5 m of water above the top of the highest pipe, if required, by Engineer-in-Charge.

5.7 PAYMENT

This clause shall be applicable for item tender rate only.

Payment shall be made on running meter basis, which includes supplying, transporting, lowering, laying, jointing and curing, concreting around RCC pipes etc., all complete.

6.0 LOWERING AND LAYING OF PVC PIPES

6.1 Lowering and laying of PVC pipes shall be done as per IS: 4985. The jointing of the pipes shall be done by expanding one end after heating and using solvent cement.

6.2 PAYMENT

Payment shall be made on running meter basis of PVC pipes, which includes supplying, transporting, lowering, laying and jointing, concreting around PVC pipes etc., all complete.

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STANDARD SPECIFICATION

FOR

MISC. CIVIL & STRUCTURAL WORKS FOR UNDERGROUND SERVICES

VCS-SS-CS-6011

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ABBREVIATION

m	Metre
mm	Millimetre
cm	Centimetre
IS	Indian Standard
m^2	Square metre
U/G	Underground
Cl	Cast Iron
M.S.	Mild Steel

CONTENTS

1.0 SCOPE

This specification covers the material and construction details for various civil works as given below:

a. All earthworks except for Site Grading and U/G Piping.

b. Plain and reinforced cement concrete work in catch pits clean outs manholes, pipe supports, water monitors, hydrant pedestals, Thrust block etc.

c. Brick work for various structures such as Manholes, Catch basins, Valve Chambers, instrument tapping chambers, Flushing chambers, etc

d. Plastering for the above structures as applicable.

e. Manhole frames, manhole covers, ladder rungs etc. for the above structures as applicable.

f. Miscellaneous structure steel work such as ladders, platforms, chequered plate c overs, gratings etc.

The work shall include supply of various materials as per relevant standards, required for the execution of work except for those items designated as Owner's scope of supply in the special conditions of contract or elsewhere in the contract documents. Contractor shall transport from Owner's stores those materials which are a part of owner's supply.

All materials not fully specified herein and which may be used in the WORK shall be of quality approved by the Engineer-in-charge and he shall have the right to determine whether all or any of the materials offered or delivered for use in the WORK are suitable for the purpose. CONTRACTOR shall give the samples of material to the Engineer-in-charge and shall get it approved before procurement and use.

2.0 REFERENCES

2.1 BIS CODES

IS: 5455 Cast Iron Steps for man holes

IS: 3502 Steel Chequered Plates

IS: 2062 Hot Rolled medium and High tensile structural steel

IS: 1726 Cast Iron Manhole covers and frames

IS: 1239 Specification for Steel tubes, Tubulars and Other wrought steel fittings

2.2 SPECIFICATIONS

VCS-SS-CS-6002, VCS-SS-CS-6003, VCS-SS-CS-6022 Earth work

VCS-SS-CS-6023 Plain and Reinforced Cement Concrete

VCS-SS-CS-6027 Brick Masonry

VCS-SS-CS-6043 Plastering & Pointing

3.0 EARTHWORK & BACKFILLING

3.1 Refer specification no VCS-SS-CS-002, VCS-SS-CS-003 & VCS-SS-CS-022

4.0 PLAIN AND REINFORCED CEMENT CONCRETE

4.1 Refer specification No. VCS-SS-CS-6023

5.0 BRICK WORK

Refer specification no. VCS-SS-CS-6027

6.0 CEMENT PLASTERING

6.1 MATERIALS

The specifications for cement, sand and water shall be as given in spec. No. VCS-SS-CS -6021 Cement mortar shall be of grade and thickness specified in drawing or as directed by the Engineer-in-Charge, if not specified. The surface on which plastering is to be done shall be thoroughly cleaned from dust, dirt, oil, etc. It should be washed properly and watered for 4 hours before plastering. The joints of brick work shall be raked out to a depth of at least 12mm when plastering has to be done. On cement concrete surface, the surface shall be scarified by lines with trowel when it is still green or hacked if concrete is hard as directed by Engineer-in-Charge.

6.2 Plaster shall not in any case, be thinner than specified. It shall have uniform specified thickness. Any extra thickness of plaster done by contractor will not be paid for. When smooth finishing is required the cement plaster shall be floated over with neat cement within 15 minutes of the application of the final coat.

During the process of plastering all corners shall be rounded to a radius of 25mm unless otherwise specified.

6.3 The plaster shall be protected from sun and rain by such means as the Engineer-in-Charge may approved. The plaster shall be cured for 7 days.

6.4 Construction joint shall be kept in plastering work at places approved by Engineer-in-Charge.

6.5 PAYMENT

This clause shall apply to item rate tender only.

6.5.1 Payment for plastering shall be made on basis of the area of surface plastered, measured before plastering. All Measurements shall be separately made for each face of walls.

6.5.2 The rate of plastering shall include cost of scaffolding, swings, cleaning the surface, raking out joints, hacking concrete surfaces, etc. needed for carrying the work and shall cover the extra labour for plastering the jambs, sills, and soffits or opening except for plastering bands, cornices and skirting up to 30 cm width.

7.0 M.S. RUNGS/C.I. STEPS

The rungs for valve pits/manholes shall be of M.S. conforming to Indian Standard and to the shape and size as shown drawings. C.I. steps for manholes if used shall be as per IS: 5455. M.S. Rungs or CI steps shall be coated with 2 coats approved bituminous paint.

Payment for steps/rungs shall be made per number and the rate shall include supply and fixing, finishing the wall etc. complete.

8.0 CHEQUERED PLATES & STRUCTURAL STEEL WORKS

Chequered plates shall be 6mm (7mm moreover chequers and shall conform to IS: 3502). Steel for chequered plate shall conform to IS: 2062 and shall be clearly rolled and free from harmful surface defects such as crack surface flaws etc. The plate shall be cut to shape and fixed to the bearing members as shown in relevant drawings and as directed by Engineer-in-Charge. The edges shall be made smooth, no burrs or gagged ends shall be left. The plates may be spliced with prior consent of the Engineer-in-Charge. But in that case care should be taken so that there is continuity in the pattern of the plates between the portions. Lifting arrangements shall be provided including lifting rods.

Grating shall be fabricated out of M.S flats, angles and rounds etc., as per drawings and as approved by Engineer-in-Charge. Steel for grating plates shall conform to IS: 2062 of general weldable quality and shall be clearly rolled and shall be free from harmful surface defects.

Payment shall be made on the basis of weight of M.S Gratings/chequered plate and supporting frame actually laid. The rate shall include supply of all necessary, steel materials cutting to size, fabricating, smoothening edge if necessary, transporting and fixing at all positions and providing lifting arrangements. Full deductions shall be made for all opening above 30mm square and the rate shall include making of opening of all sizes and supplying and painting 2 coats of anticorrosive paint over a coat of red oxide zinc chromate primer. The exposed surface of grating and frame shall be painted with two thick coats of coal tar. The rate shall include providing and laying M.S grating and frame, breaking and making good existing concrete/brick masonry surface if necessary finishing, painting etc. complete with all labour and materials. Payment shall be on number basis.

9.0 C.I. MANHOLE FRAME AND COVER

C I manhole frame and covers shall conform to IS: 1726 with size and grade as shown in drawing.

10.0 VENT PIPES

These shall be M.S. Black Steel Tube conforming to IS: 1239 Medium grade or as specified in drawing. The pipe bends shall be embedded in 1:3:6 grade cement concrete or as shown in drawing.

All pipes shall be 25mm clear of wall or column with M.S. holder bat clamp as per instructions of the Engineer-in-Charge. All holes in walls and column shall be made good by 1:2:4 grade cement concrete. All pipes and clamps shall be painted with two coats of paints of approved make.

Payment shall be made on running meter basis and the rate shall include supply of all materials, cutting, edge preparation, jointing by welding, fixing in concrete block, cutting of walls or concrete and making good the same, painting with 2 coats of anticorrosive paint necessary scaffolding etc. complete.

The rate shall also include excavation and backfilling if any.

11.0 FUNNELS, CLEAN OUTS, PLUGS

These shall be fabricated from M.S Plates, pipes chequered Plates, rounds, angles etc., to be supplied by the contractor. The fabric action shall be in accordance with the approved drawing.

Payment for these items shall be made on weight basis and rate shall include fabrication, erection, welding jointing and painting etc. all complete.

12.0 BRICK BAT FILL

11.1 The brick bats used as filling in valve pits shall be from common burnt clay building bricks. A sample of brickbats used shall be got approved from Engineer-in-charge.

11.2 The compaction of the layer of brick bats shall be proper so that brickbats are not disturbed and do not sink in the soil.

11.3 The payment for brick-bat fill shall be made on m2 basis as shown in drawing and the rate shall include supply, laying, compacting etc. complete with all materials & labour.

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VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
CHAIN LINK FENCING

VCS-SS-CS-6013

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ABBREVIATION

m	Metre
mm	Millimetre
IS	Indian Standard

CONTENTS

1.0 SCOPE

This specification specifies the requirements of chain link fence for security purposes. The height of the fence shall be approximately 2.0 m to the top of the chain link fencing at the posts and approximately 2.5 m in vertical height at the top line of barbed wire attached to the cranked tops of the posts.

2.0 REFERENCES

IS: 278	Specification for galvanized steel barbed wire for fence fabric
IS: 383	Specification for coarse and fine aggregates for concrete
IS: 456	Plain and Reinforced Concrete - Code of Practice
IS: 2721	Specification for Galvanized Steel Chain Link Fencing

NOTE: - Latest Edition of all Codes and Standards shall be followed.

3.0 REFERENCE OF SPECIFICATIONS / STANDARDS

Following standard specification shall be enclosed as part of the job specifications.

Technical Specifications - Civil and Structural Works General Scope	VCS-SS-CS-6020
Technical Specifications - Civil and Structural Works Material	VCS-SS-CS-6021
Technical Specifications - Civil and Structural Works Earth work in Foundation	VCS-SS-CS-6022
Technical Specifications - Civil and Structural Works Plain & Reinforcement Cement Concrete	VCS-SS-CS-6023
Technical Specifications - Civil and Structural Works Structural Steel Works	VCS-SS-CS-6024
Technical Specifications - Civil and Structural Works Earthwork in Site Grading	VCS-SS-CS-6002
Details of Chain Link Fencing	VCS-STD-CS-6002

4.0 CEMENT CONCRETE FOR FOUNDATION & SILL

Refer specification no VCS-SS-CS-6023

5.0 CEMENT CONCRETE IN PRECAST POSTS/STRUTS

(Straining posts, intermediate posts and struts)

5.1 Pre-Cast Cement concrete shall be of M25 grade for moderate environment exposure condition and M30 grade for severe environment exposure condition with 20mm and down size crushed stone aggregates conforming to IS: 383.

5.2 The work shall be carried out as per IS: 456 in all respects.

5.3 Necessary moulds shall be provided for casting the concrete posts and the same shall be smooth finished with 1:3 cement sand mortar as directed by the Engineer-in-Charge.

6.0 REINFORCEMENT

Refer specification No. VCS-SS-CS-6023

6.1 MATERIALS

6.1.1 CHAIN LINK FENCING

The material requirement shall conform to IS: 2721 latest edition. The chain link fencing shall be woven from 3.15 mm dia wire with mesh size of 75 sq mm. The mesh wire shall not vary from the specified dia by more than ± 0.05 mm.

6.1.2 GALVANIZED WIRES

a. All steel wires shall be hot dipped galvanized wire and dia of the wire shall be 3.15 mm over the galvanized coating.

b. The line wire shall be 4.0 mm dia Mild Steel.

c. The stirrup wire for securing the line wires to the concrete intermediate posts shall be 3.15 mm diameter Mild Steel.

d. The tying wire for securing the chain link fencing to the line wire shall be 2.50 mm diameter Mild Steel.

e. Hair pin staples for fastening down the bottom of galvanized chain link fencing to the concrete sill shall be of 3.15 mm wire. The ends shall be bent outwards to secure anchorage.

6.1.3 Cleats for eye bolts shall be of uniform size and shall consist of Mild Steel angle of 75 x 50 x 6mm.

6.1.4 EYE BOLT STRAINERS

a. The eye bolt strainer shall consist of bolts with welded eye sufficiently threaded and fitted with a nut and washer.

b. Two-way eye bolt strainer shall have suitable ring nuts, fitted after wires have been strained on one side.

6.1.5 Stretcher bar shall consist of Mild Steel flats 25 mm x 4.75 mm. They shall be secured to the cleats by steel bolts.

6.1.6 Droppers for barbed wire shall be of Mild Steel not less than 25mm x 4.75 mm thick with 38mm x 4.85mm half round staples for fastening the barbed wire to them.

6.1.7 BARBED WIRE

a. Barbed wire shall conform to IS: 278. The galvanized barbed wire shall be manufactured from galvanized Mild Steel wire conforming to IS: 280. The coating on the wire shall be smooth and relatively free of lumps, globes or points, wires with excessive roughness, blisters, Sal ammoniac spots shall be rejected. A galvanized steel barbed wire of Type A-1 IS: 278 shall be made from two strands of galvanized, twisted 2.5 mm steel wire with 4 points of barbs. Each barb shall have two turns tightening around both line wires making altogether four complete turns. The barbs shall be so finished that four points are set and looked at right angles to each other.

b. Bracing of the rows of barbed wire shall be as shown in Standard drawing.

c. The barbs shall have a length of not less than 13mm and not more than 18mm.

6.2 ERECTION

6.2.1 Straining posts shall be provided at all ends and corners of fences, at changes in direction or acute variations in level and at intervals not exceeding 60m on straight lengths of fence. Intermediate posts shall be spaced at regular intervals not exceeding 3M.

6.2.2 Struts shall be fitted to all straining posts behind the chain link fabric in the direction of the line of fence.

6.2.3 FIXING CHAIN LINK FENCING

a. There shall be four evenly spaced rows of line wire. The top wire shall be doubled, making five line wires in all. The bottom wire shall be close to the ground.

b. Each line wire shall be strained tightly by means of eyebolt strainers or winders at each straining point.

c. Each line wire shall be secured to each intermediate post by a wire stirrup passed through a hole in the posts and secured to the line wire by three complete turns on each side of the post.

d. The chain link fencing shall be strained between each pair of straining posts and secured to each straining post by means of a Stretcher bar. One of the top line wires shall be threaded through the appropriate adjacent rows of mesh, care being taken that no meshes in the rows are bypassed by the line wire except where deviation is necessary at the straining posts. The second top line wire shall

be strained in front of the fencing. The fencing shall be attached to the top and bottom line wire by wire ties spaced 150mm apart and to the other line wires by wire ties spaced 450 mm apart.

e. The bottom of the fencing shall be treated as follows:

Continuous concrete sill 230 mm wide x 300 mm high for full length between posts shall be cast with the top 25 mm above G.L. and 25mm below the chain link fencing. Hair pin staples shall be threaded through the bottom row of mesh at 0.75 m c/c and set in the sill to a depth of 150 mm.

6.2.4 FIXING BARBED WIRES FOR ANTICLIMBING DEVICE.

a. Three lines of barbed wire shall be provided as shown in drawing . The wires shall be attached by eye bolts to the cranked tops of the straining posts. On concrete intermediate posts they shall be secured to cranked tops with stirrup wires. The barbed wire shall be fitted with one dropper at the centre of each bay, secured to the wires so that they cannot be bunched together

7.0 PAYMENT

This clause shall apply to item rate tenders only.

7.1 EARTHWORK

Payment for earthwork shall be made on cubic meter basis

7.2 CEMENT CONCRETE (CAST-IN-SITU AND PRE-CAST)

Payment shall be made on cubic meter basis and the rate shall include labour, materials, mixing placing, leaving pockets, fixing chain link fencing, line wires, barbed wires inserts in concrete post while casting as shown in the drawing or as per the directions of Engineer-in-Charge, keeping the concrete post in the proper position while concreting, scaffolding, all moulds, curing etc. complete including handling & transportation from pre-casting yards to place of fixing, preparation of pre-casting yards etc. but excluding cost of reinforcement.

7.3 REINFORCEMENT

Payment for reinforcement shall be made on metric ton basis including transportation of steel to site of work, straightening, cleaning, cutting, bending to required shapes and lengths, placing, binding with soft annealed wire as per drawings, specifications and instruction of Engineer-in-Charge.

7.4 CHAIN LINK FENCING

Payment for chain link fencing shall be made on running meter basis for bottom 2.0meter height of the total height including supply of chain link fencing in 1.9meter width roll, fixing in position true to line and as per drawing. The rate shall also include supplying and fixing necessary galvanized line wires, stirrup wires, tying wires, hair pin staples for fixing the fence in cons sill, etc. tensioning the line wire and fencing, all materials and labour etc. required to complete the job as per drawings and direction of Engineer-in-Charge.

7.5 BARBED WIRE FENCING

Payment for barbed wire shall be made on running meter basis. The rate shall included supply and fixing necessary droppers, straining bolts tensioning the barbed wire etc. and all materials and labour etc. required to complete the job.

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VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
EARTHWORK IN FOUNDATIONS

VCS-SS-CS-6022

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ABBREVIATION

m	Metre
mm	Millimetre
Cm	Centimetre
m^2	Square metre
m^3	Cubic metre
CNS	Cohesive Non Swelling

CONTENTS

1.0 SCOPE

This specification deals with earth work in excavation and filling.

2.0 REFERENCES

2.1 SPECIFICATIONS

VCS-SS-CS-6002	Earthwork in Site Grading
VCS-SS-CS-6003	Earthwork for underground piping

3.0 CLASSIFICATION OF SOIL

3.1 SOFT / LOOSE / HARD / DENSE SOIL AND MUD

Generally any soil which yields to the application of pick and shovel or to phawra, rake or other, ordinary digging implement such as vegetable or organic soil, turf, gravel, sand, silt, loam, clay, peat, cobble stone, mud etc.

3.2 SOFT / DISINTEGRATED / WEATHERED ROCK (NOT REQUIRING BLASTING)

Rock or boulder which may be quarried or split with crowbar. This will also include laterite and hard conglomerate.

3.3 HARD ROCK (REQUIRING BLASTING)

Any rock or boulder for the excavation of which blasting is required.

3.4 HARD ROCK (BLASTING PROHIBITED)

Hard rock requiring blasting as described under cl. No. 3.3 above, but where blasting is prohibited for any reason(s), breaking up of rock shall be done by chiselling, wedging or by using Hydraulic Splitter and chemical substances mixed in an appropriate proportion.

4.0 BACKFILLING MATERIAL

4.1 Backfilling material shall be as approved by the Engineer-in-Charge.

4.2 Backfilling of excavation in trenches, foundations and elsewhere shall consist of one of the following materials as shown on drawing, or directed by the Engineer-in-Charge.

a. Soil

b. Selected earth from heaps or brought from borrow areas.

4.3 In case a. or b. are not available, the Engineer-in-Charge may approve use of any of the following: Stone/gravel

c. Sand

d. CNS material.

4.4 The material shall be free from rubbish, roots, hard lumps and any other foreign organic material

5.0 SETTING OUT

5.1 The Contractor shall be responsible for the true and proper setting out of the work in relation to original point's lines and levels of reference and for the correctness of the levels, dimensions and alignment of all parts of the work. If at any time during progress of the work any error appears or arises in the position of level, dimension, or alignment of part of the work, the Contractor at his own expense shall rectify such errors to the satisfaction of the Engineer-in-Charge. The checking of any line or level by the Engineer-in-Charge shall not in any way relieve the Contractor of his responsibilities.

5.2 The Contractor shall lay out and construct one or more permanent bench marks in some central place before the start of the work, from which all important levels for the excavations will be set.

5.3 These permanent bench marks shall consist of masonry pillars with top neatly plastered and levelled as per the directions of the Engineer-in-Charge. Bench marks shall be well connected with triangular grid system or any other bench mark approved by the Engineer-in-Charge.

6.0 EARTHWORK IN EXCAVATION

6.1 Excavation shall be carried out in any material met on the site to the lines, levels and contours shown on the detailed drawings and the Contractor shall remove all excavated materials to spoil heaps on site or transport for use in filling on the site or stack them for reuse as directed:

6.2 Excavated material shall not be deposited within 1.5m from the top edge of the excavation.

6.3 The sides of the excavation may be cut sloping, or shored and strutted to hold the face of earth as per site requirements and as directed by the Engineer-in- Charge.

6.4 Foundation pits/trenches shall not be excavated to the full depth unless construction is imminent. The last fifteen (15) cm depth of the excavation shall not be done until concreting work is imminent. The full depth may at the discretion of the Engineer-in-Charge be excavated and the bed covered with a fifty (50) mm (minimum) thick (or as indicated on drawing) layer of lean concrete 1:5:10 mix (1 cement: 5 coarse sand: 10 crushed stone aggregate) or as specified in schedule of rates/shown on drawing, after watering if required, and consolidating the bed.

6.5 If the bottom of any excavation has been left exposed by the Contractor and in the opinion of the Engineer-in-Charge, that has become badly affected by the atmosphere or by water, then the Contractor shall remove such portions of the deteriorated material as the Engineer-in-Charge may direct and shall make good with lean concrete

1:5:10 mix (1 Cement: 5 Coarse Sand: 10 Crushed Stone Aggregate). All expenses for such additional concrete and excavation shall be borne by the Contractor.

6.6 Where excavation is made in excess of the depth required, the Contractor shall, at his own expense, fill up to required level with lean concrete 1:5:10 mix (1 Cement : 5 Coarse Sand : 10 Crushed Stone aggregates) or as decided by Engineer-in-Charge.

6.7 The Contractor shall provide suitable drainage arrangement to prevent surface water from any source entering the foundation pits at his own cost.

6.8 The Contractor shall make all arrangements for dewatering during excavation and subsequent works, the accumulated water from any source (including subsoil water) in the excavated pits/trenches and keeping the excavated pits/trenches dry for subsequent works.

6.9 The Contractor shall make necessary arrangements for lighting, fencing and other suitable measures for protection against risk of accidents due to open excavation.

6.10 Where the excavation is to be carried out below the foundation level of an adjacent structure, the precaution to be taken such as under pinning, shoring and strutting etc. shall be determined by the Engineer- in-Charge. No excavation shall be done unless such precautionary measures are carried out as per directions of the Engineer-in-Charge. The payment for such precautionary measures shall, however, be made separately.

6.11 Loose or soft bed ground encountered in excavation at the required depth shall on the Engineers-in-Charge's instructions be excavated to a firm bed and difference made up to the required level with lean concrete 1:5:10 mix (1 Cement: 5 Coarse Sand: 10 Crushed Stone Aggregates).

6.12 In those cases where during excavation, side slips occur for reasons not attributable to the Contractor (e.g. side slips which take place on their own but not due to surcharge of earth kept near the edge of excavation and cracking of excavation top strata due to clay drying out leading to collapse of excavation sides), the Engineer-in-Charge shall admit payment at his discretion.

6.13 Any obstacle encountered during excavation shall be reported immediately to the Engineer-in-Charge and shall be dealt with as instructed by him. Removal of buried pipes or cables shall not be done without prior permission of the Engineer-in-Charge and the Contractor shall provide all measures to protect the same. Costs of such protective measures are deemed to be included in the rates for various items of excavation.

6.14 The Contractor shall not undertake any concreting in foundation until the excavation pit/trench is approved by the Engineer-in-Charge.

6.15 The specification for earth work shall also apply to excavation in rock in general.

6.16 In case of hard rock requiring blasting, the provisions mentioned below shall be strictly followed.

6.16.1 GENERAL

Where hard rock is met with and blasting operations are considered necessary, the Contractor shall intimate about the same to the Engineer-in-Charge, and obtain his approval in writing for resorting to blasting operation.

The Contractor shall obtain license from the district authorities for undertaking blasting work as well as for obtaining and storing the explosive as per Explosive Rules 1983, corrected up to date. He shall purchase the explosives, fuses, detonators etc. only from a licensed dealer. He shall be responsible for the safe custody and proper accounting of the explosive materials. The Engineer-in-Charge or his authorized representative shall have the access to check the Contractor's store of explosive and his accounts.

In case where explosives are required to be transported and stored at site, relevant clauses of the Explosive Rules, 1983 as amended subsequently, shall apply.

The Contractor shall be responsible for any accident to workmen, public or property, due to blasting operations.

6.16.2 PRECAUTIONS

Blasting operations shall be carried out under the careful supervision of a responsible, authorized and licensed blaster of the Contractor (referred subsequently as "blaster" only) during specified hours, as approved in writing by the Engineer-in-Charge. The blaster shall be fully conversant with the rules of blasting.

Proper precautions for safety of persons shall be taken. Red flags shall be prominently displayed around the area to be blasted and all the people on the work except those who actually light the fuses shall withdraw to a safe distance of not less than 200 meters from the blast. Precautions as per Explosive Rules 1983 with amendment shall be followed.

6.16.3 FUSES

All fuses shall be cut to the lengths required before being inserted into the holes. Joints in fuses shall be avoided. Where these are unavoidable, a semicircular niche shall be cut in one piece of fuse about 2 cm. deep from the end and the end of other piece inserted into this niche, and the two pieces then wrapped together with a string. All joints exposed to dampness shall be wrapped with rubber tape. Fuse and detonators shall be kept separated from the explosives.

6.16.4 BLASTING WITH GUN POWDER

Blasting shall normally be done with gun powder. Dynamite, gelatine or any other high explosive shall only be used in special cases with the written permission of the Engineer-in-Charge.

In case of blasting with gun powder, the position of all bore holes to be drilled shall be marked out in circles with white paint. The bore holes shall be jumped or drilled in the rock face. The depth of bore hole shall be about the same as that of the line of least

resistance and its size shall be such that the cartridges can easily pass down to the bottom. The bore holes must be dried before being charged and these shall be inspected by the Contractor's agent.

Gun powder may be used in the form of pellet blasting cartridges or as powder or granules. Cartridges are provided with tapered central hole. One end of fuse is passed through the narrow end of the hole and a sufficient length of the fuse is doubled back so that when the fuse is pulled, it is held tight in the tapered hole of the cartridge. Other cartridges are then inserted in the fuse to make up the required charge. The cartridge along with the fuse is lowered down in the bore hole, placed in position and gently filled and pressed home with dry hay or turf. The rest of the bore shall then be filled with dry clay, which shall be tamped with copper or brass rod until it becomes compact. Care shall be taken to avoid any possibility of an air space around the fuse. The safety fuses shall be taken to the required distance so as to allow the blasting to take place after the person lighting the fuse has withdrawn to a safe distance.

Where gun powder is used in the form of powder or granules it shall be introduced in the bore hole by means of funnel or copper tube. The bore holes shall be loaded with two thirds of the quantity of charge required, and safety fuse then directly introduced over the charge. Remaining one third charges shall then be introduced, and gently filled and pressed home with dry hay or turf. The rest of the bore hole shall be filled with dry clay in the same way as for cartridges, and the safety fuse taken to the required distance.

The charges shall be fired by igniting the fuse. The number of charges to be fired and the actual number of shots heard shall be compared, and the Contractor's blaster shall satisfy himself by examination that all the charges have exploded, before workmen are permitted to approach the site. The charge which has not exploded shall not be permitted to be withdrawn.

The tamping and charge shall be flooded with water and the holes marked with a red cross (X) over it. Another hole shall be jumped at a distance of about 45 cm from the old hole and fired in the usual way. This operation shall be continued, till the original and any subsequent unfired charges are exploded.

6.16.5 BLASTING WITH DYNAMITE OR ANY OTHER HIGH EXPLOSIVE

In case of blasting with dynamite or any other high explosive the position of all bore holes to be drilled shall be marked out in circle with white paint. These shall be inspected by the Contractor's blaster. Bore holes shall be of a size that the cartridge can easily pass down. After the drilling operation, the blaster shall reinspect the holes to see that the holes marked out by him have been drilled. He shall then prepare all charges necessary for the bore holes. The bore holes shall be thoroughly cleaned before a cartridge is inserted. Wooden tamping rods (not pointed but cylindrical throughout) shall be used, in charging holes. Metal rods shall never be used for tamping. One cartridge shall be first placed in the bore hole, gently pressed and not rammed down. Other cartridges shall then be added as may be required to make up the necessary

charge for the bore hole. The top most cartridges shall be connected to the detonator which shall in turn be connected to the safety fuse of required length.

The maximum of eight bore holes shall be loaded and fired on each occasion. The charges shall be fired successively and not simultaneously.

Immediately before firing a blast, due warning shall be given and the blaster shall see that all persons have retired to a place of safety. The safety fuses of the charged holes shall be ignited in the presence of the blaster, who shall see that all the fuses are properly ignited.

Careful count shall be kept by him and others of each blast as it explodes. After the blast the blaster shall inspect the work and ascertain that all the charged holes have been exploded. In case of misfired holes, he shall inspect the same after half an hour and mark red crosses (X) over the holes. During this interval of half an hour, no body shall approach the misfired holes. None of the drillers shall work near such holes, until one of the two following operations has been done by the blaster.

a. Either the Contractor's blaster shall very carefully (when the tamping is of damp clay) extract the tamping with a wooden scraper and withdraw the fuse, primer and detonator, after which a fresh detonator, primer and fuse shall be placed in the misfired holes and fired.

OR

b. The hole shall be cleaned for 30 cm of tamping and its direction ascertained by placing a stick in the hole. Another hole shall then be drilled 15 cm away and parallel to it. This hole shall be charged and fired. The misfired hole should also explode along with the new one

Before leaving the work, the blaster of one shift shall inform another blaster relieving him for the next shift, of any cases of misfire, and shall point out their positions denoted by red crosses and also state the action, if any, to be taken in the matter.

The Engineer-in-Charge shall also be informed by the blaster of all cases of misfire, their causes and steps taken in that connection.

6.16.6 CONTROLLED BLASTING

Whenever required by the Engineer-in-Charge, rock blasting shall be carefully controlled so that vibrations generated during the blasting do not cause damage to the buildings and installation around. Similarly, the rock pieces should not fly off and endanger the buildings and installations around. Apart from the general precautions mentioned in the preceding paragraphs, following protective measures and limits for use of explosive are suggested as guidelines. Tenderers are requested to carefully check the site conditions and submit details of the scheme they propose to adopt for controlling the blast.

Following protective measures shall be adopted while carrying out blasting operations.

The hole shall be covered with mild steel plate of minimum 12mm thickness.

Reinforcement rod meshes not less than 20mm dia. at 150mm centre in both directions shall be placed over the steel plates.

Steel plate and reinforcement shall be inspected after every blasting operation and all twists shall be removed before reuse to the satisfaction of the Engineer-in- Charge.

Sand filled bags of 6 to 8 layers shall be placed over the mesh suitably covering the whole region under blasting operation.

The thickness of covering plate and the kind of dead weight is to be duly approved by the Engineer-in-Charge.

6.16.7 Hard rock requiring blasting as described under cl.no. 2.3 above, but where blasting is prohibited for any reason(s) breaking up of rock can be done by using Hydraulic Splitter and chemical substances of approved manufacturer (Lifton or equivalent) mixed in an appropriate proportion. The method involves drilling holes into rock and then inserting/injecting hydraulic splitter/chemical solvents into the holes. The breaking-up of rock takes place in a controlled fashion without much noise and spark.

6.17 PAYMENT

This clause shall apply to item rate tenders only.

6.17.1 Payment for earth work in excavation shall be made on cubic meter (m3) basis on the measurement of volume of pit/trench of excavation with working space as per relevant Indian Standards (IS: 1200) and slopes/stepping as permitted by the Engineer-in-Charge. The rate shall include cost of all the operations of blasting with explosives & accessories, making of all arrangements for dewatering the accumulated water from any source in the excavated pit or trench, removal and disposal of surplus excavated soil within a lead of 100m from construction areas. The rate shall also include setting out and line out work required for the excavation.

6.17.2 The following works shall not be measured separately and allowance for the same shall be deemed to have been made in the description of main item:

a. Setting out works, profiles, etc.;

b. Site clearance, such as cleaning grass and vegetation;

c. Unauthorized battering or benching of excavation;

d. Forming (or leaving 'dead men' or 'tell-tales' in borrow pits and their removal after measurements;

e. Forming (or leaving) steps in sides of deep excavation and their removal after measurements;

f. Excavation for insertion of planking and strutting;

g. Unless otherwise specified, removing slips or falls in excavations;

h. Baling out or pumping of water in excavation from rains;

i. Baling out or pumping of water in excavation from sub-soil water, and

j. Slinging or supporting pipes, electric cables, etc, met during excavation.

6.17.3 Special pumping other than what is included in 6.17.2 (h and i) and well point dewatering where resorted to, shall each be measured separately, unless otherwise stated, in kilolitres of water against separate specific provision(s) made for the purpose.

6.17.4 The Contractor shall intimate to the Engineer-in-Charge as soon as different classification of soils are met with. The measurements of various soil classifications then shall be worked out by either of the following alternatives in the order of their decreasing importance.

a. Joint levels shall be taken as to the levels of different soil classifications and volume worked out on the basis of levels only.

b. Where levels of different strata cannot be clearly marked and defined, the Contractor shall stack different soils of various classifications separately for measurement purpose and then dispose it off.

c. If the quantum of work involved in (b) above is extensively large & time consuming, then the total area may be divided into various zones and reasonably representative samples as in (b) above may be taken and quantities of soils of various classifications finalized for the entire zone based on the representative.

If soil of any classification other than that specified in the Schedule of Rates is met with during excavation, the decision of the Engineer-in-Charge as to the classification of soil, levels of the strata of different classifications and their location shall be binding.

In above case, the total quantity of excavation shall be computed from the measurement of the pit/trench excavated. The hard rock and soft rock shall be measured separately from the relevant stacks and each shall be reduced by fifty percent for voids, and paid under the relevant items. The balance, that is the total quantity of excavation minus the reduced (for voids) quantity of excavation for rocks shall be paid as soft/hard soil as per the direction of the Engineer-in-Charge (However, the maximum payment shall be limited to the volume of the excavated pit/trench as approved by Engineer-in-Charge).

7.0 SHORING AND STRUTTING:

7.1 The shoring and strutting of the sides to withhold the face of excavation pits/trenches shall be done when approved or directed by the Engineer-in-Charge.

7.2 The shoring shall be of close or open timbering type depending upon the site requirements and as directed by the Engineer-in-Charge whose decision shall be final and binding as to the type of shoring to be used.

7.3 The arrangement of the shoring and strutting shall be sound and safe and shall be got approved from the Engineer-in-Charge before installation. The approval shall not absolve the Contractor of his responsibilities of safety and any other requirements of the contract.

7.4 The shoring and strutting shall be kept in position till all the relevant work in the excavated area is completed and approved. It shall be dismantled and removed only after the permission to do so is obtained from the Engineer-in-Charge.

7.5 PAYMENT

This clause shall apply to item rate tenders only.

Payment for shoring and strutting by close and open timbering shall be made on square meter (m2) basis as separate items. In both the cases, the measurement shall be done on the basis of the surface area of the sides of the excavation actually shored and strutted.

The rate shall include all labour, materials, erection of the poling boards, wales, struts, ballies etc., fixing and keeping the same in position as required, dismantling and removing the same after the work is over as directed.

8.0 BACK FILLING AROUND FOUNDATIONS AND IN PLINTH

8.1 Back filling around completed foundations, structures, trenches and in plinth shall be done to the lines and levels shown on the drawings including any trimming of the surfaces, as may be necessary. This shall be done with selected and approved earth from excavation or otherwise with materials described under clause 3.2 as directed by the Engineer-in-Charge. Where sufficient suitable material is not available from the excavation, the Engineer-in-Charge may direct to import suitable earth from other sources. The filling shall be done in layers of thickness not exceeding 15 cm with watering, rolling and ramming by manual methods/mechanical compactors to grade and level as shown on drawings to obtain 90% laboratory maximum dry density.

8.2 The Contractor shall not commence filling in and around any work until it has been permitted by the Engineer-in- Charge.

8.3 Backfilling around liquid retaining structures and pipes shall be done only after approval of the Engineer-in- Charge is obtained.

8.4 PAYMENT

This clause shall apply to item rate tenders only.

Payment for backfilling with earth shall be based on volume in cubic meters (m3) of consolidated fill. This volume shall be derived from the difference between the volume of excavation and the structure or trenches as the case may be. The rate shall include cost of extracting suitable approved earth from available excavated soil from spoil heaps within a lead of 100m, placing, watering, rolling, ramming compacting in layers,

trimming and dressing finished surface and disposal of surplus material up to a lead of 100m.

However, backfilling done with materials other than earth shall be paid separately under relevant items.

9.0 TRANSPORTATION OF SURPLUS EARTH

9.1 Surplus earth and soil from excavation shall be removed from construction area to the area demarcated by the Engineer-in-Charge.

9.2 PAYMENT

This clause shall apply to item rate tenders only.

9.2.1 Payment shall be made only for the lead beyond initial l00m from construction area. Rate shall include re- excavation, loading, transportation, dumping, stacking or spreading (as per directions of the Engineer in Charge) the surplus earth and the soil in the area demarcated by the Engineer-in-Charge Payment shall be made on cubic meter (m3) basis on the difference of measurements of the volume of the excavated pits and the measurement of the back filling. Quantity generated due to voids in back filled volume of earth shall also be removed by the Contractor at no extra cost and this disposal of earth shall not be measured and paid under any item.

9.2.2 In exceptional circumstances the Engineer-in-Charge may direct the Contractor to remove surplus earth, concrete debris or any other waste material from site to the areas of disposal on the basis of truck measurement. In such cases volume of material shall be calculated on the basis of truck volume reduced by 30% for voids in case of soft/hard soils and 50% for soft/hard rock. All other provisions of disposal such as spreading, levelling, grading shall apply in this case also.

Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
STRUCTURAL STEEL WORKS

VCS-SS-CS-6024

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ABBREVIATION

m	Metre
mm	Millimetre
IS	Indian Standard
BIS	Bureau of Indian Standards

CONTENTS

1.0 SCOPE

This specification covers the requirements for material, storage, preparation of fabrication drawings, fabrication, assembly, tests/examinations, transportation, erection and painting of all types of bolted and/or welded structural steel works for general construction work. Fabrication of structures shall also include fabricating:

a. Built up sections/plate girders made out of rolled section and/or plates.

b. Compound sections made out of rolled sections.

2.0 REFERENCE

2.1 BIS CODES

IS: 800	General Construction in steel-Code of practice
IS: 816	Code of practice for use of Metal Arc welding for General construction in mild steel
IS: 819	Code of practice for Residual spot welding for light assemblies in mild steel
IS: 822	Code of practice for Inspection of welds
IS: 919 (Part-I)	ISO system of limits and fits (Bases of tolerances, deviations and fits)
IS: 919 (Part-II)	ISO system of limits and fits (Tables of tolerances, grades and limit deviation for hole and shafts)
IS: 1024	Use of welding in bridges and structures subject to dynamic loading-Code of practice
IS: 1261	Code of practice for Seam welding in mild steel
IS: 1323	Code of practice for Oxy-Acetylene welding for structural works in mild steel
IS: 1477	Code of practice for painting of ferrous metals in buildings
IS: 1852	Specification for rolling and cutting tolerance for hot rolled steel products
IS: 2074	Ready mix paint, Air draying, Red oxide Zinc Chrome, painting specification
IS: 7205	Safety code for erection of Structural steel works
IS: 7215	Tolerance for fabrication of steel structures
IS: 7307	Approval tests for welding procedures

IS: 7310 Approval tests for welders working to approved welding procedures

IS: 7318 Approval tests for welders when welding procedures approval is not required

IS: 9595 Metal Arc welding of carbon and Carbon manganese steel - Recommendations

IS: 12843 Tolerance for Erection of Steel structure

and other relevant BIS Codes.

SP: 6(1)

2.2 SPECIFICATIONS

VCS-SS-CS-6021 Materials and Specification for Shop & Field Painting

2.3 In case of conflict between the clauses mentioned in this specification and those in the Indian Standards, this specification shall govern. Any special provision as shown or noted on the design drawings shall govern over the provisions of this specification.

3.0 MATERIALS

3.1 GENERAL

All materials shall conform to their respective specifications given in Specification no. VCS-SS-CS-6021. The use of equivalent or alternative materials shall be permitted only in very special cases and for all such cases prior written approval of the Engineer-in-Charge shall be obtained.

3.2 RECEIPT & STORING OF MATERIALS

3.2.1 Each section shall be marked for identification and each lot shall be accompanied by manufacturer's quality certificate, chemical analysis and mechanical characteristics.

3.2.2 All sections shall be checked, sorted out and arranged by grade and quality in the store. Any instruction given by the Engineer-in-Charge in this respect shall be strictly followed.

3.2.3 All material shall be free from surface defects such as pitting, cracks, laminations, twists etc. Defective material shall not be used and all such rejected material shall be immediately removed from the store/site. The decision of the Engineer-in-Charge in this regard shall be final and binding.

3.2.4 Welding wires and electrodes (packed in their original cartons) shall be stored separately by quality and lots inside a dry and enclosed room in compliance with IS: 9595 and as per the instructions given by the Engineer-in-Charge. Electrodes shall be kept perfectly dry to ensure satisfactory operation and weld metal soundness.

3.2.5 Each lot of electrodes, bolts, nuts etc. shall be accompanied by manufacturer's quality/test certificates.

3.2.6 All bolts (including nuts & washers) shall be checked, sorted out and arranged diameter-wise by grade and quality in the store.

3.3 MATERIAL TESTS

3.3.1 The Contractor shall submit manufacturers' quality certificates for all the materials supplied by him. In case, quality certificates are not available or are incomplete or when material quality differs from standard specifications, such materials shall not be used in the construction. However, the Contractor shall get all appropriate tests conducted in approved test houses for such materials as directed by the Engineer-in-Charge, at no extra cost, and submit the same to Engineer-in-Charge for his approval. The Engineer-in-Charge may approve the use of such materials entirely at his discretion.

3.3.2 The Contractor shall ensure that all materials brought to site are duly approved by the Engineer-in-Charge. Rejected materials shall not be used and shall be removed from site forthwith. Any material of doubtful quality for which specific tests are to be carried out as per the instruction of the Engineer-in-Charge shall be separately stacked and properly identified and shall not be used. These shall be removed from site forthwith.

4.0 FABRICATION DRAWINGS

4.1 Fabrication and erection drawings shall be prepared by the Contractor on the basis of "Approved for Construction (AFC)" design drawings, Standards issued to the Contractor. These drawings shall be prepared by the Contractor or by an agency appointed by the Contractor and approved by the Engineer-in-Charge.

4.2 Fabrication and erection drawings shall be thoroughly checked, stamped "Approved for Construction" and signed by the Contractor's own responsible Engineer irrespective of the fact that such drawings are prepared by the Contractor or his approved agency, to ensure accuracy and correctness of the drawings. Unchecked and unsigned drawings shall not be used for the purpose of proceeding with the work. The Contractor shall proceed with the fabrication and erection work only after thoroughly satisfying himself in this regard.

4.3 All fabrication and erection drawings shall be issued for construction by the Contractor directly to his work- site. Six copies of such drawings shall simultaneously be submitted to the Engineer-in-Charge who may check/ review some or all such drawings at his sole discretion and offer his comments for incorporation in these drawings by the Contractor.

However, the Contractor shall not proceed with the fabrication of such structures whose fabrication drawings are required to be reviewed before taking up the fabrication work as noted on "Approved for Construction (AFC)" design drawings issued to the Contractor or as conveyed by the Engineer-in-Charge. The fabrication of such structures shall be done only as per the reviewed fabrication drawings.

The review of such drawings shall be restricted to the checking of the following only:

a. Structural layout, orientation and elevation of structures/members.

b. Sizes of members.

c. Critical joint details.

4.4 Fabrication drawings shall be drawn to scale and shall convey the information clearly and adequately. Following information shall be furnished on such drawings:

a. Reference to design drawing number (along with revision number) based on which fabrication drawing has been prepared.

b. Structural layout, elevations & sections (with distinct erection marking of all members).

c. Framing plans, member sizes, orientation and elevations.

d. Layout and detailing of rain water pipes and gutters showing all necessary levels, connections and provisions wherever required.

e. Detailing of shop/field joints, connections, splices, for required strength and erection.

f. Location, type, size and dimensions of welds and bolts.

g. Shapes and sizes of edge preparation for welding.

h. Details of shop and field joints/welds.

i. Bill of materials/D.O.D. Lists.

j. Quality of structural steel, plates etc., welding electrodes, bolts, nuts and washers to be used.

k. Erection assemblies identifying all transportable parts and sub-assemblies with special erection instructions, if required.

l. Method of erection and special precautions to be taken during erection as required.

4.5 The Contractor shall additionally ensure accuracy of the following and shall be solely responsible for the same:

a. Provision for erection and erection clearances.

b. Marking of members

c. Cut length of members

d. Matching of joints and holes.

e. Provision kept in the members for other interconnected members.

f. Bill of materials/D.O.D. Lists.

4.6 Connections, splices and other details where not shown on the design drawings shall be suitably designed and shown on the fabrication drawings based on good engineering practice developing full member strength. Design calculations for such connections/splices shall be submitted to the Engineer-in-Charge along with the fabrication drawings.

4.7 Any substitution or change in section shall be allowed only when prior written approval of the Engineer-in-Charge has been obtained. Fabrication drawings shall be updated incorporating all such substitutions/changes by the Contractor at no extra cost to the Owner.

4.8 In case during execution of the work, the Engineer-in-Charge on review of drawings considers any modifications/substitutions necessary to meet the design parameters/good engineering practice, these shall be brought to the notice of the Contractor who shall incorporate the same in the drawings and works without any extra cost to the owner. The Contactor will be totally responsible for the correctness of the detailed fabrication drawings and execution of the work.

4.9 Contractor shall incorporate all the revisions made in the design drawings during the course of execution of work in his fabrication drawings, and resubmit the drawings at no extra cost to the Owner. All fabrication shall be carried out only as per the latest AFC design drawings and corresponding fabrication drawings.

4.10 The Contractor shall supply two prints each of the final/as built drawings along with their transparencies to Engineer-in-Charge for reference and record. The rates quoted shall include for the same.

5.0 FABRICATION

5.1 GENERAL

5.1.1 Fabrication of structures shall be done strictly as per "Approved for Construction" fabrication drawings (prepared by the Contractor based on the latest design drawings) and in accordance with IS: 800, IS: 9595 & other relevant BIS Codes and BIS Hand Book SP: 6(1).

5.1.2 Prior to commencement of structural fabrication, undulations in the fabrication yard, if any, shall be removed and area levelled and paved by the Contractor.

5.1.3 Any defective material used in the work shall be replaced by the Contractor at his own expense. Necessary care and precautions shall be taken so as not to cause any damage to the structure during any such removal and replacement.

5.1.4 Any faulty fabrication pointed out at any stage of work by the Engineer-in-Charge, shall be made good or replaced by the Contractor at his own cost.

5.1.5 Tolerances for fabrication of steel structures shall be as per IS: 7215.

5.2 FABRICATION PROCEDURE

5.2.1 STRAIGHTENING & BENDING

5.2.1.1 All materials shall be straight and, if necessary, before being worked shall be straightened and/or flattened (unless required to be of curvilinear form) and shall be free from twists.

5.2.1.2 Bending of rolled sections and plates shall be done by cold process to shapes as shown on drawings.

5.2.2 CLEARANCES

The erection clearance for cleated ends of members shall be not greater than 2mm at each end. The erection clearance at ends of beams without web cleats and end plates shall be not more than 3mm at each end but where for practical reasons, greater clearance is necessary, suitably designed seating's approved by the Engineer-in-Charge shall be provided.

5.2.3 CUTTING

5.2.3.1 Prior to cutting, all members shall be properly marked showing the requisite cut length/width, connection provisions e.g. location and dimensions of holes, welds, cleats etc. Marking for cutting shall be done judiciously so as to avoid wastages or unnecessary joints as far as practicable. Marking shall be done by placing the members on horizontal supports/pads in order to ensure accuracy. Marking accuracy shall be limited to + 1 mm.

5.2.3.2 Cutting may be affected by shearing, cropping or sawing. Gas cutting by mechanically controlled torch shall be permitted for mild steel. Hand flame cutting may be permitted subject to the approval of the Engineer-in-Charge.

5.2.3.3 Except where the material is subsequently joined by welding, no loads shall be transmitted into metal through a gas cut surface.

5.2.3.4 Shearing, cropping and gas cutting shall be clean, square, free from any distortion & burrs, and should the Engineer-in-Charge find it necessary, the edges shall be ground afterwards, to make the same straight and uniform at no extra cost to the Owner.

5.2.4 HOLING

5.2.4.1 Holes for bolts shall not be formed by gas cutting process.

5.2.4.2 Holes through more than one thickness of material of members such as compound stanchions and girder flanges shall, where possible, be drilled after the members are assembled and tightly clamped/bolted together. Punching may be permitted before assembly, provided the thickness of metal is less than 16mm and the holes are punched 3mm less in diameter than the required size and reamed, after assembly, to the full diameter. Punching shall not be adopted for dynamically loaded structures.

5.2.4.3 Holes may be drilled in one operation through two or more separable parts and burrs removed from each part after drilling.

5.2.4.4 Holes in connecting angles and plates, other than splices, also in roof members and light framing, may be punched full size through material not over 12mm thick, except where required for close tolerance bolts or barrel bolts.

5.2.4.5 All matching holes for black bolts shall register with each other so that a gauge of 2mm less in diameter than the diameter of hole shall pass freely through the assembled members in the direction at right angle to such members. Finished holes shall be not more than 2mm in diameter larger than the diameter of the black bolt passing through them, unless otherwise specified by the Engineer-in-Charge.

5.2.4.6 Holes for turned and fitted bolts shall be drilled to a diameter equal to the nominal diameter of the shank or barrel subject to H8 tolerance specified in IS: 919. Parts to be connected with close tolerance or barrel bolts shall be firmly held together by tacking bolts or clamps and the holes drilled through all the thicknesses in one operation and subsequently reamed to size. Holes not drilled through all the thicknesses in one operation shall be drilled to a smaller size and reamed out after assembly. Where this is not possible, the parts shall be drilled and reamed separately.

5.2.4.7 To facilitate grouting, holes shall be provided in column bases or seating plates exceeding 300mm in width for the escape of air.

5.2.4.8 To avoid accumulation of water in gusseted column bases of laced, battened or box type stanchions, suitable reverse U-type holes shall be provided at the junction of base plate and column section in the vertical gussets for draining out of any water.

5.2.5 ASSEMBLY

The component parts shall be assembled and aligned in such a manner that they are neither twisted nor otherwise damaged, and shall be so prepared that the required camber, if any, is provided. Proper clamps, clips, jigs and other fasteners (bolts and welds) shall be placed in a balanced pattern to avoid any distortion in the members and to ensure their correct positioning (i.e. angles, axes, nodes etc.). Any force fitting, pulling/stretching of members to join them shall be avoided. Proper care shall be taken for welding shrinkage & distortion so as to attain the finished dimensions of the structure shown on the drawings.

5.2.6 WELDING

5.2.6.1 GENERAL

a. All joints shall be welded unless noted otherwise on the design drawings.

b. Welding shall be in accordance with IS: 816, IS: 819, IS: 1024, IS: 1261, IS: 1323 and IS: 9595 as appropriate.

c. The Contractor shall make necessary arrangement for providing sufficient number of welding sets of the required capacity, all consumables, cutting and grinding

equipment with requisite accessories/ auxiliaries, equipment & materials required for carrying out various tests such as dye penetration, magnetic particle, ultrasonic etc.

d. Adequate protection against rain, dust, snow & strong winds shall be provided to the welding personnel and the structural members during welding operation. In the absence of such a protection no welding shall be carried out.

e. It shall be the responsibility of the Contractor to ensure that all welding is carried out in accordance with the terms of this specification and relevant BIS codes. The Contractor shall provide all the supervision to fulfill this requirement.

5.2.6.2 PREPARATION OF MEMBER FOR WELDING

a. Edge Preparation

Edge preparation/bevelling of fusion faces for welding shall be done strictly as per the dimensions shown in the drawings. In case, the same are not indicated, edges shall be prepared (depending on the type of weld indicated in the drawing) as per the details given in IS: 9595. Bevelling of fusion faces shall be got checked and approved by the Engineer-in-Charge. The tolerances on limits of gap, root face & included angle shall be as stipulated in IS: 9595.

b. Cleaning

Welding edges and the adjacent areas of the members (extending up to 20mm) shall be thoroughly cleaned of all oil, grease, scale and rust and made completely dry. Gaps between the members to be welded shall be kept free from all foreign matter.

c. Preheating

Preheating of members shall be carried out as per IS: 9595 when the base metal temperature is below the requisite temperature for the welding process being used. Preheating shall be done in such a manner that the parts, on which the weld metal is being deposited, are above the specified minimum temperature for a distance of not less than 75mm on each side of the weld line. The temperature shall be measured on the face opposite to that being heated. However, when there is access to only one face, the heat source shall be removed to allow for temperature equalization (1 minute for each 25mm of plate thickness) before measuring the temperature.

d. Grinding

i. Column splices & butt joints of struts and compression members (depending on contact for load transmission) shall be accurately ground and close-butted over the whole section with a tolerance not exceeding 0.2mm locally at any place. In column caps & bases, the ends of shafts together with the attached gussets, angles, channels etc., shall be accurately ground so that the parts connected butt over minimum 90%

surface of contact. In case of connecting angles or channels, care shall be taken so that these are fixed with such accuracy that they are not reduced in thickness by grinding by more than 2mm.

ii. Ends of all bearing stiffeners shall be ground to fit tightly at both top and bottom. Similarly bottom of the knife edge supports along with the top surface of column brackets shall be accurately ground to provide effective bearing with a tolerance not exceeding 0.2mm locally at any place.

iii. Slab bases and caps shall be accurately ground over the bearing surfaces and shall have effective contact with the ends of stanchions. Bearing faces which are to be grouted direct to foundations need not be ground if such faces are true & parallel to the upper faces.

5.2.6.3 WELDING PROCESSES

Welding of various materials under this specification shall be carried out using one or more of the following processes.

a. Manual Metal Arc Welding Process (MMAW)

b. Submerge Arc Welding Process (SAW)

c. Gas Metal Arc Welding Process (GMAW)

d. Flux Cored Arc Welding Process (FCAW)

The welding procedure adopted and consumables used shall be specifically approved by the Engineer-in-Charge. A combination of different welding processes or a combination of electrodes of different classes/makes may be employed for a particular joint only after qualifying the welding procedures to be adopted and obtaining the written approval of the Engineer-in-Charge.

5.2.6.4 APPROVAL & TESTING OF WELDERS

The Contractor shall satisfy the Engineer-in-Charge that the welders are suitable for the work upon which they will be employed. For this purpose the welders shall have satisfied the relevant requirements of IS: 7318. If the welders will be working to approved welding procedures, they shall have satisfied the relevant requirements of IS: 7310.

Adequate means of identification shall be provided to enable each weld to be traced to the welder by whom it was made. The Contractor shall intimate the Engineer-in-Charge sufficiently in advance, the commencement of tests, to enable him to be present to witness the same.

5.2.6.5 APPROVAL & TESTING OF WELDING PROCEDURES

The Contractor shall carry out procedure tests in accordance with IS:7307 to demonstrate by means of a specimen weld of adequate length on steel representative of that to be used, that he can make welds with the welding procedure to be used for

the work to the complete satisfaction of the Engineer-in-Charge. The test weld shall include weld details from the actual construction and it shall be welded in a manner simulating the most unfavorable instances of fit-up, electrode condition etc., which are anticipated to occur on the particular fabrication. Where material analyses are available, the welding procedure shall be carried out on material with the highest carbon equivalent value.

After welding, but before the relevant tests given in IS: 7307 are carried out, the test weld shall be held as long as possible at room temperature, but in any case not less than 72 hours, and shall then be examined for cracking. The examination procedure shall be sufficiently rigorous to be capable of revealing significant defects in both parent metal and weld metal.

After establishing the welding method, the Contractor shall finally submit to the Engineer-in-Charge for his approval the welding procedure specification in standard format given in IS: 9595 before starting the fabrication.

5.2.6.6 SEQUENCE OF WELDING

a. As far as practicable, all welds shall be made in a sequence that will balance the applied heat of welding while the welding progresses.

b. The direction of the general progression in welding on a member shall be from points where the parts are relatively fixed in position with respect to each other towards points where they have a greater relative freedom of movement.

c. All splices in each component part of a cover-plated beam or built up member shall be made before the component part is welded to other component parts of the member.

d. Joints expected to have significant shrinkage shall be welded before joints expected to have lesser shrinkage.

e. Welding shall be carried continuously to completion with correct number of runs.

f. The Contractor shall choose the welding sequence after carefully studying each case such as to minimize distortion and shrinkage & submit the same to the Engineer-in-Charge for comments and approval.

5.2.6.7 WELDING TECHNIQUE

a. After the fusion faces are carefully aligned and set with proper gaps, the root pass of butt joints shall be executed properly so as to achieve full penetration with complete fusion of the root edges.

b. On completion of each run, all slag and spatters shall be removed and the weld and the adjacent base metal shall be cleaned by wire brushing and light chipping. Visible defects such are cracks, cavities and other deposition faults, if any, shall be removed to sound metal before depositing subsequent run of weld.

c. All full penetration butt welds shall be completed by chipping/gouging to sound metal and then depositing a sealing run of weld metal on the back of the joints. Where butt welding is practicable from one side only, suitable backing steel strip shall be used and joint shall be arranged in such a way as to ensure that complete fusion of all the parts is readily obtained.

d. While welding is in progress care shall be taken to avoid any kind of movement of the components, shocks, vibrations to prevent occurrence of weld cracks.

e. Any deviation desired from the recommended welding technique and electrodes shall be adopted only after obtaining written approval of the Engineer-in-Charge.

5.2.6.8 INSPECTION & TESTING OF WELDS

The method of inspection shall be according to IS: 822 and extent of inspection and testing shall be in accordance with the relevant applicable standard or, in the absence of such a standard, as specified by the Engineer-in-Charge. Welds shall not be painted or otherwise obscured until they have been inspected, approved and accepted.

The Engineer-in-Charge or his representative shall have access to the Contractor's work at all reasonable times and the Contractor shall provide him with all facilities necessary for inspection during all stages of fabrication and erection without not limited to the following objectives.

a. To check the conformity with the relevant standards and suitability of various welding equipments and their performance.

b. To witness/approve the welding procedure qualification.

c. To witness/approve the welders performance qualification.

d. To check whether shop/field welding being executed is in conformity with the relevant specifications and codes of practice.

Inspection and testing of all fabricated structures shall be carried out by the Contractor by any, or, a combination of all the following methods as directed by the Engineer-in-Charge and no separate payment shall be made, unless otherwise mentioned, for inspection and testing of welds/fabricated structures:

A. Visual Inspection

All finished welds (i.e. 100 percent) shall be visually inspected for identification of the following types of weld defects & faults.

a. Weld defects occurring at the surface such as blow holes, exposed porosity, unfused welds etc.

b. Surface cracks in the weld metal or in the parent metal adjacent to it.

c. Damages to the parent metal such as undercuts, burning, overheating etc.

d. Profile defects such as excessive convexity or concavity, overlapping, unequal leg lengths, excessive reinforcement, incompletely filled grooves, excessive penetration beads, root grooves etc.

e. Distortion due to welding i.e., local shrinkage, camber, bowing, twisting, rotation, wariness etc.

f. Linear eccentric, angular and rotational misalignment of parts.

g. Dimensional errors.

B. Mechanical Tests

The mechanical testing (such as tensile load tests, bend tests, impact tests etc.) shall be done in accordance with the relevant standards and as per the instructions of the Engineer-in-Charge.

C. Magnetic Particle/Dye Penetration/Ultrasonic Examination:

The examination shall be done at random as directed by the Engineer-in-Charge. Whenever such tests are directed, the tests shall be carried out on joints chosen by him. The tests shall be carried out by employing approved testing procedure in accordance with IS: 822.

D. Radiographic Examination

Radiographic examination shall be carried out only in special cases for random joints as directed by the Engineer-in-Charge. The Contractor shall be paid extra for such examination except for penalty radiographic tests for which the cost shall be borne by him. The Contractor shall make necessary arrangement at his own expense for providing the radiographic equipment, films and all other necessary materials required for carrying out the examination. The tests shall be carried in the presence of the Engineer-in-Charge by employing approved testing procedure in accordance with IS: 822. The Contractor shall fulfill all the statutory safety requirements while handling X-ray and Gamma-ray equipment and provide the Engineer- in-Charge all the necessary facilities at site such as dark room, film viewer etc., to enable him to examine the radiographs.

5.2.6.9 Repair of Faculty Welds

No repair of defective welds shall be carried out without proper permission of the Engineer-in-Charge and his approval for the corrective procedure.

Welds not complying with the acceptance requirements (as specified by BIS Codes & the Engineer-in-Charge), as revealed during inspection & testing of welds or erection or in-situ condition shall be corrected either by removing & replacing or as follows:

a. Excessive convexity - Reduced to size by removal of excess weld metal.

b. Shrinkage cracks, - Defective portions removed down to sound

	cracks in parent plates and craters		metal and re-welded.
c.	Under cutting.	-	Additional weld metal deposited.
d.	Improperly fitted/ misaligned parts.	-	Welding cut & edges suitably prepared and parts.
e.	Members distorted the by heat of welding	-	Member straightened by mechanical means or careful application of limited amount of heat, temperature of such area not to exceed 650 degree Centigrade dull red heat).

In removing defective parts of a weld, gouging, chipping, oxygen cutting or grinding shall not extend into the parent metal to any substantial amount beyond the depth of weld penetration, unless cracks or other defects exist in the parent metal. The weld or parent metal shall not be undercut in chipping, grinding, gouging or oxygen cutting.

Any fabricated structure or its component which, in the opinion of Engineer-in-Charge, is defective and/or beyond any corrective action shall be removed forthwith from the site as instructed by the Engineer-in-Charge without any extra claim. The owner reserves the right to recover any compensation due to any loss arising out of such rejections.

5.2.7 BOLTING

5.2.7.1 All bolts shall be provided such that no part of the threaded portion of the bolts is within the thickness of the parts bolted together. Washers of suitable thickness shall be used under the nuts to avoid any threaded portion of the bolt being within the thickness of parts bolted together.

5.2.7.2 The threaded portion of each bolt shall project through the nut at least one thread.

5.2.7.3 Flat washers shall be circular and of suitable thickness. However, where bolt heads/nuts bear upon the bevelled surfaces, they shall be provided with square tapered washers of suitable thickness to afford a seating square with the axis of the bolt.

5.2.8 SPLICING

5.2.8.1 Splicing of built up/compound/latticed sections shall be done in such a fashion that each component of the section is joined in a staggered manner.

5.2.8.2 Where no butt weld is used for splicing, the meeting ends of two pieces of joist/channel/built up section shall be ground flush for bearing on each other and suitable flange and web splice plates shall be designed and provided for the full strength of the flange/ web of the section and welds designed accordingly.

5.2.8.3 Where full strength butt weld is used for splicing (after proper edge preparation of the web and flange plates) of members fabricated out of joist/ channel/ angles/ built up section, additional flange and web plates shall be provided, over and above the full strength butt welds, to have 40% strength of the flange and web.

5.2.8.4 Where a cover plate is used over a joist/channel section the splicing of the cover plate and channel/joist sections shall be staggered by minimum 500mm. Extra splice plate shall be used for the cover plate and joist/channel section as per clause 5.2.8.2 or 5.2.8.3.

5.2.8.5 Prior approval shall be obtained by the Contractor for locations of splices where not shown on design drawings. Only a single splice at approved location shall be allowed for member's up to a length of 6 to 7m. Maximum two numbers of splices shall be allowed for members exceeding this length.

5.2.9 MACHINING & GRINDING

5.2.9.1 All slab bases and slab caps shall be accurately machined over the bearing surfaces and shall be in effective contact with the ends of column sections (shafts).

5.2.9.2 For slab bases and slab caps, ends of column shafts shall be accurately machined. However, for gusseted bases and caps, the column shafts shall be ground flush for effective contact with parts connected together.

5.2.9.3 Gusseted bases and caps shall be ground flush for effective contact with ends of column sections.

5.2.9.4 End of all bearing stiffeners shall be machined or ground to fit tightly at top and bottom without any air gap.

5.2.9.5 While machining or grinding care shall be taken so that the length or thickness of any part does not get reduced by more than 2.0mm.

5.2.9.6 For all machining or grinding works for gusseted base and cap plates, the clearance between the parts joined shall not exceed 0.2mm at any location.

6.0 MARKING FOR IDENTIFICATION

6.1 Each component shall be distinctly marked (with paint) before delivery in accordance with the marking diagrams and shall bear such other marks as will facilitate erection.

6.2 For small members which are delivered in bundles or crates, the required marking shall be done on small metal tags securely tied to the bundle.

7.0 SHOP ERECTION

The steel work shall be temporarily shop erected complete or as directed by the Engineer-in-Charge, so that the accuracy of fit may be checked before dispatch.

8.0 INSPECTION & TESTING OF STRUCTURES

8.1 The Engineer-in-Charge (or his authorized representative) shall have free access at all times to those parts of the Contractor's works which are concerned with the fabrication of the steel work and shall be provided with all reasonable facilities for satisfying himself that the fabrication is being undertaken in accordance with the provisions of these specifications & other relevant BIS Codes.

8.2 Should any structure or part of a structure be found not to comply with any of the provisions of this specification (or relevant BIS Codes as referred to), it shall be liable to rejection. No structure or part of the structure, once rejected shall be resubmitted for inspection, exception cases where the Engineer-in-Charge or his authorized representative considers the defect as rectifiable.

8.3 Defects which may appear during/after fabrication/ erection shall be made good only with the consent of the Engineer-in-Charge and procedure laid down by him.

8.4 All necessary gauges and templates shall be supplied free to the Engineer-in-Charge by the Contractor whenever asked for during inspection. The Engineer-in- Charge, may at his discretion, check the test results obtained at the Contractor's works by independent tests at a test house, and the cost of such tests shall be borne by the Contractor.

9.0 SHOP PAINTING

9.1 All components and members of steel work shall be given one shop coat of primer (conforming to relevant BIS codes) or any other primer as specified, in the tender, immediately after the surfaces have been properly prepared (i.e. degreased, de-rusted, descaled & cleaned) in accordance with IS: 1477 or IS: 800, as applicable. The primer coat shall be applied over completely dry surfaces (using brushes of good quality) in a manner so as to ensure a continuous and uniform film without "holidaying". Special care shall be taken to cover all the crevices, corners, edges etc. However, in areas which are difficult to reach by brushing, daubers/mops shall be used by dipping the same in paint and then pulling/ pushing them through the narrow spaces. The primer coat shall be air dried and shall have a minimum film thickness as per table 29 of IS: 800 after drying, as applicable.

9.2 Surfaces which are inaccessible after shop assembly, shall receive the full specified protective treatment before assembly (this shall not apply to the interior of sealed hollow sections).

9.3 Steel surfaces shall not be painted within a suitable distance of any edges to be welded if the paint specified would be harmful to welders or impair the quality of the welds.

9.4 Welds and adjacent parent metal shall not be painted prior to de-slagging, inspection and approval by the Engineer-in-Charge.

9.5 Parts to be encased in concrete shall have only coat of primer and shall not be painted after erection.

10.0 PACKING

10.1 All items shall be suitably packed in case these are to be dispatched from the fabrication shop to the actual site of erection so as to protect them from any damage/distortion or falling during transit. Where necessary, slender projecting parts shall be temporarily braced to avoid warping during transportation.

10.2 Small parts such as gussets, cleats etc., shall be securely wired on to their respective main members.

10.3 Bolts, nuts washers etc. shall be packed in crates.

11.0 TRANSPORTATION

Loading and transportation shall be done in compliance with transportation rules. In case, certain parts cannot be transported in the lengths stipulated on the drawings, the position details of such additional splice joints shall be got approved by the Engineer-in-Charge.

12.0 SITE (FIELD) ERECTION

12.1 PLANT & EQUIPMENT

The suitability and capacity of all plant and equipment used shall be to the complete satisfaction of the Engineer-in-Charge.

12.2 STORING & HANDLING

All steel work shall be so stored and handled at site so that the members are not subjected to excessive stresses and any damage.

12.3 SETTING OUT

Prior to setting out of the steel work, the Contractor shall get himself satisfied about the correctness of levels, alignment, location of existing concrete pedestals/columns/brackets and holding down bolts/pockets provided therein. Any minor modification in the same including chipping, cutting and making good, adjusting the anchor bolts etc., if necessary, shall be carried out by the Contractor at his own expense. The positioning and levelling of all steel work including plumbing of columns and placing of every part of the structure with accuracy shall be in accordance with the drawings and to the complete satisfaction of the Engineer-in-Charge.

12.4 TOLERANCES

Tolerances for erection of steel structures shall be as per Annexure 'A'

13.0 SAFETY & SECURITY DURING ERECTION

13.1 The contractor shall comply with IS: 7205 for necessary safety and adhere to safe erection practices and guard against hazardous as well as unsafe working conditions during all stages of erection.

13.2 During erection, the steel work shall be securely bolted or otherwise fastened and when necessary, temporarily braced/guyed to provide for all loads to be carried by the structure during erection till the completion, including those due to the wind, erection equipment & its operation etc. at no extra cost to the owner. For the purpose of guying, the Contractor shall not use other structure in the vicinity without prior written permission of the Engineer-in-Charge.

13.3 No permanent bolting or welding shall be done until proper alignment has been achieved.

13.4 Proper access, platform and safety arrangement shall be provided for working and inspection, (at no extra cost to the owner) whenever required.

14.0 FIELD CONNECTIONS

14.1 FIELD BOLTING

Field bolting shall be carried out with the same care as required for shop bolting.

14.2 FIELD WELDING

All field assembly and welding shall be executed in accordance with the requirements for shop assembly and welding. Holes for all erection bolt – where removed after final erection shall be plugged by welding. Alternatively erection bolts may be left and secured.

15.0 GROUTING

15.1 Prior to positioning of structural columns/girders/trusses over the concrete pedestals/columns/brackets, all laitance & loose material shall be removed by wire brushing & chipping. The bearing concrete surfaces shall be sufficiently levelled, hacked with flat chisels to make them rough, cleaned (using compressed air) and made thoroughly wet. All pockets for anchor bolts shall also be similarly cleaned and any excess water removed. Thereafter, the structural member shall be erected, aligned & plumbed maintaining the base plates/shoe plates at the levels shown in the drawings, with necessary shims/pack plates/wedges.

15.2 After final alignment and plumbing of the structure, the forms shall be constructed alround and joints made tight to prevent leakage. Grouting (under the base plates/shoe plates including grouting of sleeves & pockets) shall be done with non-shrink grout having compressive strength (28 days) not less than 40N/sq.mm Non shrink grout shall be of free flow premix type and of approved quality and make. It shall be mixed with water in proportion as specified by the manufacturer. Ordinary 1:2 cement/sand mortar grout shall be used only for small, isolated structures e.g. operating platforms not supporting any equipment, pipe supports, cross-over's, stairs & ladders. The thickness of grout shall be as shown on the drawings but not less than 25 mm nor more than 40mm in any case.

15.3 The grout mixture shall be poured continuously (without any interruption till completion) by grouting pumps from one side of the base plate and spread uniformly

with flexible steel strips and rammed with rods, till the space is filled solidly and the grout mixture carried to the other side of the base plate.

15.4 The grout mixture shall be allowed to harden for a period as decided by the Engineer-in-Charge. At the end of this period, the shims/wedges/pack plates may be removed and anchor bolts tightened uniformly. The alignment of the structure shall now be rechecked and if found correct, the voids left by the removal of shims/wedges/pack plates (if removed) must be filled up with a similar mixture of grout. In case after checking, serious misalignment is indicated, the grout shall be removed completely and fresh grouting done after making appropriate correction of alignment.

16.0 SCHEME AND SEQUENCE OF ERECTION

The Contractor shall furnish the detailed scheme and sequence of erection to match with the project schedule and get the same approved by the Engineer-in-Charge. All necessary co-ordination and synchronization shall be done with the Civil contractor where Civil works are not included in the scope of structural contractor at no extra cost so as to match with the project schedule.

17.0 PAYMENT

This clause shall apply to Item Rate tender only.

17.1 Payment for structural steel works shall be made on the basis of admissible weight in metric tons (determined as described in clause 17.2 and 17.3) of the structure accepted by the Engineer-in-Charge. The rate shall include supplying (as per supply conditions given in the Tender) fabricating, erecting in position (at all levels & locations), testing/examining (excluding radiography only) of bolted and/or welded structural steel works of all types (including all built up/compound sections made out of rolled sections and/or plates) including all handling, transporting, storing, straightening if required, cutting, edge preparation, preheating, bolting and welding of joints (including sealing the joints of box sections with continuous welding), finishing edges by grinding/machining as shown, fixing in line & level with temporary staging & bracing and removal of the same after erection, grouting with no shrink/ordinary grout as specified, preparation of fabrication & erection drawings, & erection schedule and getting them reviewed, preparation and submission of as built drawings, as built drawings, preparing the surfaces for painting, surface cleaning, wire brushing, removal of mill scale, dust, rust, oil or grease and applying coat of primer or any other primer as specified after fabrication, return of surplus materials to owner's stores and material reconciliation in the case of materials supplied by the owner as per relevant contract conditions etc. all complete for all the operations mentioned in the foregoing clauses.

17.2 The weight for payment shall be determined from the fabrication drawings and respective bill of materials prepared by the Contractor. The bill of materials shall be checked and approved by the Engineer-in-Charge before making the payment. The Contractor shall prepare full scale template in order to supplement/verify the actual cutting dimensions where so directed by the Engineer-in-Charge. The weight shall be calculated on the basis of BIS Hand Book wherever applicable. In case sections used

are different from BIS sections, then Manufacturers' Hand Book shall be adopted. No allowance in weight shall be made for rolling tolerances.

17.3 Welds, bolts, nuts, washers, shims, pack plates, wedges, grout and shop painting shall not be separately measured. The quoted rate shall be deemed to include the same.

17.4 The rate shall include all expenses related to safety & security arrangements during erection and all plants & tools required for fabrication, transportation & erection.

18.0 PAINTING AFTER ERECTION

18.1 GENERAL

18.1.1 The scope of painting after erection shall be at the sole discretion of the Engineer-in-Charge and the Contractor shall obtain written instruction in this regard sufficiently prior to taking up any procurement of paint and execution of painting work after erection of steel structures.

18.1.2 The Contractor shall carry out the painting work in all respects with the best quality of approved materials (conforming to relevant BIS Codes or IS: 800, as applicable) and workmanship in accordance with the best engineering practice. The Contractor shall furnish characteristics of paints (to be used) indicating the suitability for the required service conditions. The paint manufacturer's instructions supplemented by Engineer-in-Charge's direction, if any, shall be followed at all times. Particular attention shall be paid to the following:

a. Proper storage to avoid exposure & extremes of temperature.

b. Surface preparation prior to painting.

c. Mixing & thinning.

d. Application of paint and the recommended limit on time intervals between consecutive coats.

18.1.3 Painting shall not be done in frost or foggy weather, or when humidity is such as to cause condensation on the surfaces to be painted.

18.1.4 Surface which shall be inaccessible after site assembly shall receive the full specified protective treatment before assembly.

18.1.5 Primers & finish coat paints shall be from the same manufacturer in order to ensure compatibility. Painting colour code shall be as per Annexure-'B'.

18.2 RUB DOWN & PRIMER APPLICATION

The shop coated surfaces shall be rubbed down thoroughly with emery/abrasive paper to remove dust, rust, other foreign matters and degreased, if required, in accordance with IS: 1477 or IS: 800, as applicable, cleaned with warm fresh water and air dried. The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry.

Primer coat as per table 29 of IS: 800 shall be applied by brushing/ spraying over the shop coat in a manner so as to ensure a continuous and uniform film throughout. Special care shall be taken to cover all the crevices, corners, edges etc. The final primer coat shall be air dried and shall have a minimum film thickness as per IS: 800 after drying, as applicable.

In case a different cleaning procedure & primer specifications are specified in the drawing/Tender, the same shall be adopted.

18.3 FINAL PAINT APPLICATION

After the primer is hard dry, the surfaces shall be dusted off and one coat of synthetic enamel paint of approved colour & shade (conforming to IS: 2932) or any other paint as per IS: 800, shall be applied by brushing/spraying so that a film free from "holidaying" is obtained. The colour & shade of first coat of paint shall be slightly lighter than the second coat in order to identify the application of each coat. The second coat of paint shall be applied after the first coat is hard dry. The minimum thickness of each film shall be as per IS: 800 after drying.

In case a different type of paint & painting procedure are specified in the drawing/tender, the same shall be adopted.

Color coding for structural steel shall be as per ANNEXURE "B".

18.4 INSPECTION & TESTING OF PAINTING WORKS

18.4.1 All painting materials including primers & thinners brought to site by the Contractor for application shall be procured directly from reputed and approved manufacturers and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates shall not be accepted.

18.4.2 The Engineer-in-Charge at his discretion may call for additional tests for paint formulations. The Contractor shall arrange to have such tests performance including batch wise test of wet paints for physical & chemical analysis. All costs shall be borne by the Contractor.

18.4.3 The painting work shall be subject to inspection by the Engineer-in-Charge at all times. In particular, the stage inspection will be performed and Contractor shall offer the work for inspection and approval at every stage before proceeding with the next stage. The record of inspection shall be maintained. Stages of inspection are as follows:

a. Surface preparation

b. Primer application

c. Each coat of paint

18.4.4 Any defect noticed during the various stages of inspection shall be rectified by the Contractor to the entire satisfaction of the Engineer-in-Charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of

work the Contractor shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period, as defined in General Conditions of Contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat. The thickness shall be measured at as many locations as decided by the Engineer-in-Charge. The Contractor shall provide standard thickness measuring instrument such as elkometer (with appropriate range for measuring dry film thickness of each coat) free of cost to the Engineer-in-Charge whenever asked for.

18.5 PAYMENT

This clause shall apply to Item Rate tender only.

Payment for painting of structural steel works shall be made on the basis of admissible weight in metric tons of the painted structures accepted by the Engineer-in-Charge.

The rate shall include supplying & applying two coats of synthetic enamel paint or any other paint specified in the tender of approved quality and shade over a coat of red oxide zinc chromate primer or any other primer specified in the tender over one coat of shop primer already applied to structural steel works of all types/shapes at all levels, locations & positions including storage, surface preparation, degreasing, cleaning, drying, touching up of shop primer coat, providing temporary staging, testing etc. all complete to the entire satisfaction of the Engineer-in-Charge.

ANNEXURE-'A'

(Clause 12.4)

Maximum Permissible Erection Tolerances

A. Columns

1. Deviation of column axes at foundation top level with respect to true axes.

i) In longitudinal direction	±5mm
ii) In lateral direction	±5mm

2. Deviation in the level of bearing surface of columns at foundation top with respect to true level ±5mm

3. Out of plumb (Verticality) of column axis from true vertical axis, as measured at top:

i)	Up to and including 30m height	±H/1000 or ±25mm Whichever is less.
ii)	Over 30m height	±H/1200 or ±35mm Whichever is less.

4. Deviation in straightness in longitudinal & transverse planes of column at any point along the height. ±H/1000 or ±10mm Whichever is less.

5. Difference in the erected positions of adjacent pairs of columns along length or across width of building prior to connecting trusses/beams with respect to true distance. ±5mm

6. Deviation in any bearing or seating level with respect to true level. ±5mm

7. Deviation in difference in bearing levels of a member on adjacent pair of columns both across & along the building. ±5mm

Note: 1. Tolerance specified under 3 should be read in conjunction with 4 & 5.
Note: 2. 'H' is the column height in mm.

B.	**Trusses**	
1.	Shift at the centre of span of top chord member with respect to the vertical plane passing through the centre of bottom chord.	±1/250 of height of truss in mm at centre of span or ±15mm whichever is less.
2.	Lateral shift of top chord of truss at the centre of span from the vertical plane passing through the centre of supports of the truss.	±1/1500 of height of truss in mm or ±10mm whichever is less.
3.	Lateral shift in location of truss from its true position.	±10mm
4.	Lateral shift in location of purlin from true position.	±5mm
5.	Deviation in difference of bearing levels of truss from the true level.	±1/1200 of span of truss in mm or ±20mm whichever is less.
C.	**Gantry Girders & Rails**	
1.	Shift in the centre line of crane rail with respect to centre line of web of gantry girder.	$\pm\frac{[\{\text{web thickness (mm)}\}+2\text{mm}]}{2}$
2.	Shift of alignment of crane rail (in plan) with respect to true axis of crane rail at any point.	±5mm
3.	Deviation in crane track gauge with respect to true gauge.	
i)	For track gauge up to and including 15m.	±5mm
ii)	For track gauge more than 15m.	±[5+0.25 (S-15)] Subjected to maximum ±100mm, where S in Metres is true gauge.
4.	Deviation in the crane rail level at any point from true level.	±10mm
5.	Difference in level between crane track rails (across the bay) at	
i)	Supports of gantry girders	15mm
ii)	Mid span of gantry girders	20mm
6.	Relative shift of crane rail surfaces (at a joining) in plan and elevation.	2mm

ANNEXURE-'B'

(Clause 18.3)

PAINTING COLOUR CODE FOR STRUCTURAL STEEL

1.	GANTRY GIRDER & MONORAIL	DARK GREEN
2.	GANTRY GIRDER & MONORAIL STOPPER	SIGNAL RED
3.	BUILDING STRUCTURAL STEEL COLUMNS, BRACKETS, BEAMS, BRACINGS, ROOF TRUSS, PURLINS, SIDEGIRTS, LOUVERS, STRINGERS,	DARK ADMIRALITY GREY
4.	PIPE RACK STRUCTURE & TRESTLE	DARK ADMIRALITY GREY
5.	CHEQUERED PLATE (BOTH FACES)	BLACK
6.	GRATING	BLACK
7.	LADDER	RUNGS-BLACK VERTICALS & CAGE RED
8.	HAND RAILING	
	- HANDRAIL, MIDDLE RAIL, TOE PLATE	SIGNAL RED
	- VERTICAL POST	BLACK

Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
BRICK MASONRY

VCS-SS-CS-6027

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ABBREVIATION

m	Metre
mm	Millimetre
Cm	Centimetre
m^2	Square metre
m^3	Cubic Metre
Kg	Kilogram
IS	Indian Standard
MS	Mild Steel
C/C	Center to Center
RCC	Reinforced Cement Concrete
PCC	Plain Cement Concrete

CONTENTS

1.0 SCOPE

THIS SPECIFICATION ESTABLISHES THE MATERIALS, DRESSING, LAYING, JOINING, CURING, WORKMANSHIP ETC. FOR BRICK MASONRY WORKS. BRICK MASONRY SHALL ALSO COMPLY WITH ALL THE REQUIREMENTS OF IS: 2212.

2.0 REFERENCES

2.1 BIS CODES

IS: 2212 Brick works-code of practice

IS: 2250 Code of practice for preparation and use of masonry works

2.2 SPECIFICATIONS

VCS-SS-CS-6021 Materials

3.0 MATERIALS

Refer specification no. VCS-SS-CS-6021: Materials

4.0 GENERAL REQUIREMENTS

4.1 CEMENT MORTAR

Cement mortar shall meet the requirements of IS: 2250 and shall be prepared by mixing cement and sand by volume. Proportion of cement and sand shall be 1:6 (1 part of cement and 6 parts of sand), or as directed by the Engineer-in-Charge/shown on the drawing, for brick masonry of one brick thickness or more, while 1:4 cement mortar (1 part of cement and 4 parts of sand) shall be used for brick masonry of half brick thickness. The sand being used for mortar shall be sieved. The mortar shall be used as soon as possible after mixing and before it has begun to set and in any case within initial setting time of cement after water is added to the dry mixture. Mortar unused for more than initial setting time of cement, shall be rejected and removed from the site of work.

4.1.1 PROPORTIONING

The unit of measurement for cement shall be a bag of cement weighing 50 kgs and this shall be taken as 0.035 cubic metre. Sand shall be measured in boxes of suitable size on the basis of its dry volume. In case of damp sand, its quantity shall be increased suitably to allow for bulkage.

4.1.2 MIXING

The mixing of mortar shall be done in a mechanical mixer operated manually or by power. The Engineer-in-Charge may, however, permit hand-mixing as a special case, taking into account the magnitude, nature and location of work. The Contractor shall take the prior permission of Engineer-in-Charge, in writing, for using hand-mixing before the commencement of work.

a. Mixing in Mechanical Mixer

Cement and sand in specified proportions, by volume, shall be thoroughly mixed dry in a mixer. Water shall then be added gradually and wet mixing continued for at-least one minute. Care shall be taken not to add more water than that which shall bring the mortar to the consistency of stiff paste. Wet mix from the mixer shall be unloaded on water-tight masonry platform, made adjacent to the mixer. Platform shall be at-least 150 mm above the levelled ground to avoid contact of surrounding earth with the mix. Size of the platform shall be such that it shall extend at-least 300mm al-round the loaded wet mix area. Wet mix, so prepared, shall be utilized within initial setting time [thirty (30) minutes either for ordinary Portland cements conforming to IS: 269 or for Portland slag cement conforming to IS: 455] after addition of water. Mixer shall be cleaned with water each time before suspending the work.

b. Hand Mixing

The measured quantity of sand shall be levelled on a clean water-tight masonry platform and cement bags emptied on top. The cement and sand shall be thoroughly mixed dry by being turned over and over, backward and forward, several times till the mixture is of uniform colour. The quantity of dry mix which can be consumed within initial setting time of cement shall then be mixed with just sufficient quantity of water to bring the mortar to the consistency of stiff paste.

5.0 CONSTRUCTION PROCEDURE

5.1 SOAKING OF BRICKS

Bricks shall be soaked in water before use for a period that is sufficient for the water to just penetrate the whole depth of bricks as well as to remove dirt, dust and sand. Proper soaking of bricks shall prevent the suction of water from the wet mortar as otherwise mortar will dry out soon and crumble before attaining any strength. The bricks shall not be too wet at the time of use as they are likely to slip on mortar bed and there will be difficulty in achieving the plumb-ness of wall as well as proper adhesion of bricks to mortar. The period of soaking shall be determined at site by a field test by immersing the bricks in water for different periods and then breaking the bricks to find the extent of water penetration. The least period that corresponds to complete soaking, will be the one, to be allowed for in the construction work.

The soaked bricks shall be removed from the tank, sufficient early, so that at the time of laying, they are skin dry. The soaked bricks shall be stacked over a clean place, wooden planks or masonry platforms to avoid earth, dirt being smeared on them.

5.2 LAYING

5.2.1 BRICK WORK (ONE OR MORE BRICK THICKNESS)

Brick work (one or more brick thickness) shall be laid in English Bond unless otherwise specified. Half or cut bricks shall not be used except when needed to complete the bond. In no case the defective bricks shall be used.

A layer of average thickness of 10mm of cement mortar shall be spread on full width over a suitable length of lower course or the concrete surface. In order to check and achieve uniformity in masonry, the thickness of bed joints shall be such that four courses and three joints taken consecutively shall measure equal to four times the actual thickness of the brick plus 30mm. Each brick with frog upward shall be properly bedded and set in position by gently tapping with handle of trowel or wooden mallet. Its inside faces shall be buttered with mortar before the next brick is laid and pressed against it. After completion of the course, all vertical joints shall be filled from top with mortar.

All brick courses shall be taken up truly plumb; if battered, the batter is to be truly maintained. All courses shall be laid truly horizontal and vertical joints shall be truly vertical. The level and verticality of work in walls shall be checked up at every one metre interval.

The masonry walls of structures shall be carried up progressively, leaving no part one metre lower than the other. If this cannot be adhered to, the brick work shall be raked back according to bond (and not left toothed) at an angle not more than 45 degrees but raking back shall not start within 60 cm of a corner. In all cases returns, buttresses, counter forts, pillars etc. shall be built up carefully course by course, and properly bonded with the main walls. The brick work shall not be raised more than fourteen (14) courses per day.

At the junction of any two walls, the bricks shall at each alternate course, be carried into each of the respective walls so as to thoroughly unite the work.

The courses at the top of plinth and sills, at the top of the wall just below the soffit of the roof slab or roof beam and at the top of the parapet, shall be laid with bricks on edge. Brick on edge course shall be so arranged as to tightly fit under the soffit of the roof beam or roof slab, restricting the mortar layer thickness up to 12mm, however, any gap between the finished brick work and soffit of roof slab/beam shall be suitably sealed with the mortar.

5.2.2 BRICK WORK (HALF BRICK THICKNESS)

For brick walls of half brick thickness, all courses shall be laid with stretchers. Wall shall be reinforced with 2 nos. - 6mm diameter mild steel reinforcement bars, placed at every fourth course. The reinforcement bars, shall be straightened and thoroughly cleaned. Half the mortar thickness for the bedding joint shall be laid first and mild steel reinforcement, one on each face of the wall, shall be embedded, keeping a side cover of 12mm mortar. Subsequently, the other half of the mortar thickness shall be laid over the reinforcement covering it fully.

The reinforcement bars shall be carried at least 150mm into the adjoining walls or RCC columns. In case the adjoining wall being of half brick thickness, the length of bars

shall be achieved by bending the bars in plan. During casting of reinforced concrete columns, 6mm dia. M.S. reinforcing bar shall be placed at every fourth course of brick masonry. At the junction of two walls, the brick shall, at each alternate course, be carried into each of the respective walls so as to thoroughly unite the work. The brick masonry work shall not be raised more than 14 courses per day.

Brick course under the soffit of beam or slab, shall be laid by restricting the mortar thickness to 12mm. However, any gap between the finished brickwork and soffit of slab/beam shall be suitably sealed with the mortar.

5.2.3 CAVITY WALLS

Brick work in cavity walls shall be included with general brickwork. It shall consist of one wall of one or more brick thickness while the other wall shall be of half brick thickness at a clear gap of 50mm. The brick work on either side of cavity shall conform to the specifications already stated under clause no. 5.2.1 and 5.2.2. At the base of the cavity wall, the walls shall be solidly constructed up to 300mm above the ground level. The cavity wall shall be terminated 300mm below the soffit of roof slab/beam and the courses over this shall be continued in solid brickwork.

Cavity should be continuous and free from obstructions. Mortar droppings shall be prevented from falling down the cavity by the use of laths or by hay hands which shall be drawn up the cavity as the work proceeds. Any mortar which may unavoidably fall on the wall-ties, shall be removed daily and temporary openings shall be provided to permit the daily removal of mortar droppings from the bottom of the cavity.

The outer and inner leaves shall be tied by means of wall ties. Ties shall be of mild steel round bars of 8mm dia. 200 mm long with hooks at both the ends. These shall be placed not more than 750mm c/c horizontally and not more than 300mm vertically, and staggered. Additional ties shall be provided near the openings. There shall at least, be 5 ties per square metre of surface area of the wall. Ties shall be given a bituminous coat before placement, to protect them from corrosion.

In order to keep the cavity dry, air slots shall be provided in the cavity walls at bottom as well as top to the extent of 50 sq.cm areas of vents to every 2.0 sq.metre area of the wall.

5.2.4 CIRCULAR BRICK WORK

The detailed specification for brick work covered under clause no. 5.2.1 & 5.2.2 shall apply, in so far as these are applicable. Bricks forming skew backs shall be dressed or cut so as to give proper radial bearing. Defects in dressing of bricks shall not be covered up by extravagant use of mortar, nor shall the use of chips etc., be permitted.

The circular brick work shall be carried up from both ends simultaneously and keyed in the centre. The bricks shall be flushed with mortar and well pressed into their positions so as to squeeze out a part of their mortar and leave the joints thin and compact. All joints shall be full of mortar and thickness of joints shall be between 5mm and 15mm.

5.3 JOINTING

Joints shall be restricted to a width of 10mm with brickwork of any classification. All bed joints shall be normal to the pressure upon them i.e. horizontal in vertical walls, radial in circular brick masonry and at right angles to the face in the battered retaining walls. The vertical joints in alternate courses shall come directly one over the other and shall be truly vertical. Care shall be taken that all the joints are full of mortar, well flushed up. In case no pointing is to be done, cement mortar shall be neatly struck as the work proceeds. The joints in faces which are to be plastered or pointed shall be squarely raked out to a depth of 12mm while the mortar is still green. The rake joints shall be brushed to remove loose particles. After the day's work, the faces of the brick work shall be cleaned on the same day with wire brush and all mortar droppings removed.

5.4 CURING

Green work shall be protected from rain or any other running water or accumulated water from any source, by suitable means. Masonry work as it progresses shall be, kept thoroughly wet by sprinkling water at regular intervals, on all faces. Curing shall be done after 24 hours of completion of day's work and shall be done for at-least 10 days after completion. Proper watering cans with spray nozzles, rubber or PVC pipes shall be used for this purpose.

5.5 STAGING / SCAFFOLDING

5.5.1 Staging/scaffolding shall be properly planned and designed by the Contractor. Use of only steel tubes is permitted for staging/scaffolding. Design of staging/scaffolding shall be submitted for approval of the Engineer-in-Charge, before commencement of work.

Single scaffolding having one set of vertical support, shall be used and other end of the horizontal scaffolding member shall rest in a hole provided in the header course. The support shall be sound and strongly clamped with the horizontal pieces over which the scaffolding planks shall be fixed. The holes left in the masonry work for supporting the scaffolding shall be filled and made good with plain cement concrete of grade 1:3:6 during plastering. Suitable access shall be provided to the working platform area. The scaffolding shall be strong enough to withstand all loads likely to come upon it and shall also meet the requirements specified in IS: 2750.

Double scaffolding shall be provided for pillars less than one metre in width or for the first class masonry or for a building having more than two storey.

The following measures shall also be considered during erection of the scaffolding/staging.

a. Sufficient sills or underpinnings, in addition to base plates, shall be provided particularly, where scaffoldings are erected on soft grounds.

b. Adjustable bases to compensate for uneven ground shall be used.

c. Proper anchoring of the scaffolding/staging at reasonable intervals shall be provided in each direction with the main structure wherever available.

d. Horizontal braces shall be provided to prevent the scaffolding from rocking.

e. Diagonal braces shall be provided continuously from bottom to top between two adjacent rows of uprights.

f. The scaffolding/staging shall be checked at every stage for plumb line.

g. Wherever the scaffolding/staging is found to be out of plumb line, it shall be dismantled and re-erected afresh. Efforts shall not be made to bring it in line with a physical force.

h. All nuts and bolts shall be properly tightened and care shall be taken that all the clamps/couplings are firmly tightened to avoid slippage.

i. Erection work of a scaffolding/staging, under no circumstance shall be left totally to semiskilled or skilled workmen and shall be carried out under the supervision of Contractor's technically qualified civil engineer.

5.5.2 For smaller works or works in remote areas wooden ballies may be permitted for scaffolding/staging by the Engineer-in-Charge at his sole discretion. The contractor must ensure the safety and suitability of such works as described under clause 5.5.1 above.

5.6 EMBEDMENT OF FIXTURES

All fixtures, pipes, conduits, holdfasts of doors and windows etc. required to be built in walls, shall be embedded in plain cement concrete block of grade 1:3:6, at the required positions, as the work proceeds.

6.0 PAYMENT

This clause shall apply to Item Rate tender only.

6.1 GENERAL

The payment of brick masonry shall be inclusive of all labour, material, scaffolding/staging sampling and testing, soaking of bricks, laying of bricks, raking of joints, cutting of bricks, providing recesses and making rectangular or round openings, sealing the gap between brick masonry and soffit of beam/slab with and including cement mortar, curing, making of masonry platform for unloading the wet mix, embedding the fittings/fixtures including providing PCC(1:3:6) etc, all as specified for all heights and depths. Deduction for rectangular or circular openings shall be done as per relevant BIS Codes

6.1.1 Payment for brick masonry works of one or more brick thickness, including circular brickwork, shall be made on cubic metre basis of the work done

6.1.2 Payment for half brick masonry work shall be made on square metre basis on the area of works done and shall also include the cost of supplying and fixing of reinforcement bars in position

6.1.3 Payment for forming the cavity shall be in square metres and shall include the cost of laying of bitumen coated MS ties in position, labour required for keeping the cavity clear, providing air slots etc

Energising Quality

VCS Quality Services Pvt Ltd

STANDARD SPECIFICATION
FOR
DEMOLITION AND DISMANTLING

VCS-SS-CS-6029

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ABBREVIATION

m	Metre
mm	Millimetre
Sqm	Square Metre
Cum	Cubic Metre

CONTENTS

1.0 SCOPE

This specification covers the procedure and safety requirements for demolition and dismantling of masonry (Brick & Stone), concrete (Plain /Reinforced), structural steel (sheeted / un sheeted) works.

2.0 REFERENCES

2.1 Specification No. VCS-SS-CS-6002, Earth work in site grading

2.2 VCS-SS-CS-6003, Earth work for Underground piping

2.3 VCS-SS-CS-6022, Earth work in foundations

for Earth work.

3.0 GENERAL

3.1 Apart from this specification, the demolition and dismantling of structures (part or whole) shall be in compliance with all statutory safety regulations and any other special requirement as shown/noted on the drawings and General Conditions of Contract. Prior consent and approval of the Engineer-in-charge shall be obtained in writing before starting any dismantling works. Any restrictions imposed regarding working hours shall also be strictly followed by the Contractor.

3.2 All materials obtained from dismantling/demolition operations shall be the property of the Owner unless otherwise specified and shall be kept in safe custody until handed over to the Engineer-in-charge.

3.3 Where it becomes necessary to disconnect any existing service line(s) (such as electrical, piping etc.) during dismantling/demolishing operation and where so required by the Engineer-charge, suitable alternate arrangement shall be made by the Contractor to maintain the continuity and proper functioning of the affected service line(s) with the approval of the Engineer-in-charge at no extra cost to the Owner.

4.0 SAFETY PRECAUTIONS

4.1 The Contractor shall adhere to safe demolishing/dismantling practices at all stages of work to guard against accidents, hazardous and unsafe working procedures.

4.2 Necessary propping, shoring strutting and/or underpinning shall be done for the safety of all surrounding structures (whose safety is likely to be endangered) before taking up, the demolishing and dismantling work.

4.3 Temporary enclosures made out of GI sheets, fencings, danger lights etc. shall be provided by the Contractor and got approved by the Engineer-in-charge before start of work to prevent accidents.

4.4 Contractor must ensure the availability of adequate firefighting equipment / arrangements before starting actual demolishing/dismantling works. These facilities

shall be made available throughout the entire operation of demolition and dismantling of structures.

4.5 All equipment's, pipes, fittings and instruments, underground utilities etc. located in the vicinity shall be protected by suitable means, as decided by the Engineer-in-charge, during demolishing, dismantling operations.

4.6 Roads and working spaces shall be kept free of any debris/dismantled materials at the end of day's work.

4.7 Necessary measures shall be taken to keep the dust and noise nuisance to minimum levels.

4.8 Dismantled elements/components shall not be dropped from a height or thrown from a distance. Dismantling of elements fixed by screws/bolts/hooks etc. shall be done by taking out the fixtures with proper tools only. Such fixtures may be allowed to be cut by sawing or flame cutting, in the event of their being stuck-up due to corrosion etc. however the decision of Engineer-in-charge in this regard shall be final and binding, Welds shall be removed by flame cutting. Tearing or ripping of elements shall not be resorted to under any condition.

5.0 PROCEDURE

5.1 Entire work of demolishing & dismantling shall be meticulously planned. Prior to start of work, the Contractor shall thoroughly understand the scope and nature of the work, and then prepare and submit the proposed work execution plan of demolishing & dismantling to the Engineer-charge for his review. Comments if any, shall be taken care by the contractor and execution of the work shall be done based on the revised execution plan.

5.2 Demolition and dismantling shall be restricted to the extent shown on drawings or as directed by the Engineer-in-charge.

5.3 Demolition of any structure shall be carried out in the sequence reverse to that followed at the time of its construction.

5.4 Dismantling shall be done in a systematic manner. All elements shall be carefully removed without causing any damage.

5.5 Blasting in any form shall not be permitted.

5.6 Chipping of concrete/grout shall be done with precision by chiseling. The finished surfaces shall be made true to the requisite size and shape.

5.7 Pockets/holes of specified size shall be made/cut by drilling/chiseling.

6.0 CLEANING & STACKING

6.1 All demolished/dismantled serviceable materials such as bricks, stones, reinforcement bars, structural steel, sheeting etc. shall be separated out, cleaned and stacked in separate lots within the plant boundary as directed by the Engineer-in-charge.

7.0 DISPOSAL

All unserviceable materials shall be disposed off in spoil heaps within or outside the plant boundary as per the directions of the Engineer-in-charge. Areas required outside the plant boundary for dumping of disposed material shall be arranged by the contractor and got approved by the Engineer-in- charge.

8.0 PAYMENT

This clause shall be applicable for item tender rate only.

8.1 GENERAL

Measurement of all works shall be taken prior to start of demolishing / chipping / dismantling works.

8.2 MASONRY/CONCRETE WORKS (DEMOLITION)

8.2.1 Payment shall be made on the basis of actual volume in cubic meters (cu.m.) of masonry/concrete works demolished. The thickness of plaster/bitumen felt shall be included in measurements. The rate for demolishing shall include supply of labour, tools & tackles, necessary safety measures, propping, underpinning, scaffolding, handling, cutting, straightening, scraping & cleaning of reinforcement bars and other embedment's (in case of reinforced concrete works), sorting out and stacking of all serviceable materials, disposal of all unserviceable material, clearing the site, etc. all complete as specified and directed by the Engineer-in-charge.

8.3 EXCAVATION & BACKFILLING

8.3.1 Excavation and backfilling shall be paid separately as per relevant clauses of specification No. VCS-SS-CS-6002, VCS-SS-CS-6003, VCS-SS-CS-6022 for Earth Work.

8.4 CHIPPING OF CONCRETE WORKS

Payment shall be made on the basis of admissible area in square meters (sq.m.) of concrete surfaces chipped, pertaining to the different categories of thicknesses specified in the schedule of items.

The rate for chipping shall include supply of labour, tools and tackles, necessary safety measures, scaffolding, chiseling, handling exposing, cutting, straightening, scraping, clearing the reinforcement bars (in case of reinforced concrete works), wire brushing and washing the exposed surfaces, disposal of all unserviceable material etc. all complete as directed.

8.5 MAKING POCKETS/HOLES IN CONCRETE WORKS

Payment shall be made on the basis of number (Each) of pockets/holes of sizes up to & inclusive of 200x200x500 mm, made or cut in the concrete works.

The rate for making pockets/holes shall include supply of labour, tools & tackles, necessary safety measures, scaffolding, chiseling, drilling, handling, cutting or relocating reinforcement bars, cleaning, disposal of all unserviceable material etc. all complete as directed.

8.6 DISMANTLING OF STRUCTURAL STEEL WORKS

Payment shall be made on the basis of weight (MT) of the structure/components being dismantled. Assessment of weight shall be done as per the specifications or as per the direction of Engineer-in-charge.

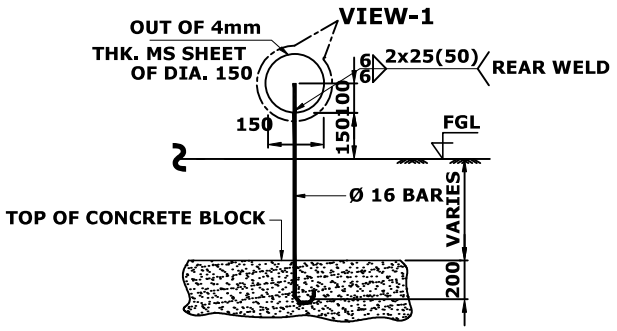
The rate for dismantling shall include supply of labour, tools and tackles, equipment, consumables, necessary safety measures, scaffolding, propping, handling, unbolting, cutting (by sawing or flame cutting) of gussets/plates/bolts/hooks/welds, cleaning, sorting out and stacking of all serviceable materials, disposal of all unserviceable material, etc. all complete as specified and directed.

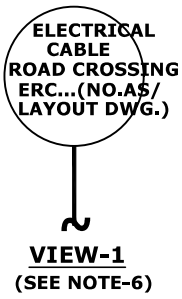
8.7 DISMANTLING OF ROOF & WALL SHEETING

Payment shall be made on the basis of dismantled sheeted area in square meters (sq.m.) of plan area in case of roof sheeting and area in elevation in case of side and louver sheeting.

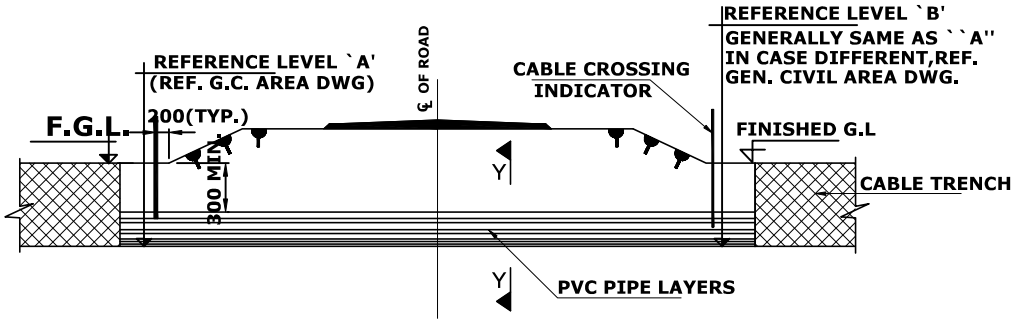
The rate for dismantling shall include supply of labour, tools and tackles, equipments, consumables, necessary safety measures, handling, scaffolding, unbolting, cutting (by saw or l flame cutting) of hook bolts, removal of ridges, gutters, flashings, transporting, stacking of all serviceable materials, disposal of all unserviceable material etc. all complete as directed.

VCS QUALITY SERVICES PRIVATE LIMITED	CABLE CROSSING UNDER ROAD (P.V.C. PIPES)	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6021		03	A4
		SHEET NO.	1 OF 1		

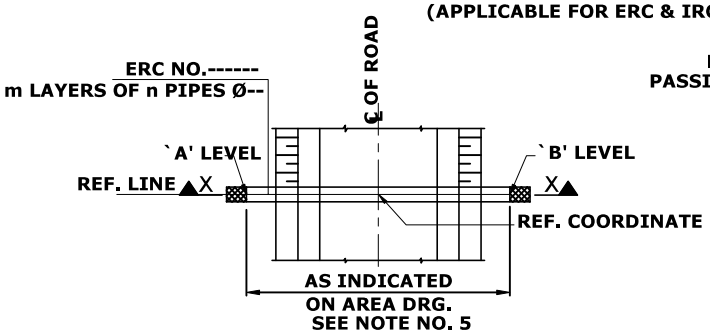




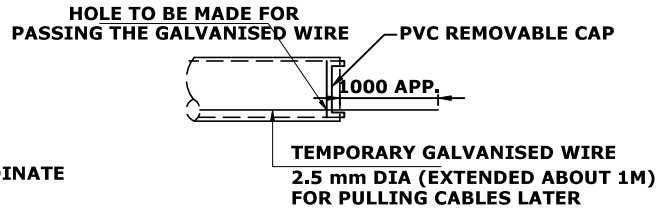
DETAIL OF CABLE CROSSING INDICATOR



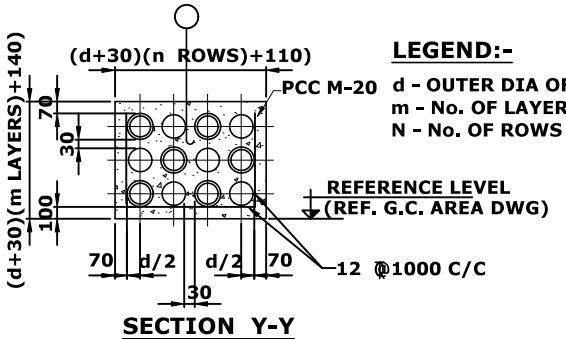
SECTION X-X
(APPLICABLE FOR ERC & IRC)



PLAN
(REPRESENTATION ON AREA DRG.)



SLEEVE END PLUGGING DETAIL



SECTION Y-Y

LEGEND:-

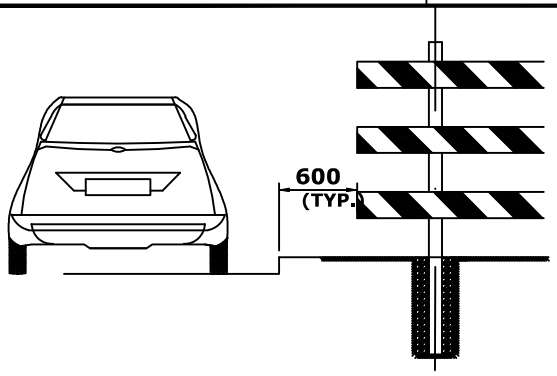
d - OUTER DIA OF PIPE
m - No. OF LAYERS
N - No. OF ROWS

NOTES:-

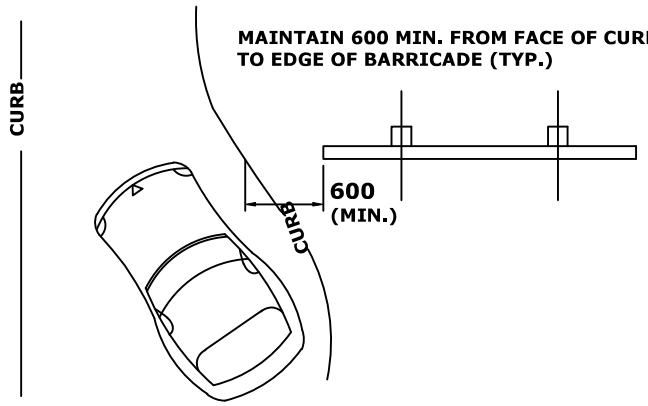
1. ALL DIMENSIONS ARE IN MM. UNLESS NOTED OTHERWISE.
2. CONDUIT MATERIAL P.V.C. PIPE OF NOM. OUT SIDE PIPE DIA.Ø110, Ø160 OR Ø210 AS PER LAYOUT PLAN
3. PIPES SHALL CONFIRM TO IS: 4985 CLASS-I AND EMBEDDED IN PLAIN CEMENT CONCRETE.
4. BACK FILLING WITH ROAD MATERIAL SHALL BE DONE IN 150 MM THK. LAYER WELL WATERED AND COMPACTED AS PER ROAD SPECIFICATION.
5. INCASE CABLE CROSSING IS REQUIRED TO CROSS THE OPEN DITCHES ON EITHER SIDE THE LENGTH & THE LEVEL OF CABLE CROSSING SHALL BE DECIDED CLEARING THE SERVICE ALONG ROAD SIDE.
6. CABLE CROSSING INDICATOR MADE OF 4mm THK. MILD STEEL PLATE AS PER IS:2062, ENAMEL PAINTED IN JADE GREEN BACKGROUND ON BOTH SIDES WITH WHITE LETTERING.
7. THE SHAPE OF PVC REMOVABLE TYPE CAP AS SHOWN IS INDICATIVE.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	RK	GDS	RKB	SK

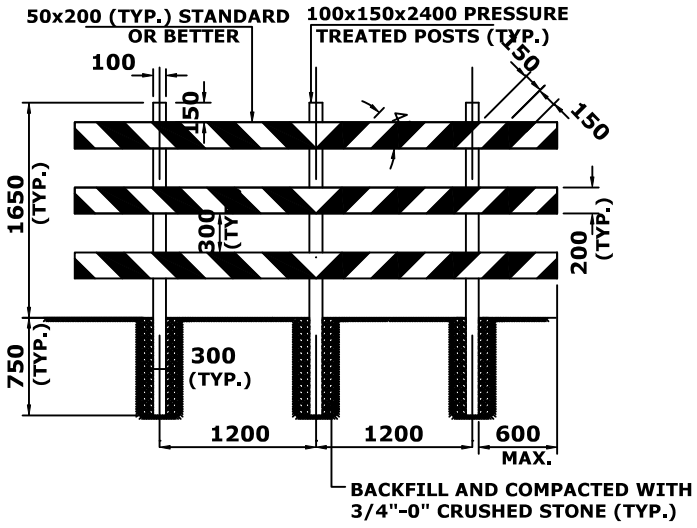
VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR BARRICADES	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6022		03	A4
		SHEET NO.	1 OF 1		



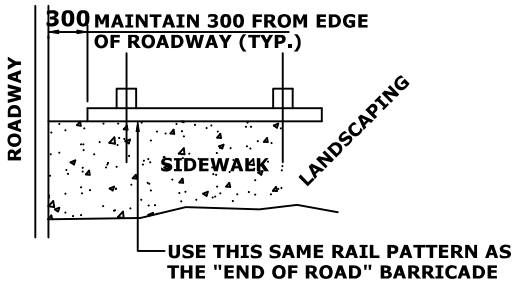
TYPICAL NARROWING OF DRIVING AREA BARRICADE (USW DIMENSIONS BELOW)
ORIENT DIAGOINAL BARS TO CHANNEL TRAFIC AS SHOWN



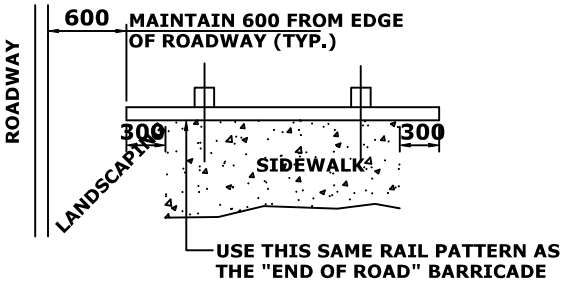
NARROWING OF DRIVING AREA



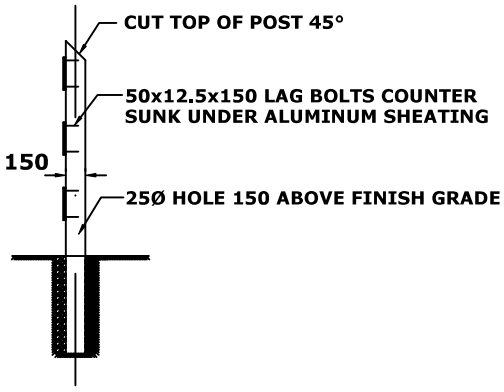
END OF ROAD BARRICADE
(TYPICAL DIMENSIONS AND LAYOUT)



END OF SIDEWALK ('TYPE B')



END OF SIDEWALK ('TYPE A')



SECTION

NOTES:-

ALL WOOD SHALL BE PAINTED WHITE.

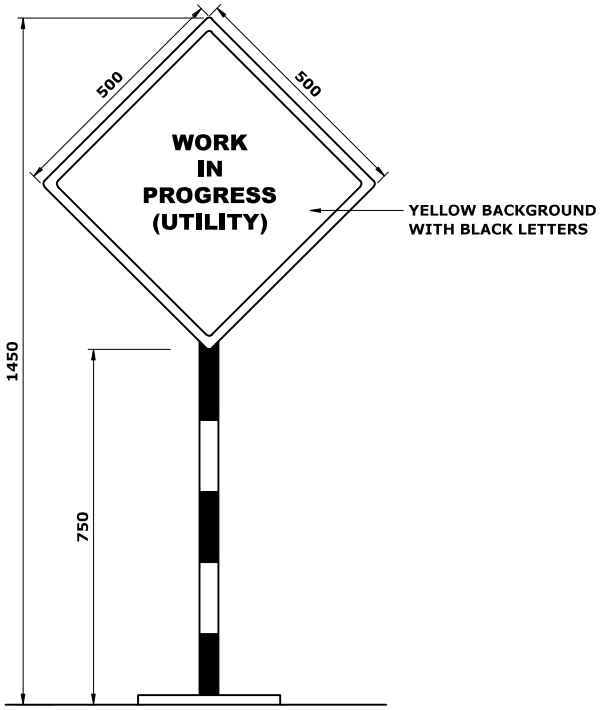
ALTERNATING RED & WHITE HIGH INTENSITY PRISMATIC 0.80. ALUMINUM SHEATING SHALL BE SCREWED TO THE HORIZONTAL RAILS

ALL FASTENERS TO BE STAINLESS STEEL OR RUST PROOF HEAVT GALVANIZED

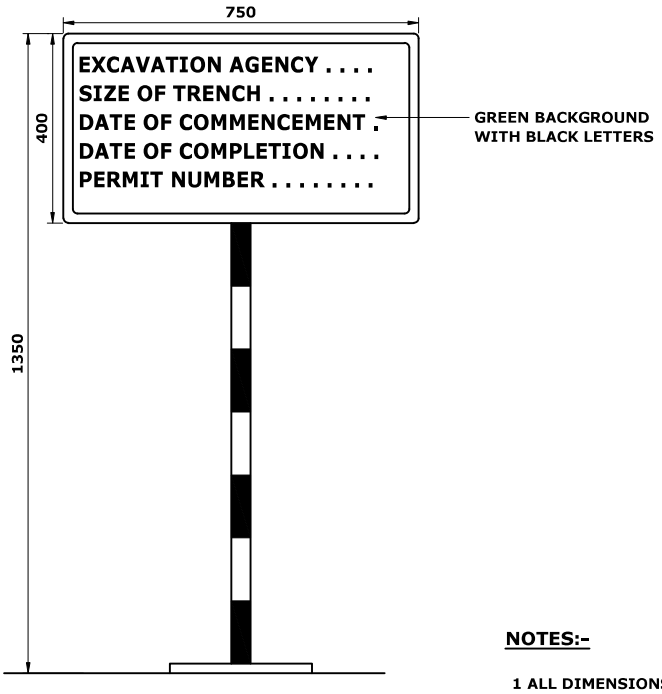
FOR STREET BARRICADES HORIZONTAL RAIL LENGTH SHALL EQUAL THE DISTANCE BETWEEN THE FACE OF CURB PLUS 600. (EG. 1000 CURB 1600 RAILS).

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	RK	GDS	RKB	SK

VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR SAFE SIGNING	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6023		03	A4
		SHEET NO.	1 OF 1		



CAUTION BOARD



INFORMATION BOARD

NOTES:-

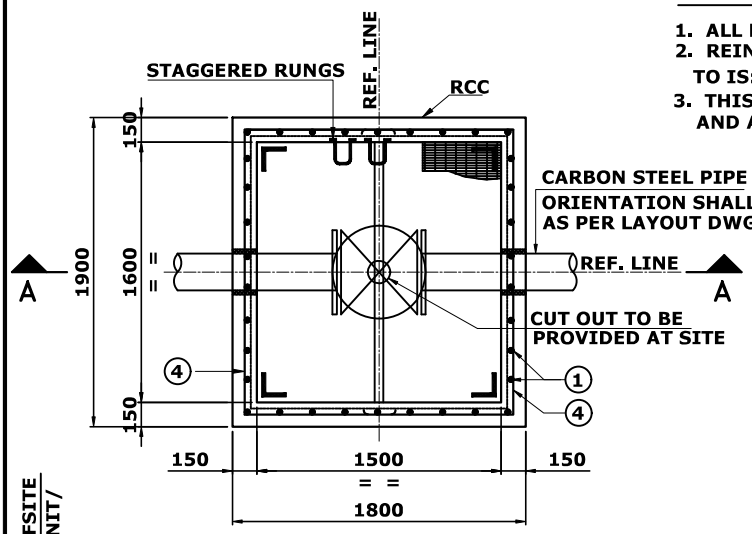
1 ALL DIMENSIONS ARE IN MILLIMETERS.

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	RK	GDS	RKB	SK

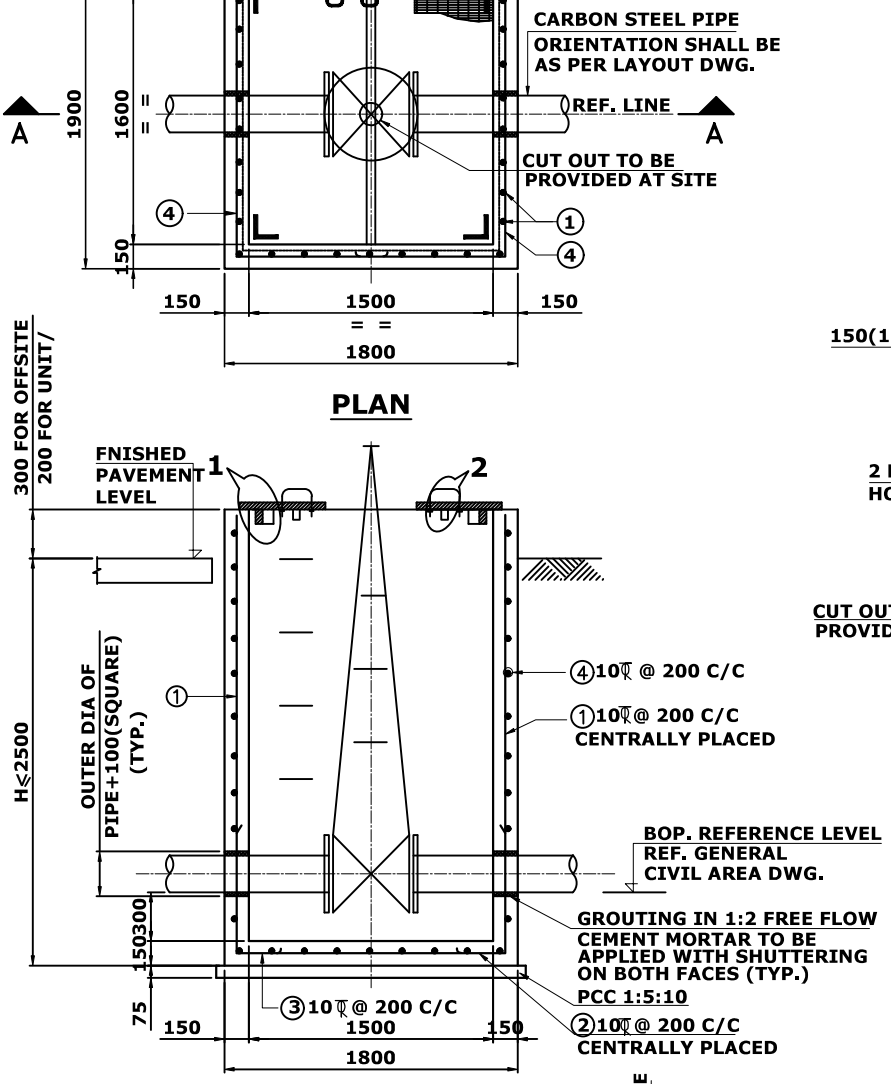
VCS QUALITY SERVICES PRIVATE LIMITED	VALVE PIT (RCC) TYPE-VI FOR Ø 8" > 8" TO < 16" VALVE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6030		03	A4
		SHEET NO.	1 OF 1		

NOTE:

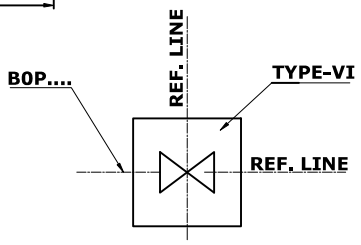
1. ALL DIMENSIONS ARE IN mm. UNLESS NOTED OTHERWISE.
2. REINFORCEMENT SHALL BE OF GRADE Fe 415 CONFORMING TO IS:1786
3. THIS STD. IS ALSO APPLICABLE FOR UNIT AREA, OFFSITE AREA AND AREA WHERE GROUND WATER TABLE IS UPTO FGL..



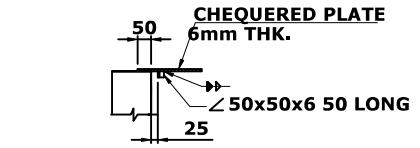
PLAN



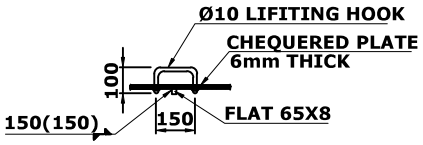
SECTION - A A



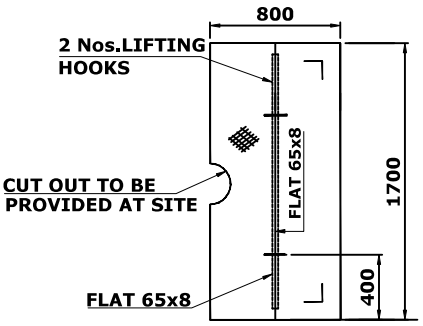
REPRESENTATION ON AREA DRG.



DETAIL-1



DETAIL-2



PLAN

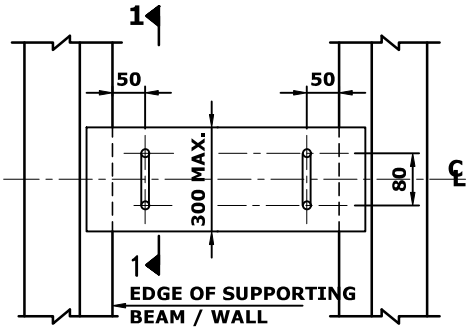
CHEQUERED PLATE
(2.NOS PER VALVE PIT)

BAR BENDING SCHEDULE

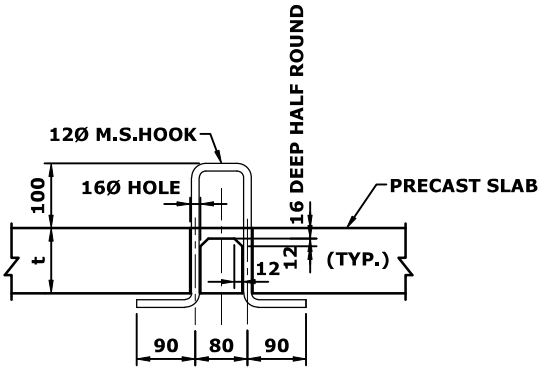
BAR MARK	DIA	BAR SHAPE
①	10 Ø	H+325 (OFFSITE) H+225 (UNIT), 450
②	10 Ø	600, 600, 1630
③	10 Ø	600, 600, 1750
④	10 Ø	1650, 1350, 300

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	BSS	MO	RKB	SK

VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR DETAIL OF LIFTING HOOKS IN PRECAST SLABS AND CHQD.PLATES	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6045		03	A4
		SHEET NO.	1 OF 1		

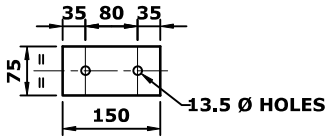


PLAN

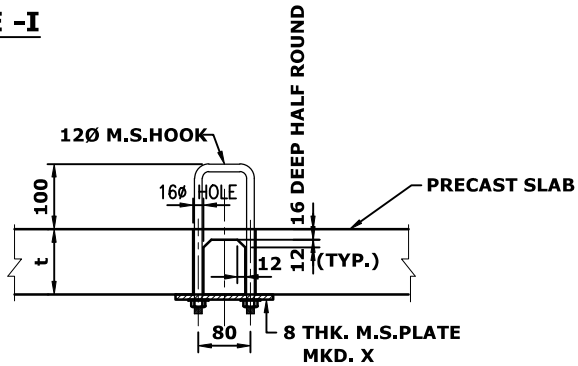


SECTION 1-1

TYPE -I

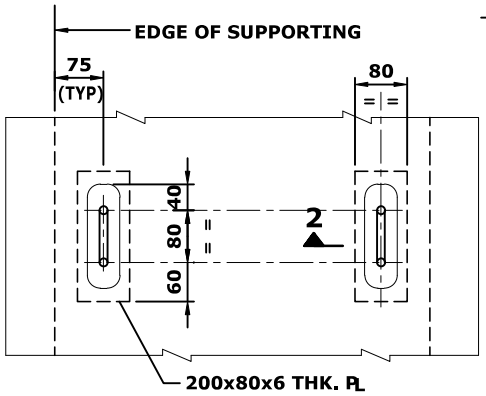


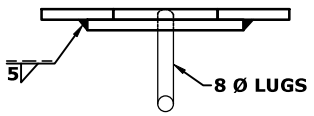
DETAIL OF M.S PLATE MKD. (X)



SECTION 1-1

TYPE -II





(OTHER DETAILS SAME AS IN TYPE-I ABOVE)

SECTION 2-2

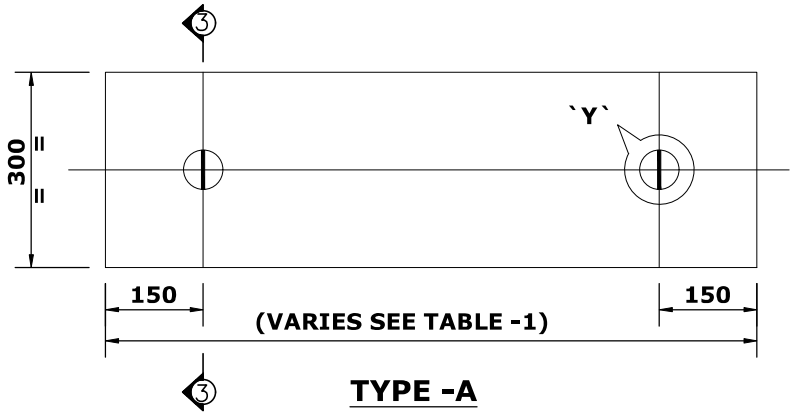
TYPE -II
(FOR CHQD. PLATE ONLY)

NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. FOR PRECAST SLABS GENERALLY LIFTING HOOK TYPE-I SHALL BE USED UNLESS TYPE-II IS SPECIFIED IN THE DRAWING.

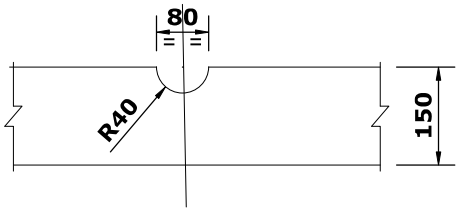
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	YS	GDS	RKB	SK

VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR DETAIL OF R.C.C SLAB FOR LOW COVER PIPELINE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6056		03	A4
		SHEET NO.	1 OF 1		



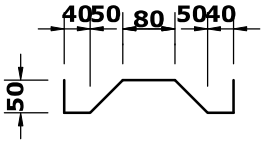
TYPE -A

(WITH LIFTING HOOK TYPE)

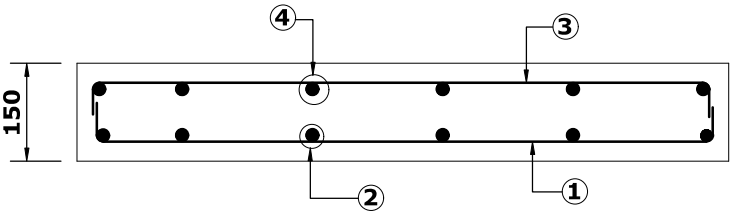


DETAIL- `Y`

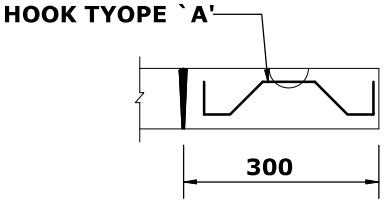
(TYP.)



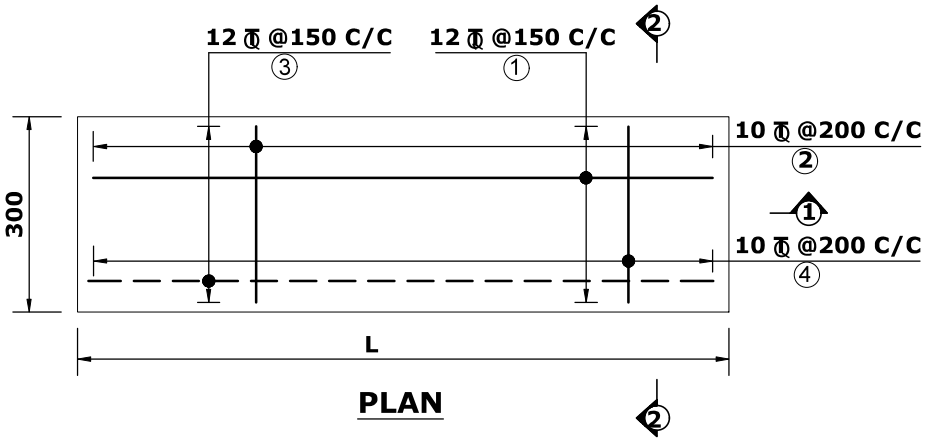
HOOK TYOPE `A'



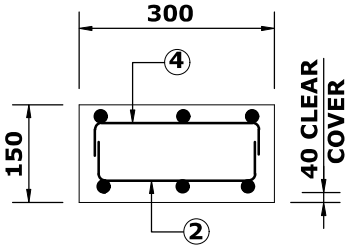
SECTION 1-1



SECTION 3-3



PLAN



SECTION 2-2

NOTES:-

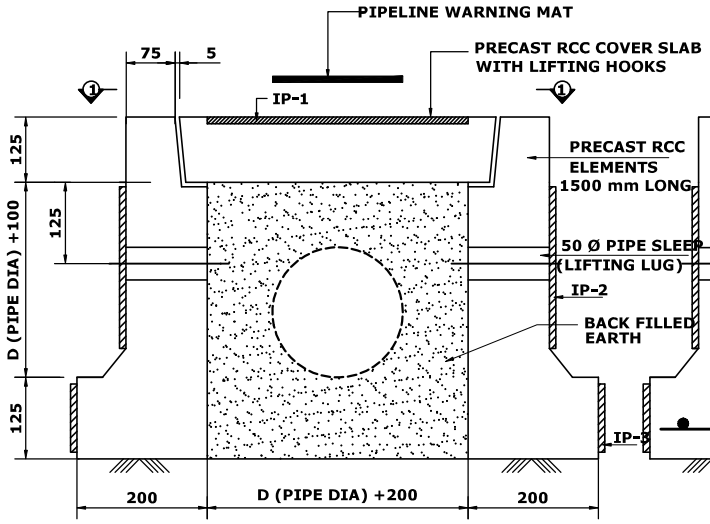
1. ALL DIMENSIONS ARE IN MILLIMETERS & LEVELS ARE IN METRES.
2. GRADE OF CONC MIX SHALL BE M-25 CONFORMING TO IS- 456.
3. REINF SHALL BE HYSD BARS OF GRADE Fe 415 CONFORMING TO IS- 1786.
4. THIS STANDARD SHALL BE NOT BE USED FOR VEHICULAR MOVEMENT AREAS

TABLE - 1

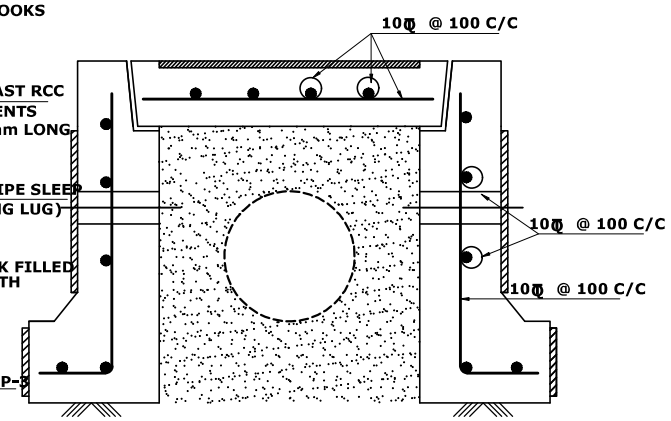
S.NO	PIPE DIA	LENGTH IN mm
1.	UP TO 16" Ø	1000
2.	18" Ø & ABOVE	D+600

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	YS	GDS	RKB	SK

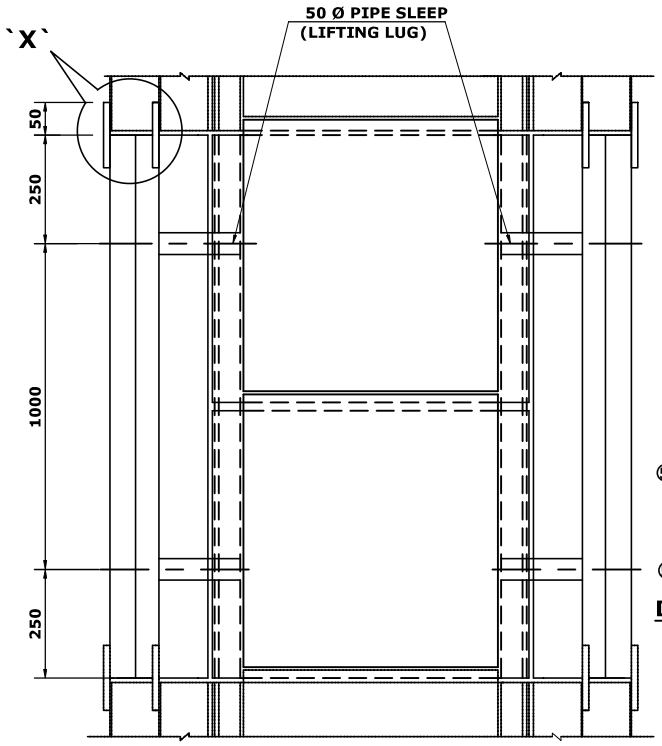
VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR DETAIL IN SERVICE PIPELINE SAFETY PROTECTION AGAINST ACCIDENTAL DAMAGE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6057		03	A4
		SHEET NO.	1 OF 2		



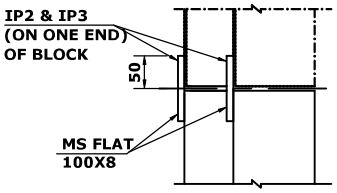
G.A. OF SAFETY PROTECTION



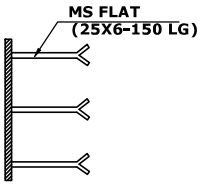
REINFORCEMENT DETAIL OF SAFETY PROTECTION



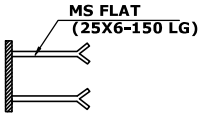
VIEW 1-1



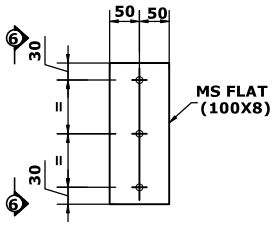
DETAIL- `X`



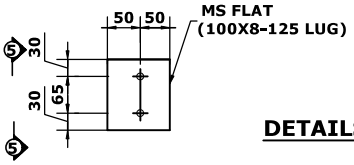
VEIW 6-6



VEIW 5-5



DETAILS OF INSERT PLATE (IP-2)



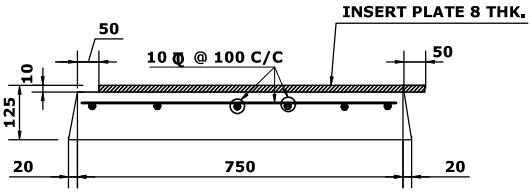
DETAILS OF INSERT PLATE (IP-3)

NOTES:-

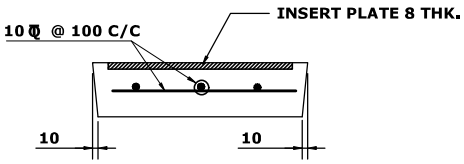
1. ALL DIMENSIONS ARE IN MILLIMETERS & LEVELS ARE IN METRES.
2. GRADE OF CONC MIX SHALL BE M-25 (MIN.) CONFORMING TO IS- 456.
3. REINF SHALL BE HYSD BARS OF GRADE Fe 415 CONFORMING TO IS- 1786.
4. THIS STANDARD SHALL BE NOT BE USED FOR VEHICULAR MOVEMENT AREAS
5. ALL INSERTS PLATES SHALL BE EPOXY PAINTED

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	YS	GDS	RKB	SK

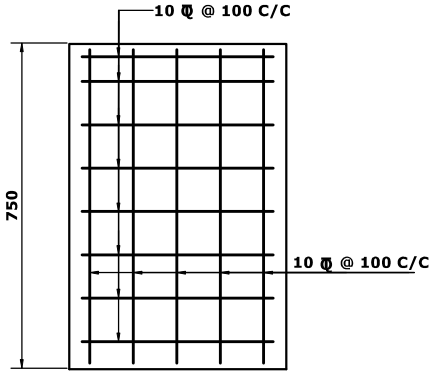
VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR DETAIL IN SERVICE PIPELINE SAFETY PROTECTION AGAINST ACCIDENTAL DAMAGE	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6057		03	A4
		SHEET NO.	2 OF 2		



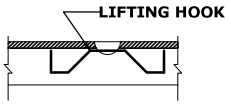
SECTION 2-2



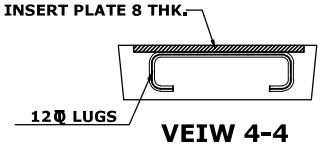
SECTION 3-3



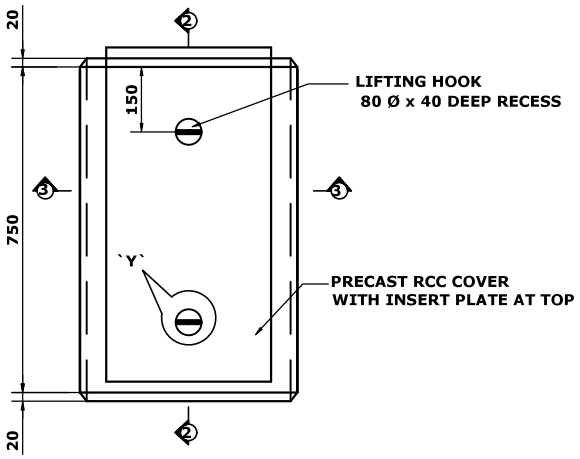
REINFORCEMENT DETAILS OF COVER SLAB



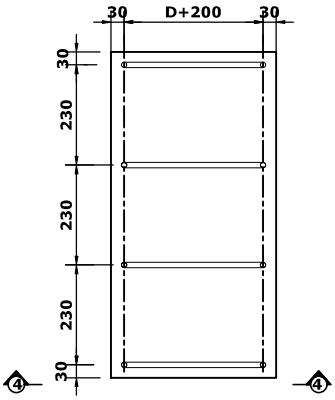
DETAIL- `Y`
(TYP.)



VEIW 4-4



DETAIL OF PRECAST COVER



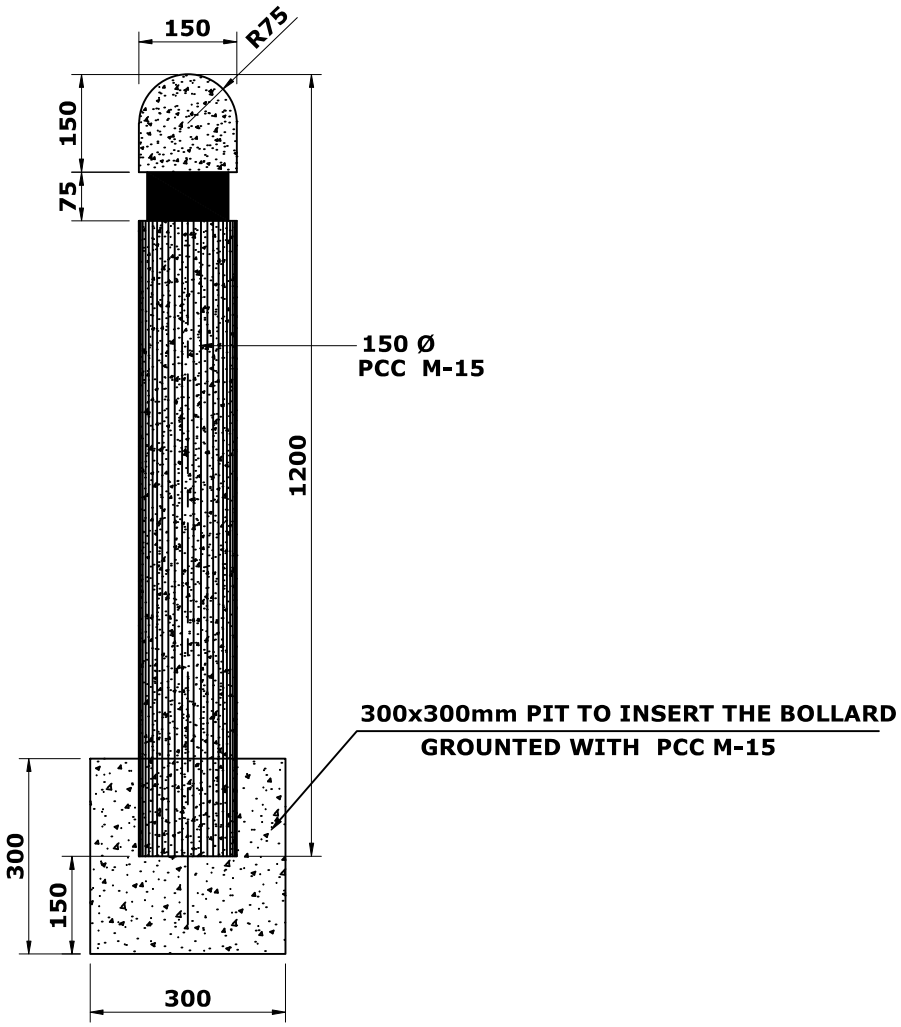
DETAILS OF INSERT PLATE (IP-1)

NOTES:-

1. ALL DIMENSIONS ARE IN MILLIMETERS & LEVELS ARE IN METRES.
2. GRADE OF CONC MIX SHALL BE M-25 (MIN.) CONFORMING TO IS- 456.
3. REINF SHALL BE HYSD BARS OF GRADE Fe 415 (MIN.) CONFORMING TO IS- 1786.
4. THIS STANDARD SHALL BE NOT BE USED FOR VEHICULAR MOVEMENT AREAS
5. ALL INSERTS PLATES SHALL BE EPOXY PAINTED

03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	YS	GDS	RKB	SK
REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY

VCS QUALITY SERVICES PRIVATE LIMITED	STANDARD FOR DETAIL OF BOLLARD	STANDARD DRAWING NO.		REV.	SIZE
		VCS-STD-CS-6074		03	A4
		SHEET NO.	1 OF 1		



DETAIL OF BOLLARD

REV NO.	DATE	PURPOSE	PREPARED BY	CHECKED BY	APPROVED BY	AUTHORIZED BY
03	03.02.22	RE-ISSUED AS STANDARD	MN	GDS	HK	WG
02	30.01.20	RE-ISSUED AS STANDARD	YS	GDS	RKB	SK