TABLE-1: TYPICAL LOADS OF STEEL TANK SHELL AND ROOF (W) ON TOP OF RING WALL IN t/m OF THE PERIMETER

H(m) / D(m)	3.0	5.0	7.5	10.0	12.5	15.0
3.0	0.25	0.38				
5.0	0.28	0.41	0.57			
7.5		0.46	0.62	0.74		
10.0		0.52	0.68	0.83	1.00	
12.5			0.71	0.87	1.03	1.18
15.0			0.76	0.96	1.18	1.47
17.5			0.93	1.14	1.36	1.63
20.0			0.97	1.17	1.40	1.68

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.93	ISSUED AS STANDARD			

TABLE–2 : RING WALL FOUNDATION DESIGN

h=upto 2.5m σ=upto 1.0 t/m³

W = SP GRAVITY OF FLUID X WT AS PER TABLE–1

H(m)	3.0			5.0			7.5			10.0			12.5			15.0		
D(m)	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As
3.0	* 0.25	5.80	+ 0.20	* 0.25	7.32	+ 0.20												
5.0	* 0.25	5.92	+ 0.20	* 0.25	7.44	+ 0.20	0.30	9.96	+ 0.20									
7.5				0.30	7.44	+ 0.20	0.30	9.12	+ 0.20	0.30	10.77	0.20						
10.0				0.30	7.50	+ 0.20	0.30	9.32	0.21	0.30	11.07	0.26	0.30	12.88	0.32			
12.5							0.30	9.42	0.26	0.30	11.20	0.33	0.30	12.98	0.40	0.30	14.75	0.46
15.0							0.30	9.58	0.32	0.30	11.57	0.40	0.30	13.48	0.48	0.30	15.53	0.56
17.5							0.30	9.71	0.32	0.30	12.10	0.46	0.30	14.08	0.55	0.30	16.25	0.65
20.0							0.35	9.82	0.36	0.30	12.20	0.53	0.30	14.22	0.64	0.30	16.40	0.75
Pt (t/m²)	4.8			6.8			9.3			11.8			14.3			16.8		
P	7.5						10.0			12.5			15.0			17.5		

H = HEIGHT OF TANK (m)
D = DIA OF TANK (m)
As = CIRCUMFERENTIAL REINFORCEMENT (HYD BARS) IN PERCENTAGE OF CROSS SECTIONAL AREA OF RING WALL
h = HEIGHT OF RING WALL(m)
t = THICKNESS OF RING WALL(m)
σ = DENSITY OF FLUID INSIDE TANK (t/m³)
* = MINIMUM THICKNESS OF WALL SHALL BE 350mm WHERE ANCHOR BOLTS ARE PROVIDED
+ = BASED ON NOTE A–10 ON SHT. 8 OF 8
pw = NET SOIL PRESSURE UNDER RING WALL (t/m²)
Pt = NET SOIL PRESSURE UNDER TANK (t/m.)²
P = NET ALLOWABLE BEARING PRESSURE OF SOIL (t/m²)

ALL NET PRESSURES ARE AT FOUNDING LEVEL OF RING WALL

FILE NAME: 43554 | SHT. 4 OF 8

PROJECT ENGINEERING BHEL HYDERABAD	RING WALL FOUNDATION FOR STORAGE TANKS	DRAWING NO.	REV
		4–38144–00035	00

CIVIL ENGINEERING	NO	DATE	REVISION	DRN	CHD	APPD
	D	03.08.93	ISSUED AS STANDARD			

TABLE-3 : RING WALL FOUNDATION DESIGN

W = SP GRAVITY OF FLUID
X WT AS PER TABLE-1

a = upto 2.5m e = upto 1.2 t/m³

H(m) / D(m)	3.0			5.0			7.5			10.0			12.5			15.0		
	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As
3.0	* 0.25	8.30	+ 0.20	* 0.25	8.12	+ 0.20												
5.0	* 0.25	8.44	+ 0.20	* 0.25	8.27	+ 0.20	0.30	10.08	+ 0.20									
7.5				* 0.25	8.51	+ 0.20	0.30	10.28	+ 0.20	0.30	12.28	0.23						
10.0				* 0.25	8.80	0.22	0.30	10.52	0.25	0.30	12.52	0.31	0.30	14.80	0.37			
12.5							0.30	10.64	0.30	0.30	12.78	0.38	0.30	14.92	0.46	0.30	17.02	0.55
15.0							0.30	10.84	0.36	0.30	13.22	0.46	0.30	15.52	0.56	0.30	17.96	0.66
17.5							0.30	11.52	0.43	0.30	13.86	0.54	0.30	16.24	0.65	0.30	18.82	0.76
20.0							0.30	11.66	0.49	0.30	13.98	0.62	0.30	16.40	0.75	0.30	19.02	0.87
Pt (t/m²)	5.4			7.8			10.8			13.8			16.8			19.8		
P	7.5			10.0			12.5			15.0			17.5			20.0		

H = HEIGHT OF TANK (m)
D = DIA OF TANK (m)
As = CIRCUMFERENTIAL REINFORCEMENT (HYD BARS) IN PERCENTAGE OF CROSS SECTIONAL AREA OF RING WALL
h = HEIGHT OF RING WALL (m)
t = THICKNESS OF RING WALL (m)
G = DENSITY OF FLUID INSIDE TANK (t/m³)
* = MINIMUM THICKNESS OF WALL SHALL BE 300mm WHERE ANCHOR BOLTS ARE PROVIDED
+ = BASED ON NOTE A-10 ON SHT. 8 OF 8
pw = NET SOIL PRESSURE UNDER RING WALL (t/m²)
Pt = NET SOIL PRESSURE UNDER TANK (t/m²)
P = NET ALLOWABLE BEARING PRESSURE OF SOIL (t/m²)

ALL NET PRESSURES ARE AT FOUNDING LEVEL OF RING WALL

FILE NAME: 43565 | SHT. 5 OF 8

BHEL	PROJECT ENGINEERING BHEL HYDERABAD	RING WALL FOUNDATION FOR STORAGE TANKS	DRAWING NO. 4-38144-00036	REV 00

TAB E-3 : RING WALL FOUNDATION DESIGN

h=upto 2.5m σ^-=upto 1.4 t/m^3

W = SP GRAVITY OF FLUID X WT AS PER TABLE-1

H(m) / D(m)	3.0			5.0			7.5			10.0			12.5			15.0		
	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As	t	Pw	As
3.0	* 0.25	8.80	+ 0.20	* 0.25	8.93	+ 0.20												
5.0	* 0.25	8.97	+ 0.20	* 0.25	9.10	+ 0.20	0.30	11.2	+ 0.20									
7.5				* 0.25	9.38	+ 0.20	0.30	11.44	0.21	0.30	13.75	0.26						
10.0				* 0.25	9.71	0.24	0.30	11.72	0.27	0.30	14.17	0.35	0.30	16.72	0.43			
12.5							0.30	11.86	0.35	0.30	14.36	0.44	0.30	16.86	0.54	0.30	19.31	0.63
15.0							0.30	12.10	0.42	0.30	14.81	0.53	0.30	17.56	0.65	0.30	20.43	0.76
17.5							0.35	12.27	0.42	0.30	15.62	0.62	0.30	18.40	0.75	0.30	21.41	0.88
20.0							0.35	12.43	0.47	0.30	15.76	0.70	0.30	18.58	0.86	0.30	21.64	1.01
Pt (t/m^2)	6.0			8.6			12.3			15.6			19.3			22.6		
P	7.5			10.0			15.0			17.5			20.0			25.0		

H = HEIGHT OF TANK (m)
D = DIA OF TANK (m)
As = CIRCUMFERENTIAL REINFORCEMENT (HYD BARS) IN PERCENTAGE OF CROSS SECTIONAL AREA OF RING WALL
h = HEIGHT OF RING WALL(m)
t = THICKNESS OF RING WALL(m)
σ^- = DENSITY OF FLUID INSIDE TANK (t/m^3)
* = MINIMUM THICKNESS OF WALL SHALL BE 300mm WHERE ANCHOR BOLTS ARE PROVIDED
+ = BASED ON NOTE A-10 ON SHT. 8 OF 8
pw = NET SOIL PRESSURE UNDER RING WALL (t/m^2)
Pt = NET SOIL PRESSURE UNDER TANK (t/m)^2
P = NET ALLOWABLE BEARING PRESSURE OF SOIL (t/m^2)

ALL NET PRESSURES ARE AT FOUNDING LEVEL OF RING WALL.

A–PROCEDURE FOR DESIGN OF RING WALL FDN. FOR STORAGE TANKS.

1. WHERE STORAGE TANKS ARE REQUIRED TO BE SUPPORTED ON RING WALL FOUNDATION, THIS STANDARD SHALL BE FOLLOWED.

2. THIS STANDARD INCLUDES DESIGN BASIS AND GENERAL REQUIREMENT OF CONCRETE RING WALL FOUNDATION FOR STORAGE TANKS.

3. THE RING WALL SHALL BE FOUNDED IN THE FIRM STRATUM. THE EMBEDMENT DEPTH SHALL BE MINIMUM 300mm INSIDE THE FIRM STRATUM OR AS PER SOIL INVESTIGATION REPORT.

4. TABLES 2 TO 4 GIVE THICKNESS OF RING WALL (t) AND PERCENTAGE OF TOTAL REINFORCEMENT (As) REQUIRED IN A SECTION OF THE WALL FOR STORAGE TANKS UPTO D=20m AND H=15m. FOR STORAGE TANKS HAVING 'D' AND 'H' GREATER THAN THESE VALUES, THE DESIGN BASIS GIVEN HERE UNDER SHALL BE FOLLOWED.

5. ALTHOUGH THE TABLES SHOW RING WALL FDN. DETAIL FOR TANKS UPTO DIA. 20 AND HEIGHT 15m, IT DOES NOT NECESSARILY MEAN THAT ALL SUCH TANKS SHALL BE FOUNDED ON RING WALLS. THE REQUIREMENT OF RING WALL SHALL BE DECIDED JOINTLY WITH GENERAL CIVIL, GEO–TECH. AND PIPING DEPARTMENTS.

6. THE THICKNESS OF RING WALL (t) IS SO ASSUMED THAT PRESSURE UNDER RING WALL (pw) AT FOUNDING LEVEL DOES NOT EXCEED THE NEXT ALLOWABLE PRESSURE OF THE SOIL (p). THE EXPRESSIONS USED FOR WORKING OUT NET PRESSURE UNDER TANK AND RING WALL AT THE FOUNDING LEVEL OF RING WALL ARE GIVEN BELOW :

$$pt = \sigma H + 1.8\, h_1$$

$$pw = \frac{w}{t} + \frac{\sigma H}{2} + 0.6h + 1.8h_1$$

WHERE w = WEIGHT OF SHELL AND ROOF IN t/m OF CIRCUMFERENCE.
ABOVE EXPRESSIONS ARE BASED ON FOLLOWING ASSUMPTIONS.

DENSITY OF CONCRETE = 2.4 t/m^3
DENSITY OF EARTH = 1.8 t/m^3

h_1 = ELEVATION OF TANK BOTTOM ABOVE FGL (m)
= 1.0m (FOR TABULATION OF VALUES)

NGL = FGL

σ – DENSITY OF FLUID (t/m^3)
H = HEIGHT OF STEEL TANK (m)

7. THE REINFORCEMENT IS WORKED OUT TO RESIST HOOP STRESS RESULTING FROM LATERAL PRESSURE OF CONFINED EARTH. THE COEFFICIENT OF ACTIVE EARTH PRESSURE IS TAKEN AS 0.3 IN THESE CALCULATIONS.

8. THE PERCENTAGE OF TOTAL CIRCUMFERENTIAL REINFORCEMENT SHALL BE WORKED OUT FROM FOLLOWING FORMULA

$$A_s\ (\%) = \frac{(0.36\,H + 0.2/h)R}{230t}$$

WHERE R=RADIUS OF THE RING WALL CENTER LINE IN m. AND ASSUMED ALLOWABLE STRESS IN REBARS = 2300 x 10 t/m^2

9. MINIMUM VERTICAL STEEL SHALL BE 0.12% OF THE GROSS CONCRETE AREA EQUALLY DIVIDED ON BOTH FACES IN THE FORM OF STIRRUPS. THE MINIMUM DIAMETER OF VERTICAL STEEL SHALL BE 10mm AND MAXIMUM SPACING OF THESE STIRRUPS SHALL NOT BE MORE THAN THREE TIMES THE WALL THICKNESS OR 450mm WHICHEVER IS LESS.

10. MIMIMUM CIRCUMFERENTIAL STEEL SHALL BE 0.2% OF THE CROSS SECTIONAL AREA OF RING WALL DISTRIBUTED ON BOTH FACES.

11. FOLLOWING LOADS HAVE NOT BEEN CONSIDERED IN THE DESIGN AS THEIR EFFECT IS NEGLIGIBLE OR ON THE SAFER SIDE.
    (I) ECCENTRICITY OF LOAD DUE TO FLUID COLUMN INSIDE TANK DIRECTLY COMING OVER RING WALL.
    (II) SUBMERGED WEIGHT OF RING WALL DUE TO WATER TABLE IN DETERMINING pw.

B—NOTES TO BE INCLUDED ON CONSTRUCTION DRAWINGS.

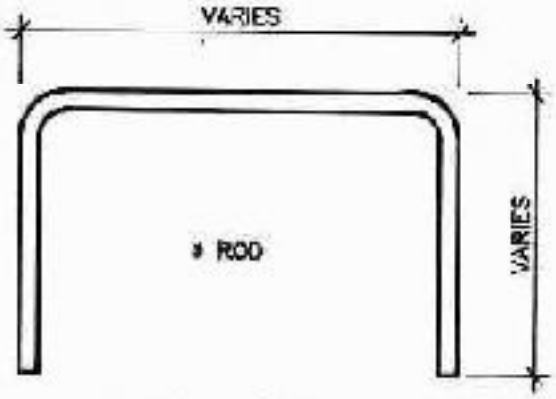
1. TOP OF RING WALL SHALL BE MADE LEVEL TO AVOID LARGE DEFORMATIONS THAT CAN ARISE FROM RELATIVELY SMALL DIFFERENCE S IN RING WALL ELEVATION.

2. THE RING WALL SHALL BE LEVEL WITHIN 6mm (± 3mm) IN A PERIMETER OF 10m AND THAT NO TWO POINTS ON THE WALL SHALL DIFFER IN ELEVATION BY MORE THAN 12mm (± 6mm).

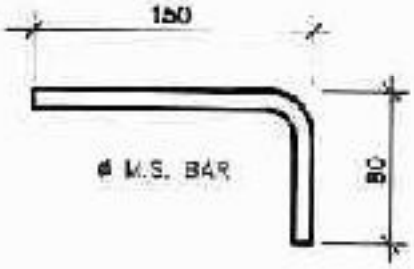
3. IF POSSIBLE AVOID SITUATIONS, WHERE TANK RESTS PARTLY ON CUT AND PARTLY IN FILL. IF THIS IS UNAVOIDABLE, ENSURE THAT FILL IS OF A READILY COMPACTIABLE MATERIAL AND THAT IT IS WELL COMPACTED.

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.93	ISSUED AS STANDARD			



TYPE – 'A1'



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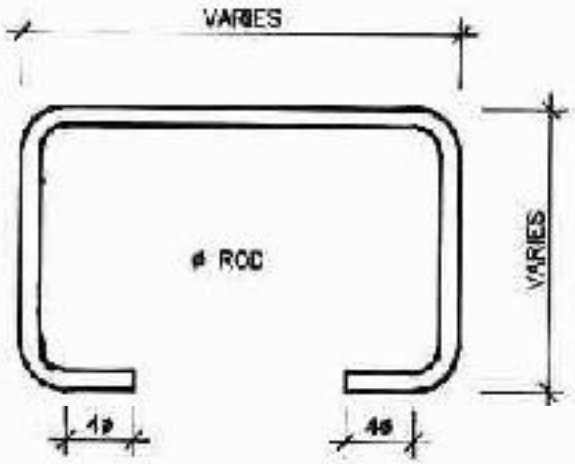

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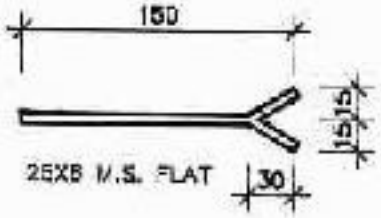

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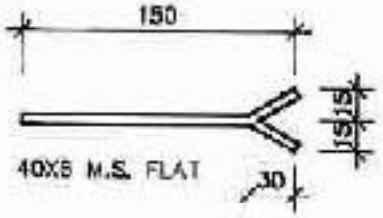

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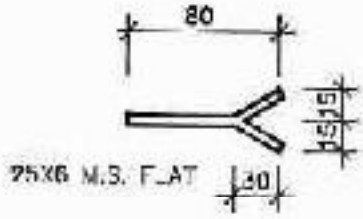


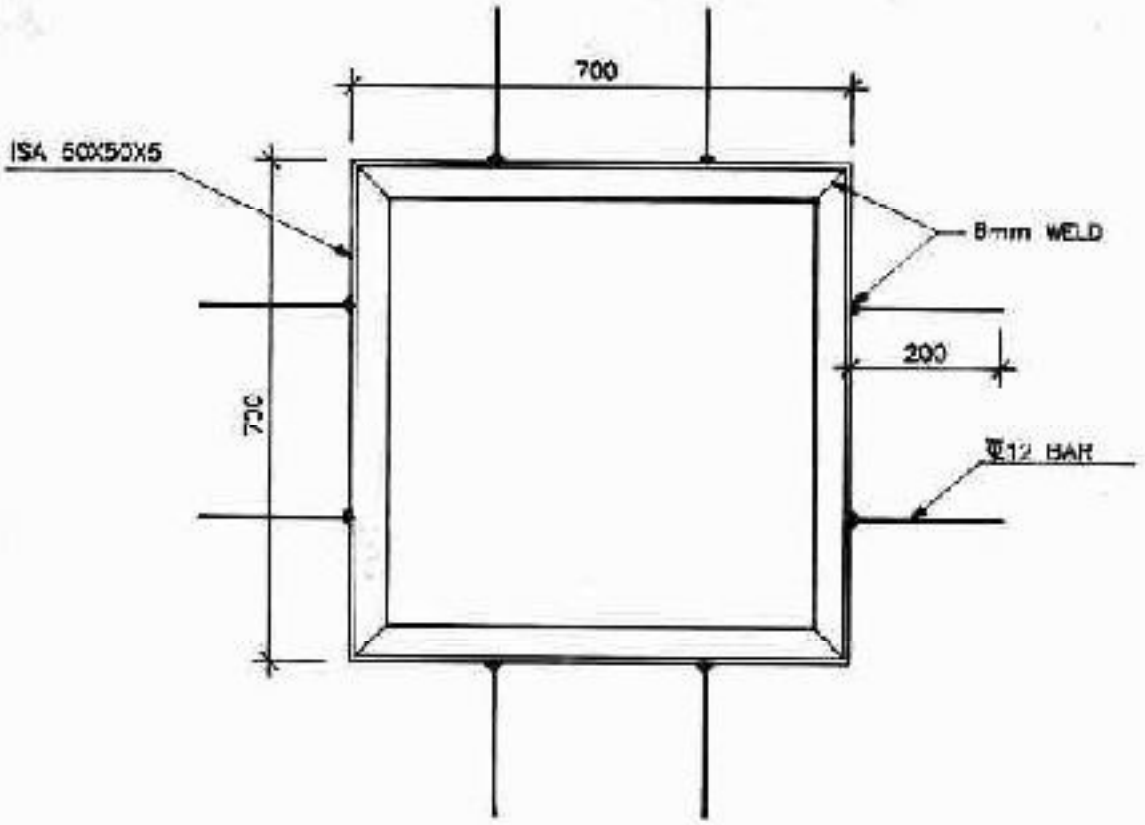
TYPE – 'C3'

FILE NAME: 436

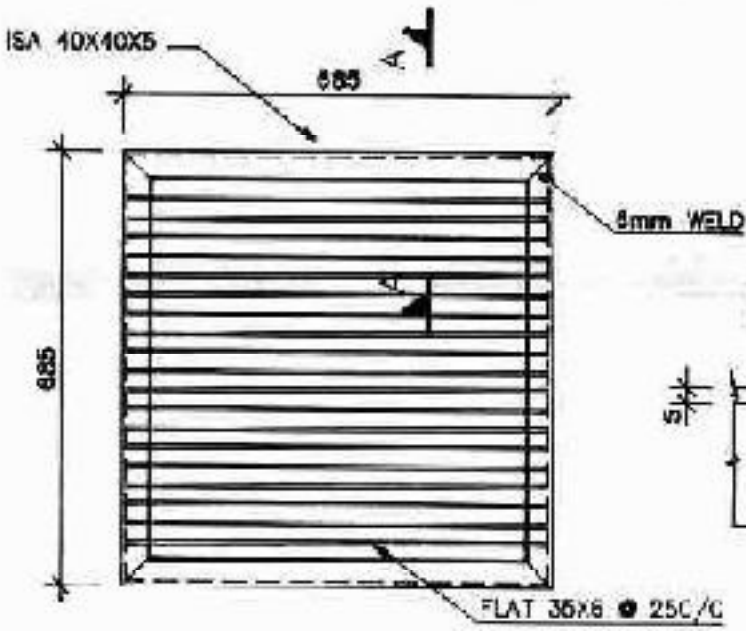
PROJECT ENGINEERING BHEL HYDERABAD	STANDARD LUGS	DRAWING NO.	REV
		4–38144–00036	00

CIVIL ENGINEERING

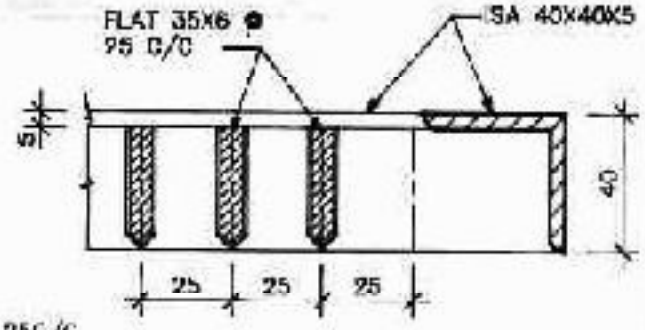
NO	DATE	REVISION	DRN	CHD	APPD
0	03.06.93	ISSUED AS STANDARD			



DETAIL OF FRAME



DETAIL OF GRATING



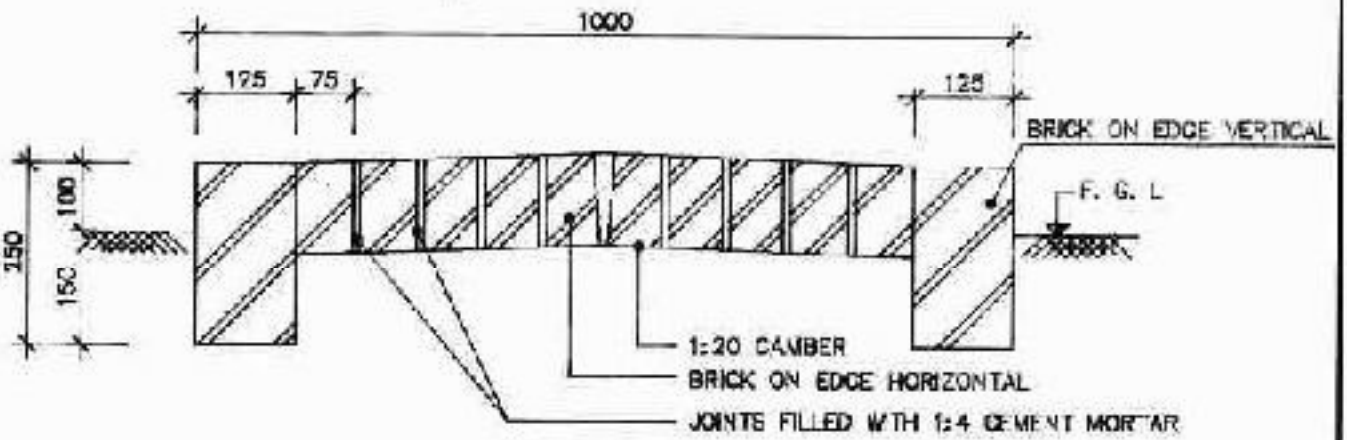
SECTION A A

FILE NAME 437	SHT. 1 OF 1

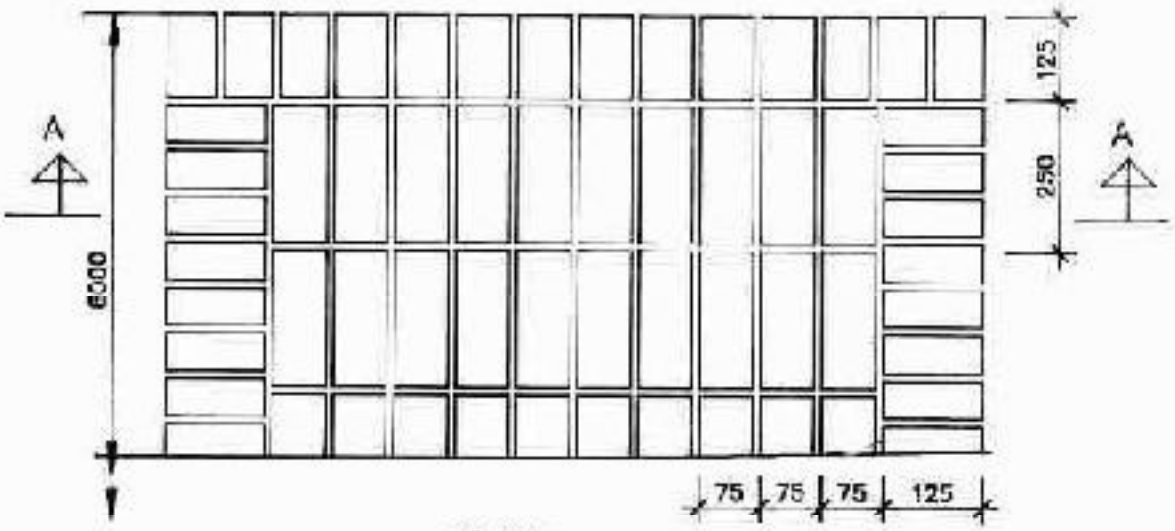
	PROJECT ENGINEERING BHEL HYDERABAD	GRATING DETAIL FOR CATCH BASIN	DRAWING NO.	REV
			4-38144-00037	00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	08.08.86	ISSUED AS STANDARD			



SECTION A–A



PLAN

NOTES:

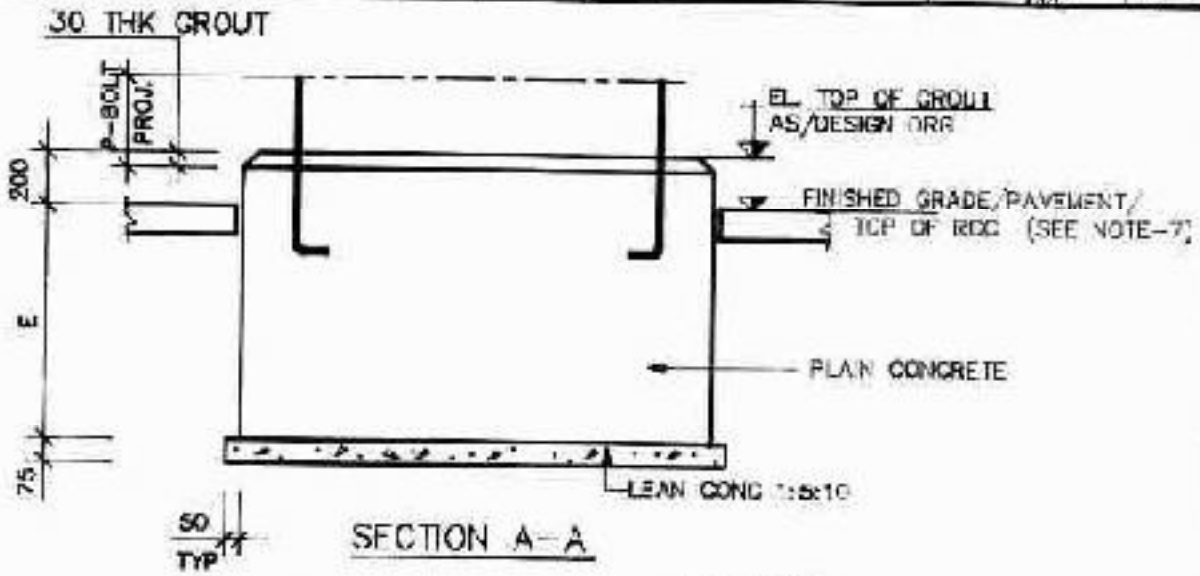
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. AFTER EVERY 6000 LENGTH OF FOOTPATH A BREAK OF 100mm WIDTH SHALL BE LEFT UNPAVED TO ALLOW THE SURFACE DRAINAGE

FILE NAME 438	SHT. 1 OF 1

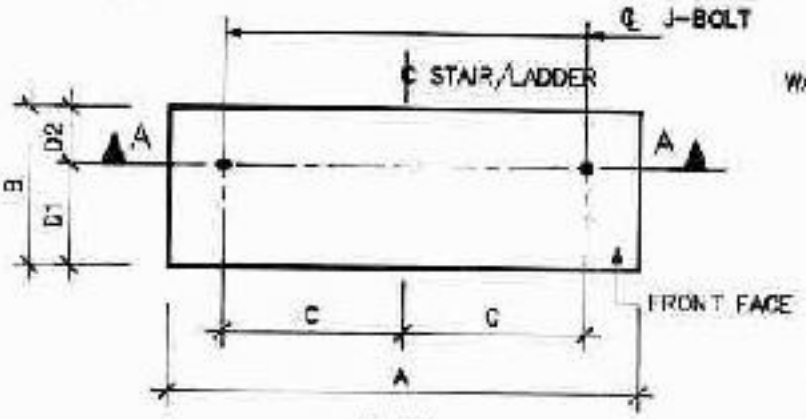
PROJECT ENGINEERING BHEL HYDERABAD	FOOTPATHS	DRAWING NO.	REV
		4–38144–00038	00

CIVIL ENGINEERING

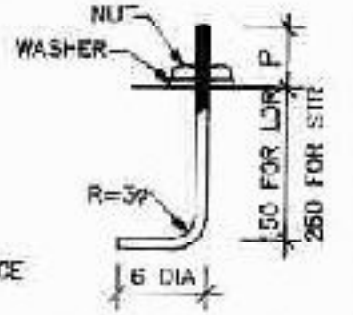
NO	DATE	REVISION	DRN	CHD	APPD
0	09.06.93	ISSUED AS STANDARD			



SECTION A-A



PLAN



DET. OF J-BOLT

SNO	ITEM	WIDTH	A	B	C	D1	D2	P	E	NUT	REMARKS
1	LADDER	450	750	300	280	200	100	70	500	SINGLE	
2	STAIR	750	1100	310	440	210	100	100	600	DOUBLE	FOR STRINGER BEAM
3	STAIR	750	1100	355	440	255	100	100	600	DOUBLE	FOR STRINGER BEAM

NOTES :

1. IN CASE OF PEDESTAL OVER PILE CAP DIMENSION E TO SUIT ACCORDINGLY BUT NOT TO EXCEED VALUES GIVEN IN ABOVE
2. CONCRETE SHALL BE OF GRADE M-15 /M20
3. PROVIDE J-BOLT Ø- Ø12 FOR LADDERS AND Ø20 FOR STAIRS AS/DETAIL GIVEN ABOVE
4. BOLTS SHALL BE TURNED FROM MILD STEEL BARS CONFORMING TO IS:226 OR IS:432 GR-1
5. HEXAGONAL NUTS AND WASHERS SHALL CONFORM TO IS:1363 AND IS:3138
6. THREADING SHALL BE COARSE AND CONFORM TO IS:1367 AND IS: 4218
7. THE PEDESTAL ON ROC FLOOR SLAB SHALL BE MADE MONOLITHIC WITH ROC SLAB TO SUIT THE ABOVE WITH DIMENSION E-0 ; IN SUCH CASES THE PEDESTAL PORTION SHALL BE REINFORCED WITH 8 ℄ BARS AT 150 (INVERTED U-SHAPE) BOTH WAYS.

FILE NAME 439 | SHT. 1 OF 1

BHEL

PROJECT ENGINEERING
BHEL HYDERABAD

PEDESTAL FOR STAIR / LADDER

DRAWING NO. 4-38144-00039 | REV 00

NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.93	ISSUED AS STANDARD			

INTRODUCTION :

THIS STANDARD ON WELDING SYMBOLS HAS BEEN MADE TO INCORPORATE THE REQUIREMENTS OF THE REVISED IS (INDIAN STANDARD) CODE ON 'SCHEME OF SYMBOLS FOR WELDING' (IS : 813–1986).

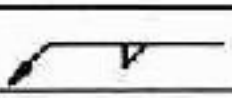
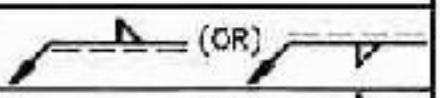
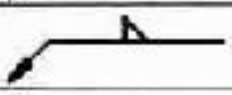
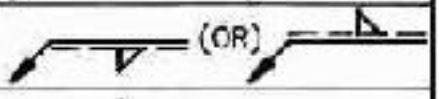
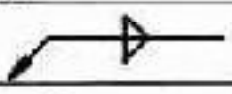
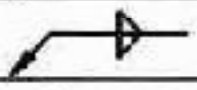
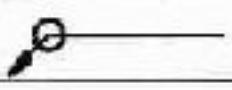
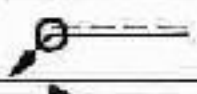
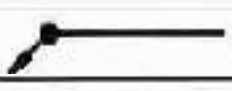
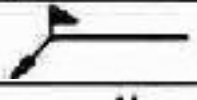
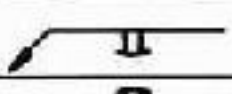
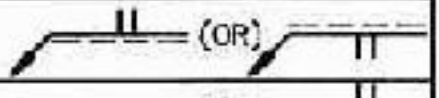
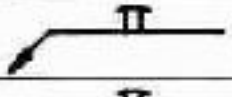
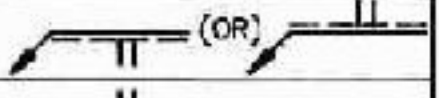
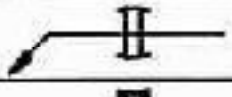
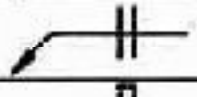
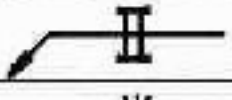
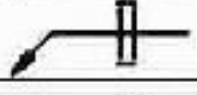
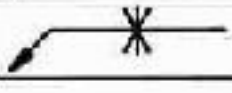
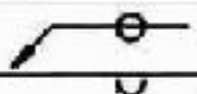
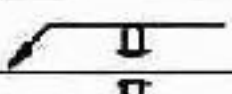
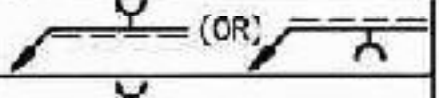
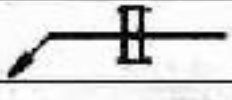
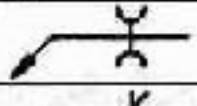
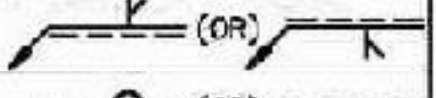
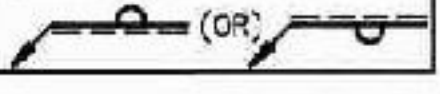
WITH A VIEW TO FACILITATE ITS USAGE, AND TO MINIMIZE THE CHANCES OF ERROR IN THE TRANSITION PERIOD, THE STANDARD GIVES THE REQUIREMENTS OF BOTH THE EARLIER IS : 813–(1961) AS WELL AS THE REVISED IS : 813–(1986).

THIS STANDARD ON WELDING SYMBOLS SHALL BE USED ON DRAWINGS FOR ALL JOBS. SPECIFIC MENTION SHALL BE MADE ON DRAWING GIVING REFERENCE TO USE OF THE REVISED IS : 813–(1986). SYMBOLS FOR WELDING.

NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.93	ISSUED AS STANDARD			

STANDARD BASIC SYMBOLS FOR WELDING

REF. IS : 813–1961/1986

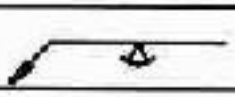
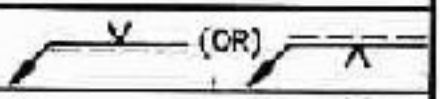
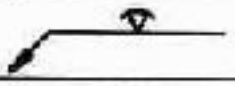
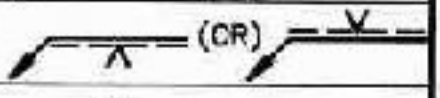
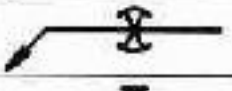
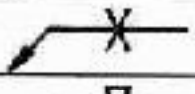
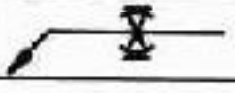
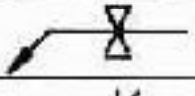
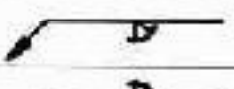
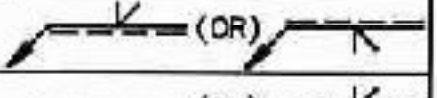
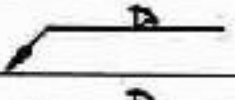
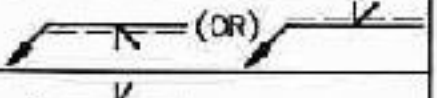
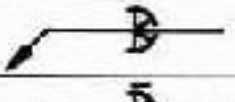
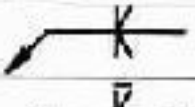
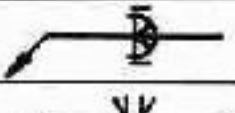
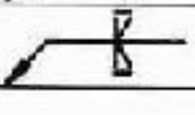
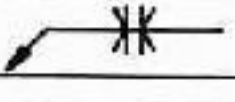
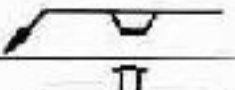
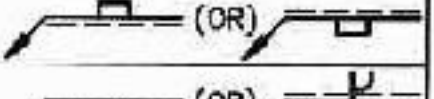
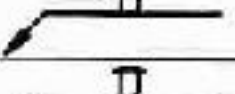
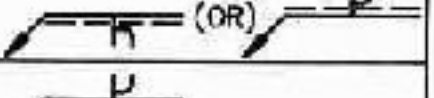
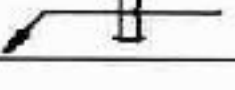
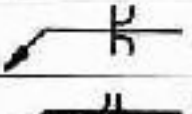
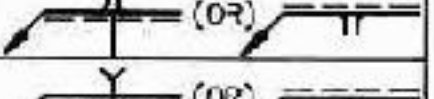
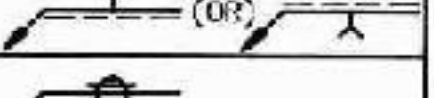
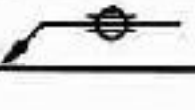
S.NO	INSTRUCTIONS	DRG REPRESENTATION IS : 813–1961	DRG REPRESENTATION S : 813–1986
1.	NEAR SIDE FILLET WELD		
2.	FAR SIDE FILLET WELD		
3.	BOTH SIDE FILLET WELD		
4.	WELD ALL ROUND		
5.	SITE WELD		
6.	SQUARE BUTT NEAR SIDE		
7.	SQUARE BUTT FAR SIDE		
8.	SQUARE BUTT BOTH SIDE		
9.	SQUARE BUTT BOTH SIDE GRINDING FINISH.		
10.	SPOT WELD		
11.	SINGLE U BUTT (NEAR SIDE)		
12.	DOUBLE –U BUTT.		
13.	SINGLE BEVEL BUTT WELD WITH BROAD ROOT FACE (NEAR SIDE)		
14.	BACKING RUN, BACK RUN BACKING WELD (NEAR SIDE).		

PROJECT ENGINEERING BHEL HYDERABAD	WELDING SYMBOLS	DRAWING NO.	REV
		4–38144–00040	00

CIVIL ENGINEERING	NO	DATE	REVISION	DRN	CHD	APPD
	0	03.08.93	ISSUED AS STANDARD			

STANDARD BASIC SYMBOLS FOR WELDING

REF. IS : 813–1961/1986

S.NO	INSTRUCTIONS	DRG REPRESENTATION IS : 813–1961	DRG REPRESENTATION IS : 813–1986
15	SINGLE–V BUTT NEAR SIDE		
16	SINGLE–V BUTT FAR SIDE		
17	DOUBLE–V BUTT		
18	DOUBLE–V BUTT GRINDING FINISH		
19	SINGLE BEVEL–BUTT NEAR SIDE		
20	SINGLE BEVEL–BUTT FAR SIDE		
21	DOUBLE BEVEL–BUTT		
22	DOUBLE BEVEL–BUTT GRINDING FINISH		
23	STITCH WELD		
24	PLUG OR SLOT WELD (NEAR SIDE)		
25	SINGLE J–BUTT FAR SIDE		
26	DOUBLE J–BUTT		
27	BUTT WELD BETWEEN PLATES WITH RAISED EDGES (NEAR SIDE)		
28	SINGLE–V BUTT WELD WITH BOARD ROOT FACE (NEAR SIDE)		
29	SEAM WELD		

FILE NAME : 11063 | SHT. 3 OF 6

BHEL	PROJECT ENGINEERING BHEL HYDERABAD	WELDING SYMBOLS	DRAWING NO.	REV
			4–38144–00040	00

NO	DATE	REVISION	DRN	CHD	APPD
0	03.06.96	ISSUED AS STANDARD			

SUPPLEMENTARY SYMBOLS (IS : 813–1986)

SHAPE OF WELD SURFACE	SYMBOL
(a) FLAT (USUALLY FINISHED FLUSH)	
(b) CONVEX	
(c) CONCAVE	

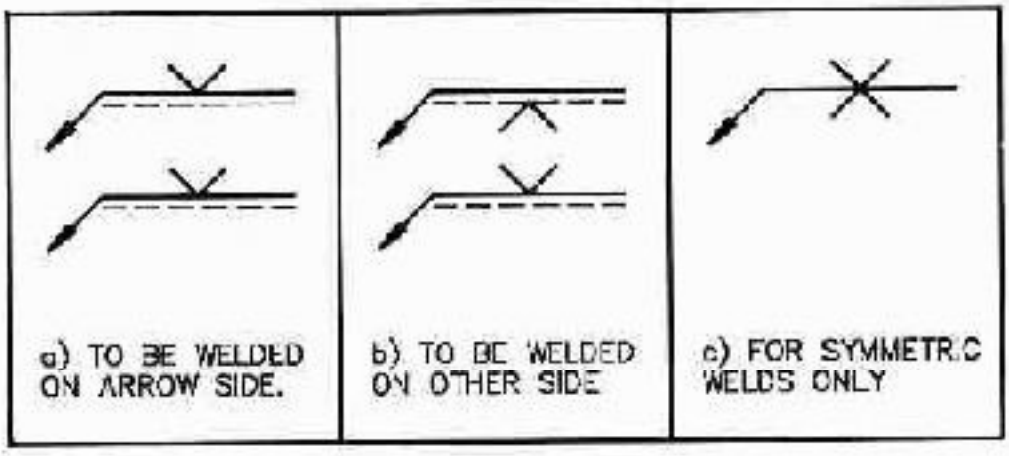
EXAMPLE OF APPLICATION OF SUPPLEMENTARY SYMBOLS

IS : 813–1986

DESIGNATION	SYMBOL
FLAT (FLUSH) SINGLE–V BUTT WELD	
CONVEX DOUBLE–V BUTT WELD	
CONCAVE FILLET WELD	
FLAT (FLUSH) SINGLE–V BUTT WELD WITH FLAT (FLUSH) BACKING RUN	

POSITION OF SYMBOL ACCORDING TO THE REFERENCE LINE

IS : 813–1986

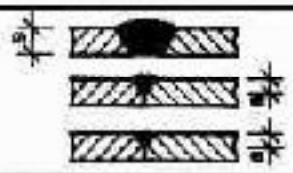
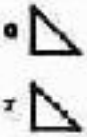
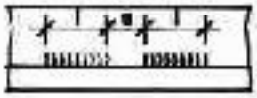
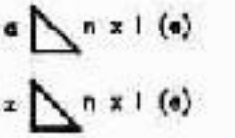
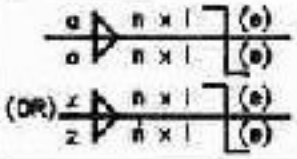
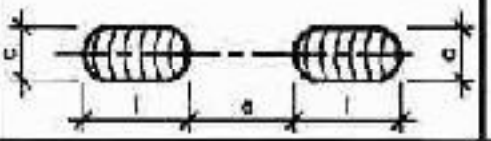
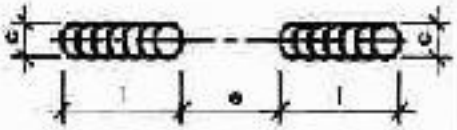
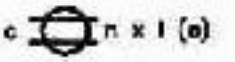
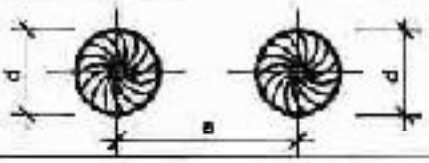
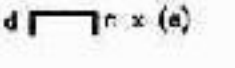
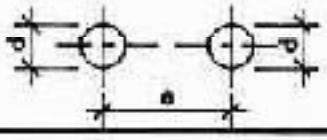


PROJECT ENGINEERING BHEL HYDERABAD	WELDING SYMBOLS	DRAWING NO.	REV
		4–38144–00040	00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.06.93	ISSUED AS STANDARD			

METHOD OF INDICATING DIMENSIONS OF WELDS:
(IS:813–'986)

S NO	DESIGNATION OF WELDS	DEFINITION	INSCRIPTION
1	BUTT WELD		
2	BUTT WELD BETWEEN PLATES WITH RAISED EDGES		
3	CONTINUOUS FILLET WELD		
4	INTERMITTENT FILLET WELD		
5	STAGGERED INTERMITTENT FILLET WELD		
6	PLUG OR SLOT WELD		
7	SEAM WELD		
8	PLUG WELD		
9	SPOT WELD		

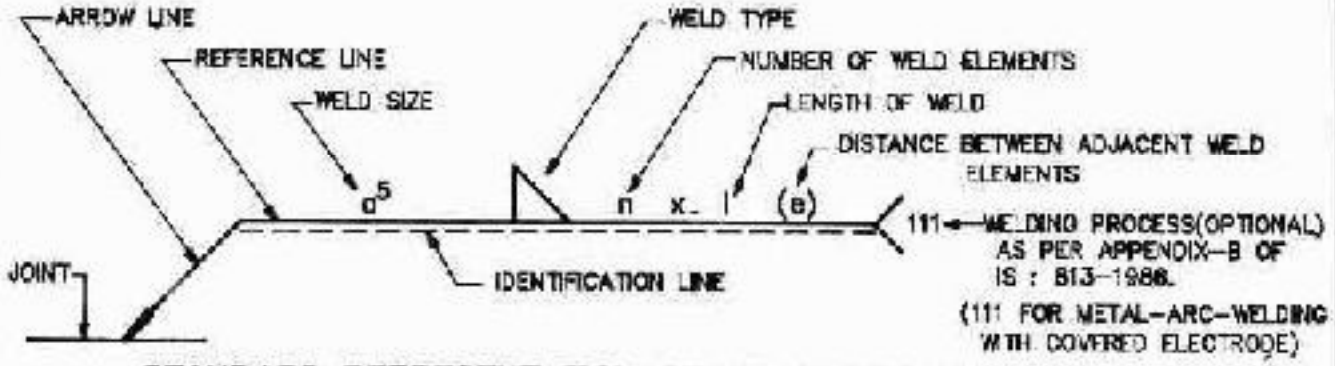
NOTE: 'n' INDICATES NUMBER OF WELD ELEMENTS
'l' INDICATES LENGTH OF WELD (WITHOUT END CRATERS)

FILE NAME : 44055 | SHT. 5 OF 6

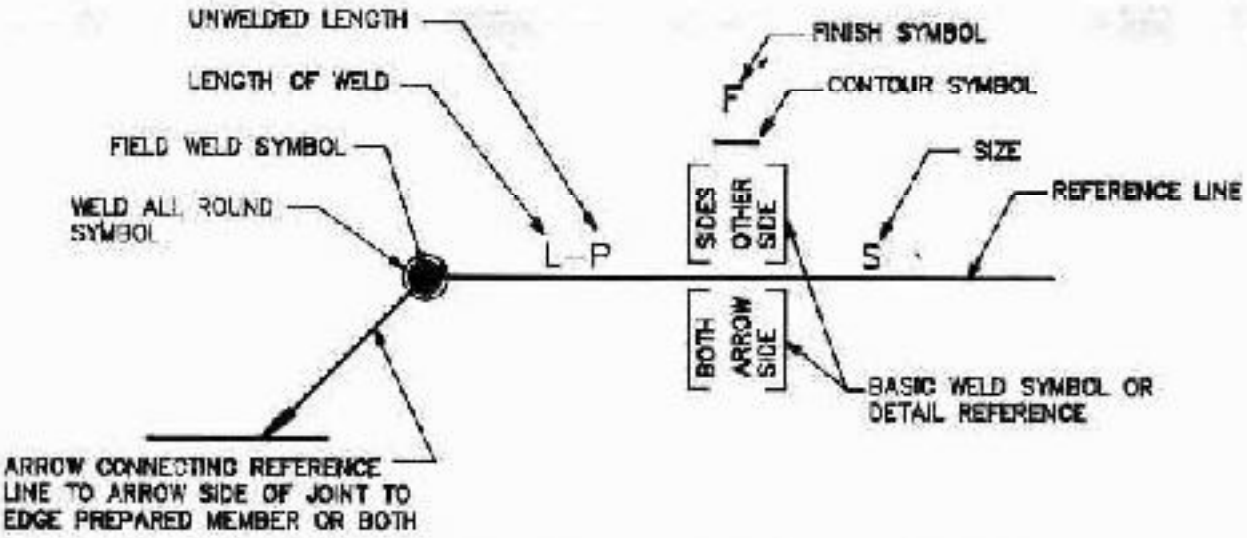
BHEL	PROJECT ENGINEERING BHEL HYDERABAD	WELDING SYMBOLS	DRAWING NO. 4–38144–00040 / REV 00

CIVIL ENGINEERING

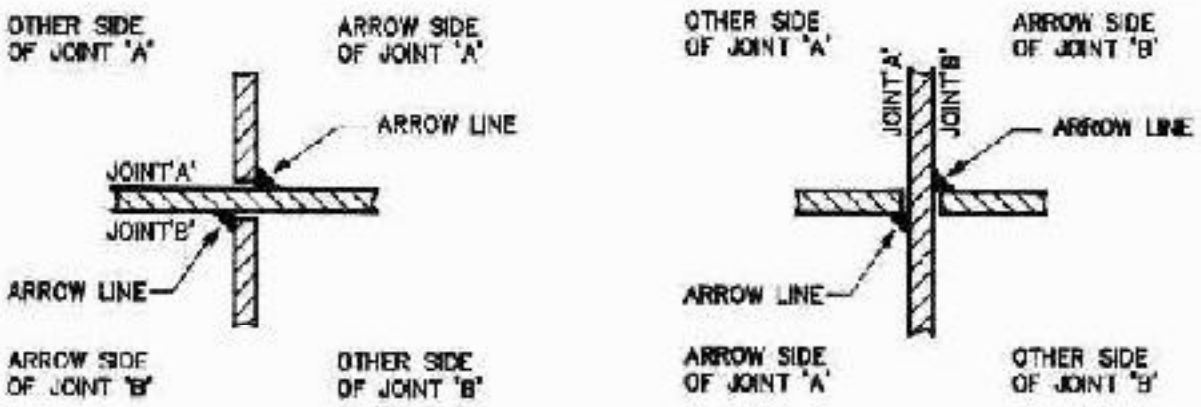
NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.99	ISSUED AS STANDARD			



STANDARD REPRESENTATION OF WELDS IN DRAWINGS IS : 813-1986



STANDARD REPRESENTATION OF WELDS IN DRAWINGS IS : 813-1961



POSITION OF WELDING SYMBOL ACCORDING TO THE REFERENCE LINE

FILE NAME : 44056 | SHT. 6 OF 6

PROJECT ENGINEERING BHEL HYDERABAD	WELDING SYMBOLS	DRAWING NO.	REV
		4-38144-00040	00

LAP LENGTH FOR H.Y.D. BARS (IN mm)

BAR DIA (mm)	LAP LENGTH OF BARS GRADE OF CONCRETE			
	M-15	M-20	M-25	M 30
6	410	310	270	250
8	550	410	370	330
10	690	510	460	410
12	820	620	550	490
16	1100	820	730	660
18	1230	920	820	740
20	1370	1030	910	820
22	1510	1130	1000	900
25	1710	1280	1140	1030
28	1920	1440	1280	1150
32	2190	1640	1460	1310
36	2460	1850	1640	1480

NOTES :

1. BASED ON SP : 16 (S & T) – 1980, DESIGNS TO IS : 456–1978 AND APPLICABLE TO WORKING STRESS METHOD OF DESIGN.
2. THIS TABLE SHALL BE USED FOR WATER RETAINING STRUCTURES : CIRCULAR BINS & CHIMNEYS

LAP LENGTH FOR H.Y.D. BARS IN mm

BAR DIA (mm)	LAP LENGTH OF BARS GRADE OF CONCRETE			
	M-15	M-20	M-25	M 30
6	340	280	240	230
8	450	380	320	300
10	560	470	400	380
12	680	560	480	450
16	900	760	650	600
18	1020	850	730	680
20	1130	940	810	750
22	1240	1030	890	830
25	1410	1180	1010	940
28	1580	1320	1130	1050
32	1810	1500	1290	1200
36	2030	1690	1450	1350

NOTES :

1. THE LAP LENGTHS GIVEN ABOVE ARE FOR LIMIT STATE / ULTIMATE STRESS METHOD OF DESIGN; BASED ON SP – 16 (S & T) 1980 DESIGN AIDS TO IS : 456–1978.
2. THIS TABLE SHALL BE FOLLOWED FOR ALL R.C.C STRUCTURES EXCEPT FOR WATER RETAINING STRUCTURES, CIRCULAR BINS & CHIMNEYS.

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CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	08.06.08	ISSUED AS STANDARD			

LAP LENGTH FOR PLAIN ROUND BARS (IN mm)

BAR DIA (mm)	LAP LENGTH OF BARS			
	GRADE OF CONCRETE			
	M-15	M-20	M-25	M-30
6	350	260	230	210
8	470	350	310	280
10	580	440	390	350
12	700	530	470	420
16	930	700	620	560
18	1050	790	700	630
20	1170	880	780	700
22	1190	890	790	720
25	1350	1070	900	810
28	1520	1140	1010	910
32	1730	1300	1160	1040
36	1950	1460	1300	1170

NOTES :

1. BASED ON SP : 16 (S & T) – 1980, DESIGNS TO IS : 456–1978 AND APPLICABLE TO WORKING STRESS METHOD OF DESIGN.
2. THIS TABLE SHALL BE USED FOR WATER RETAINING STRUCTURES ; CIRCULAR BINS & CHIMNEYS

FILE NAME 44153 | SHT. 3 OF 5

PROJECT ENGINEERING
BHEL HYDERABAD

STANDARD LAPS & HOOKS FOR REINFORCEMENT

DRAWING NO.	REV
4-38144-00041	00

LAP LENGTH FOR PLAIN ROUND BARS (IN mm)

BAR DIA (mm)	LAP LENGTH OF BARS IN GRADE OF CONCRETE			
	M-15	M-20	M-25	M-30
6	330	270	250	230
8	440	360	310	290
10	540	450	390	360
12	650	540	470	440
16	870	730	620	580
18	980	820	700	650
20	1090	910	780	730
22	1150	960	820	770
25	1310	1090	930	870
28	1460	1220	1040	970
32	1670	1390	1190	1110
36	1880	1570	1340	1250

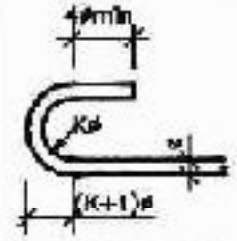
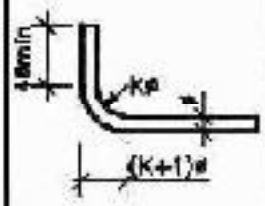
NOTES :

1. THE LAP LENGTHS GIVEN ABOVE ARE FOR LIMIT STATE / ULTIMATE STRESS METHOD OF DESIGN BASED ON SP 16 (S & T)- 1980 DESIGN AIDS TO IS : 456-1978.
2. THIS TABLE SHALL BE FOLLOWED FOR ALL R.C.C STRUCTURES EXCEPT FOR WATER RETAINING STRUCTURES, CIRCULAR BINS & CHIMNEYS.

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.93	ISSUED AS STANDARD			

ANCHORAGE VALUE OF HOOKS & BENDS (IN mm)

SHAPE \ BAR #	6	8	10	12	16	18	20	22	25	28	32	36
 STANDARD HOOK	95	130	160	190	255	290	320	350	400	450	510	575
 STANDARD 90° BEND	60	85	80	95	130	145	160	175	200	225	255	290
 FOR H.Y.D. BARS	120	160	200	240	320	360	400	440	500	560	640	720
 FOR PLAIN BARS	145	190	210	290	385	430	480	530	600	670	770	865

MIN. K VALUE FOR MILD STEEL = 2

MIN. K VALUE FOR HIGH YEILD DEFORMED BARS = 4

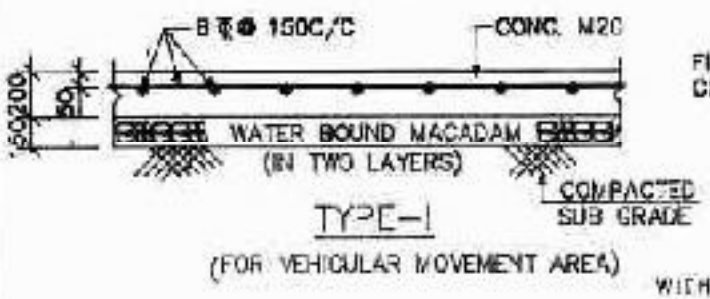
- ABOVE TABLE IS APPLICABLE TO ALL GRADES OF RE-BARS UNLESS NOTED.
- HOOKS & BENDS SHALL CONFORM TO THE DETAILS AS SHOWN.
- HOOKS & BENDS ARE BASED ON SP : 16(S & T) -1980. DESIGN AIDS TO IS: 456-1978

FILE NAME 44155 | SHT. 5 OF 5

BHEL	PROJECT ENGINEERING BHEL HYDERABAD	STANDARD LAPS & HOOKS FOR REINFORCEMENT	DRAWING NO. 4-38144-00041 / REV 00

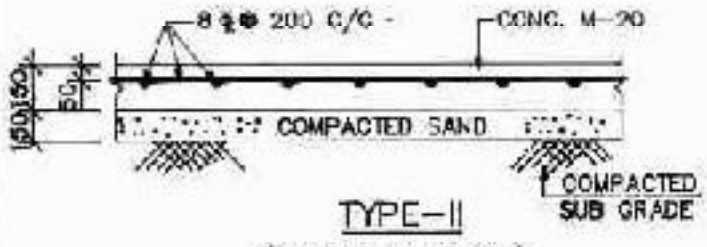
CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	08.08.03	ISSUED AS STANDARD			



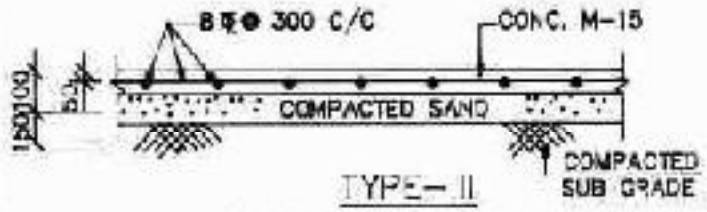
TYPE-I

(FOR VEHICULAR MOVEMENT AREA)



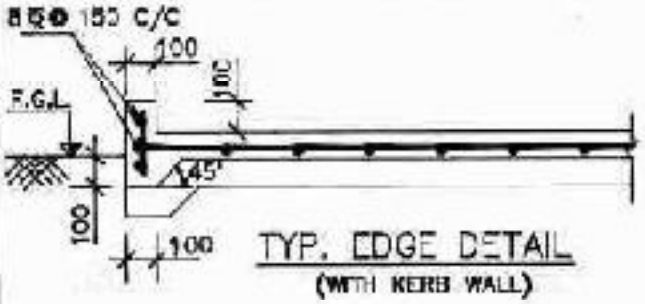
TYPE-II

(FOR UNIT PAVEMENT)



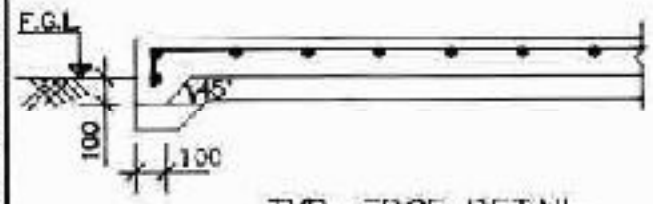
TYPE-II

(FOR OFFSITE PUMP STATION)



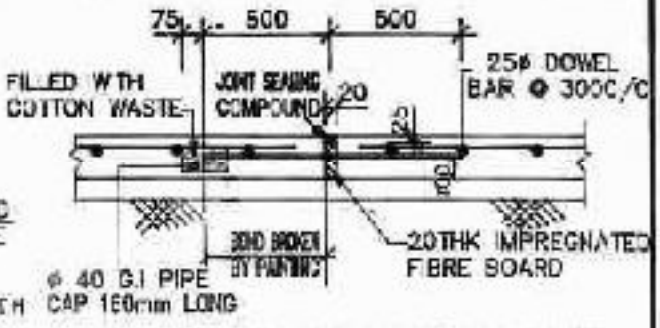
TYP. EDGE DETAIL

(WITH KERB WALL)



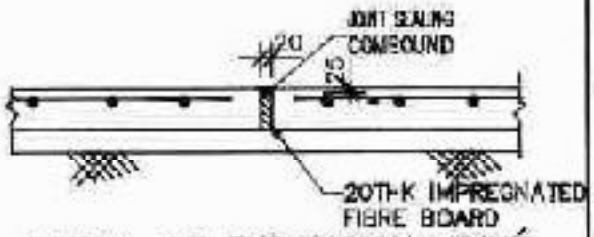
TYP. EDGE DETAIL

(WITHOUT KERB WALL)



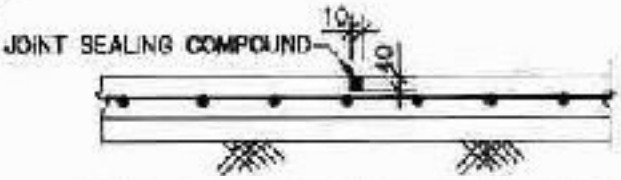
DETAIL OF EXPANSION JOINT

(FOR TYPE-I PAVEMENT)

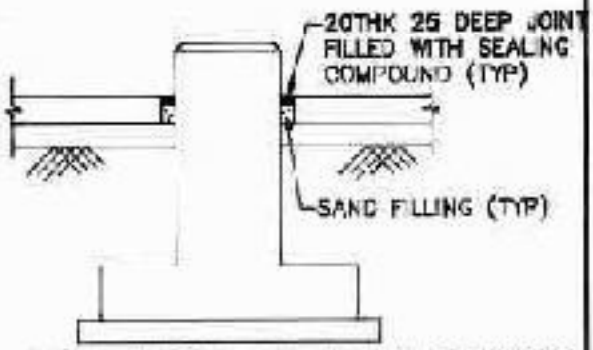


DETAIL OF EXPANSION JOINT

(FOR TYPE -II & II PAVEMENTS)



DETAIL OF CONSTRUCTION JOINT



TYP. DETAIL OF JOINT SEALING AROUND FOUNDATION

FILE NAME 44251	SHT. 1 OF 2

BHEL	PROJECT ENGINEERING BHEL HYDERABAD	R.C.C. PAVEMENT DETAILS	DRAWING NO. 4-38144-00042 / REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.08.93	ISSUED AS STANDARD			

NOTES :

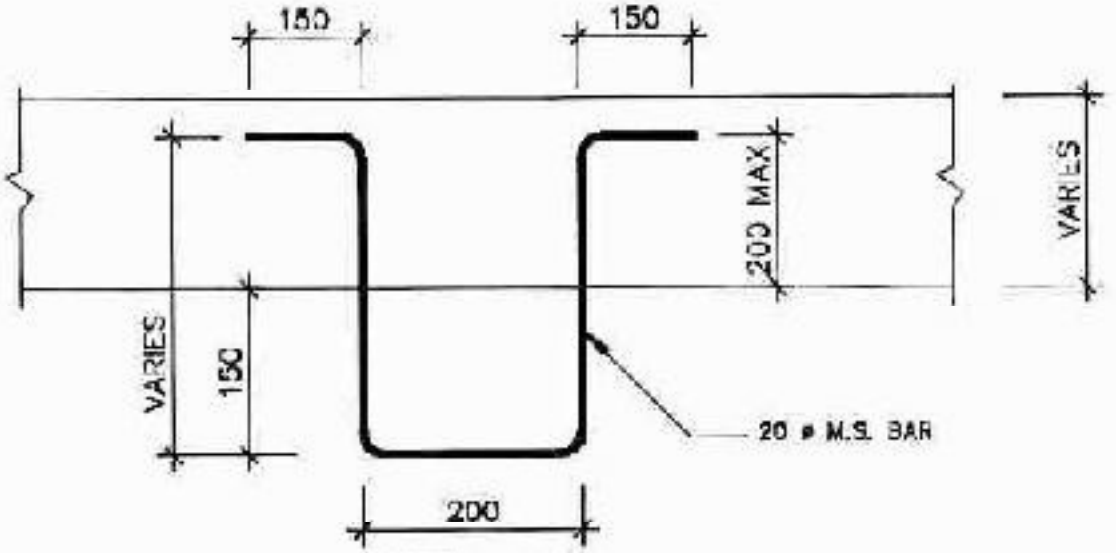
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. CONC. SHALL CONFORM TO IS : 456.
3. ℞ DENOTES HIGH YIELD DEFORMED BARS CONFORMING TO IS : 1786
4. JOINT SEALING COMPOUND IN PAVING & AROUND EQUIPMENT FOUNDATIONS SHALL CONFORM TO IS : 1834 TYPE B.
5. EXPANSION JOINT FILLER MATERIAL SHALL BE PREMOULDED FIBRE IMPPREGNATED FELT CONFORMING TO IS : 1838.
6. CONC. PAVING SHALL BE SLOPED TO 1:100 UNLESS OTHERWISE SHOWN IN DETAIL ENGINEERING DRG.
7. SUB GRADE SHALL BE THOROUGHLY COMPACTED TO PROPER SLOPE & GRADE BEFORE LAYING WBM/COMPACTED SAND FILLING.
8. SAND SHALL BE COMPACTED TO 90% LAB MAX. DRY DENSITY THE COMPACTED SAND FILLING TO BE SATURATED WITH WATER BEFORE CONCRETING.
9. CONC. PAVEMENT SHALL BE LAID IN ALTERNATE CAST IN SITU PANELS OF 3.0Mx3.0M SIZE, PANEL SIZE SHALL BE ADJUSTED AROUND COLUMNS & FOUNDATIONS.
10. EXPPANSION JOINTS SHALL BE SPACED AT 15.0M C/C.

FILE NAME 1482 | SHT. 2 OF 2

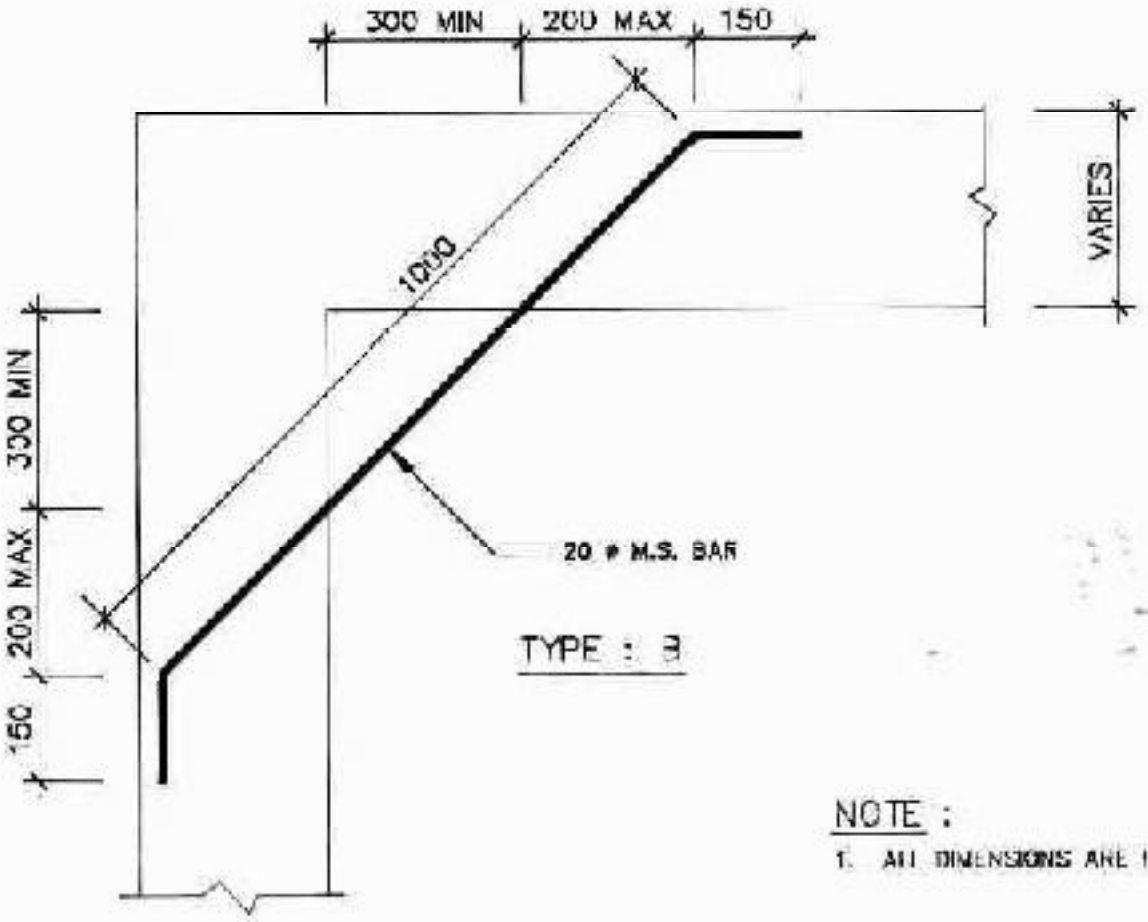
PROJECT ENGINEERING BHEL HYDERABAD	R.C.C. PAVEMENT DETAILS	DRAWING NO.	REV
		4-48-44-00042	00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.05.93	ISSUED AS STANDARD			



TYPE : A



TYPE : B

NOTE :

1. ALL DIMENSIONS ARE IN MM.

FILE NAME 143 | SHT. 1 OF 1

		DRAWING NO.	REV
PROJECT ENGINEERING BHEL HYDERABAD	DETAILS OF M.S. RUNGS	4-38144-00043	00

OFFICE COPY

CIVIL ENGINEERING	NO	DATE	REVISION	DRN	CHD	APPD
	0	03.06.93	ISSUED AS STANDARD			

NOTES:

1. THIS STANDARD IS BASED ON FOLLOWING PRINCIPLE OF LAYING CABLES IN THE PLANT AREA
   a) UNIT AREA – CABLES IN RCC TRENCH/BRICK MASONRY TO BE FILLED WITH SAND AND COVERED WITH PRECAST RCC SLABS.
   b) INSIDE BUILDING – CABLES IN RCC TRENCH TO BE COVERED WITH CHEQUERED PLATE/RCC PRECAST COVERS
   c) OFFSITE AREA – NO TRENCH TO BE LAID UNDER GROUND OR OVERHEAD.
2. ELECTRICAL DEPTT. WILL PROVIDE FOLLOWING INFORMATION ON THEIR DRAWINGS WHICH WILL BE ISSUED FOR CONSTRUCTION:
   a) LAYOUT AND SIZE OF THE CABLE TRENCH.
   b) TYPE OF COVER REQUIRED i.e. PRECAST RCC / CHEQD. PLATE.
   c) LIVE LOAD ON THE COVERS IF MORE THAN AS DEFINED IN TABLE 1 & 7.
   d) INSERT PLATE REQUIREMENT AND ITS SPACING.
   e) LAYOUT AND SIZE OF OPENING FOR PANELS .(SHEET 16 OF 17)
3. GRADE OF CONCRETE FOR PRECAST COVER SHALL BE M 20 AND FOR CABLE TRENCH M–15 AS PER IS : 456 U.C.S IN THE DRAWING.
4. CABLE TRENCH AS PER S.NO 14 TO 16 OF TABLE 5 & 6 SHALL NORMALLY BE IN BRICK MASONRY. IN CASE IT IS REQUIRED TO BE CONSTRUCTED IN RCC, REBAR AND OTHER DETAILS SHALL BE SIMILAR TO S.NO 13 OF TABLE 5 & 6.
5. SPECIAL PRECAST COVERS AT THE JUNCTION OF THE CABLE TRENCH SHALL PREFERABLY BE IN CAST-IN-SITU (REFER SHEET 9 OF 17 AND 10 OF 17)
6. EVERY FIFTH COVER SHALL HAVE LIFTING HOOK AS PER TYPE A OR TYPE B (REFER SHEET 3 OF 17 & 15 OF 17)
7. THIS STANDARD IS NOT APPLICABLE FOR CABLE TRENCH / COVERS AT ROAD CROSSING.

FILE NAME : 44651	SHT. 1 OF 17

PROJECT ENGINEERING BHEL HYDERABAD	CABLE TRENCH	DRAWING NO.	REV
		4–38144–00046	00