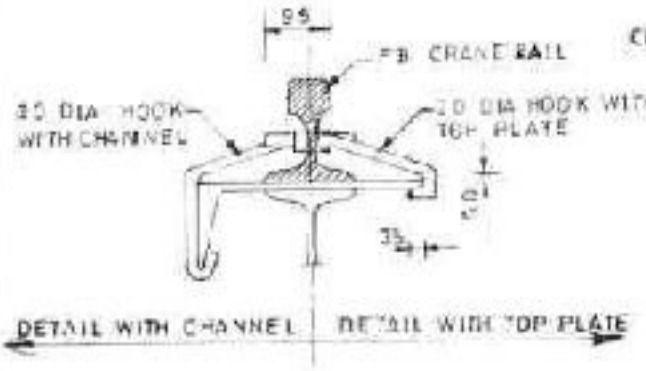
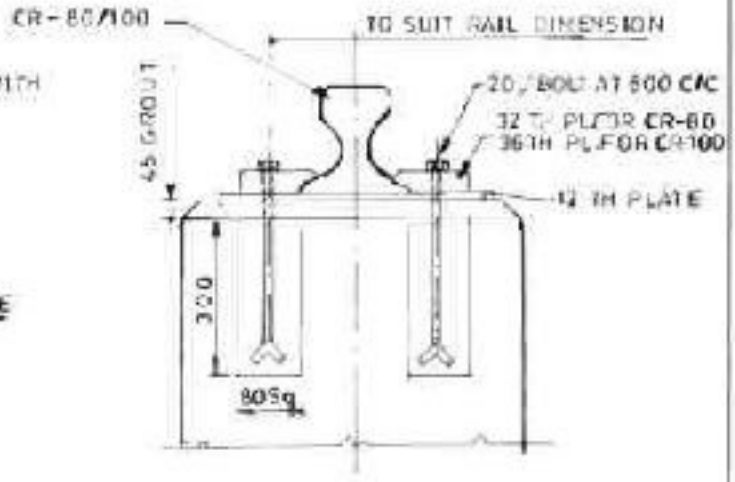
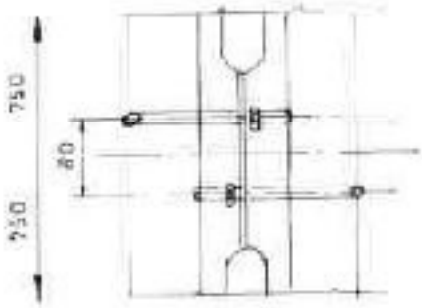
CIVIL ENGINEERING	NO	DATE	REVISIONS	DRN	CHD	APPD
	0	24/7/92	ISSUED AS STANDARD	Q E S		

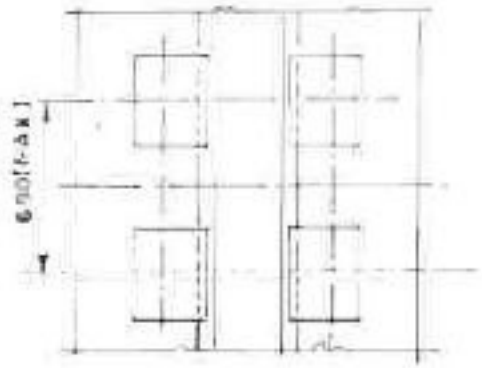






TYPE V

(VALID FOR 18 lbs/yd TO 35 lbs/yd RAIL AS PER B.S.)



TYPE VI

FLAT BOTTOM CRANE RAIL FIXING

NOTE

1 ALL DIMENSIONS ARE IN MM

SHEET 2 OF 2

PROJECT ENGINEERING BHEL HYDERABAD	CRANE RAIL FIXING DETAILS	DRAWING NO: 4-38144-00010	REV 0

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

GENERAL NOTES:

1. ALL LUGS SHALL BE OF 12 ℄ OR 16 ℄ H.Y.D. BARS CONFORMING TO IS : 1786 AND SHALL BE CONNECTED TO METAL INSERT PLATES BY 6MM FILLET WELDS AS SHOWN IN SKETCHES.

2. METAL INSERT PLATES SHALL BE 12MM THICK OR 16MM THICK AS PER REQUIREMENT CONFORMING TO IS : 226.

3. MOMENT SHEAR AND TENSILE CAPACITIES IN TABLES ARE 3/4 OF THE VALUES CALCULATED BASED ON ALLOWABLE STRESSES AS PER IS : 456 (1978) AND IS : 800 (1962). THE EXTRA FACTOR OF SAFETY OF 1.33 IS TO ACCOUNT FOR THE NON – UNIFORM WELDING AND WORKMANSHIP AT SITE.

4. METAL INSERT PLATES SHALL BE MARKED ON DRAWING AS UNDER:–
   IP–(A) @ (C)
   IP = INSERT PLATE
   A = TYPE OF INSERT PLATE
   C = ELEVATION OF INSERT PLATE (TOP EDGE)
   e.g. IP–R9a @ EL.110.300 MEANS INSERT PLATE TYPE R9a AT ELEVATION 110.300

5. METAL INSERT PLATES SHALL BE KEPT FLUSH WITH CONCRETE SURFACE

6. THE LONGER SIDE OF THE METAL INSERT PLATE SHALL BE KEPT VERTICAL UNLESS SHOWN OTHERWISE.

7. METAL INSERT PLATE ON COLUMN OR BEAM SHALL BE KEPT SYMMETRICAL ABOUT ℄ OF COLUMN OR BEAM, UNLESS SHOWN OTHERWISE

8. WHERE REQUIRED LUGS SHALL BE BENT AS SHOWN IN SHT 04.

PROJECT ENGINEERING BHEL HYDERABAD	METAL INSERT PLATES	DRAWING NO.	REV
		4–38144–00011	00

FORMULAE USED IN CALCULATION :-

(A) PURE SHEAR

SHEAR CAPACITY,

(i) $\leq 3/4 \times (n \times AL \times Pq)$

OR

(ii) $\leq 3/4 \times (n \times 78.4 \times \phi^2 \times \sqrt{\sigma cu})$

WHICH EVER IS LESS

(A) COMBINED MOMENT AND SHEAR :-

1. $T = \pi \times \phi \times L \times Tbd$

OR $AL \times \sigma st$

OR $\pi \times \phi \times$ WELD SIZE $\times 0.7 \times 110$

WHICH EVER IS LESS

2. $M = T.Z$

3. $\left(\frac{T}{AL \times \sigma st}\right)^2 + \left(\frac{S}{AL \times Pq}\right)^2 \leq 1$, HENCE $S \leq \left[\left\{\sqrt{1-\left(\frac{T}{AL\,\sigma st}\right)^2}\right\} \times AL \times Pq\right]$

4. SHEAR CAPACITY

(i) $\leq 3/4 \times n \times s$

(ii) $\leq 3/4 \times (n \times 78.4 \times \phi^2 \times \sqrt{\sigma cu})$

WHICH EVER IS LESS

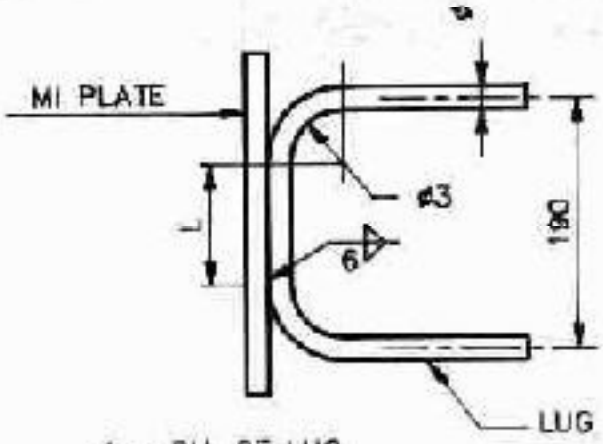
5. MOMENT CAPACITY $= 3/4 \times M$

WHERE

1. Pq = ALLOWABLE SHEAR STRESS OF LUGS = 1600Kg/Cm^2
2. σst = ALLOWABLE TENSILE STRESS IN LUGS = 2300Kg/Cm^2
3. Tbd = BOND STRENGTH OF CONCRETE , Kg/Cm
4. σcu = 28 DAYS 150mm CUBE STRENGTH OF CONCRETE , Kg/Cm^2
5. ϕ = LUG DIAMETER, Cm
6. AL = SECTIONAL AREA OF A SINGLE LUG, Cm^2
7. n = NUMBER OF LUGS
8. Z = SECTION MODULUS OF LUG GROUP
9. L = EMBEDDED LENGTH
10. S = SHEAR STRENGTH OF SINGLE LUG, Kgs.
11. T = TENSILE STRENGTH OF SINGLE LUG, Kgs.

CIVIL ENGINEERING

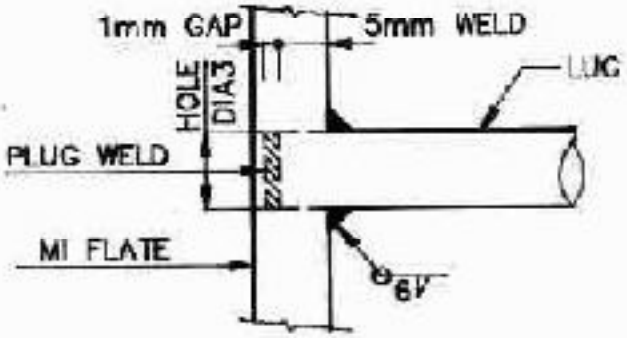
NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			



ø = DIA OF LUG
L = WELD LENGTH AVAILABLE ≤(190−7ø)

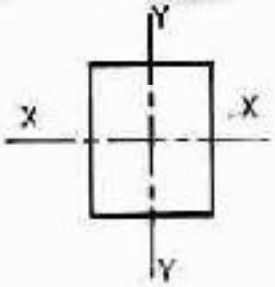
BENDING DIMENSION FOR 12ø & 16ø LUGS

(FOR SPACING OF LUGS ≥ 190)



WELD DET OF 12ø & 16ø LUGS WITH METAL INSERT PLATE

(FOR SPACING OF LUGS < 190)



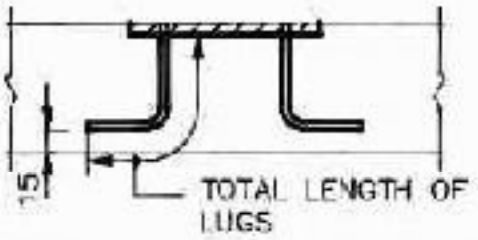
TYP "X" AND "Y" DIRECTIONS

SHT 03 OF 15 | FILE NAME 41153

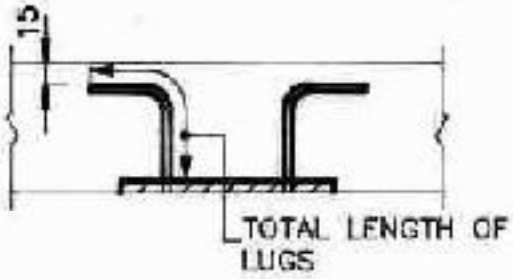
PROJECT INGINEERING BHEL HYDERABAD	METAL INSERT PLATES	DRAWING NO.	REV
		4−38144−00011	00

CIVIL ENGINEERING

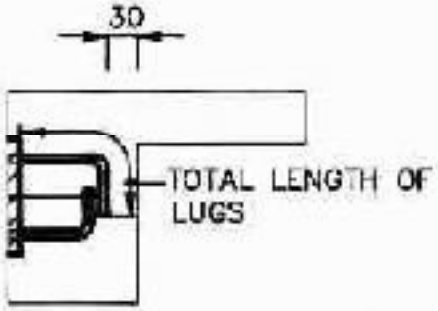
NO	DATE	REVSION	DRN	CHD	APPD
0		ISSUED AS STANDARD			



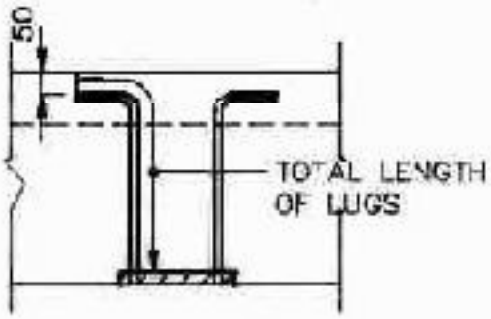
TYP. METAL INSERT DETAIL ON SIDE OF BEAM



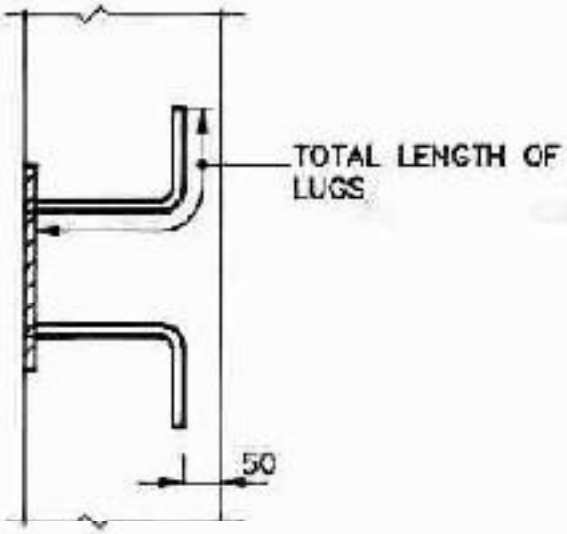
TYP. METAL INSERT DETAIL ON BOTTOM OF SLAB



TYP. METAL INSERT DETAIL ON SIDE OF BEAM



TYP. METAL INSERT DETAIL ON BOTTOM OF BEAM



TYP. METAL INSERT DETAIL ON COLUMNS

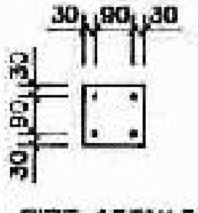
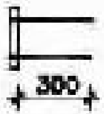
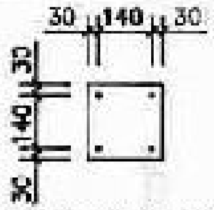
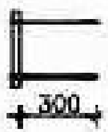
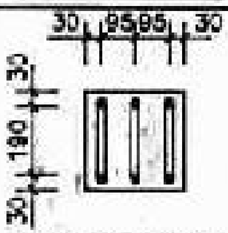
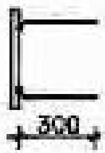
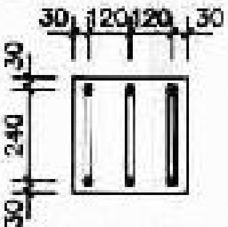
SHT 04 OF 13 | FILE NAME 411 S 4

PROJECT INGINEERING BHEL HYDERABAD	METAL INSERT PLATES (LUG BENDING DETAIL)	DRAWING NO: 4-38144-00011	REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

SQUARE M.I. PLATES FOR SHEAR & MOMENT , SHEAR & TENSION CAPACITIES

S NO	TYPE OF INSERT PLATE	DIA OF LUGS (mm) Φ	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE: PLAN	DETAILS OF INSERT PLATE: CROSS SECTION	SHEAR AND MOMENT CAPACITY M-20 SHEAR (T)	M-20 MOMENT (TM) Mx	M-20 MOMENT (TM) My	M-25 SHEAR (T)	M-25 MOMENT (TM) Mx	M-25 MOMENT (TM) My	SHEAR AND TENSION CAPACITY M-20 SHEAR (T)	M-20 TENSION (T)	M25 SHEAR (T)	M25 TENSION (T)	UNIT WT (Kg) M.I.P	UNIT WT (Kg) LUGS
1	S1a	12	12	 SIZE 150X150		4.75	0.15	0.15	4.50	0.20	0.20	4.75	5.00	4.50	5.70	2.10	1.05
	S1b	16	16			8.95	0.20	0.20	8.70	0.25	0.25	8.95	6.50	8.70	7.60	2.80	1.90
2	S2a	12	12	 SIZE 200X200		4.75	0.25	0.25	4.50	0.30	0.30	4.75	5.00	4.50	5.70	3.90	1.05
	S2b	16	16			8.95	0.30	0.30	8.70	0.40	0.40	8.95	6.50	8.70	7.60	5.00	1.90
3	S3a	12	12	 SIZE 250X250		7.15	0.50	0.35	6.70	0.60	0.40	7.10	7.60	6.70	8.55	5.80	2.10
	S3b	16	16			13.40	0.70	0.45	13.10	0.80	0.50	13.40	9.80	13.10	11.40	7.85	3.75
4	S4a	12	12	 SIZE 300X300		6.70	0.75	0.50	6.25	0.85	0.55	6.70	8.85	6.25	9.95	6.50	2.60
	S4b	16	16			13.00	0.95	0.60	12.60	1.15	0.75	13.00	10.00	12.60	13.30	11.30	4.45

SHT05OF13   FILE NAME 4115

PROJECT ENGINEERING
BHEL HYDERABAD

METAL INSERT PLATES

DRAWING NO: 4-38144-00011   REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

SQUARE M.I. PLATES FOR SHEAR & MOMENT , SHEAR & TENSION CAPACITIES

S NO	TYPE OF INSERT PLATE	DIA OF LUGS T (mm)	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE: PLAN	DETAILS OF INSERT PLATE: CROSS SECTION	SHEAR AND MOMENT CAPACITY: M-20 SHEAR (T)	M-20 MOMENT(TM) Mx	M-20 MOMENT(TM) My	M-25 SHEAR (T)	M-25 MOMENT(TM) Mx	M-25 MOMENT(TM) My	SHEAR AND TENSION CAPACITY: M-20 SHEAR (T)	M-20 TENSION (T)	M25 SHEAR (T)	M25 TENSION (T)	UNIT WT (Kg): M.I.P.	UNIT WT (Kg): LUGS
1	S5a	12	12	SIZE 350X350	350	6.70	0.95	0.60	6.25	1.05	0.70	6.70	8.85	6.25	9.95	11.55	2.65
	S5b	16	16			13.00	1.05	0.70	12.60	1.45	0.95	13.00	10.00	12.60	13.30	15.40	4.70
2	S6a	12	12	SIZE 400X400	350	8.70	1.10	0.75	6.25	1.30	0.85	8.70	8.85	6.25	9.95	15.00	2.75
	S6b	16	16			13.00	1.30	0.85	12.60	1.70	1.10	13.00	10.00	12.60	13.30	20.00	4.95
3	S7a	12	12	SIZE 450X450	400	8.10	1.50	1.50	7.40	1.65	1.65	8.10	13.50	7.40	15.65	19.10	3.55
	S7b	16	16			16.70	1.95	1.95	16.00	2.20	2.20	16.70	18.00	16.00	20.25	25.40	6.30

FILE NAME 411 SHT 06 OF 13

PROJECT ENGINEERING
BHEL HYDERABAD

METAL INSERT PLATES

DRAWING NO: 4-38144-00011

REV 00

RECTANGULAR M.I. PLATE FOR SHEAR & MOMENT, SHEAR & TENSION CAPACITIES

S NO.	TYPE OF INSERT PLATE	DIA OF LUGS (mm) Φ	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE: PLAN	DETAILS OF INSERT PLATE: CROSS SECTION	SHEAR AND MOMENT CAPACITY M-20: SHEAR (T)	M-20: MOMENT (TM) Mx	M-20: MOMENT (TM) My	SHEAR AND MOMENT CAPACITY M-25: SHEAR (T)	M-25: MOMENT (TM) Mx	M-25: MOMENT (TM) My	SHEAR AND TENSION CAPACITY M-20: SHEAR (T)	M-20: TENSION (T)	M25: SHEAR (T)	M25: TENSION (T)	UNIT WT (Kg): M.I.P.	UNIT WT (Kg): LUGS
1	R1a	12	12	30, 90, 30 / 30, 140, 30 / SIZE 150X200	300	4.75	0.25	0.15	4.50	0.30	0.20	4.75	5.00	4.50	5.70	2.85	1.05
	R1b	16	16			8.95	0.30	0.20	8.70	0.40	0.25	8.95	6.50	8.70	7.60	3.75	1.90
2	R2a	12	12	30, 90, 30 / 30, 240, 30 / SIZE 150X300	300	4.75	0.45	0.15	4.50	0.60	0.20	4.75	5.00	4.50	5.70	4.25	1.50
	R2b	16	16			8.95	0.60	0.20	8.70	0.70	0.25	8.95	6.50	8.70	7.60	5.65	2.65
3	R3a	12	12	30, 10, 30 / 30, 240, 30 / SIZE 200X300	350	4.35	0.50	0.30	4.00	0.60	0.30	4.35	5.90	4.00	6.60	5.65	1.65
	R3b	16	16			8.85	0.80	0.35	8.40	0.80	0.45	8.85	6.65	8.40	8.85	7.55	3.00
4	R4a	12	12	30, 40, 30 / 30, 340, 30 / SIZE 200X400	350	4.35	0.75	0.30	4.00	0.80	0.30	4.35	5.90	4.00	6.60	7.55	1.85
	R4b	16	16			8.85	0.85	0.75	8.40	1.10	0.45	8.85	6.65	8.40	8.85	10.06	3.30

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

PROJECT ENGINEERING
BHEL HYDERABAD

METAL INSERT PLATES

DRAWING NO: 4-38144-00011

REV 00

FILE NAME 411 | SHT 07 OF 13

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

RECTANGULAR M.I. PLATE FOR SHEAR & MOMENT, SHEAR & TENSION CAPACITIES

S.NO	TYPE OF INSERT PLATE	DIA OF LUGS (mm)	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE: PLAN	CROSS SECTION	SHEAR AND MOMENT CAPACITY M-20: SHEAR (T)	M-20: MOMENT (TM) Mx	M-20: MOMENT (TM) My	M-25: SHEAR (T)	M-25: MOMENT (TM) Mx	M-25: MOMENT (TM) My	SHEAR AND TENSION CAPACITY M-20: SHEAR (T)	M-20: TENSION (T)	M25: SHEAR (T)	M25: TENSION (T)	UNIT WT (Kg) M.I.P	UNIT WT (Kg) LUGS
5	R5a	12	12	30, 190, 30; 30, 240, 30; SIZE 250X300	350		0.50	0.40	4.60	0.60	0.45	4.35	5.90	4.00	6.60	7.05	1.65
	R5b	16	16			8.85	0.60	0.45	8.40	0.80	0.60	8.85	6.65	8.40	6.85	8.40	3.00
6	R6a	12	12	30, 190, 30; 30, 170, 170, 30; SIZE 250X400	350	6.70	0.75	0.60	8.25	0.85	0.70	6.70	8.85	25	9.85	9.40	2.40
	R6b	16	16			13.00	0.85	0.70	12.60	1.10	0.95	13.00	10.00	12.60	13.30	2.55	4.20
7	R7a	12	12	30, 190, 30; 30, 80, 80, 80, 30; SIZE 250X500	400	8.10	1.30	1.00	7.45	1.40	1.00	8.10	13.50	7.40	15.63	7.80	3.50
	R7b	16	16									16.70	20.00	6.00	20.25	15.70	6.25
8	R8a	12	12	30, 240, 30; 30, 170, 170, 30; SIZE 300X400	350		0.75				0.30	6.70	8.65	6.20	9.90	11.30	2.50
	R8b	16	16				0.85	0.75		1.10						15.05	4.45

FILE NAME 4:1 | SHT 08 OF 13

PROJECT ENGINEERING BHEL HYDERABAD	METAL INSERT PLATES	DRAWING NO.	REV
		4-38144-00011	00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

RECTANGULAR M.I. PLATE FOR SHEAR & MOMENT, SHEAR & TENSION CAPACITIES

SL NO	TYPE OF INSERT PLATE	DIA OF LUGS (mm)	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE: PLAN	DETAILS OF INSERT PLATE: CROSS SECTION	SHEAR AND MOMENT CAPACITY: M-20 SHEAR (T)	M-20 MOMENT(TM) Mx	M-20 MOMENT(TM) My	M-25 SHEAR (T)	M-25 MOMENT(TM) Mx	M-25 MOMENT(TM) My	SHEAR AND TENSION CAPACITY: M-20 SHEAR (T)	M-20 TENSION (T)	M-25 SHEAR (T)	M-25 TENSION (T)	UNIT WT (Kg) M.I.PLUGS
9	R9a	12	12	SIZE 300X500		10.30	1.80	1.20	9.25		1.40	10.30	6.65	9.25	19.00	14.10 3.60
	R9b	16	16			20.80	2.40		20.00	2.65	1.80	20.80	22.50	20.00	25.30	18.85 6.30
10	R10a	12	12	SIZE 300X600		10.30	2.10	1.20	9.25	2.40	1.40	10.30	6.65	9.25	19.00	16.95 3.60
	R10b	16	16			20.80	2.80	1.60	20.00	3.15	1.80	20.80	22.50	23.00	25.30	22.60 6.30
11	R11a	12	12	SIZE 350X400		6.70	0.75	0.95	6.25	0.85	1.10	6.70	8.85	6.20	9.95	13.20 1.90
	R11b	16	16			13.00	0.85	1.10	12.60	1.15	1.50	13.00	0.00	12.60	13.30	7.80 3.30
12	R12a	12	12	SIZE 350X500		10.30	1.80	1.45	9.25	2.00	1.70	10.30	6.65	9.25	19.00	16.45 3.60
	R12b	16	16			20.80	2.40		20.00		2.20	20.80	22.50	20.00	25.30	22.00 6.30

FILE NAME 411 | SHT 09 OF 13

BHEL

PROJECT ENGINEERING
BHEL HYDERABAD

METAL INSERT PLATES

DRAWING NO. 4-38144-00011

REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

RECTANGULAR M.I. PLATE FOR SHEAR & MOMENT, SHEAR & TENSION CAPACITIES.

S. NO.	TYPE OF INSERT PLATE	DIA OF LUGS (mm)	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE: PLAN	DETAILS OF INSERT PLATE: CROSS SECTION	SHEAR AND MOMENT CAPACITY: M-20 SHEAR (T)	M-20 MOMENT (TM) Mx	M-20 MOMENT (TM) My	M-25 SHEAR (T)	M-25 MOMENT (TM) Mx	M-25 MOMENT (TM) My	SHEAR AND TENSION CAPACITY: M-20 SHEAR (T)	M-20 TENSION (T)	M25 SHEAR (T)	M25 TENSION (T)	UNIT WT (Kg) M.I.PLUGS
14	R13a	12	12			10.30	2.10	1.45	9.25	2.40	1.70	10.30	16.63	9.25	19.00	9.95 3.60
	R13b	16	16			20.80	2.80	1.95	20.00	3.15	2.20	20.80	22.50	20.00	25.30	26.40 6.30
15	R14a	12	12			12.35	2.40	1.80	11.10	2.70	2.00	12.35	20.00	11.10	22.75	18.85 3.60
	R14b	16	16			25.00	3.10	2.50	24.80	3.50	2.75	25.00	27.00	24.80	30.35	25.10 6.30

FILE NAME 411 | SHT 10 OF13

BHEL

PROJECT ENGINEERING
BHEL HYDERABAD

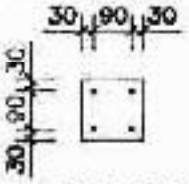
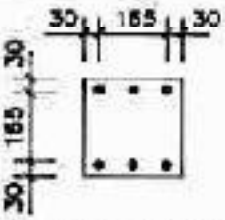
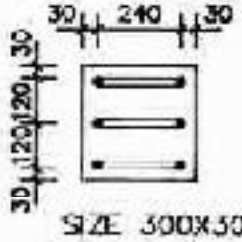
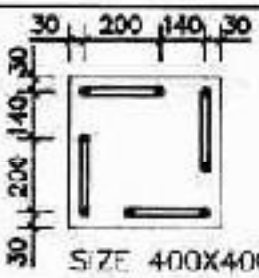
METAL INSERT PLATES

DRAWING NO. 4-38144-00011 | REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

DETAILS OF M.I. PLATE FOR PURE SHEAR CONNECTIONS ONLY

S NO	TYPE OF INSERT PLATE	DIA OF LUGS (mm) Φ	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE		SHEAR CAPACITY (T)		UNIT WT (Kg)	
				PLAN	CROSS SECTION	M_20	M_25	M.I.P.	LUGS
1	PS1	12	12	 SIZE 150X150		4.75	5.35	2.10	0.90
	PS2	16	16			8.50		2.80	1.90
2	PS3	12	12	 SIZE 225X225		7.20	8.00	4.75	1.35
	PS4	16	16					6.35	2.85
3	PS5	12	12	 SIZE 300X300			8.00	8.50	2.00
	PS6	16	16			12.75	14.35	11.30	4.00
4	PS7	12	12	 SIZE 400X400		9.60	10.70	15.00	2.50
	PS8	16	16			17.00		20.00	5.00

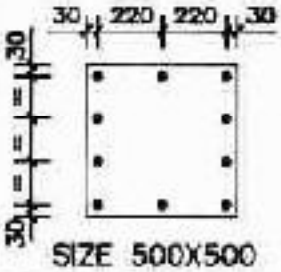
FILE NAME:411 | SHT 11 OF 13

PROJECT ENGINEERING BHEL HYDERABAD	METAL INSERT PLATES	DRAWING NO: 4-38144-00011	REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			

DETAILS OF M.I. PLATE FOR PURE SHEAR CONNECTIONS ONLY

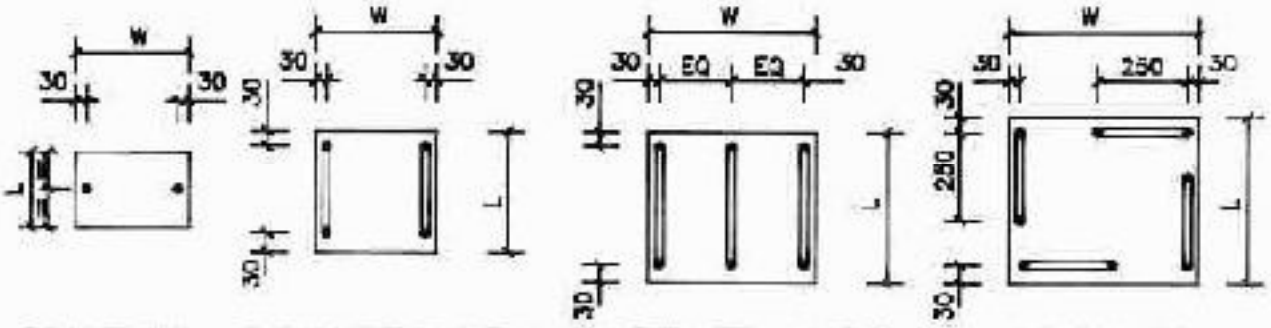
S NO	TYPE OF INSERT PLATE	DIA OF LUGS (mm) ℄	THK OF INSERT PLATE (mm)	DETAILS OF INSERT PLATE		SHEAR CAPACITY (T)		UNIT WT (Kg)	
				PLAN	CROSS SECTION	M_20	M_25	M.I.P.	LUGS
5	PS9	12	12	 SIZE 450X450		9.60		19.10	2.60
	PS10	16	16			17.00	19.00	25.40	5.00
6	PS11	12	12	 SIZE 500X500		12.00	13.40	23.55	2.25
	PS12	16	16			21.30	23.80	31.40	4.75

FILE NAME 411 | SHT 12 OF 13

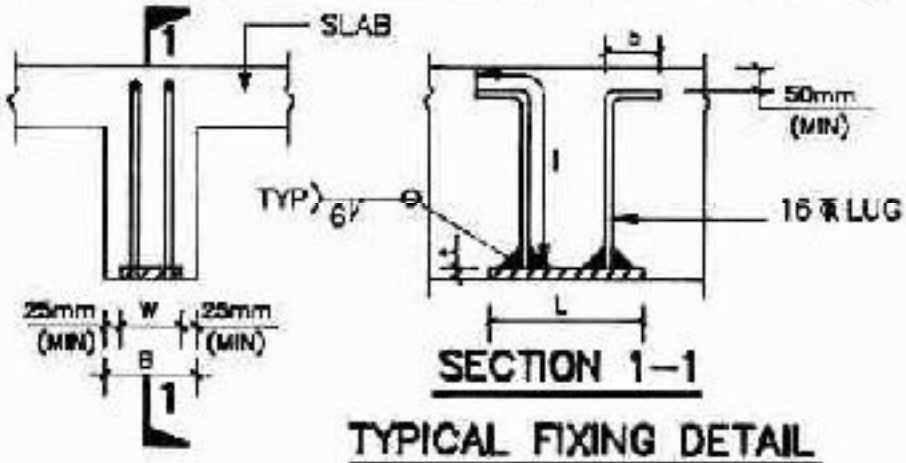
BHEL	PROJECT ENGINEERING BHEL HYDERABAD	METAL INSERT PLATES	DRAWING NO. 4-38144-00011 / REV 00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			



TYPE T1 TYPE T2,T3&T4 TYPE T5 & T6 TYPE T7



SECTION 1–1

TYPICAL FIXING DETAIL

DETAILS OF M I PLATE FOR TENSILE LOAD

S NO.	TYPE OF INSERT PLATE	WIDTH OF BEAM 'B' (mm)	MAX. WIDTH OF PLATE 'W' (mm)	LENGTH OF PLATE 'L' (mm)	MAX. 'b' (mm)	THK. OF PLATE 't' (mm)	TOTAL ANCHORAGE LENGTH 'l' (mm)	UNIAXIAL TENSION CAPACITY (TONNES)		REMARKS
								M20	M25	
1	T1	230	180	180	110	16	350	3.90	4.40	
2	T2	300	220	250	110	20	350	7.90	8.80	
3	T3	350	270	250	110	20	350	7.90	8.80	
4	T4	400	320	250	110	20	350	7.90	8.80	
5	T5	450	370	300	110	32	350	11.80	13.30	
6	T6	500	420	300	110	32	350	11.80	13.30	
7	T7	500	420	400	110	32	350	15.75	17.70	

FILENAME 411
SHT 13 OF 13

PROJECT ENGINEERING BHEL HYDERABAD	METAL INSERT PLATES	DRAWING NO	REV
		4-38144-00011	00

GENERAL NOTES ON CONCRETE WORK

1. GENERAL:

a. All drawings shall be read in conjunction with the Contract Terms and Conditions, specifications & schedule of items.

b. Appropriate Indian Standard Codes incorporated in the contract work specification shall be followed.

c. All dimensions and local levels are in Millimetres and general co-ordinates and elevations in metres, unless mentioned otherwise.

d. No dimensions shall be scaled off.

e. Location and details of construction joints shall be decided by the Engineer-in-Charge of the site unless mentioned otherwise.

f. For liquid retaining structures and structures in contract with earth and water, water - stop shall be provided along all construction joints as per the direction of the Engineer-in-Charge of the site, and as shown in drawings.

g. Wherever water bars are provided as indicated in drawings, the ends of reinforcement bars shall be bent suitably.

h. If any foundation rests on back filled soil the soil shall be well compacted (90% proctor density). If compaction is not possible, the back filled earth shall be removed and filled with P.C.C. 1:5:10 between the bottom of the foundation and bottom of the excavation.

2. CONCRETE:

a. For all concrete works in general applicable requirements of IS: 456-1978 shall be met with.

b. For extreme weather concreting suitable provisions of IS: 7861-1987 is to be followed.

c. Ordinary Portland cement conforming to IS: 269 shall be used for all concrete works,

d. All structural concrete shall be of grade M20 (in SI units) unless mentioned otherwise.

e. The concrete mix proportioning shall be either designed or nominal as per Art 8 of IS: 456-1978 proportions for nominal, mix concrete will be as per Table 3 of IS: 456-1978.

f. Minimum cement content - For M25 Concrete - 420 kg/cu.m.

For M20 Concrete - 360 kg/cu.m.

For M15 Concrete - 325 kg/cu.m.

2. g. The slump of the concrete shall be as per Article 6 of IS: 456-1978.

h. Sampling and strength test of concrete shall be as per Art. 14 of IS: 456-1978, IS: 1199-1159, IS: 516-1959 and contract specifications.

i. All lean concrete shall be minimum 75 mm thick of grade 1:5:10 and shall extend 50 mm beyond foundation edge unless mentioned otherwise.

j. All pockets left in concrete for grouting later shall have rough finish suffaces.

3. REINFORCING STEEL:

a: All reinforcing steel shall be high yield strength deformed bars conforming to IS:1786 or IS:1139 above 6 mm dia., and conforming to IS: 432 grade I for 6 mm dia rods.

b. All splices and bends shall be as per IS: 456. Unless otherwise stated, the decision of the Engineer-in-Charge of the site shall be final.

c. All dowel bars and laps provided shall have a bond length of 50 times the diameter of the bar unless mentioned otherwise. Reinforcement may be welded using low hydrogen electrodes.

d. Suitable adjustment in reinforcement placing shall be made at site to clear pockets, anchor bolts, etc. with prior approval of the Engineer-in-Charge at the site.

4. COVER:

The minimum clear concrete cover to the main reinforcement shall be the greater of the dia of the main reinforcement and the figures given below unless mentioned otherwise.

	Top	Bottom	Sides
a. Foundations and footings	50	75	50
b. Base raftof basements, pits, Trenches	40	50	50
c. Top slab of cable tunnel	50	40	50
d. Walls of basements, pits, trenches			
i) Depth 2.0 M	40	-	40 outside 40 inside
ii) Depth /= 2.0 M	40	-	50 outside 40 inside

.....contd 3

4.	Top	Bottom	Sides
e. Columns	40	-	40
f. Beams	25	25	25
g. Slabs	15	15	15

5. EMBEDMENTS:

a. Plates, angles and other sections used as embedments shall conform to IS: 226, unless mentioned otherwise.

b. Lugs used for anchoring embedments shall conform to IS: 226, IS: 1786, IS: 1139.

c. Welding on lugs to embedments shall be done as per IS: 816.

d. Exposed surfaces of embedded parts shall be coated with two coats of red oxide primer.

e. Tolerance for fixing embedments and penetrations shall be 6 mm in general unless mentioned otherwise.

f. Spacing of embedment lugs and reinforcement shall be suitably adjusted so as to avoid interference.

g. Whereas possible, embedment plates shall be cut from IS FLAT sections.

GENERAL NOTES ON STRUCTURAL STEEL WORK

1. GENERAL:

a. This drawing shall be read in conjunction with the contract terms and conditions, specifications and schedule of items.

b. Appropriate Indian Standard Codes incorporated in the contract work specifications shall be followed. In case of any controversy the decision of the Engineer-in-Charge shall be binding on the Contractor.

c. Unless mentioned otherwise, all dimensions are in millimetres.

2. MATERIAL:

a. Unless otherwise specified, steel for hot rolled structural shapes and plates shall conform to IS:226/2062.

b. Steel tubes for structural purposes shall conform to IS:1161.

c. High strength bolts shall conform to IS:3757.

d. All mild steel bolts and nuts shall conform to black grade-B specified in IS:1367, unless specified otherwise.

e. All bolts, nuts and lock nuts shall conform to the requirements of IS:1367.

3. CONNECTIONS:

a. All Shop & field connections shall be generally welded unless otherwise specified.

b. Field connections shall be made with black bolts for ladders, handrail posts, stair stringers, removable members and floor plates, platform framing members 200mm and under in size, purlins, girts and minor pipe support members that require not more than three bolts per connection.

c. Splices shall not be located closer than one metre. No splice in cantilevered beams shall be located closer to the support than one half the length. No splice shall be made in middle fourth or in one eighth of the span from support.

d. All connections shall be designed for the full capacity of the connected members.

e. Ends of members are to be cut at site to suit opposite profiles (if not already done)

..... contd 2

4. WELDING:

a. All weld thickness to be equal to 0.8 times the thickness of the thinner member or plate connected unless specified otherwise. Ends of members to be welded alround to opposite profiles at site are as follows wherever not indicated otherwise.

Sl.no.	Section	Size of weld
1.	I 600, L 130 x 130 x 12 L 150 x 150 x 12	10 A
2.	I 500, I 450, I 400, (I 400) L 100 x 100 x 10	8 A
3.	I 350, I 300, ([300, [250, I 250) L 80 x 80 x 8	6 A
4.	I 200, ([200, [150, L 75 x 75 x6) L 65 x 65 x 6, L 50 x 50 x 6	5 A
5.	I 150, I 125	4 A

b. Length of fillet welds shall not be less than 4 times nominal size of the weld or 40 mm whichever is more.

c. Fillet welds terminating at ends must have returns around corners not less than twice the nominal size of the weld.

d. Welding should be done as per IS:816-1969 for electric arc welding wherever required.

e. Edge preparation for welding should be done as per IS:823-1964 and welding symbols shall conform to IS:813-1961 wherever required.

f. All butt welds shall be full penetration butt welds.

g. Materials conforming to IS: 226, IS: 2062, BS 4360, GR 43D, ASTM-A36 specifications and having thickness above 20mm are to be preheated to 100 to 120 deg C during welding.

5. BOLTING:

a. The minimum size of bolts shall be 16 mm unless limited by the size of the connected parts.

b. Holes for anchor bolts in base plates to be 5mm greater than the size of anchor bolts unless specified otherwise.

c. Holes for bolts shall not be formed by gas cutting process.

.....cont6. 3

5.d. Length of bolt threads to be limited by washers. Every bolt shall be provided with a steel washer (other than HSFG Bolts) under the nut so that no part of the threaded portion of the bolt is within the thickness of the parts bolted together.

e. No painting shall be done for a distance of 75 mm from a group of HSFG Bolts. Cement washing or any treatment provided on the surface of structural materials near HSFG Bolt connections are to be removed by wire brushing before the structural members are fastened.

f. High Strength Friction Grip Bolts to be tightened with wrenches by the Turn-of-the nut Method, as outlined in the specifications for structural joints, using BS:4395, Part 1 bolts. HSFG Bolts once tightened are not to be slackened, removed and reused.

6. SURFACE FINISH:

Out of flatness for flange shall not be more than (+) 1.0 mm and surface roughness shall not be more than 160 microns. Surface preparation holes is 12.5 Microns and edge preparations for welds is 25 Microns unless otherwise specified.

7. GENERAL:

a. Fabrication and erection of steel work shall conform to IS:800 and IS:806 as applicable.

b. Separator, diaphragms, filler plates, washers, tapered or plain shall be used wherever necessary or as required by the Engineer.

c. All gusset plates shall be 10 mm thick unless noted otherwise.

d. All fabricated structural steel, unless galvanised shall recive a shop coat of primer & painted as per Technical Specifications.

e. Column levels to be marked at every 5 metre level starting from the nearest whole number from top (if not done in shop).

f. Shim plates are to be provided below the flanges of columns under the base plate.

g. Before erection of columns on the foundations the top surface of base concrete shall be thoroughly cleaned with wire brushes and by chipping to remove all loose material to ensure proper bond between the grout and the base concrete.

h. Columns shall be erected plumb to a tolerance not exceeding 1 in 1000 with a maximum of 25 mm at the column centre line.

i. The symbol thus shown in the floor drawings indicates the direction of load bearing bars of the grill.

.....contd 4

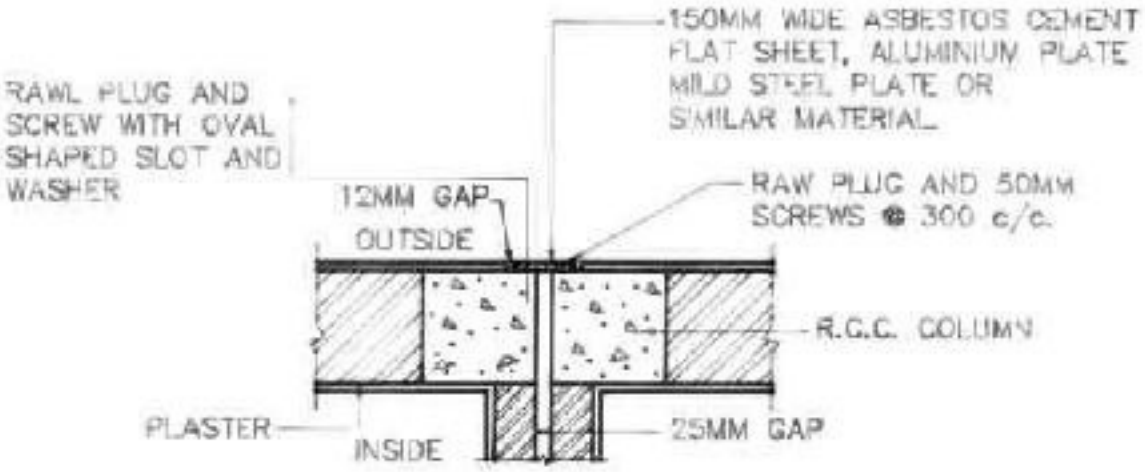
7.j. Floor grills are to be cut at site suitably wherever necessary. Where the edges of floor grills are to be cut at site to suit the openings, columns or other floor requirements, they shall be neatly cut and banded around all openings using edge strips 5 x 32 or 5 x 30 as the case may be.

k. Edges of all platforms are to be provided with guard plate.

l. If width of gap due to discontinuation of floors/platforms exceeds 150 mm ends of such floors/platforms shall be provided with hand railings. Handrailing shall not cantilever more than 900 mm beyond the last handrail post.

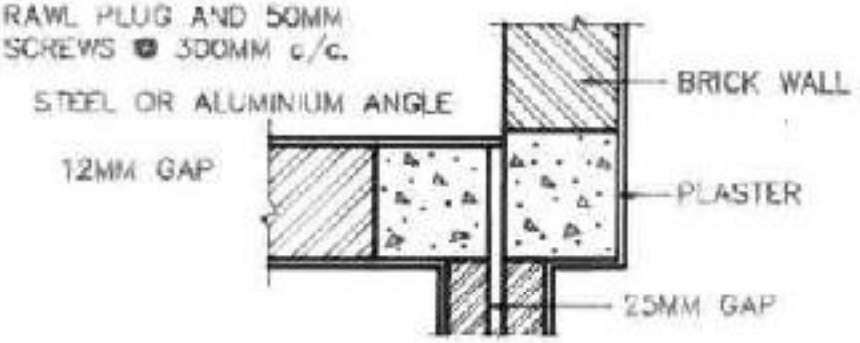
CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0		ISSUED AS STANDARD			



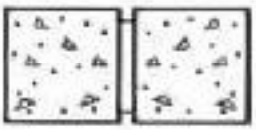
TYPICAL DETAILS OF EXPANSION JOINT

ON OUTER FACE OF COLUMNS



TYPICAL DETAILS OF EXPANSION JOINT

AT CORNER COLUMNS



COLUMNS SEALING COMPOUND

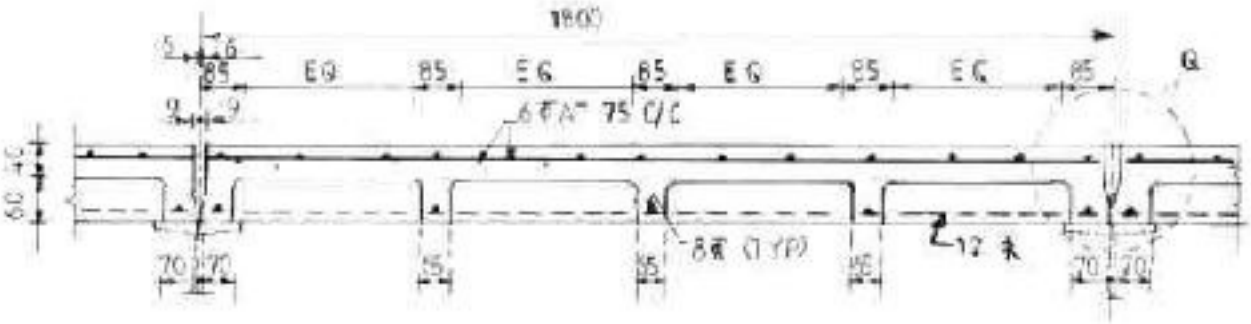
TYPICAL DETAILS OF EXPANSION JOINT

AT ISOLATED TWIN COLUMNS

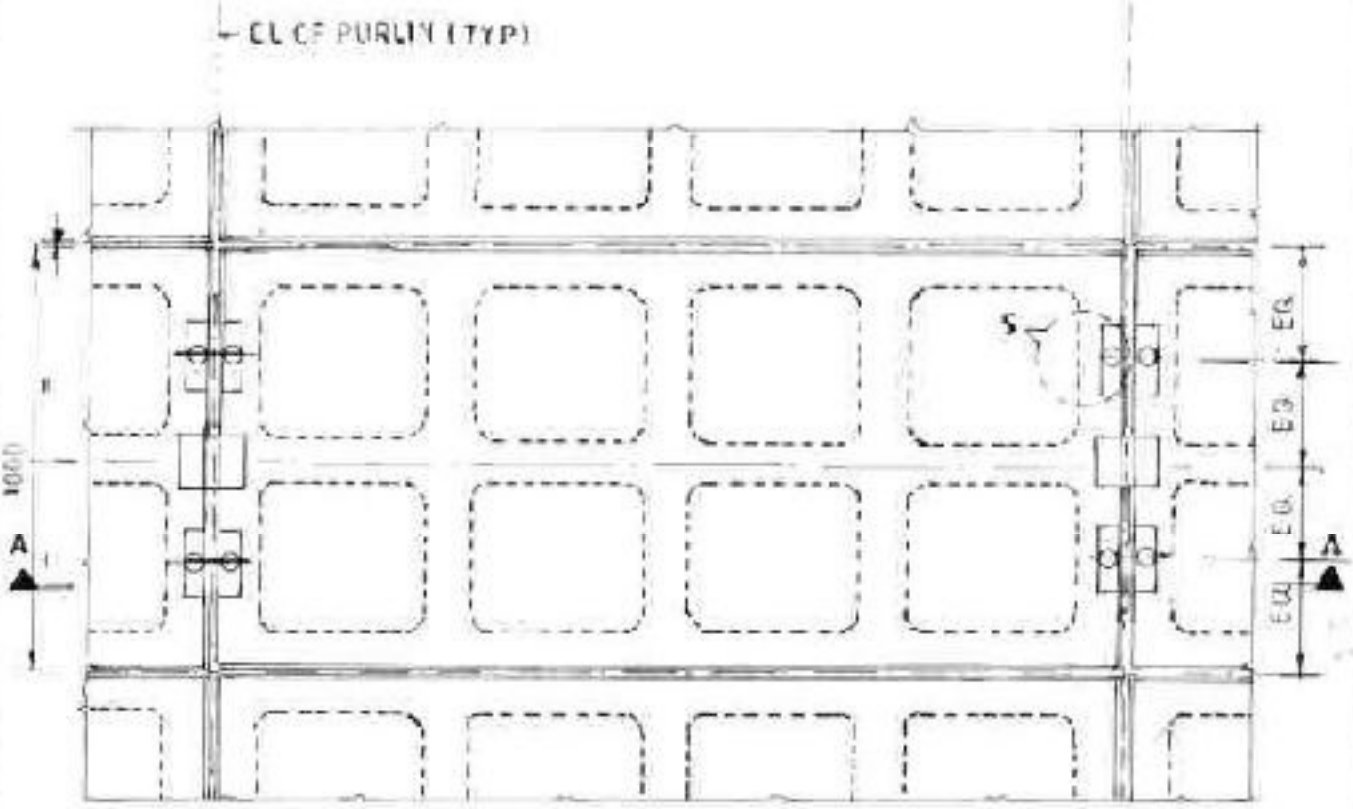
FILE NAME 415

PROJECT ENGINEERING BHEL HYDERABAD	COLUMN EXPANSION JOINT DETAILS	DRAWING NO:	REV
		4-38144-00015	00

CIVIL ENGINEERING	NO	DATE	REVISIONS	DRN	CHD	APPD
	00	19/7/93	ISSUED AS STANDARD	G.F.S		



SECTION A-A

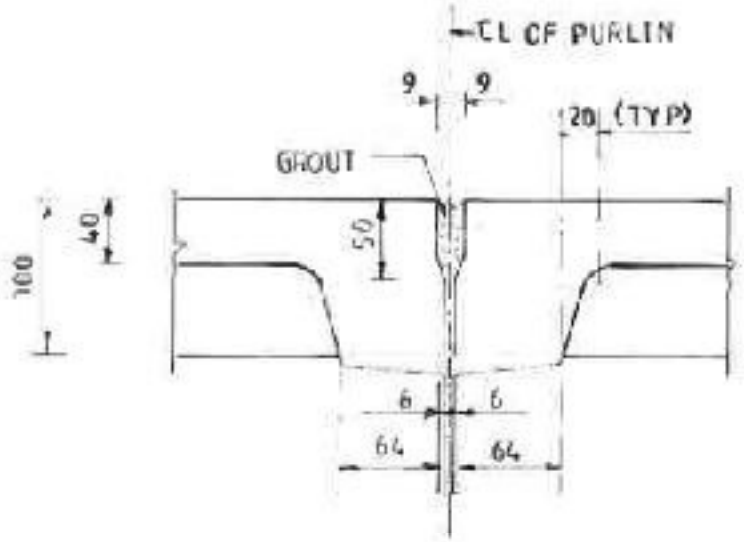


PLAN

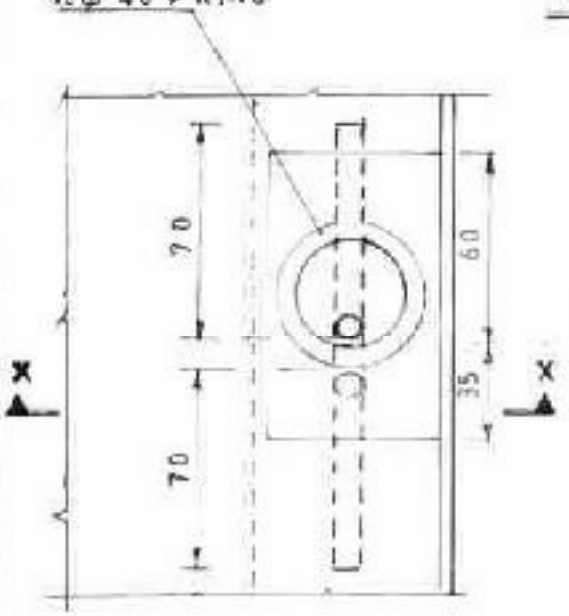
SHEET 1 OF 2

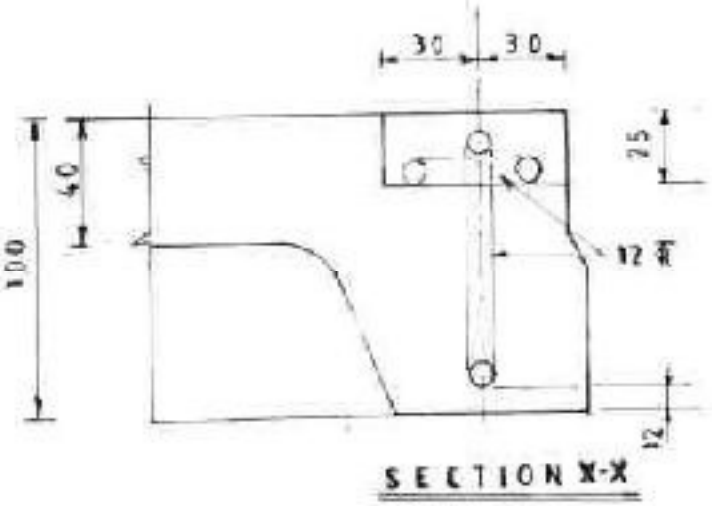
PROJECT ENGINEERING BHEL HYDERABAD	PRECAST ROOFING UNITS (TYP)	DRAWING NO	REV
		4-38144-0.0022	00

CIVIL ENGINEERING	NO	DATE	REVISIONS	DRN	CHD	APPD
	00	19/9/83	ISSUED AS STANDARD			



DETAIL Q





SECTION X-X

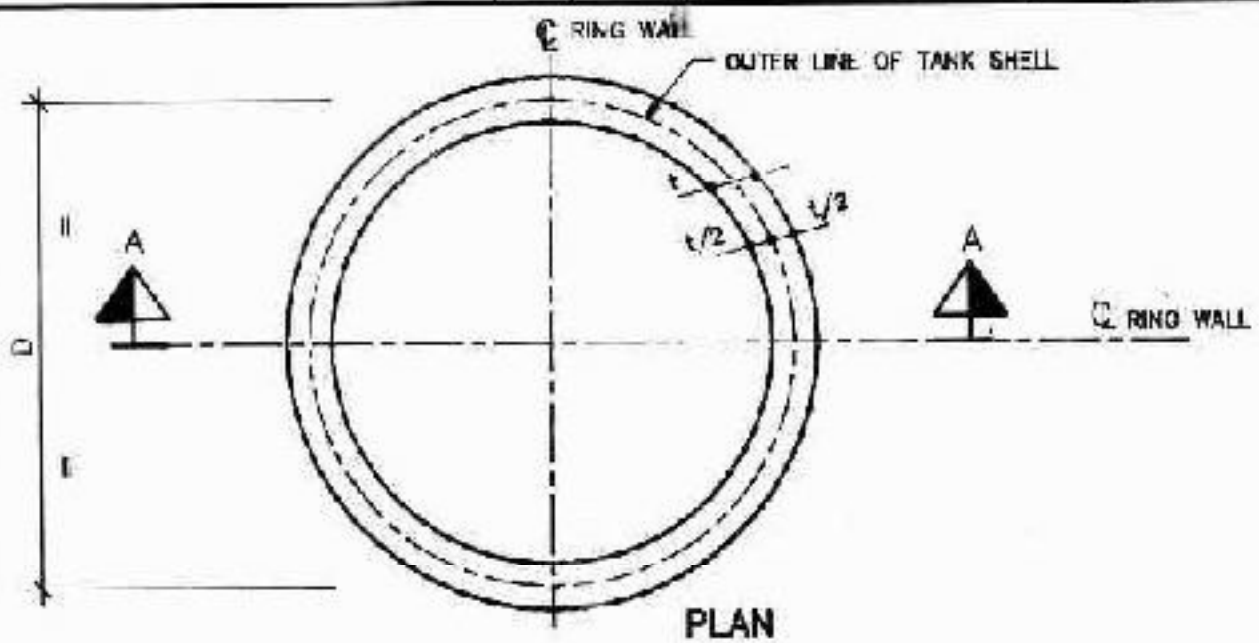
DETAIL-S LIFTING HOOK

SHEET 2 OF 2

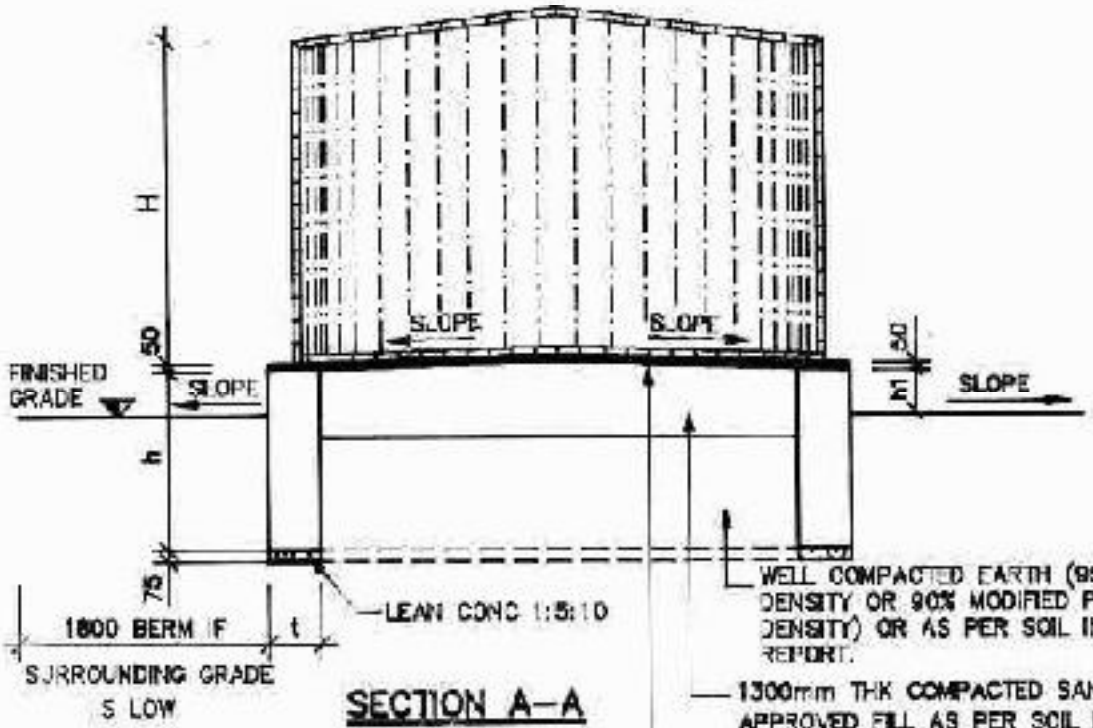
PROJECT ENGINEERING BHEL HYDERABAD	PRECAST ROOFING UNITS (TYP)	DRAWING NO	REV
		4-38144-00022	00

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	03.06.93	ISSUED AS STANDARD			



PLAN



SECTION A–A

NOTES :

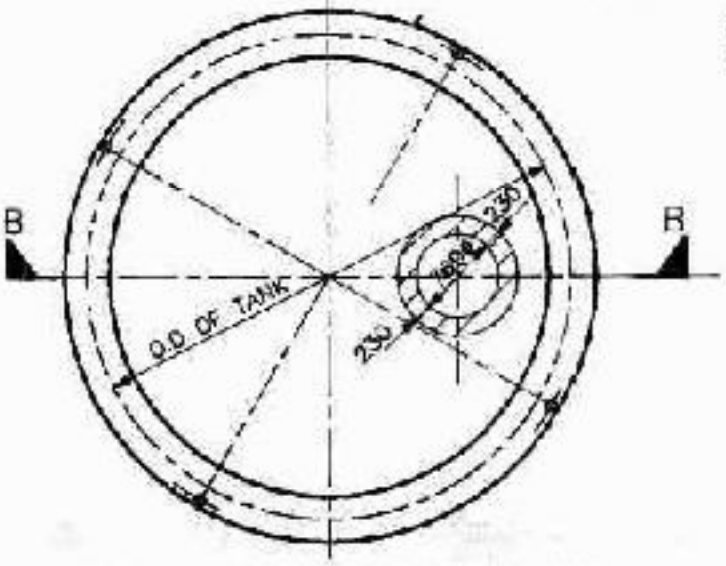
1. ALL DIMENSIONS ARE IN MM.
2. GRADE OF CONC. SHALL BE M20 CONFORMING TO IS:456
3. RE-BARS SHALL CONFORM TO IS : 1786.
4. SLOPE OF TOP OF ANTICORROSIVE LAYER SHALL SUIT TANK DATA
5. NECESSARY INSERT PLATES SHALL BE PROVIDED IN THE RING WALL TO SUIT SPIRAL STAIR REQUIREMENT
6. FOR DESIGN BASIS AND OTHER REQUIREMENTS REFER SHEET Nos. 7&8

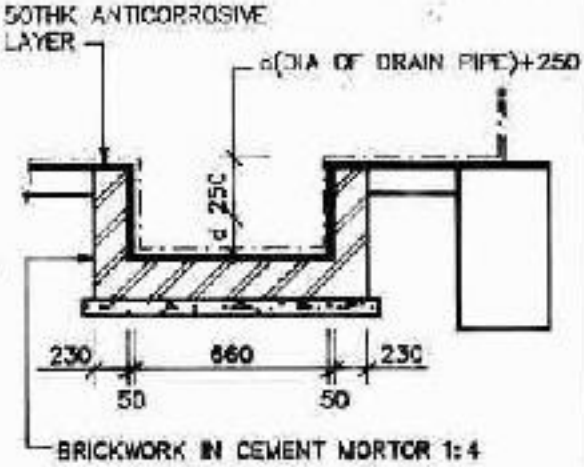
FILE NAME : 43551 | SHT. 1 OF 8

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

CIVIL ENGINEERING

NO	DATE	REVISION	DRN	CHD	APPD
0	08.08.93	ISSUED AS STANDARD			



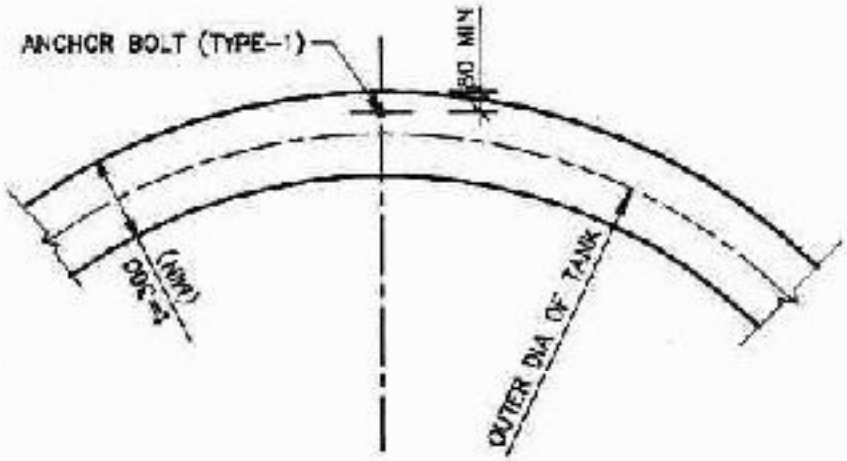


SECTION B–B

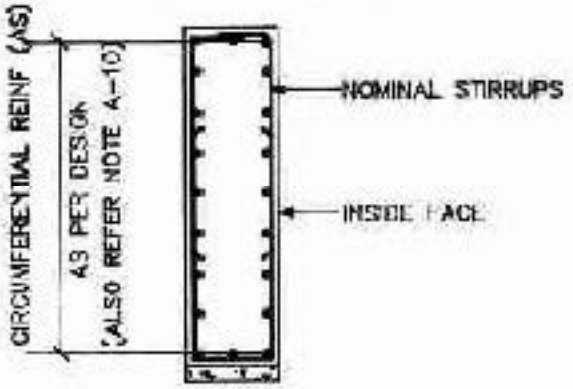
(ABOVE DIMENSIONS SHALL BE VERIFIED TO SUIT DRAIN OUTLET)

TYPICAL DETAIL FOR DRAIN PIT

FOR ORIENTATION AND LOCATION REFER TANK DATA



TYP. DET OF RING WALL AT ANCHOR BOLT LOCATION



TYP. DETAIL OF R/F

FILE NAME: 13552 | SH. 2 OF 8

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