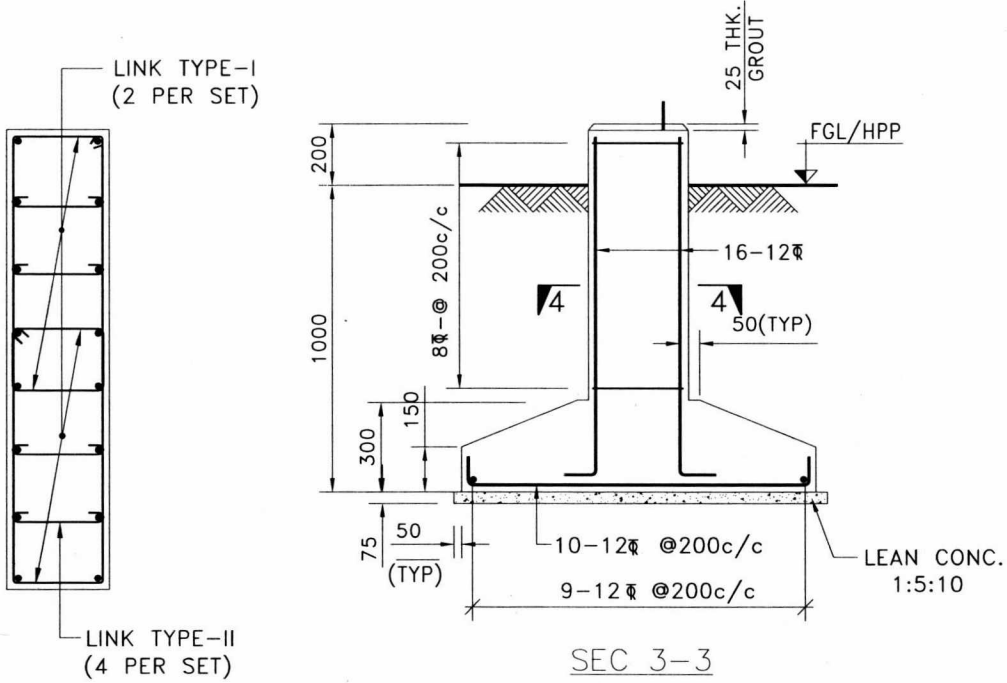


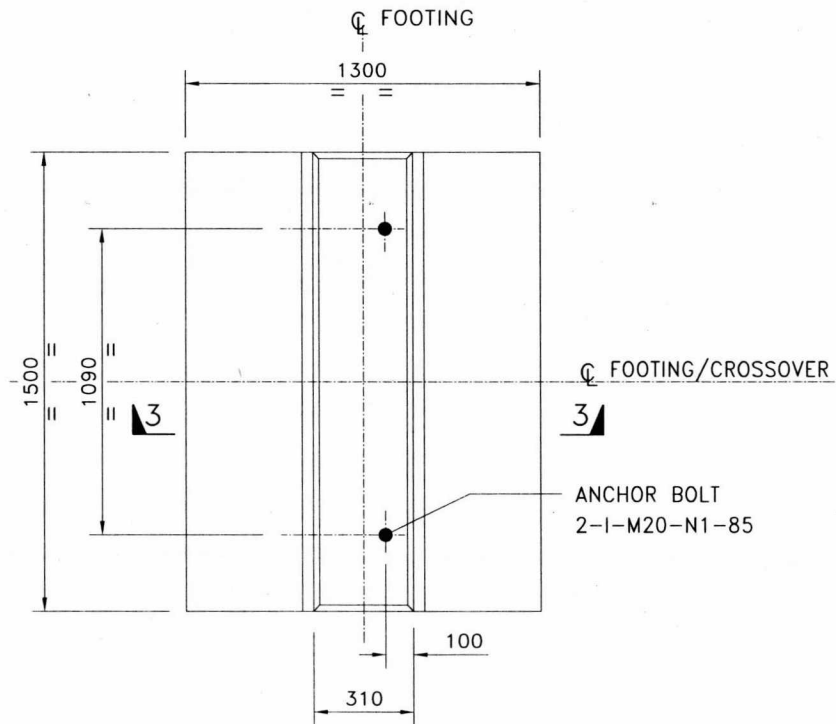
DESIGN FORCES IN VERTICAL AND HORIZONTAL
DIRECTION, FOR PIPE SLEEPER CROSSOVERS

SL. NO.	LENGTH A, mm	HEIGHT D, mm	FORCES AT TOP OF PEDEDTAL, TONNE	
			V	H
1	1000	1000	0.38	0.35
2	1500	1000	0.38	0.35
3	2000	1000	0.38	0.35
4	2500	1000	0.49	0.56
5	3000	1000	0.49	0.56
6	3500	1000	0.49	0.56
7	1000	1600	0.52	0.42
8	1500	1600	0.52	0.42
9	2000	1600	0.52	0.42
10	2500	1600	0.62	0.59
11	3000	1600	0.62	0.59
12	3500	1600	0.62	0.59
13	1000	2000	0.61	0.48
14	1500	2000	0.61	0.48
15	2000	2000	0.61	0.48
16	2500	2000	0.72	0.64
17	3000	2000	0.72	0.64
18	3500	2000	0.72	0.64
19	3000	2500	0.83	0.70

5	28.11.22	REVISED AND ISSUED AS STANDARD	ATULYA	DEEPAK	ANURAG SINHA	S.MAZUMDAR
4	23.07.14	REVISED AND ISSUED AS STANDARD	SUSHMA	AJS	P.K.MITTAL	S.CHANDA
Rev. No.	Date	Purpose	Prepared by	Checked	Stds. Committee Convenor	Stds. Bureau Chairman
						Approved by



SEC 4-4



Rev. No.	Date	Purpose	Prepared by	Checked	Stds. Committee Convener	Stds Bureau Chairman
5	28.11.22	REVISED AND ISSUED AS STANDARD	ATULYA	DEEPAK	ANURAG SINHA	S.MAJUMDAR
4	23.07.14	REVISED AND ISSUED AS STANDARD	SUSHMA	AJS	P.K.MITTAL	S.CHANDA

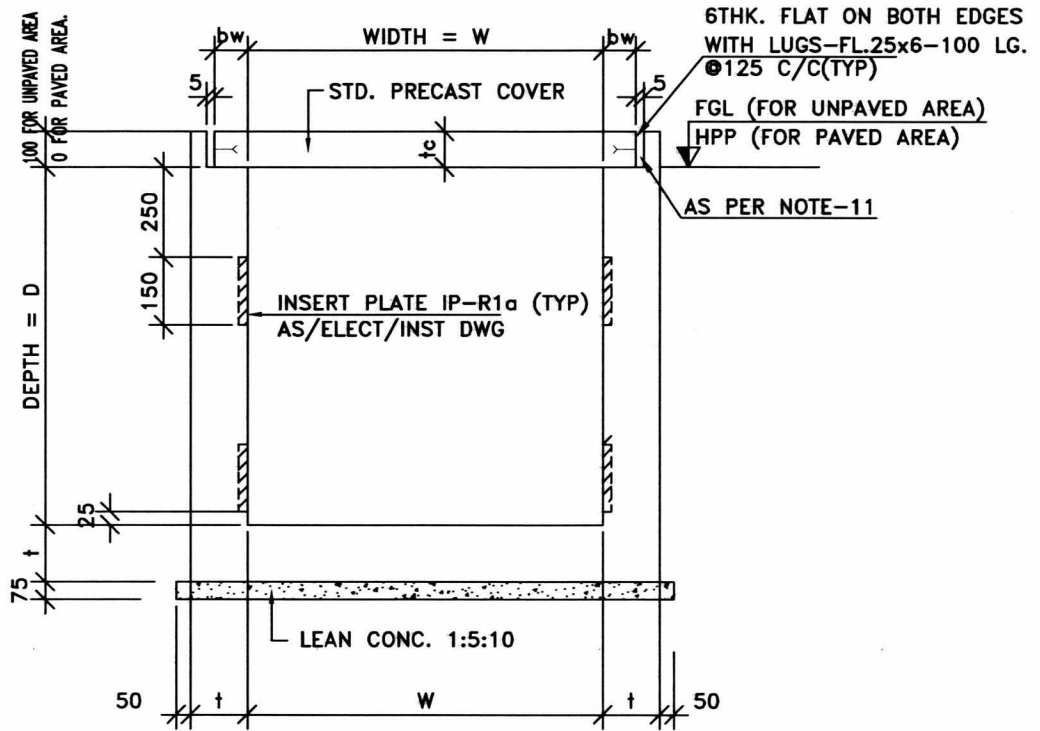
Approved by

NOTES :-

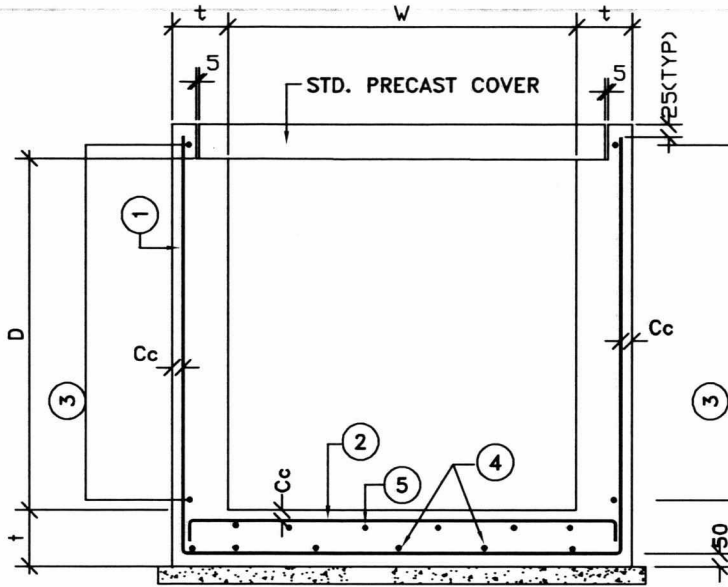
1. THIS STANDARD IS BASED ON FOLLOWING PRINCIPLES OF LAYING CABLES IN THE PLANT AREA
 - a) UNIT AREA - CABLES IN RCC TRENCH/BRICK MASONRY TO BE FILLED WITH SAND AND COVERED WITH PRECAST RCC SLABS.
 - b) INSIDE BUILDING - CABLES IN RCC TRENCH TO BE COVERED WITH CHEQUERED PLATE/RCC COVERS.
 - c) OFFSITE AREA - AS PER PROJECT SPECIFIC REQUIREMENT.
2. ELECTRICAL DEPTT. & INSTRUMENTATION 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 / CHEQUERED PLATE.
 - c) LIVE LOAD ON THE COVERS IF MORE THAN AS DEFINED IN TABLE 2.
 - d) INSERT PLATE REQUIREMENT AND ITS SPACING.
 - e) LAYOUT AND SIZE OF OPENING FOR PANELS. (SHEET 15 OF 17)
3. RELEVANT GENERAL CIVIL DRAWINGS SHALL BE REFERRED FOR THE TRENCHES IN UNIT & OFFSITE AREA.
4. R.C.C. CABLE TRENCHES ARE DESIGNED FOR A SURCHARGE LOAD OF 10.0 T HYDRA.
5. GRADE OF CONCRETE AND REBARS FOR CABLE TRENCH & PRECAST COVER SHALL BE AS PER GENERAL NOTES OF THE PROJECT. HOWEVER, M25 AS MINIMUM GRADE OF RCC AND Fe500D AS MINIMUM GRADE OF REINFORCEMENT HAS BEEN CONSIDERED IN DESIGN.
6. THIS STANDARD IS NOT APPLICABLE FOR CABLE TRENCH / COVERS AT ROAD CROSSING.
7. STRUCTURAL STEEL FOR CABLE SUPPORTS INCLUDING INSERT PLATES IS IN SCOPE OF CIVIL CONTRACTOR.
8. ALL OTHER STRUCTURAL STEEL WORKS SHALL BE UNDER THE SCOPE OF ELECTRICAL CONTRACTOR INCLUDING CHEQUERED PLATE.
9. STRUCTURAL STEEL SHALL CONFORM TO MINIMUM E250 GRADE A/BR/B0 AS PER IS 2062. CHEQUERED PLATE SHALL CONFORM TO IS 3502.
10. Cc STANDS FOR CLEAR COVER. CLEAR COVER SHALL BE 30MM MINIMUM, UNLESS NOTED OTHERWISE. IN CASE CLEAR COVER IS MORE FOR A PROJECT, THE ELEMENT THICKNESS SHALL BE INCREASED ACCORDINGLY.
11. 5MM GAP TO BE FILLED WITH 1:3 CEMENT MORTAR.

PRECAST COVERS DESIGNED FOR 10 T. HYDRA

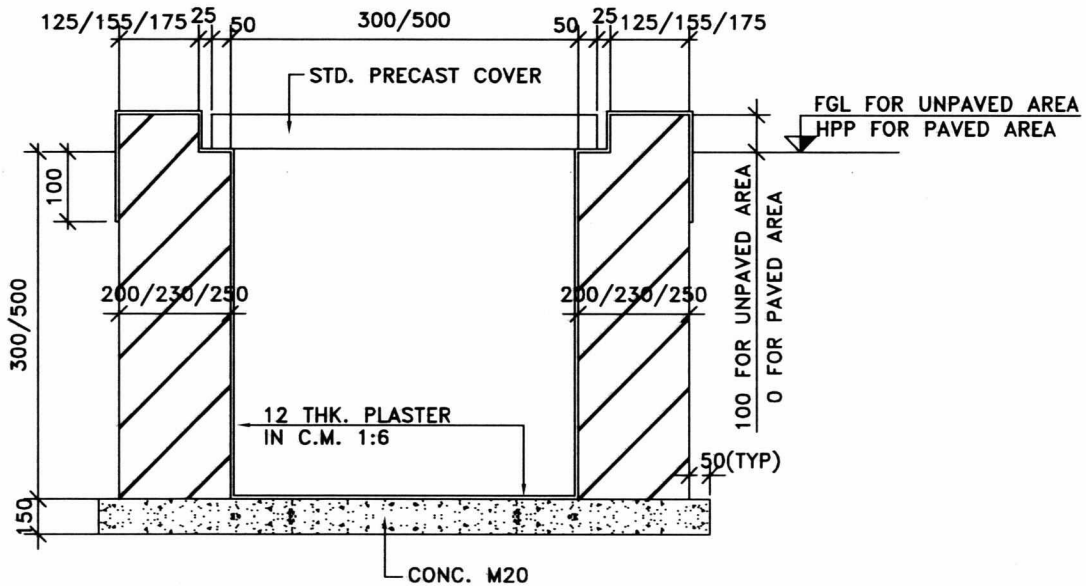
6	19.03.24	REVISED AND ISSUED AS STANDARD	ANURAG KR. SINHA	MAITRAYED MAJUMDER	ANURAG SINHA	MAINAK NANDI
5	20.06.22	REVISED AND ISSUED AS STANDARD	ANURAG KR. SINHA	S.C.MAITY	ANURAG SINHA	S. MAZUMDAR
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	



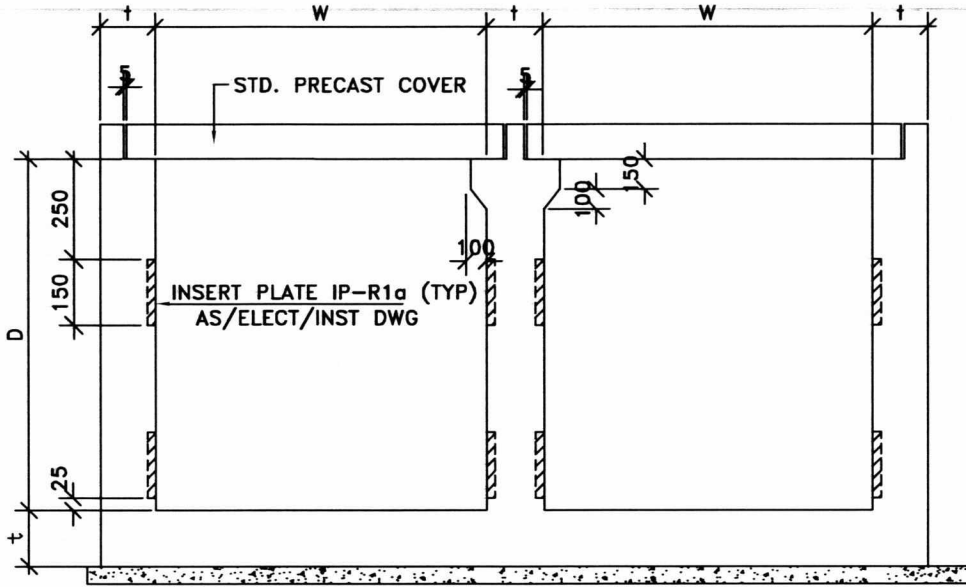
TYP. SECTION OF CABLE TRENCH



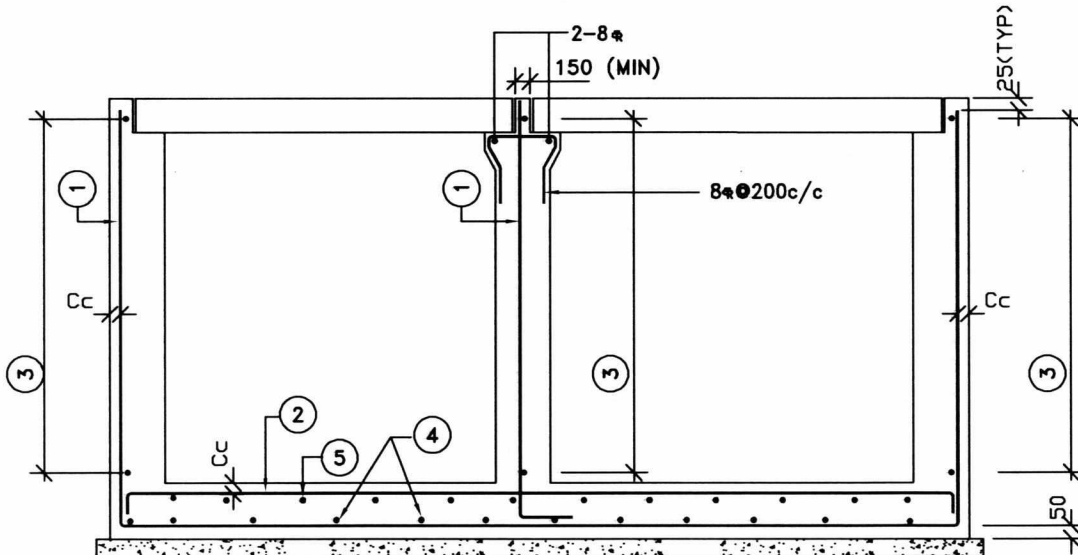
CABLE TRENCH SECTION WITH R.C.C.
(FOR DETS OF R/F BARS ① TO ⑤ REFER TABLE-1 SHT 5 OF 17)



CABLE TRENCH SECTION WITH BRICK MASONRY
(IN C.M. 1:6)



CABLE TRENCH SECTION WITH PARTITION



CABLE TRENCH SECTION WITH PARTITION
(FOR DETS OF R/F BARS ① TO ⑤ REFER TABLE-1 SHT 5 OF 17)

TABLE- 1: DETAIL OF CABLE TRENCH REINFORCEMENT

S.NO.	WORKING DIMENSIONS			R/F CONFORMING TO IS: 1786 GRADE Fe-500(TMT).	BAR MARK (REF. SHT. 10 OF 17)					APPROX. QUANTITIES PER METRE LENGTH.		
	DEPTH D (mm)	WIDTH W (mm)	THICK- NESS t (mm)		①	②	③	④	⑤	LEAN CONC. 1:5:10 (m ³)	CONC. (m ³)	REBARS (kg)
1.	300	300	125	8 Φ -200C/C.		8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.045	0.09	3.80	
2.	300	500	125	8 Φ -200C/C.		8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.048	0.11	4.70	
3.	500	500	125	8 Φ -200C/C.		8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.060	0.15	5.60	
4.	750	750	125	8 Φ -200C/C.	8 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.079	0.25	19.0	
5.		1000	150	10 Φ -150C/C.	8 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.098	0.41	26.0	
6.		1250	150	10 Φ -150C/C.	8 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.116	0.44	29.0	
7.		1500	150	10 Φ -150C/C.	12 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.139	0.47	36.0	
8.		2000	150	10 Φ -150C/C.	12 Φ -150C/C.	8 Φ -250C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.180	0.65	49.0	
9.		1000	150	10 Φ -150C/C.	10 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.101	0.57	32.0	
10.		1250	150	10 Φ -150C/C.	10 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.120	0.61	37.0	
11.		1500	150	10 Φ -150C/C.	12 Φ -150C/C.	8 Φ -300C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.139	0.65	43.0	
12.		2000	150	10 Φ -150C/C.	12 Φ -150C/C.	8 Φ -250C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.180	0.72	49.0	
13.		1000	200	12 Φ -200C/C.	10 Φ -150C/C.	8 Φ -250C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.105	0.88	36.0	
14.		1250	200	12 Φ -200C/C.	10 Φ -150C/C.	8 Φ -250C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.124	0.93	40.0	
15.		1500	200	12 Φ -200C/C.	10 Φ -150C/C.	8 Φ -250C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.143	0.98	44.0	
16.		2000	200	12 Φ -200C/C.	12 Φ -175C/C.	8 Φ -250C/C.	8 Φ -300C/C.	8 Φ -300C/C.	0.180	1.08	56.0	

- NOTES-
1. THE QUANTITIES GIVEN IN THIS TABLE ARE FOR ESTIMATION PURPOSE ONLY.
 2. PREFERABLY THE DEPTH OF CABLE TRENCH SHALL NOT BE MORE THAN THE WIDTH.
 3. TRENCHES OF DEPTH 300 & 500mm IN BRICK MASONRY WHEREVER SPECIFIED.

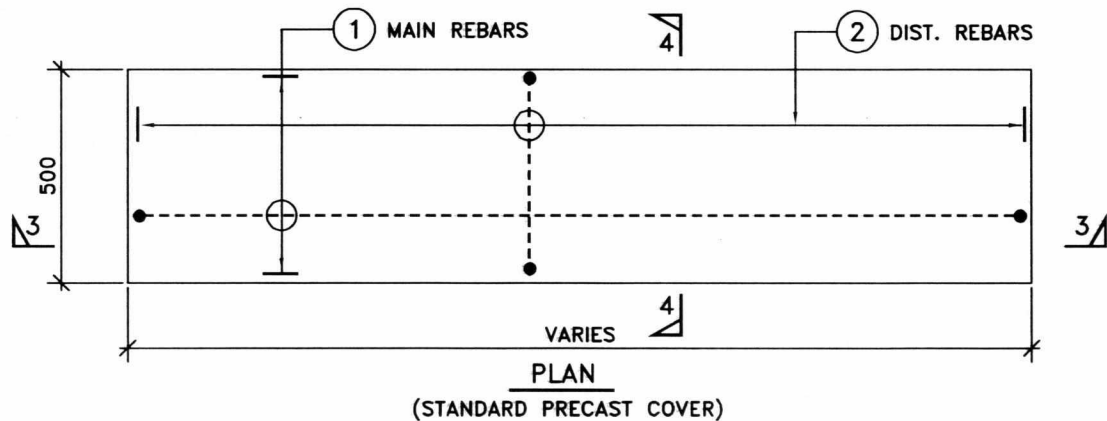
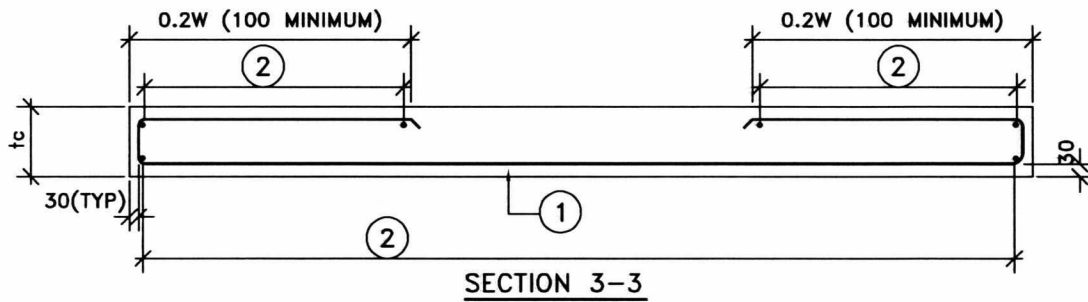
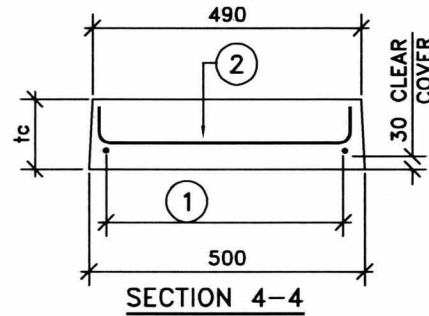
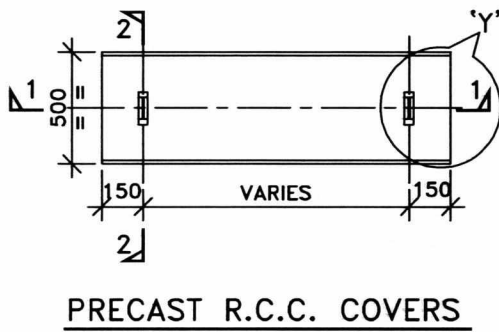
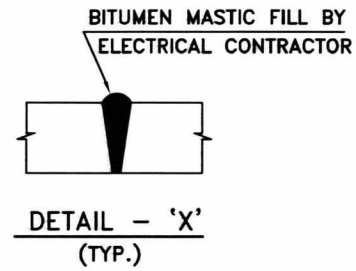
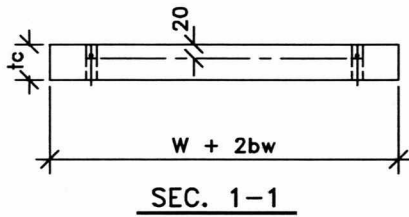
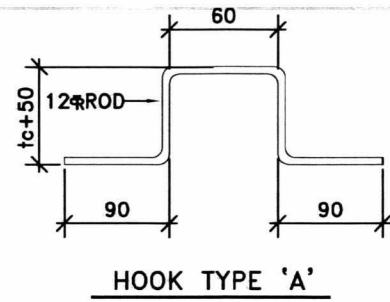
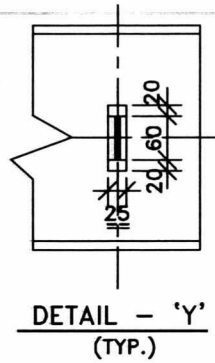
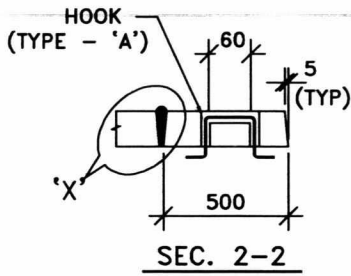
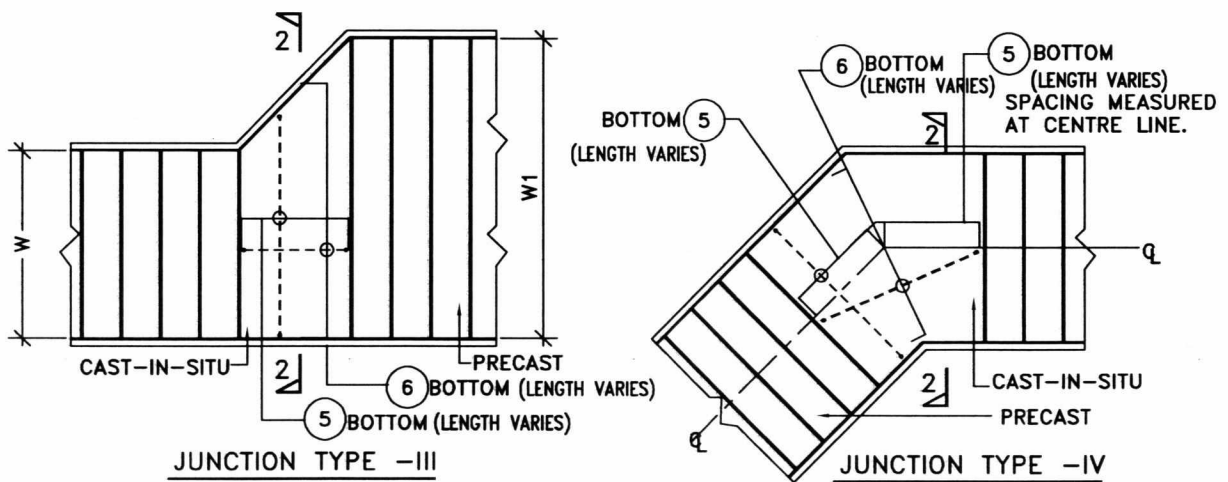
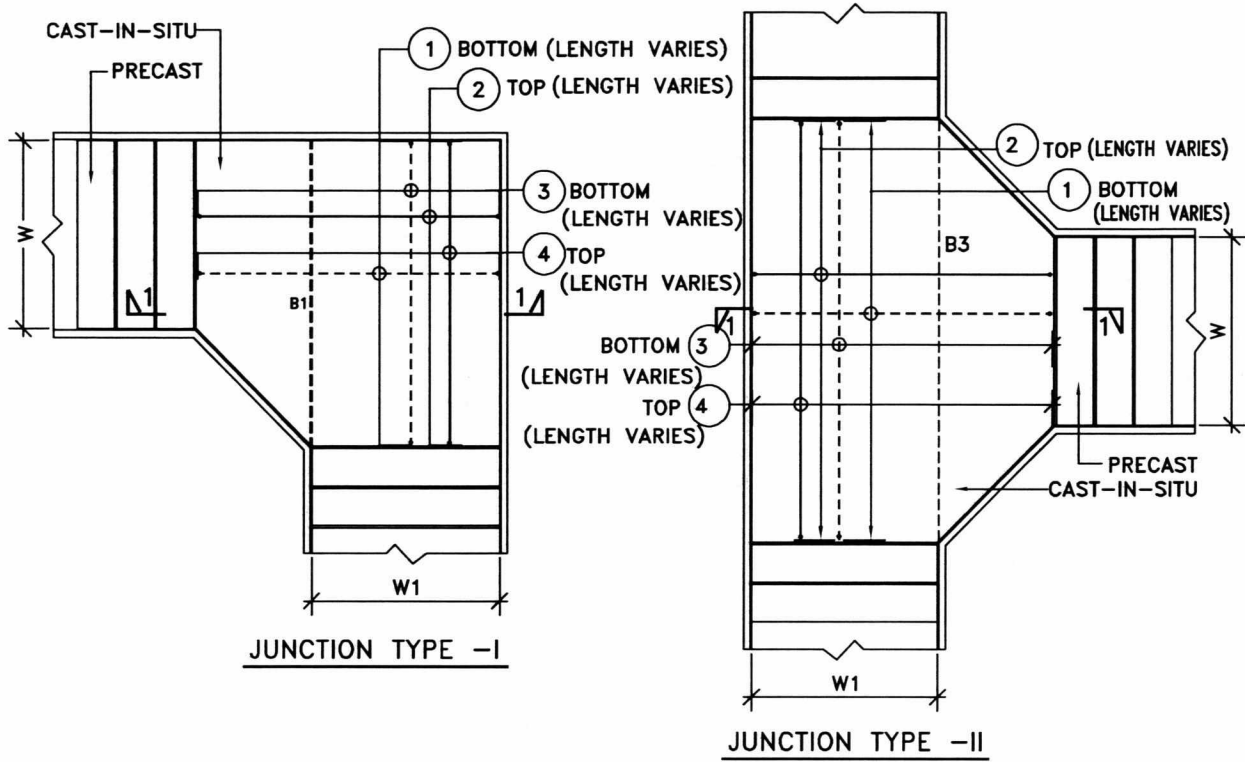


TABLE-2: DETAIL OF STANDARD PRECAST COVERS

S.NO.	TYPE	WORKING DIMENSIONS				DESIGN LOAD ON EACH COVER	FOR ONE UNIT OF WIDTH 500 mm INCLUDING LIFTING HOOK				SELF WEIGHT (kgs)	
		CLEAR WIDTH OF TRENCH W (mm)	BEARING OF COVER bw (mm)	TOTAL LENGTH OF COVER W+2bw (mm)	THICKNESS OF COVER tc (mm)		CONCENTRATED LOAD AT CENTRE OF SPAN (kgs)	REINFORCEMENT CONFORMING TO IS: 1786, GRADE Fe-500 (TMT).		APPROX. QUANTITIES		
								BAR MKD. ①	BAR MKD. ②	CONCRETE (m ³)		REINF. (kg)
1.	PC-1	300	50	400	150	≤5000	5-8ϕ	3-8ϕ	0.030	2.00	75	
2.	PC-2	500	50	600	150	≤5000	7-10 ϕ	4-8ϕ	0.045	4.30	113	
3.	PC-3	750	50	850	200	≤5000	7-10 ϕ	5-8ϕ	0.085	6.64	213	
4.	PC-4	1000	50	1100	200	≤5000	7-12 ϕ	5-8ϕ	0.110	11.36	275	
5.	PC-5	1250	50	1350	250	≤5000	7-12 ϕ	6-8ϕ	0.168	14.37	422	
6.	PC-6	1500	75	1650	250	≤5000	7-12 ϕ	7-8ϕ	0.207	17.16	517	
7.	PC-7	2000	75	2150	250	≤5000	5-16 ϕ	9-8ϕ	0.268	26.74	672	

NOTES :-

- FOR LOCATION OF BARS MKD. ① AND ② REFER SHT. 6 OF 17.
- ALL PRECAST COVERS SHALL BE MARKED (T) ON THE TOP FOR PROPER PLACEMENT.
- THE QUANTITIES GIVEN IN THIS TABLE ARE FOR ESTIMATION PURPOSE ONLY.
- DESIGN IS VALID FOR POINT LOAD AT CENTRE OF SPAN.



CAST-IN-SITU COVERS

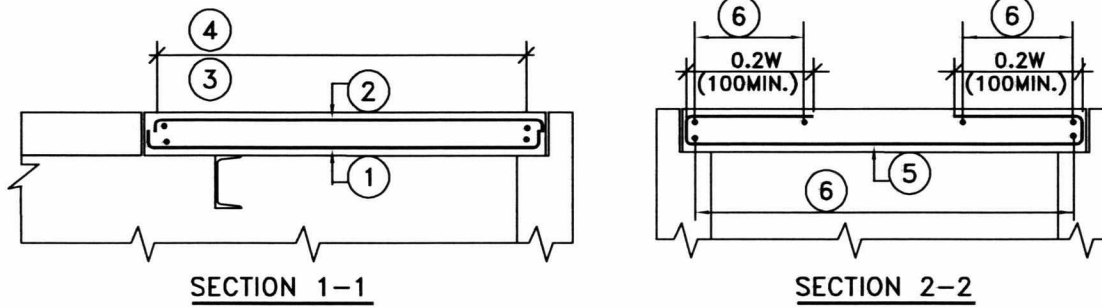
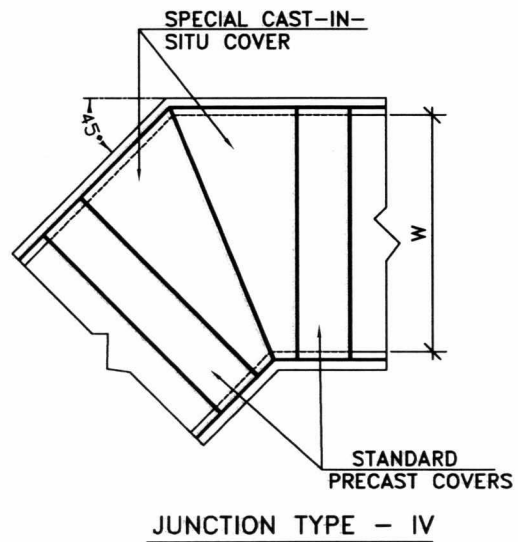
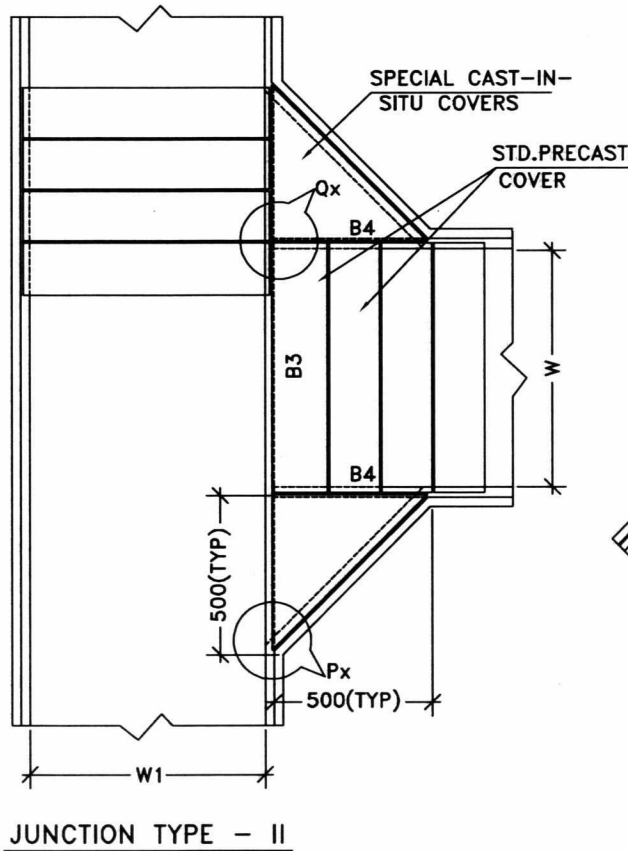
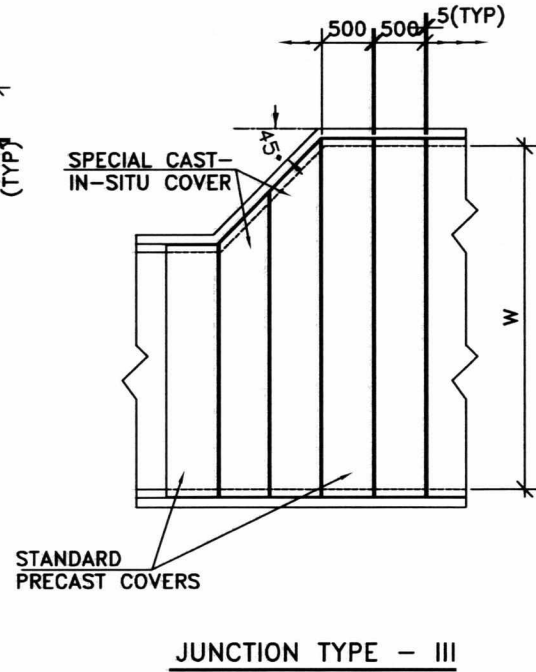
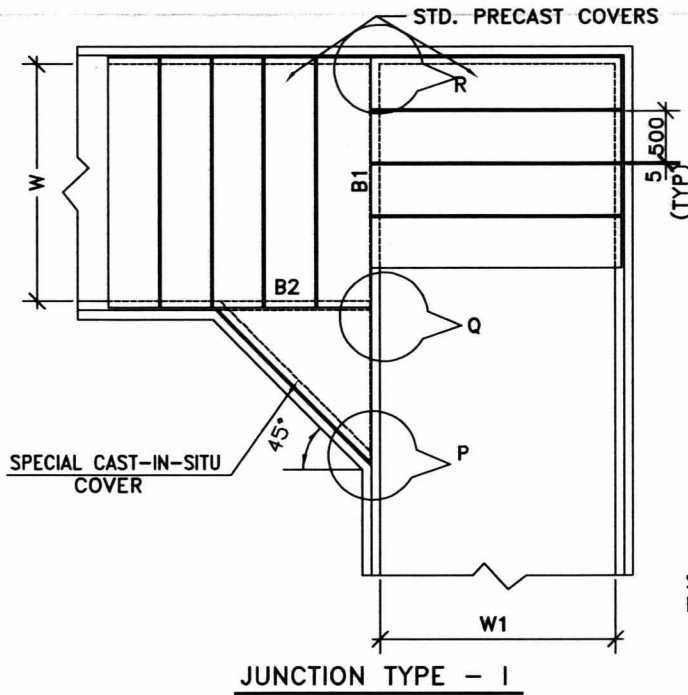


TABLE-3:DETAIL OF CAST-IN-SITU COVERS

S.NO.	CLEAR WIDTH OF TRENCH W1 (mm)	tc (mm)	REINFORCEMENT DETAIL FOR CAST-IN-SITU COVERS					
			JUNCTION TYPE I & II				JUNCTION TYPE III & IV	
			BAR MARK ①	BAR MARK ②	BAR MARK ③	BAR MARK ④	BAR MARK ⑤	BAR MARK ⑥
1.	300	150	8# Φ 120c/c	-	8# Φ 150c/c	-	8# Φ 120c/c	8# Φ 150c/c
2.	500	150	8# Φ 100c/c	-	8# Φ 150c/c	-	8# Φ 120c/c	8# Φ 150c/c
3.	750	200	10# Φ 150c/c	8# Φ 150c/c	8# Φ 150c/c	8# Φ 150c/c	10# Φ 200c/c	8# Φ 150c/c
4.	1000	200	12# Φ 120c/c	8# Φ 150c/c	8# Φ 200c/c	8# Φ 200c/c	10# Φ 200c/c	8# Φ 200c/c
5.	1250	250	12# Φ 150c/c	8# Φ 150c/c	8# Φ 200c/c	8# Φ 200c/c	12# Φ 200c/c	8# Φ 200c/c
6.	1500	250	12# Φ 200c/c	8# Φ 150c/c	8# Φ 200c/c	8# Φ 200c/c	12# Φ 200c/c	8# Φ 200c/c
7.	2000	250	16# Φ 200c/c	8# Φ 150c/c	8# Φ 200c/c	8# Φ 200c/c	12# Φ 150c/c	8# Φ 200c/c

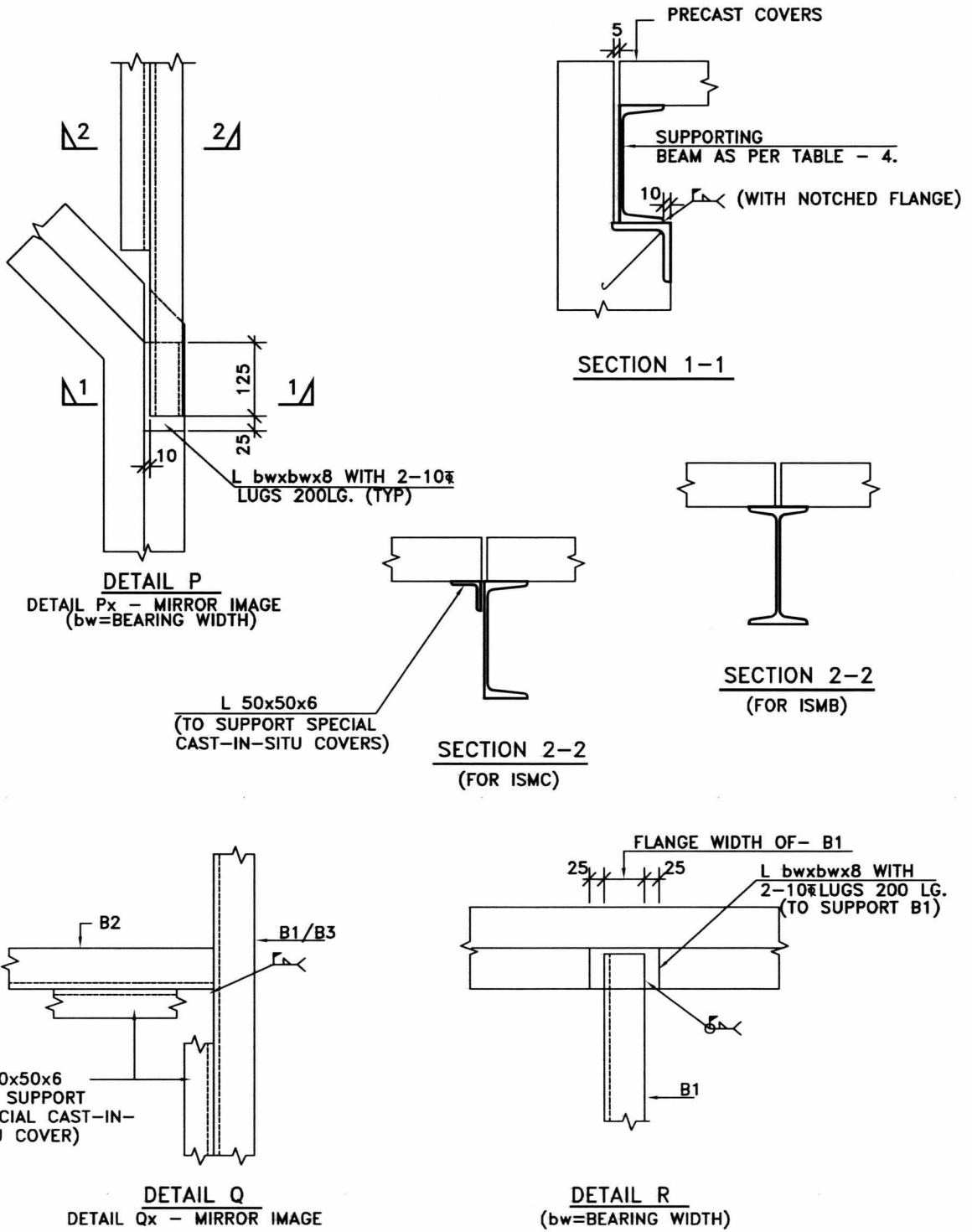
- NOTES :-**
1. THE CAST-IN-SITU COVERS ARE DESIGNED FOR POINT LOAD OF 5000 kg ACTING AT MID SPAN.
 2. FOR CONNECTION DETAIL AND SIZES OF B1 & B3 REFER SHT. 8 OF 17 AND 12 OF 17.
 3. FOR LOCATION OF BAR MARKS ① TO ⑥ REFER ABOVE SECTIONS 1-1 & 2-2.



NOTES :

1. FOR DETAILS P, Q, Px, Qx & R REFER SHT. 11 OF 17.
2. FOR DETAIL OF BEAMS B1 TO B4 REF. TABLE 4 SHT 12 OF 17.

SPECIAL CAST-IN-SITU COVERS



SUPPORTING MEMBERS

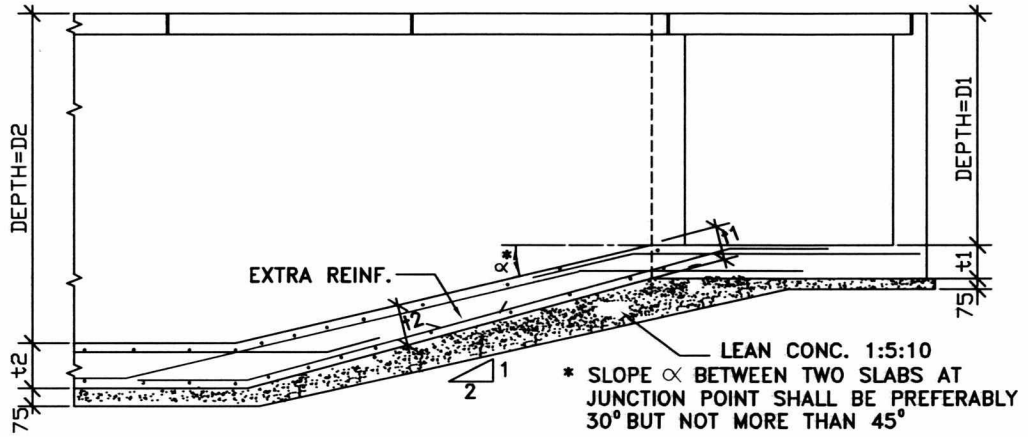
(FOR LOCATION OF DET. P, Q, Px, Qx & R REF. SHT. 10 OF 17)

TABLE-4: DETAIL OF SUPPORTING MEMBERS B1, B2, B3 & B4 AT JUNCTIONS

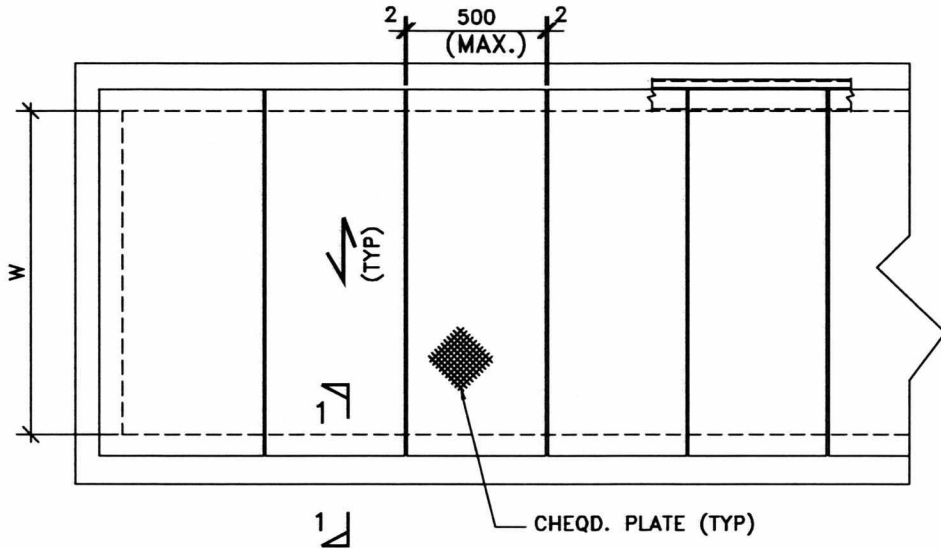
S.NO.	CLEAR WIDTH OF MAIN TRENCH W	JUNCTION TYPE - I						JUNCTION TYPE - II					
		SUPPORTING MEMBER B1		SUPPORTING MEMBER B2		SUPPORTING MEMBER B3		SUPPORTING MEMBER B4		SUPPORTING MEMBER B3		SUPPORTING MEMBER B4	
		SIZE	LENGTH	SIZE	LENGTH	SIZE	LENGTH	SIZE	LENGTH	SIZE	LENGTH	SIZE	LENGTH
1.	300	MC 150	1020	MC 125	625	MC 200	1650	MC 125	625	MC 200	1650	MC 125	625
2.	500	MC 150	1220	MC 125	625	MC 200	1850	MC 125	625	MC 200	1850	MC 125	625
3.	750	MC 200	1470	MC 125	625	MC 250	2100	MC 125	625	MC 250	2100	MC 125	625
4.	1000	MC 200	1720	MC 125	625	MC 250	2350	MC 125	625	MC 250	2350	MC 125	625
5.	1250	MC 250	1970	MC 125	625	MC 300	2600	MC 125	625	MC 300	2600	MC 125	625
6.	1500	MC 250	2270	MC 125	625	MC 300	2900	MC 125	625	MC 300	2900	MC 125	625
7.	2000	MB 250	2770	MC 125	625	MC 300	3400	MC 125	625	MC 300	3400	MC 125	625

NOTE

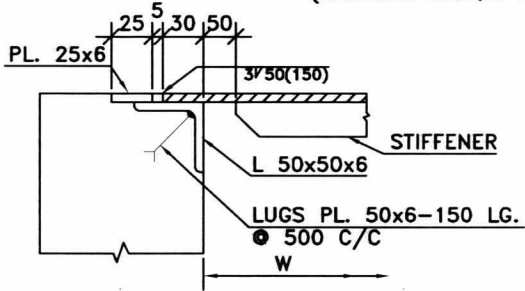
THE SUPPORTING MEMBERS ARE DESIGNED FOR COVER WT. PLUS A POINT LOAD OF 5000 kg. AT MID SPAN.



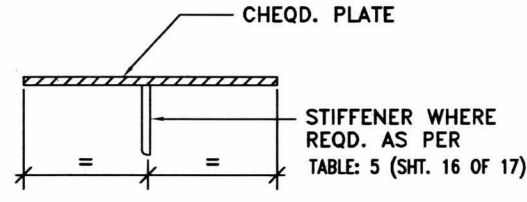
TYPICAL DETAIL AT JUNCTION FOR
DIFFERENT DEPTHS OF TRENCH.
(R/F DETAIL OF TRENCH IN SLOPE SHALL BE BASED ON DEPTH D2).



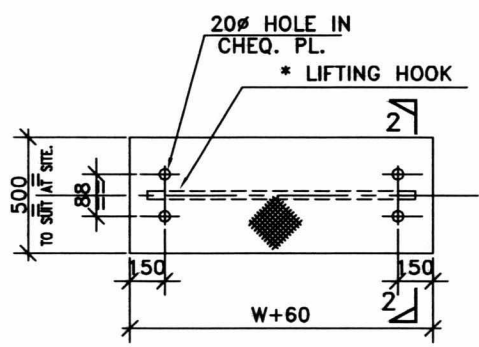
TYPICAL TRENCH PLAN
(SHOWING CHEQD. PLATE)



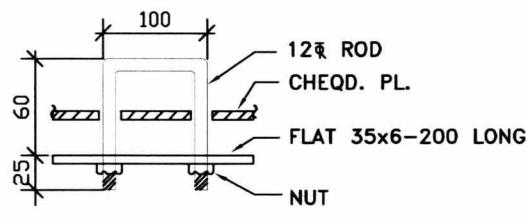
SECTION 1-1



SECTION 2-2

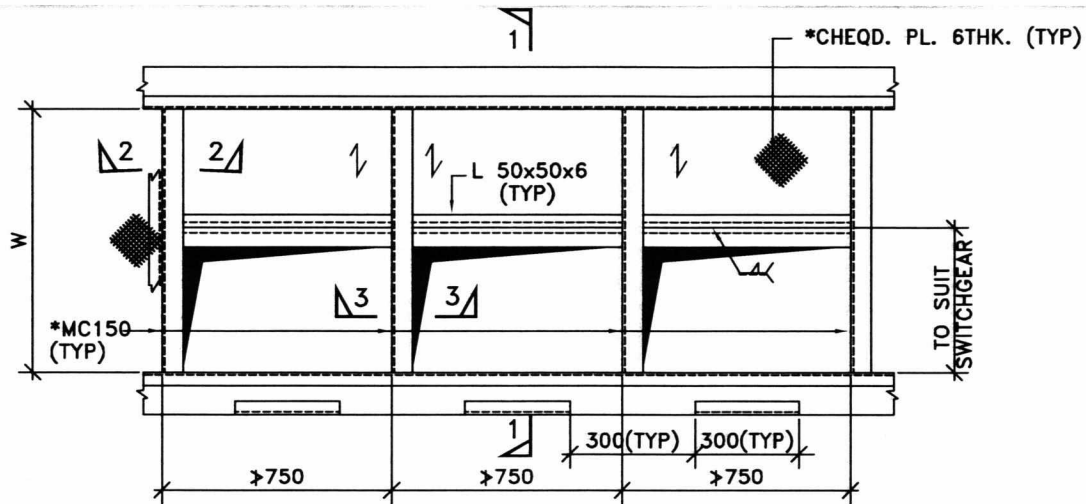


TYP. CHEQD. PLATE DETAIL
(SHOWING CHEQD. PLATE)

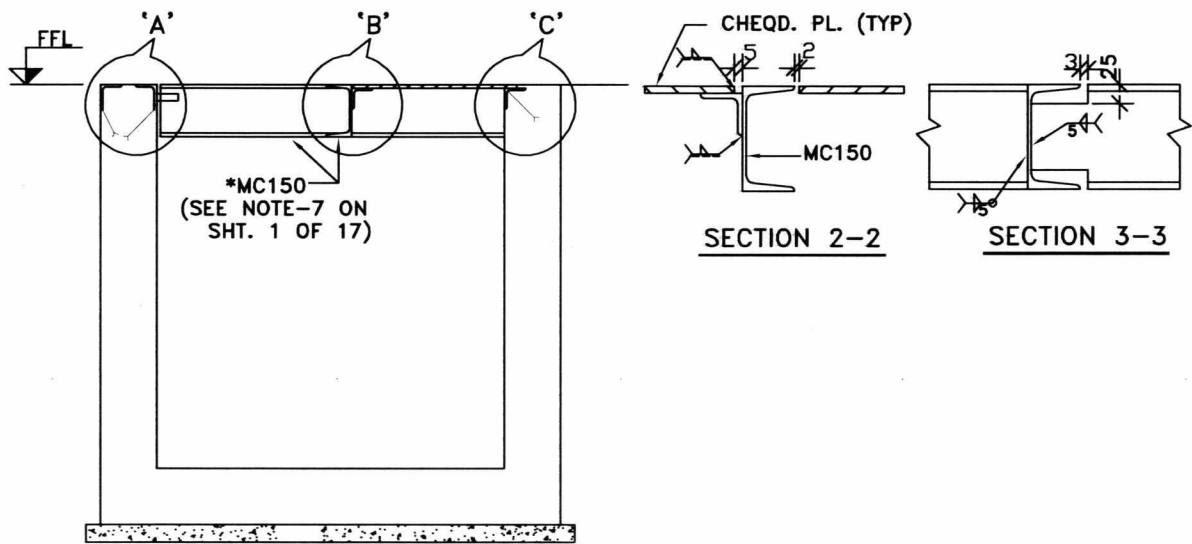


TYP. LIFTING HOOK DETAIL

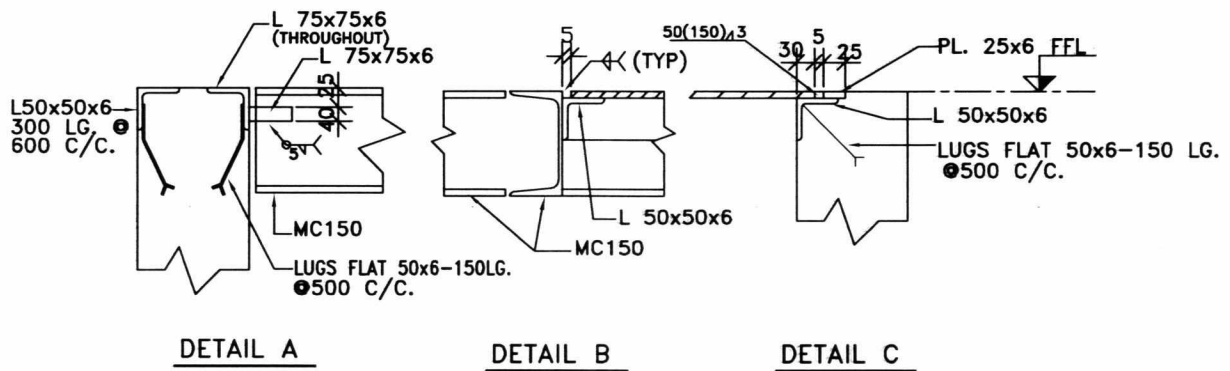
* ONE HOOK FOR SPAN UPTO 500
TWO HOOKS FOR SPAN ABOVE 500.



TYPICAL TRENCH PLAN
(AT SWITCH GEARS)



SECTION 1-1

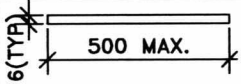
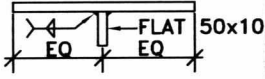
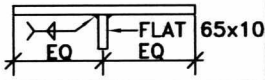
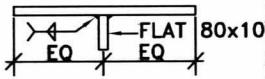


DETAIL A

DETAIL B

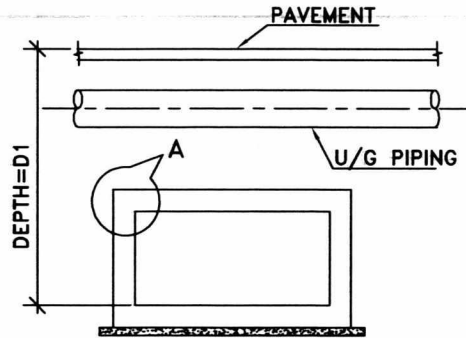
DETAIL C

TABLE- 5: DETAIL OF CHEQUERED PLATE COVER

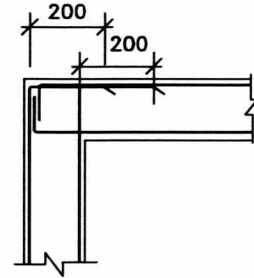
S.NO.	TYPE	SECTION	SECTION PROPERTIES FOR 500mm WIDE PLATE			RECOMMENDED SPAN (W) mm
			WT. kg/m	$I=cm^4$	$Z_{min}=cm^3$	
1.	I		23.55	0.90	3.00	$W < 500$
2.	II		27.45	44.90	9.16	$500 < W \leq 1250$
3.	III		28.62	91.00	14.76	$1250 < W \leq 1500$
4.	IV		29.79	160.30	21.66	$1500 < W \leq 2000$

NOTE-

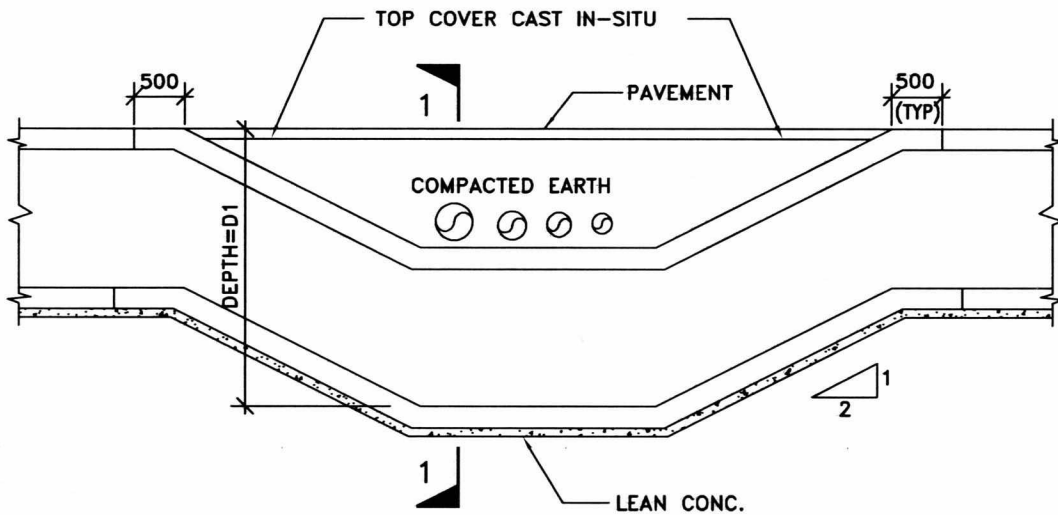
THE DESIGN IS BASED ON A LIVE LOAD OF 500 Kg/m² AND
MAXIMUM ALLOWABLE DEFLECTION = $W/200$ (W = SPAN)



SECTION 1-1



DET. A



TYPICAL DETAIL AT JUNCTION FOR
DIFFERENT DEPTHS OF TRENCH.

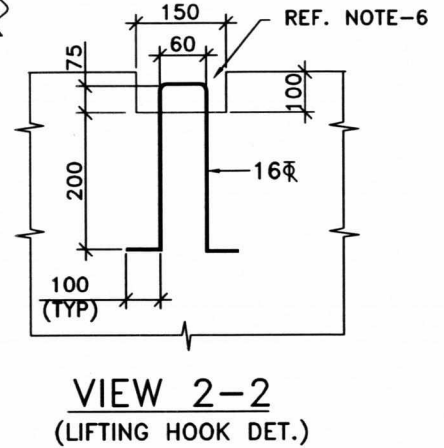
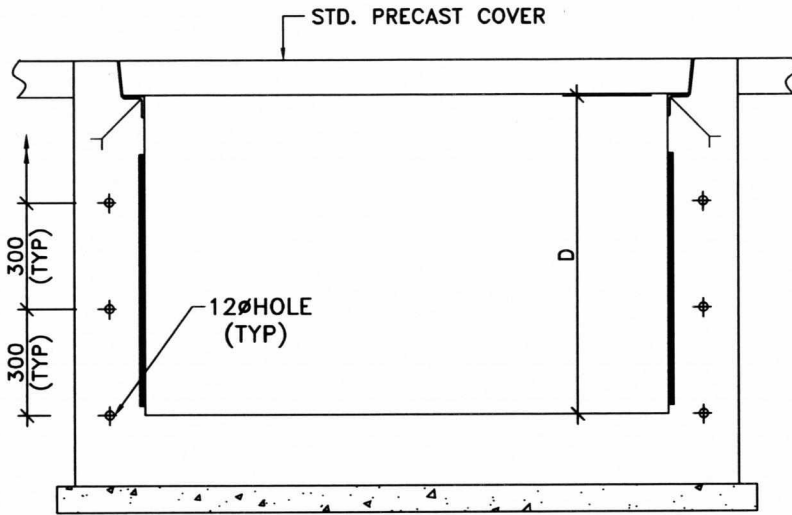
NOTES : -

- (1) TOP COVER FOR THE INDICATED PORTION SHALL BE CAST IN SITU. RCC DETAILS FOR THE COVER SLAB SHALL BE SAME AS THE PRECAST COVERS OF SAME SPAN, EXCEPT THE CORNER DETAIL WHICH IS SHOWN HERE.
- (2) RC DETAILS FOR THE TRENCH WALL / BASE SHALL BE BASED ON DEPTH "D1".

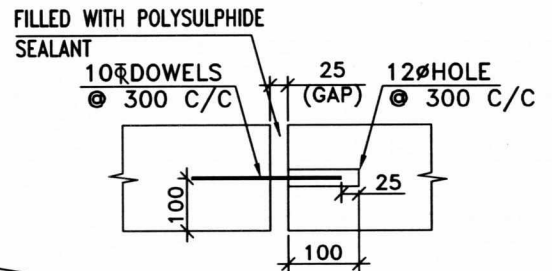
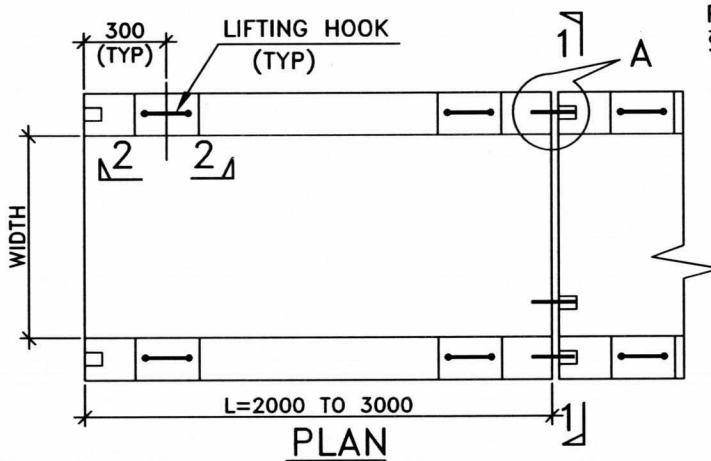
NOTES :

1. ALL DIMENSIONS ARE IN mm & LEVELS IN METRES.
2. MAX. WEIGHT OF EACH PRECAST TRENCH IS 5T.
3. THIS STANDARD IS SHOWING JOINT DETAILS AND LIFTING LUG OF PRECAST ELEMENTS ONLY.
4. FOR THICKNESS, R/F DETAILS OF WALL AND PRECAST COVER REFER STD.NO. 7-68-0625, 7-68-0626 & 7-68-0655.
5. LEAN CONCRETE TO BE SUITABLY ALIGNED/LEVEL TO ENSURE MATCHING OF WALL WITH FGL/HPP.
6. LIFTING POCKET SHALL BE FILLED WITH CONCRETE AFTER ERECTION/ALIGNMENT.

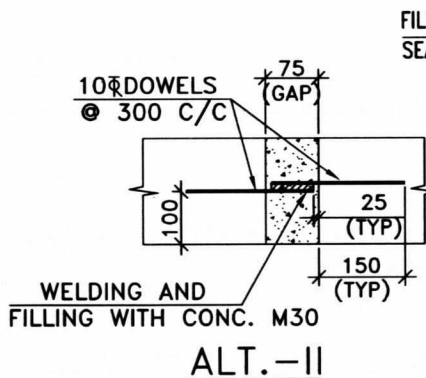
2	20-06-2022	REAFFIRMED AND ISSUED AS STANDARD	ANURAG KR. SINHA	S.C.MAITY	ANURAG SINHA	SANJAY MAZUMDAR
1	29-09-2016	REAFFIRMED AND ISSUED AS STANDARD	JITENDER	ALPANA	RAJANJI SRIVASTAVA	R.NANDA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
						Approved by



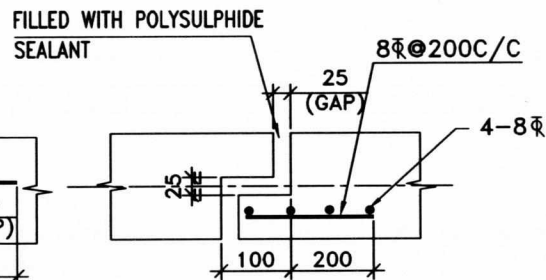
SECTION 1-1



DET.-A (ALT.-I)
(REFER ALT-II & ALT-III ALSO)



ALT.-II



ALT.-III

Anurag K. Sinha

S.C. Maity

Anurag Sinha

Sanjay Mazumdar

2	20-06-2022	REAFFIRMED AND ISSUED AS STANDARD	ANURAG KR. SINHA	S.C. MAITY	ANURAG SINHA	SANJAY MAZUMDAR
1	29-09-2016	REAFFIRMED AND ISSUED AS STANDARD	JITENDER	ALPANA	RAJANJI SRIVASTAVA	R. NANDA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

NOTES:

1.0 GENERAL

- 1.1 THIS STANDARD DEFINES THE TYPES AND DETAILS OF JOINTS REQUIRED TO BE PROVIDED IN REINFORCED CEMENT CONCRETE LIQUID RETAINING STRUCTURES. THIS STANDARD DOES NOT COVER THE REQUIREMENT OF PROTECTIVE LINING FOR CONCRETE IN CASE OF STORAGE OF LIQUIDS HARMFUL TO CONCRETE.
- 1.2 THIS STANDARD IS BASED ON IS 3370 (PART-I)-CODE OF PRACTICE FOR CONCRETE STRUCTURES FOR THE STORAGE OF LIQUIDS. FOR FURTHER DETAILS REFERENCE MAY BE MADE TO THE SAME.
- 1.3 THIS STANDARD SHALL BE READ IN CONJUNCTION WITH SPECIFICATION NO. 6-68-0005 AND RELEVANT DESIGN DRAWINGS.

2.0 TYPES OF JOINTS

- 2.1 CONSTRUCTION JOINT : A CONSTRUCTION JOINT IS A JOINT IN THE CONCRETE INTRODUCED FOR CONVENIENCE IN CONSTRUCTION AT WHICH SPECIAL MEASURES ARE TAKEN TO ACHIEVE SUBSEQUENT CONTINUITY WITHOUT PROVISION FOR FURTHER RELATIVE MOVEMENT.
- 2.2 MOVEMENT JOINT : A MOVEMENT JOINT IS A SPECIALLY FORMED JOINT INTENDED TO ACCOMMODATE RELATIVE MOVEMENT BETWEEN ADJOINING PARTS OF A STRUCTURE WITH SPECIAL PROVISION BEING MADE FOR MAINTAINING THE WATER TIGHTNESS OF THE JOINT BY USING JOINTING MATERIAL.

MOVEMENT JOINTS ARE OF THE FOLLOWING TYPES:

(a) CONTRACTION JOINT

THIS IS A MOVEMENT JOINT WHICH HAS A DELIBERATE DISCONTINUITY BUT NO INITIAL GAP BETWEEN THE CONCRETE ON EITHER SIDE OF THE JOINT. THIS JOINT IS INTENDED TO ACCOMMODATE CONTRACTION OF THE CONCRETE. THERE ARE TWO TYPES OF CONTRACTION JOINTS:

- (i) PARTIAL CONTRACTION JOINT: IN THIS JOINT, ONLY THE CONCRETE IS INTERRUPTED WHILE THE REINFORCEMENT IS CONTINUED THROUGH THE JOINT.
- (ii) COMPLETE CONTRACTION JOINT: IN THIS JOINT, BOTH THE CONCRETE AND THE REINFORCEMENT ARE INTERRUPTED.

b) EXPANSION JOINT

THIS IS A MOVEMENT JOINT WHICH HAS COMPLETE DISCONTINUITY IN BOTH REINFORCEMENT AND CONCRETE WITH AN INITIAL GAP AND IS INTENDED TO ACCOMMODATE EITHER EXPANSION OR CONTRACTION OF THE STRUCTURE.

3.0 JOINTING MATERIALS

JOINTING MATERIALS ARE CLASSIFIED AS FOLLOWS:

- (a) JOINT FILLERS
(b) PVC WATER STOPS / SWELLABLE WATER BARS
(c) JOINT SEALING COMPOUNDS (INCLUDING PRIMERS WHEREVER REQUIRED)

- 3.1 JOINT FILLERS : JOINT FILLERS ARE COMPRESSIBLE SHEET OR STRIP MATERIALS FIXED TO THE FACE OF THE FIRST PLACED CONCRETE AND AGAINST WHICH THE SECOND PLACED CONCRETE IS CAST. JOINT FILLERS MAY THEMSELVES FUNCTION AS WATER-TIGHT EXPANSION JOINTS. THESE MAY BE USED AS SUPPORT FOR AN EFFECTIVE JOINT SEALING COMPOUND IN FLOOR AND ROOF JOINTS. BUT THEY CAN ONLY BE RELIED UPON AS SPACERS TO PROVIDE THE GAP IN AN EXPANSION JOINT, THE GAP BEING BRIDGED BY A WATER STOP/ WATER BAR.

7	21-04-25	REVISED AND ISSUED AS STANDARD	JG	ANKUR	ANURAG SINHA	M.NANDI
6	24-09-20	REAFFIRMED AND ISSUED AS STANDARD	JG	AVM	AS	SM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
						Approved by

3.2 PVC WATER STOPS

- 3.2.1 PVC WATER STOPS ARE GENERALLY PRE-FORMED STRIPS RESISTANT TO HYDROSTATIC HEAD MADE OF DURABLE IMPERMEABLE PVC MATERIAL CONFORMING TO IS 15058/BS 2571 WHICH ARE WHOLLY OR PARTIALLY EMBEDDED IN THE CONCRETE DURING CONSTRUCTION SO AS TO SPAN ACROSS THE JOINT AND PROVIDE A PERMANENT WATER TIGHT SEAL DURING THE WHOLE RANGE OF JOINT MOVEMENT. FOR TEMPERATURE HIGHER THAN 70°C, SPECIAL HEAT RESISTANT WATER STOPS SHALL BE USED.
- 3.2.2 THE CONTINUITY OF PVC WATER STOP SYSTEM ACROSS ALL INTERSECTIONS, PARTICULARLY BETWEEN FLOOR AND WALL SYSTEM, IS ACHIEVED BY USING PREFABRICATED SPECIAL JUNCTION PIECES.
- 3.2.3 FIELD SPLICING OF PVC WATER STOP SHALL BE DONE BY USING HEAT FUSED BUTT JOINTS OR SOLVENT ETC. STRICTLY AS PER MANUFACTURER'S SPECIFICATIONS.
- 3.2.4 CENTRALLY PLACED INTERNAL PVC WATER STOPS SHALL BE RIBBED / SERRATED TYPE WITH CENTRAL BULB AT THE CENTRE AND EXPANSION TYPE PVC WATER STOPS PLACED ON OPPOSITE EDGE OF LIQUID FACE SHALL BE KICKER TYPE WITH CENTRAL BULB TO WITHSTAND THE HYDROSTATIC HEAD. THE WIDTH OF PVC WATER STOPS SHALL BE 150mm FOR CONCRETE MEMBERS UP TO 300mm THICK AND 230mm FOR CONCRETE MEMBERS MORE THAN 300mm THICK. PVC WATER STOPS SHALL BE MINIMUM 5mm THICK.
- 3.2.5 IN ORDER TO PREVENT THE EDGES OF THE PVC WATER STOP FROM MOVING DURING CONCRETING IN WALL/SLAB JOINTS, THE PVC WATER STOPS SHOULD BE ADEQUATELY HELD IN POSITION BY TYING TO ADJACENT REINFORCEMENT BARS USING REBAR CHAIRS/ U-BARS ETC. OR BY USING OTHER SUITABLE MEANS. PUNCTURING OF PVC WATER STOPS SHALL NOT BE ALLOWED.

3.3 JOINT SEALING COMPOUNDS

- 3.3.1 JOINT SEALING COMPOUNDS ARE IMPERMEABLE DUCTILE MATERIALS WHICH ARE REQUIRED TO PROVIDE A WATER TIGHT SEAL BY ADHESION TO THE CONCRETE THROUGHOUT THE RANGE OF JOINT MOVEMENT.
- 3.3.2 MATERIALS TO BE USED FOR THIS PURPOSE SHALL BE TWO COMPONENT LIQUID POLYSULPHIDE RUBBER BASED SEALANT CONFORMING TO IS 12118/BS 4254. THESE ARE APPLIED IN A CHASE FORMED IN THE SURFACE OF THE CONCRETE ALONG THE LINE OF THE JOINT AS PER MANUFACTURER'S INSTRUCTIONS.

4.0 SPACING OF JOINTS

4.1 CONSTRUCTION JOINTS

- 4.1.1 CONSTRUCTION JOINTS ARE NOT INTENDED TO ACCOMMODATE MOVEMENT ACROSS THE JOINT BUT SLIGHT SHRINKAGE MAY OCCUR DUE TO DISCONTINUITY OF CONCRETE.
- 4.1.2 THE DESIGNER SHALL SPECIFY THE LOCATION OF CONSTRUCTION JOINTS ON DRAWINGS BASED ON CONVENIENT BREAKS IN PLACING CONCRETE.
- 4.1.3 AT THE JUNCTION BETWEEN A BASE SLAB AND A WALL, A SHORT KICKER OF MINIMUM HEIGHT 150mm SHALL BE PROVIDED TO ENABLE THE FORMWORK FOR THE WALLS TO BE PLACED ACCURATELY AND EASILY.

4.1.4 THE CONCRETE JOINT SURFACE SHALL BE PREPARED BY REMOVING LAITANCE IN ORDER TO EXPOSE SHARP ANGULAR FACES OF LARGE AGGREGATES FOR SUBSEQUENT CONTINUITY. A KEY SHALL ALSO BE PROVIDED FOR SECTIONS THICKER THAN 250mm.

IN ADDITION TO ABOVE ALL CONSTRUCTION JOINTS SHALL BE TREATED AS PER SPECIFIED IN SPECIFICATION NO. 6-68-0005 BEFORE STARTING FRESH CONCRETING SO AS TO FORM A LEAK PROOF JOINT.

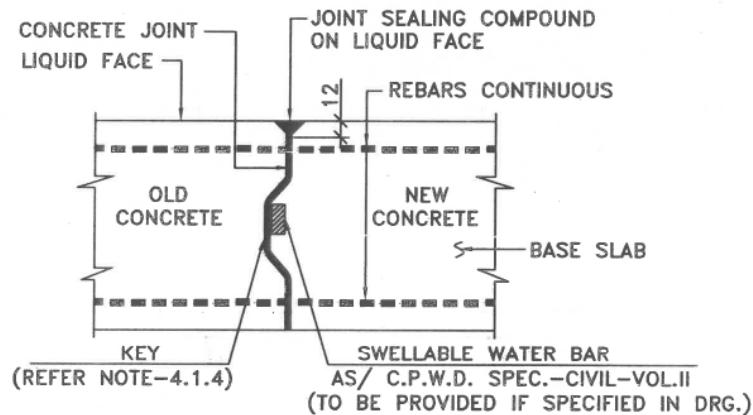
4.1.5 CONSTRUCTION JOINTS IN BASE SLABS AND VERTICAL CONSTRUCTION JOINTS IN WALLS SHOULD BE AVOIDED, SINCE CONSTRUCTION AND EXPANSION JOINTS CAN ACHIEVE THE SAME OBJECTIVE.

4.2 MOVEMENT JOINTS

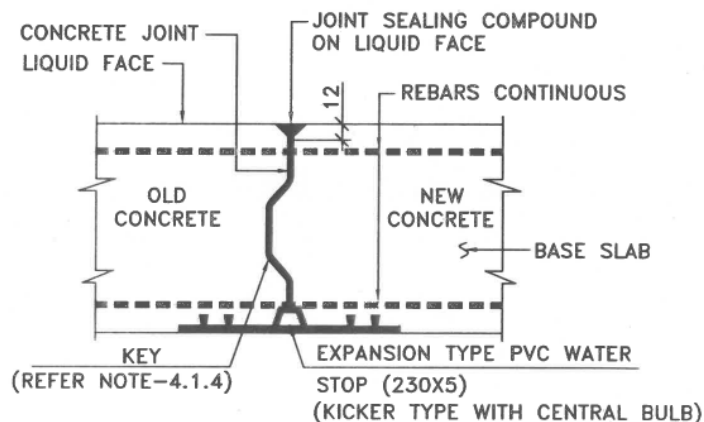
4.2.1 MOVEMENT JOINTS ARE DESIGNED TO PROVIDE A BREAK IN THE CONTINUITY OF THE STRUCTURE, SO THAT RELATIVE MOVEMENT MAY OCCUR ACROSS THE JOINT IN THE LONGITUDINAL DIRECTION.

4.2.2 THE MAXIMUM SPACING BETWEEN PARTIAL CONTRACTION JOINTS SHALL BE GENERALLY ABOUT 7.5m. WHERE COMPLETE CONTRACTION JOINT IS PROVIDED, THE SPACING BETWEEN TWO SUCCESSIVE JOINTS SHALL BE NOT MORE THAN 15.0m.

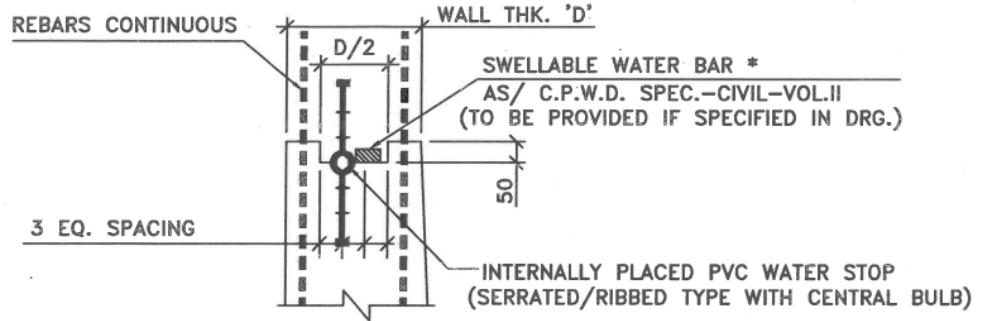
4.2.3 THE MAXIMUM SPACING BETWEEN TWO SUCCESSIVE EXPANSION JOINTS SHALL BE NOT MORE THAN 30.0m. THE WALL AND FLOOR JOINTS SHALL BE IN LINE WITH EACH OTHER.



A(i) - CONSTRUCTION JOINT SWELLABLE WATER BAR
(REFER NOTE 4.1.5)

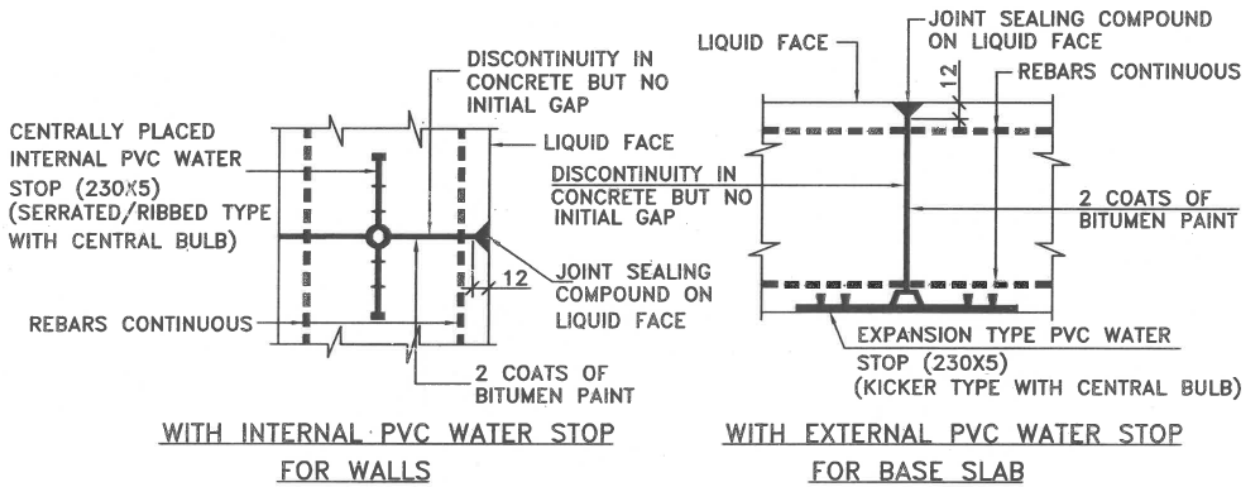


A(ii) - CONSTRUCTION JOINT WITH PVC WATER STOP
(REFER NOTE 4.1.5)

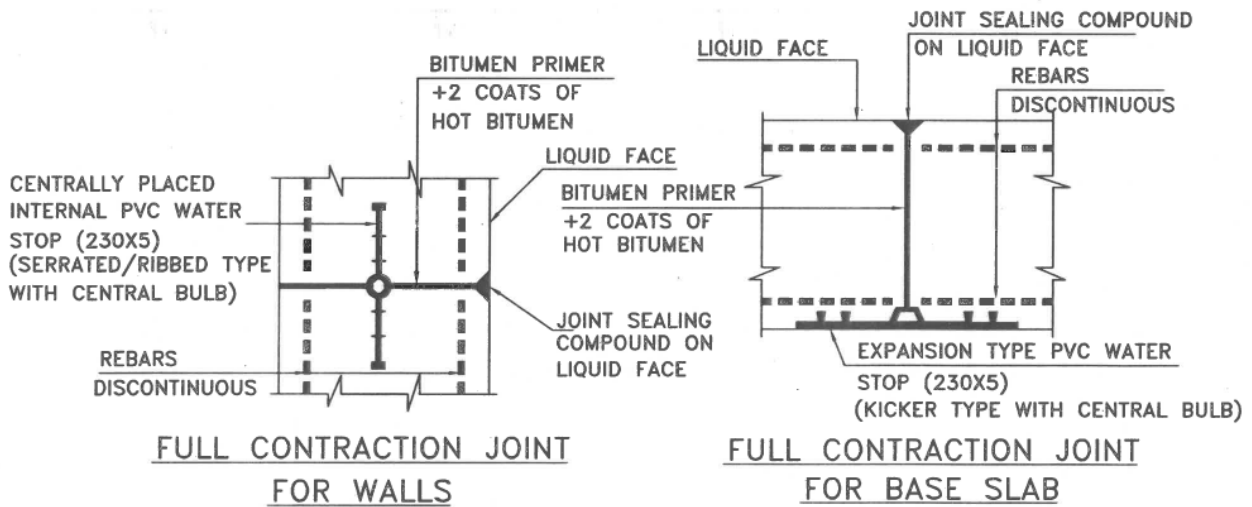


A(iii) - CONSTRUCTION JOINT FOR WALLS

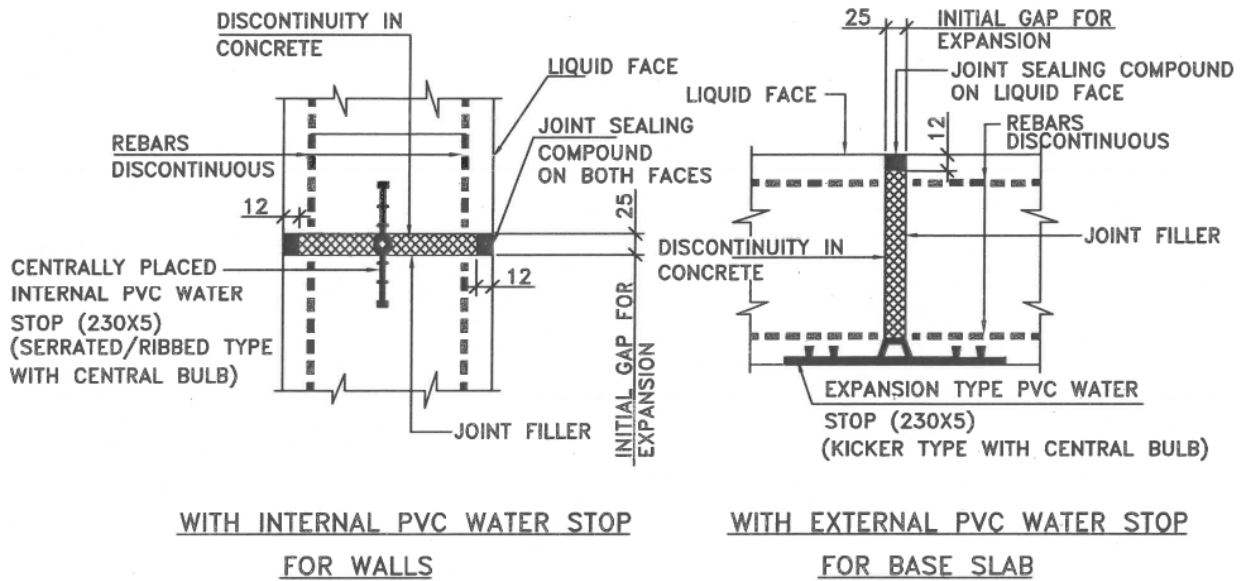
(* NOTE:- EITHER PVC WATER STOP OR SWELLABLE WATER BAR SHALL BE PROVIDED)



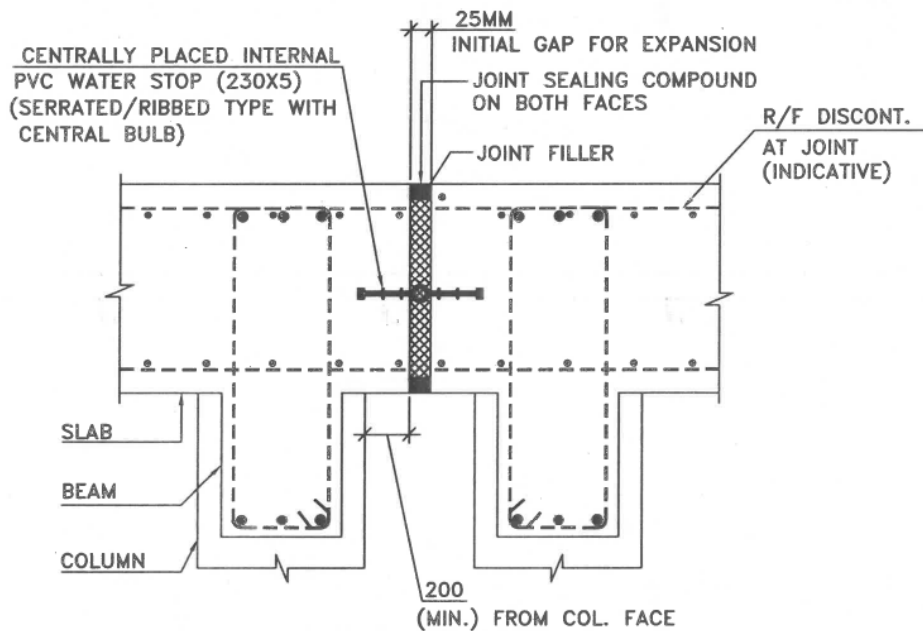
B (i) - PARTIAL CONTRACTION JOINTS



B (ii) - COMPLETE CONTRACTION JOINTS



C - EXPANSION JOINT



SUGGESTED ARRANGEMENT FOR PLACING PVC WATER STOP AT EXPANSION JOINT LOCATIONS [NTS]

(TYP. X-SEC. VIEW FOR RCC SLABS)

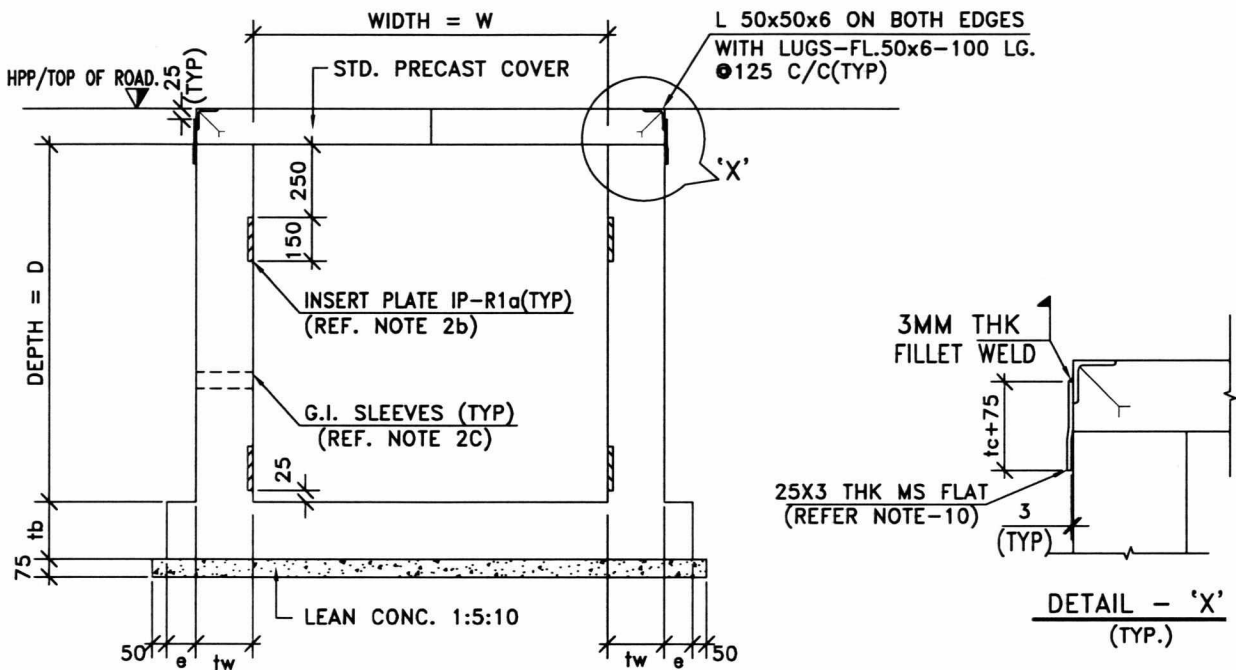
NOTES :-

1. FOR LOCATION OF TRENCHES SUBJECTED TO CRANE LOADING, REFERENCE SHALL BE MADE TO RELEVANT GENERAL CIVIL DRAWINGS.
2. ELECTRICAL DEPTT. & INSTRUMENTATION DEPTT. WILL PROVIDE FOLLOWING INFORMATION ON THEIR DRAWINGS WHICH WILL BE ISSUED FOR CONSTRUCTION:
 - a) LAYOUT AND SIZE OF CABLE TRENCH.
 - b) INSERT PLATE REQUIREMENTS AND ITS SPACING.
 - c) LOCATION & SIZE OF G.I. CONDUIT SLEEVES.
3. GRADE OF CONCRETE AND REBARS FOR CABLE TRENCH & PRECAST COVER SHALL BE AS PER GENERAL NOTES OF THE PROJECT. HOWEVER, M25 AS MINIMUM GRADE OF RCC AND FE500D AS MINIMUM GRADE OF REINFORCEMENT HAS BEEN CONSIDERED IN DESIGN.
4. CABLE TRENCHES ARE DESIGNED FOR THE FOLLOWING CONSIDERATIONS:
 - a) CLASS-AA TRACKED VEHICULAR LOADS AS GIVEN IN IRC:6 (i.e UDL OF 11.40 T/SQ.M).
 - b) CLASS-70R WHEELED VEHICULAR LOADS AS GIVEN IN IRC:6 (i.e. MAXIMUM TYRE PRESSURE OF 52.73 T/SQ.M).
 - c) SURCHARGE LOADS FOR VEHICLES CALCULATED AS PER IRC: 6.
 - d) NET SAFE BEARING CAPACITY OF SOIL IS 5 MT/SQ.M AT FOUNDATION LEVEL.
 - e) WATER TABLE AT ANY DEPTH.
5. CABLE TRENCHES FOR JUNCTIONS WHEREVER REQUIRED SHALL BE DESIGNED & DETAILED SPECIFICALLY BASED ON THE AVAILABLE LAYOUT.
6. EVERY FIFTH COVER SHALL HAVE LIFTING HOOK OF TYPE H1 (REF. SHT. 4 OF 6).
7. CABLE TRENCHES IN UNIT AREAS (CLASSIFIED) SHALL BE FILLED WITH SAND.
8. JOINTS BETWEEN PRECAST COVERS TO BE FILLED AFTER CABLE LAYING.
9. CLEAR COVER SHALL BE 30MM MINIMUM, UNLESS NOTED OTHERWISE. IN CASE CLEAR COVER IS MORE FOR A PROJECT, THE ELEMENT THICKNESS SHALL BE INCREASED ACCORDINGLY.
10. 25X3 THK MS FLAT TO BE PROVIDED AFTER PLACEMENT OF PRECAST COVER.THE SAME IS TO BE LOCALLY BENT IN CASES WHERE THE WIDTH OF COVER SLAB IS LESS THAN THE TRENCH OUTER-TO-OUTER WIDTH.

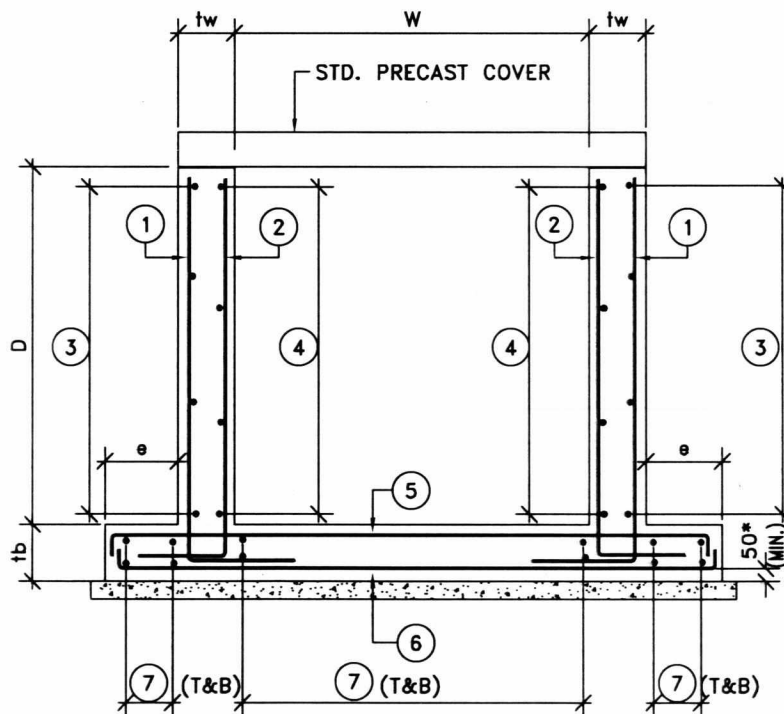
Anurag Krishna K. Sinha

Chaudhary

6	19.03.24	REVISED & REISSUED AS STANDARD	ANURAG KR. SINHA	MAITRAYEE MAJUMDER	ANURAG SINHA	MAINAK NANDI
5	20.06.22	REVISED & REISSUED AS STANDARD	ANURAG KR. SINHA	S.C.MAITY	ANURAG SINHA	SANJAY MAZUMDAR
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
					Approved by	



TYP. SECTION OF CABLE TRENCH



TYPICAL CABLE TRENCH SECTION

(FOR DETS OF R/F BARS ① TO ⑦ REFER TABLE-1 SHT 3 OF 6)

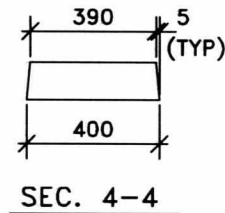
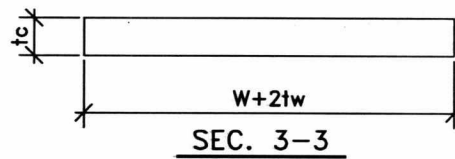
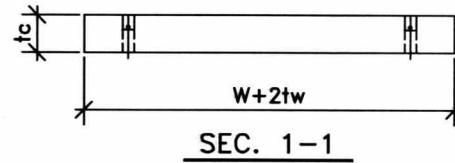
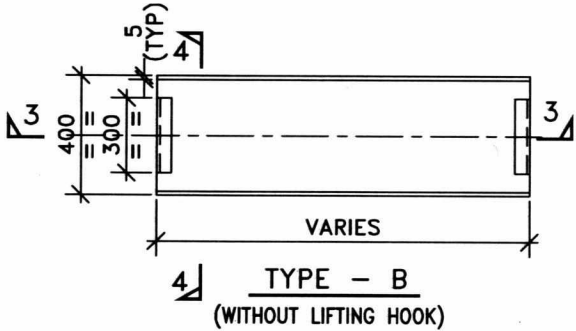
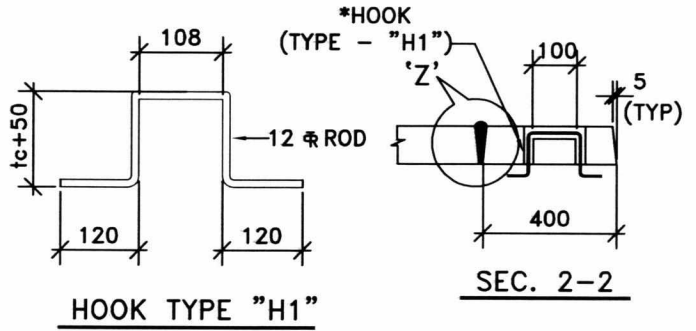
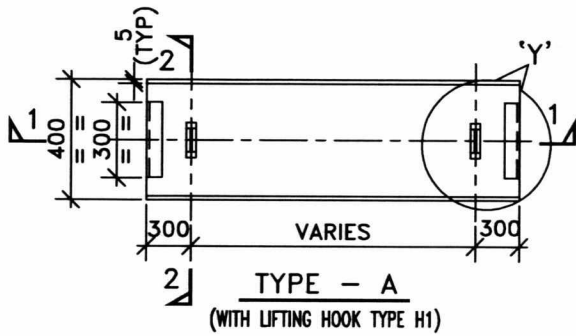
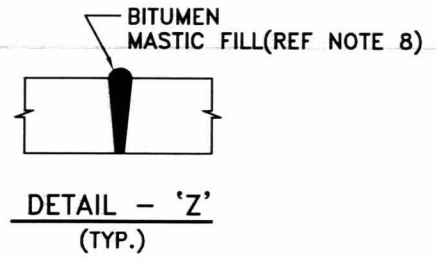
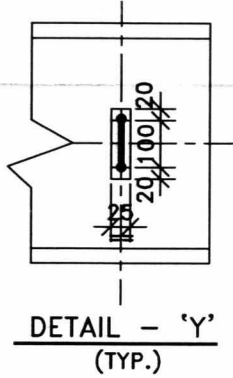
* REFER NOTE-9

TABLE :1- DETAIL OF CABLE TRENCH REINFORCEMENT

S.NO.	WORKING DIMENSIONS				R/F CONFORMING TO IS: 1786							APPROX. QUANTITIES PER METRE LENGTH.			
	DEPTH D (mm)	WIDTH W (mm)	WALL THICKNESS tw (mm)	BASE THICKNESS tb (mm)	PROJECTION e (mm)	BAR MARK							LEAN CONC. 1:5:10 (m ³)	CONC. (m ³)	REINF.
						①	②	③	④	⑤	⑥	⑦			
1.	300	300	150	150	300	10#-150C/C.	8#-150C/C.	8#-300C/C.	8#-300C/C.	10#-175C/C.	10#-175C/C.	8#-300C/C.	0.10	0.31	32.10
2.		500	150	150	300	10#-150C/C.	8#-150C/C.	8#-300C/C.	8#-300C/C.	10#-175C/C.	10#-175C/C.	8#-300C/C.	0.12	0.34	33.80
3.	500	500	150	200	300	10#-150C/C.	8#-150C/C.	8#-300C/C.	8#-300C/C.	10#-175C/C.	10#-175C/C.	8#-250C/C.	0.12	0.40	41.50
4.		750	200	200	400	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	10#-175C/C.	10#-175C/C.	8#-250C/C.	0.16	0.72	60.70
5.	750	750	200	200	400	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-175C/C.	12#-175C/C.	8#-250C/C.	0.16	0.82	74.10
6.		1000	200	200	500	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-175C/C.	12#-175C/C.	8#-250C/C.	0.19	0.92	83.50
7.	1000	1250	200	200	450	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-175C/C.	12#-175C/C.	8#-250C/C.	0.20	0.95	90.30
8.		1500	200	200	450	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-175C/C.	12#-175C/C.	8#-250C/C.	0.22	1.00	90.50
9.	1250	2000	200	200	500	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-175C/C.	12#-175C/C.	8#-250C/C.	0.27	1.12	100.00
10.		1000	200	200	500	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-175C/C.	12#-175C/C.	8#-250C/C.	0.19	1.00	129.40
11.	1250	1250	200	200	450	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-125C/C.	12#-125C/C.	8#-250C/C.	0.20	1.05	132.80
12.		1500	200	200	450	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-125C/C.	12#-125C/C.	8#-250C/C.	0.22	1.10	137.90
13.	1500	2000	200	200	500	12#-150C/C.	10#-250C/C.	8#-250C/C.	8#-250C/C.	12#-125C/C.	12#-125C/C.	8#-250C/C.	0.27	1.20	147.80
14.		1000	250	250	500	12#-150C/C.	10#-250C/C.	8#-200C/C.	8#-200C/C.	12#-150C/C.	12#-150C/C.	8#-200C/C.	0.19	1.30	109.30
15.	1500	1250	250	250	450	12#-150C/C.	10#-250C/C.	8#-200C/C.	8#-200C/C.	12#-150C/C.	12#-150C/C.	8#-200C/C.	0.20	1.45	114.80
16.		1500	250	250	450	12#-150C/C.	10#-250C/C.	8#-200C/C.	8#-200C/C.	12#-150C/C.	12#-150C/C.	8#-200C/C.	0.22	1.50	120.30
17.	2000	250	250	500	12#-150C/C.	10#-250C/C.	8#-200C/C.	8#-200C/C.	12#-150C/C.	12#-150C/C.	8#-200C/C.	0.27	1.70	128.50	

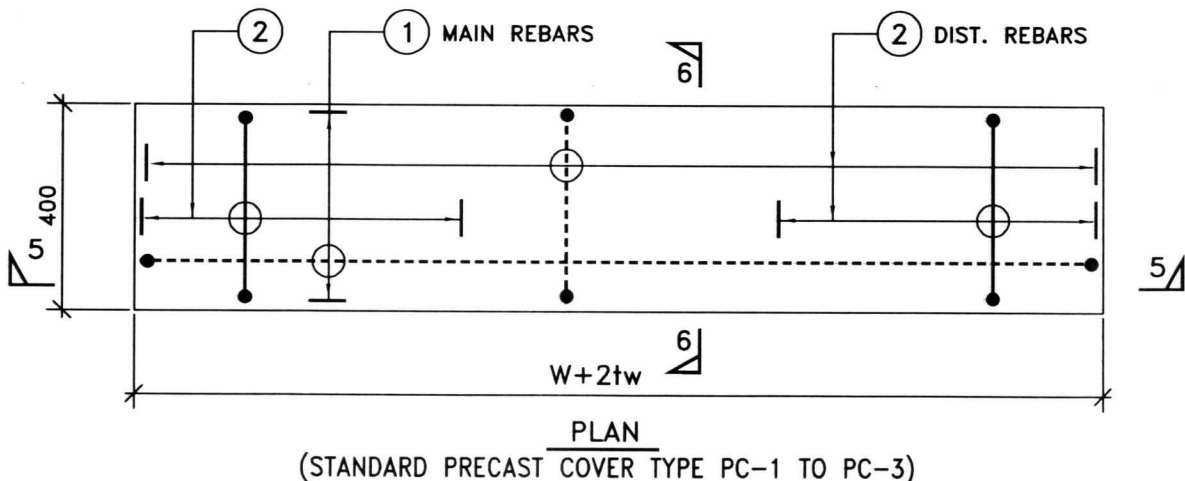
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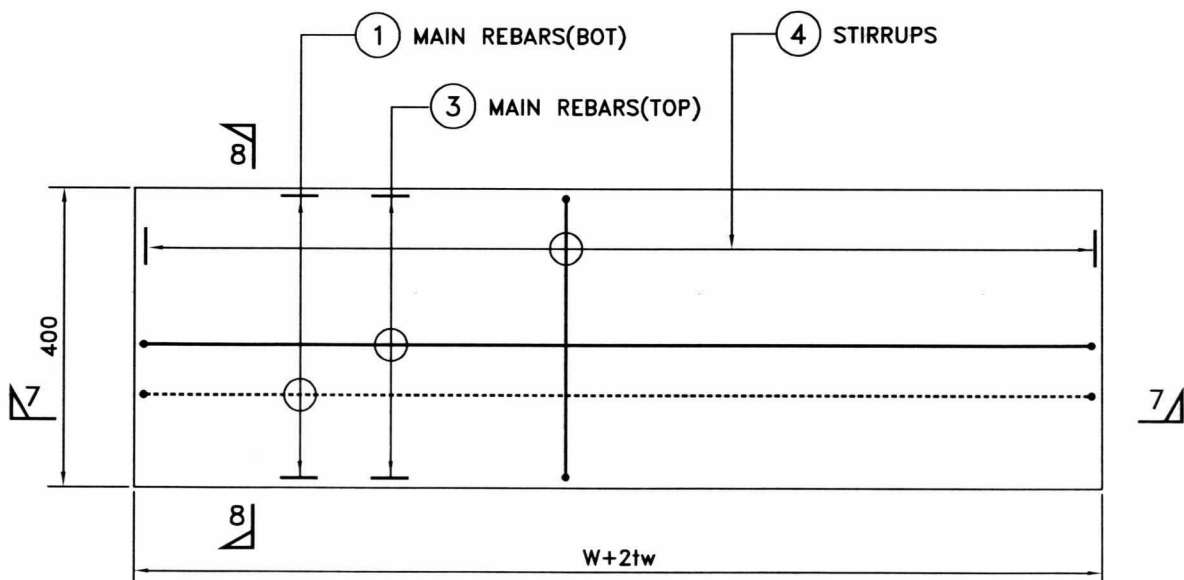
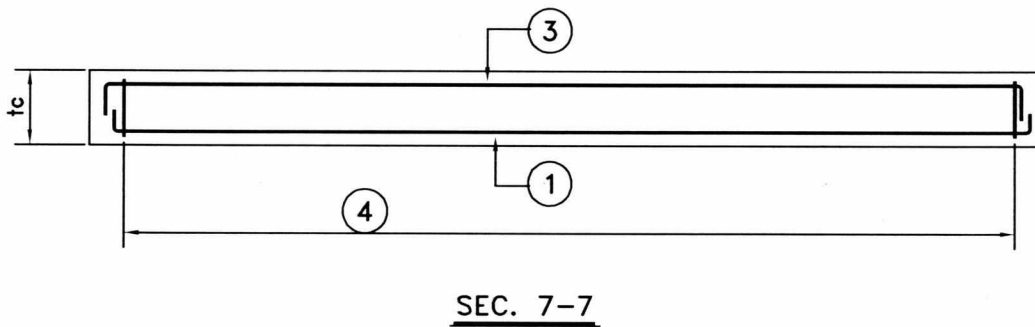
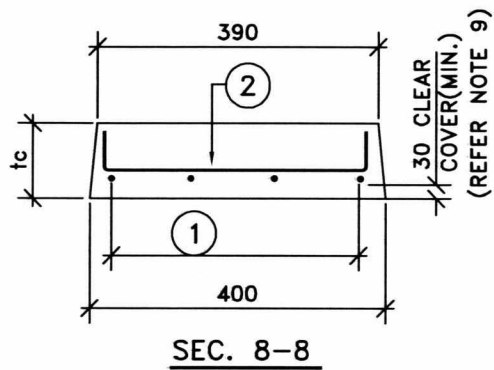
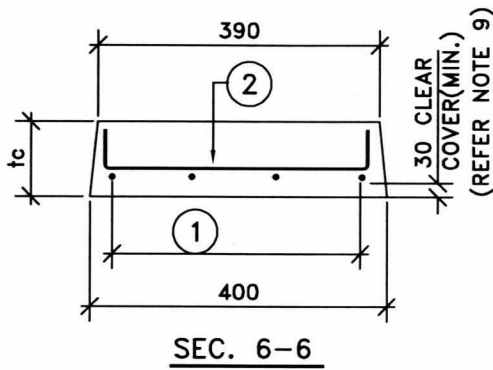
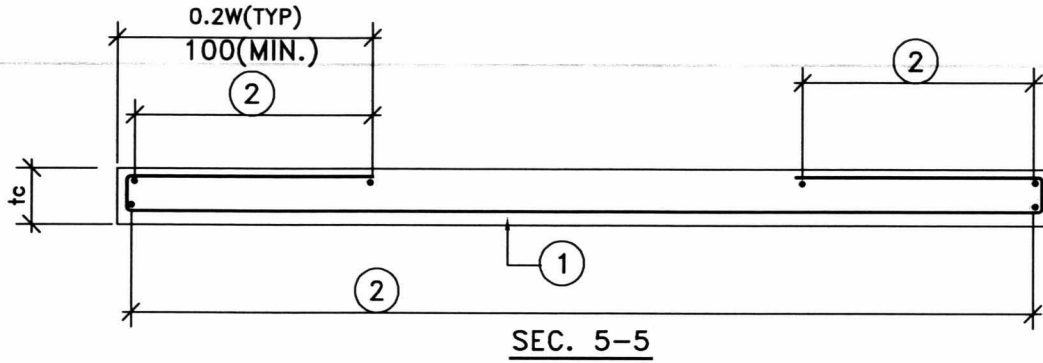
1. TRENCH IS DESIGNED FOR LOADS AND CONDITIONS SPECIFIED IN NOTE 4 (SHT.1 OF 6).
2. THE QUANTITIES GIVEN IN THIS TABLE ARE FOR ESTIMATION PURPOSE ONLY.



*ONE HOOK IN THE MIDDLE FOR TRENCH WIDTH UPTO 500
 TWO HOOKS AS SHOWN FOR TRENCH WIDTH ABOVE 500

PRECAST R.C.C. COVERS





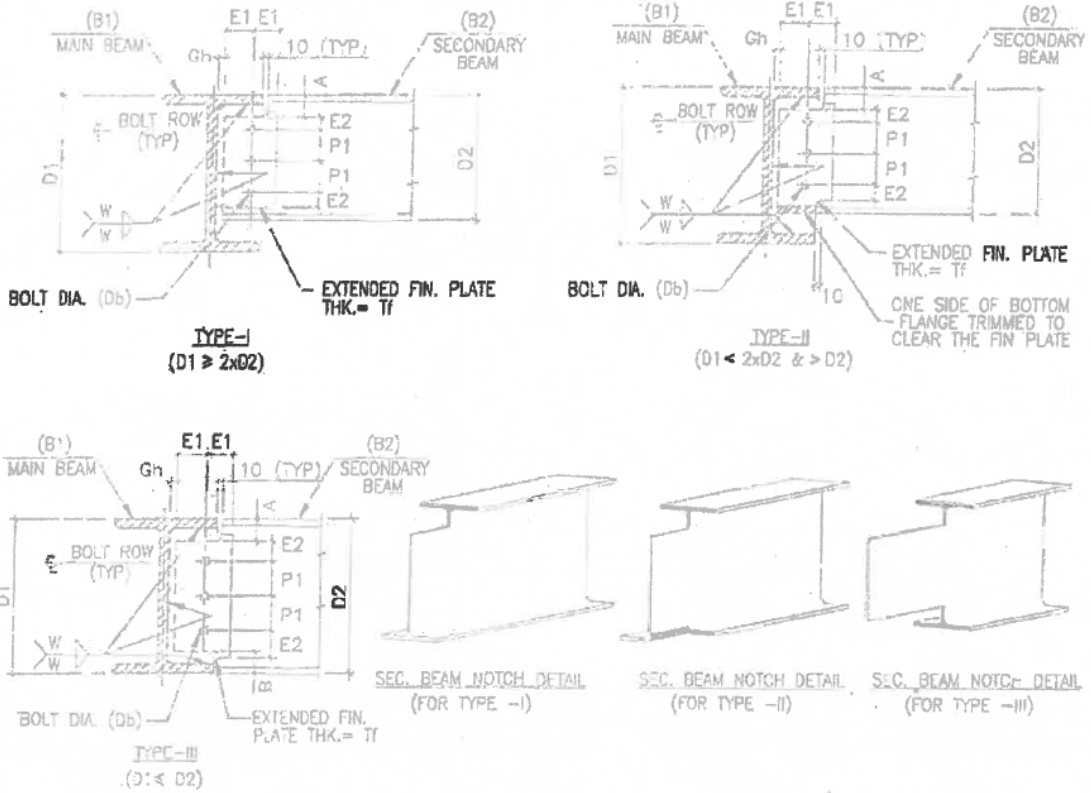
PLAN
 (STANDARD PRECAST COVER SLAB TYPE PC-4 TO PC-7)

TABLE 2: DETAILS OF STANDARD PRECAST COVERS

S.NO.	TYPE	WORKING DIMENSIONS				FOR ONE UNIT OF WIDTH 400 mm						SELF WEIGHT (kg)	
		CLEAR WIDTH OF TRENCH W (mm)	BEARING OF COVER SLAB tw (mm)	TOTAL LENGTH OF COVER SLAB W+2tw (mm)	THICKNESS OF COVER SLAB tc (mm)	REINFORCEMENT CONFORMING TO IS:1786				APPROX. QUANTITIES			
						BAR MKD. ①	BAR MKD. ②	BAR MKD. ③	BAR MKD. ④	CONCRETE (m ³)	REINF. (kg)		
1.	PC-1	300	150	600	150	4-10 Φ	8-10 Φ	-	-	-	0.036	5.481	90.0
2.	PC-2	500	150	800	150	4-10 Φ	8-10 Φ	-	-	-	0.048	5.975	120.0
3.	PC-3	750	200	1150	200	4-10 Φ	9-10 Φ	-	-	-	0.069	8.185	230.0
4.	PC-4	1000	200	1400	200	4-12 Φ	-	3-10 Φ	17-10 Φ	-	0.112	20.343	280.0
			250	1500									
5.	PC-5	1250	200	1650	200	5-12 Φ	-	3-10 Φ	20-10 Φ	-	0.132	18.210	330.0
			250	1750									
6.	PC-6	1500	200	1900	250	5-12 Φ	-	3-10 Φ	15-10 Φ	-	0.190	17.765	475.0
			250	2000									
7.	PC-7	2000	200	2400	250	5-12 Φ	-	3-10 Φ	31-10 Φ	-	0.240	29.667	600.0
			250	2500									

NOTES :-

- FOR LOCATION OF BARS MKD. ① TO ④ REFER SHT. 4 OF 6 & SHT. 5 OF 6.
- ALL PRECAST COVER SLABS SHALL BE MARKED (T) ON THE TOP FOR PROPER PLACEMENT.
- THE QUANTITIES GIVEN IN THIS TABLE ARE FOR ESTIMATION PURPOSE ONLY.
- COVER SLABS ARE DESIGNED FOR LOADS SPECIFIED IN NOTE 4 (SHT. 1 OF 6).



NOTES:-

1. ALL DIMENSIONS ARE IN mm.
2. THIS STANDARD IS VALID FOR STRUCTURAL STEEL OF GRADE E350 & E250 CONFIRMING TO IS 2062.
3. BEAM SECTIONS SHALL CONFIRM TO IS 808.
4. CONNECTION DESIGN IS AS PER CLAUSE 10.3 (BEARING TYPE BOLTS) OF IS 800 : 2007.
5. ALL CONNECTION BOLTS SHALL BE OF PROPERTY CLASS 8.8 CONFORMING TO IS 3757 & IS 4000.
6. HEXAGONAL NUTS SHALL CONFIRM TO IS 6623.
7. WASHERS SHALL CONFORM TO IS 6649.
8. ALL BOLTS, NUTS & WASHERS SHALL BE GALVANIZED AS PER IS. 1367; PART XIII.
9. WELDING ELECTRODE SHALL BE COMPATIBLE WITH CORRESPONDING GRADE OF STEEL.
10. THIS STANDARD IS ALSO APPLICABLE FOR NPB SECTIONS EQUIVALENT TO ISMB SECTIONS.

* % SHEAR CAPACITY OF CONNECTION W.R.T. SECONDARY BEAM SECTION SHEAR CAPACITY.
 # % AXIAL CAPACITY OF CONNECTION W.R.T. SECONDARY BEAM SECTION AXIAL CAPACITY.

ABBREVIATIONS:-

ISMB - MB ; ISMC - MC ; ISNPB - NPB ; ISWPB - WPB

1	28.01.2025	REVISED AND ISSUED AS STANDARD	SS/SS	<i>S. Sankar</i>	ANURAG SINHA	MAINAK NANDI
0	24.10.2020	ISSUED AS STANDARD	GR	SS/PM	ANURAG SINHA	SM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds Committee Conveor	Stds. Bureau Chairman

Shankar

TABLE FOR CONNECTION SCHEDULE

(B2)	(B1)	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G _h) (mm)	Edge Dist. (E ₁) (mm)	End dist. (E ₂) (mm)	Bolt Spacing (P ₁) (mm)	Thk of Fin Plate (T _f) (mm)	Weld Size (w) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) ⁴	Axial Capacity (%) ⁴	STEEL GRADE E250		STEEL GRADE E250	
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)
WPB900x300x291.46	WPB900x300x291.46	III	36	7	20	75	75	100	16	14	65	65	42	4	128.5	47.3	91.0	33.8
	WPB800x300x262.34	III	36	7	20	75	65	90	16	14	65	165	40	4	122.4	47.3	87.4	33.8
WPB800x300x262.34	WPB900x300x291.46	II	36	7	20	75	65	90	16	14	65	0	47	5	120.9	53.1	86.3	38.0
	WPB800x300x262.34	III	36	7	20	75	65	90	16	14	65	65	47	5	120.5	53.1	86.3	38.0
WPB700x300x240.51	WPB700x300x240.51	III	36	6	20	75	60	90	16	14	65	160	40	5	102.9	53.1	73.5	36.0
	WPB900x300x291.46	II	36	6	20	75	65	90	16	14	65	0	45	5	98.4	48.7	70.2	34.8
WPB700x300x240.51	WPB800x300x262.34	II	36	6	20	75	65	90	16	14	65	0	45	5	98.4	48.7	70.2	34.8
	WPB700x300x240.51	III	36	6	20	75	65	90	16	14	60	60	45	4	98.4	38.9	70.2	27.8
WPB700x300x204.48	WPB700x300x204.48	III	36	6	20	75	60	90	16	14	60	65	45	4	98.4	38.9	70.2	27.8
	WPB600x300x177.78	III	36	5	16	75	55	90	16	12	60	165	39	4	85.3	38.9	60.9	27.8
WPB700x300x204.48	WPB900x300x291.46	II	36	5	20	75	75	90	16	14	65	0	45	5	82.7	41.4	59.1	29.5
	WPB800x300x262.34	II	36	5	20	75	75	90	16	14	65	0	45	5	82.7	41.4	59.1	29.5
WPB700x300x204.48	WPB700x300x240.51	III	36	5	20	75	75	90	16	14	60	55	45	5	82.7	41.4	59.1	29.5
	WPB700x300x204.48	III	36	5	20	75	75	90	16	14	55	55	45	5	82.7	41.4	59.1	29.5
WPB700x300x149.89	WPB700x300x149.89	III	36	5	20	75	75	90	16	12	55	65	45	4	82.7	33.1	59.1	23.6
	WPB600x300x177.78	III	36	5	16	75	60	90	16	12	55	155	43	4	79.0	33.1	56.5	23.6
WPB700x300x149.89	WPB900x300x291.46	II	36	5	20	75	75	90	16	12	65	0	53	5	94.8	30.4	60.6	21.7
	WPB800x300x262.34	II	36	5	20	75	75	90	16	12	65	0	53	5	94.8	30.4	60.6	21.7
WPB700x300x149.89	WPB700x300x240.51	III	36	5	20	75	75	90	16	12	60	45	53	5	84.8	30.4	60.6	21.7
	WPB700x300x204.48	III	36	5	20	75	75	90	16	12	55	45	53	5	84.8	30.4	60.6	21.7
WPB700x300x149.89	WPB700x300x149.89	III	36	5	20	75	75	90	16	12	45	45	50	5	80.0	30.4	57.2	21.7
	WPB600x300x177.78	III	26	5	20	75	60	90	16	12	55	135	45	5	72.0	30.4	51.4	21.7
	WPB600x300x128.79	III	36	5	20	75	60	90	16	12	45	145	45	5	72.0	30.4	51.4	21.7

TABLE FOR CONNECTION SCHEDULE (CONT.)

(B2) Secondary Beam	(B1) Main Beam	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G _b) (mm)	Edge Dist (E ₁) (mm)	End dist (E ₂) (mm)	Bolt Spacing (P ₁) (mm)	Thk of Rip Plate (T ₀) (mm)	Weld Size (W) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%)	Axial Capacity (%)	STEEL GRADE E50		STEEL GRADE E50		
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)	
WPB600x300x177.78	WPB900x300x291.46	II	36	5	14	75	60	90	14	12	65	0	53	5	74.7	36.0	53.3	25.7	
	WPB800x300x262.34	II	36	5	14	75	60	90	14	12	65	0	53	5	74.7	36.0	53.3	25.7	
	WPB700x300x240.51	II	36	5	14	75	60	90	14	12	60	0	53	5	74.7	36.0	53.3	25.7	
	WPB700x300x204.48	II	36	5	14	75	60	90	14	12	55	0	53	5	74.7	36.0	53.3	25.7	
	WPB700x300x149.89	II	36	5	14	75	60	90	14	12	55	0	50	4	70.5	28.8	50.3	20.6	
	WPB600x300x177.78	III	36	5	14	75	60	90	14	12	55	55	55	50	4	70.5	28.8	50.3	20.6
	WPB600x300x128.79	III	36	4	14	75	75	100	14	12	55	65	65	45	4	63.4	28.8	45.3	20.6
	WPB900x300x291.46	II	36	5	12	75	60	90	14	10	10	65	0	55	5	69.2	26.1	49.4	18.6
	WPB800x300x262.34	II	36	5	12	75	60	90	14	10	10	65	0	55	5	69.2	26.1	49.4	18.6
	WPB700x300x240.51	II	36	5	12	75	60	90	14	10	10	60	0	55	5	69.2	26.1	49.4	18.6
WPB600x300x128.79	WPB700x300x204.48	II	36	5	12	75	60	90	14	10	55	0	55	5	69.2	26.1	49.4	18.6	
	WPB700x300x149.89	II	36	5	12	75	60	90	14	10	45	0	55	4	69.2	20.9	49.4	14.9	
	WPB600x300x177.78	III	36	5	12	75	60	90	14	10	55	0	55	4	69.2	20.9	49.4	14.9	
	WPB600x300x128.79	III	36	5	12	75	60	90	14	10	45	45	50	4	63.0	20.9	45.0	14.9	
	MB600	III	36	5	12	75	60	90	14	10	45	0	50	4	63.0	20.9	45.0	14.9	
	MB500	III	30	5	12	60	55	75	12	10	45	110	45	3	56.7	15.7	40.5	11.2	
	WPB900x300x291.46	II	36	5	14	75	75	90	14	12	65	0	55	5	72.8	24.5	52.0	17.5	
	WPB800x300x262.34	II	36	5	12	75	75	90	14	10	65	0	55	5	72.8	24.5	52.0	17.5	
	WPB700x300x240.51	II	36	5	12	75	75	90	14	10	60	0	55	5	72.8	24.5	52.0	17.5	
	WPB700x300x204.48	II	36	5	12	75	75	90	14	10	55	0	55	5	72.8	24.5	52.0	17.5	
MB600	WPB700x300x149.89	II	36	5	12	75	75	90	14	10	45	0	55	5	72.8	24.5	52.0	17.5	
	WPB600x300x177.78	III	36	5	12	75	60	90	14	10	55	65	50	5	66.2	24.5	47.3	17.5	
	WPB600x300x128.79	III	36	5	12	75	60	90	14	10	45	75	50	5	66.2	24.5	47.3	17.5	
	MB600	III	36	5	12	75	75	90	14	10	45	45	45	55	5	72.8	24.5	52.0	17.5
MB500	MB600	III	30	5	12	60	60	75	12	10	45	135	45	3	59.5	14.7	42.5	10.5	
	MB500	III	30	5	12	60	60	75	12	10	45	135	45	3	59.5	14.7	42.5	10.5	

TABLE FOR CONNECTION SCHEDULE (CONT.)

Secondary Beam (B2)	Main Beam (B1)	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G _h) (mm)	Edge Dist (E ₁) (mm)	End dist (E ₂) (mm)	Bolt Spacing (P ₁) (mm)	Thk of Flt Plate (T ₁) (mm)	Weld Size (w) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE E250		STEEL GRADE E50		
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)	
MB500	WPB900x300x291.46	II	30	5	12	60	60	75	12	10	65	0	57	5	53.4	17.5	38.1	12.5	
	WPB800x300x262.34	II	30	5	12	60	60	75	12	10	65	0	57	5	53.4	17.5	38.1	12.5	
	WPB700x300x240.51	II	30	5	12	60	60	75	12	10	60	0	57	5	53.4	17.5	38.1	12.5	
	WPB700x300x204.48	II	30	5	12	60	60	75	12	10	55	0	60	5	56.2	17.5	40.1	12.5	
	WPB700x300x149.89	II	30	5	12	60	60	75	12	10	45	0	60	5	56.2	17.5	40.1	12.5	
	WPB600x300x177.78	II	30	5	12	60	60	75	12	10	55	0	60	5	56.2	17.5	40.1	12.5	
	WPB600x300x128.79	II	30	5	12	60	60	75	12	10	45	0	60	5	56.2	17.5	40.1	12.5	
	MB600	II	30	5	12	60	60	75	12	10	45	0	60	5	56.2	17.5	40.1	12.5	
	MB500	III	30	5	12	60	60	75	12	10	35	35	35	55	5	51.5	17.5	36.8	12.5
	MB450	III	24	5	10	50	50	60	60	10	8	35	85	42	2	39.4	7.0	28.1	5.0
MB450	MB400	III	24	5	10	50	45	60	10	8	35	130	42	2	39.4	7.0	28.1	5.0	
	MC400	III	24	5	10	50	45	60	10	8	35	135	36	2	33.8	7.0	24.1	5.0	
	WPB900x300x291.46	I	30	4	12	60	60	75	12	10	65	0	58	3	45.1	8.8	32.2	6.3	
	WPB800x300x262.34	II	30	4	12	60	60	75	12	10	65	0	58	3	45.1	8.8	32.2	6.3	
	WPB700x300x240.51	II	30	4	12	60	60	75	12	10	60	0	58	3	45.1	8.8	32.2	6.3	
	WPB700x300x204.48	II	30	4	12	60	60	75	12	10	55	0	58	3	45.1	8.8	32.2	6.3	
	WPB700x300x149.89	II	30	4	12	60	60	75	12	10	45	0	58	3	45.1	8.8	32.2	6.3	
	WPB600x300x177.78	II	30	4	12	60	60	75	12	10	55	0	58	3	45.1	8.8	32.2	6.3	
	WPB600x300x128.79	II	30	4	12	60	60	75	12	10	45	0	58	3	45.1	8.8	32.2	6.3	
	MB600	II	30	4	12	60	60	75	12	10	60	0	58	3	45.0	8.8	32.2	6.3	
MB400	MB500	II	30	4	12	60	60	75	12	10	35	0	58	3	45.0	8.8	32.2	6.3	
	MB450	III	24	5	10	50	50	60	10	8	35	35	52	3	40.4	8.8	28.9	6.3	
	MB400	III	24	5	10	50	45	60	10	8	35	80	47	3	36.5	8.8	26.1	6.3	
	MC400	III	24	5	10	50	45	60	10	8	35	85	47	3	36.5	8.8	26.1	6.3	
	WPB900x300x291.46	I	24	5	10	50	40	60	10	8	65	0	54	3	35.3	7.5	25.2	5.3	
	WPB800x300x262.34	I	24	5	10	50	40	60	10	8	65	0	54	3	35.3	7.5	25.2	5.3	

TABLE FOR CONNECTION SCHEDULE (CONT.)

(B2) Secondary Beam	(B1) Main Beam	Connection Type	Bolt Dia (Db) (mm)	No. of BoltRows	Gap (Gh) (mm)	Edge Dist. (E1) (mm)	End dist. (E2) (mm)	Bolt Spacing (P1) (mm)	Thk. of Fin Plate (T) (mm)	Weld Size (W) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE E50		STEEL GRADE E250		
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)	
MB-400	WPB700x300x240.51	II	24	5	10	50	50	60	10	8	60	0	55	3	36.0	7.5	25.7	5.3	
	WPB700x300x204.48	II	24	5	10	50	50	60	10	8	55	0	55	3	36.0	7.5	25.7	5.3	
	WPB700x300x149.89	II	24	5	10	50	50	60	10	8	45	0	55	3	36.0	7.5	25.7	5.3	
	WPB600x300x177.78	II	24	5	10	50	50	60	10	8	55	0	55	3	36.0	7.5	25.7	5.3	
	WPB600x300x128.79	II	24	5	10	50	50	60	10	8	45	0	57	3	37.3	7.5	26.6	5.3	
	WPB300x300x125.81	III	24	4	10	40	40	60	8	8	45	95	0	35	1	22.9	2.5	16.3	1.8
	MB600	II	24	5	10	50	50	60	10	8	45	0	0	57	4	37.3	10.0	26.6	7.1
	MB500	II	24	5	10	50	50	60	10	8	35	0	0	57	4	37.3	10.0	26.6	7.1
	MB450	II	24	5	10	50	50	60	10	8	35	0	0	57	4	37.3	10.0	26.6	7.1
	MB400	III	24	5	10	50	50	60	10	8	30	30	0	54	5	35.3	12.5	25.2	8.9
	MC400	III	24	5	10	50	50	60	10	8	30	35	0	54	3	35.3	7.5	25.2	5.3
	MB-300	MB300	III	20	4	10	40	40	55	8	6	30	130	33	1	21.6	2.5	15.4	1.8
MC300		III	20	4	10	40	40	55	8	6	30	130	33	1	21.6	2.5	15.4	1.8	
WPB900x300x291.46		I	24	3	10	50	45	60	10	10	65	0	45	1	19.1	1.9	13.6	1.3	
WPB800x300x262.34		I	24	3	10	50	45	60	10	10	65	0	45	1	19.1	1.9	13.6	1.3	
WPB700x300x240.51		I	24	3	10	50	50	60	10	8	60	0	45	1	19.1	1.9	13.6	1.3	
WPB700x300x204.48		I	24	3	10	50	50	60	10	8	55	0	45	1	19.1	1.9	13.6	1.3	
WPB700x300x149.89		I	24	3	10	50	50	60	10	8	45	0	45	1	19.1	1.9	13.6	1.3	
WPB500x300x177.78		II	24	3	10	50	50	60	10	8	55	0	45	1	19.1	1.9	13.6	1.3	
WPB600x300x128.79		II	24	3	10	50	50	60	10	8	45	0	45	1	19.1	1.9	13.6	1.3	
WPB360x300x125.81		II	24	3	10	50	50	60	10	8	45	0	45	2	19.1	3.7	13.6	2.7	
WPB300x300x100.85		III	24	3	10	50	40	60	10	8	45	50	0	45	1	19.1	1.9	13.6	1.3
MB600		I	24	3	10	50	50	60	10	8	45	0	0	29	1	12.3	1.9	8.8	1.3
MB500	II	24	3	10	50	50	60	10	8	35	0	0	45	2	19.1	3.7	13.6	2.7	
MB450	II	24	3	10	50	50	60	10	8	35	0	0	45	2	19.1	3.7	13.6	2.7	
MB400	II	24	3	10	50	50	60	10	8	35	0	0	45	2	19.1	3.7	13.6	2.7	
		II	24	3	10	50	50	60	10	8	30	0	45	2	19.1	3.7	13.6	2.7	

TABLE FOR CONNECTION SCHEDULE (CONT.)

Secondary Beam (B2)	Main Beam (B1)	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G _h) (mm)	Edge Dist (E ₁) (mm)	End dist (E ₂) (mm)	Bolt Spacing (P ₁) (mm)	Thic of Rin Plate (T _r) (mm)	Weld Size (w) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE E350		STEEL GRADE E250	
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)
MB300	MC400	II	24	3	10	50	50	60	10	8	30	0	34	1	14.4	1.9	10.3	1.3
	MB300	III	20	4	10	40	40	50	8	6	30	30	45	1	19.1	1.9	13.6	1.3
	MC300	III	20	4	10	40	40	50	8	6	30	30	34	1	14.4	1.9	10.3	1.3
	MB250	III	20	3	10	40	40	50	8	6	30	80	33	1	14.0	1.9	10.0	1.3
	MC250	III	20	3	10	40	40	50	8	6	30	80	24	1	10.2	1.9	7.3	1.3
	WPB900x300x291.46	I	20	3	10	40	35	50	8	8	65	0	42	1	13.3	1.5	9.5	1.1
	WPB800x300x262.34	I	20	3	10	40	35	50	8	8	65	0	42	1	13.3	1.5	9.5	1.1
	WPB700x300x240.51	I	20	3	10	40	40	50	8	8	60	0	42	1	13.3	1.5	9.5	1.1
	WPB700x300x204.48	I	20	3	10	40	40	50	8	8	55	0	42	1	13.3	1.5	9.5	1.1
	WPB700x300x149.89	I	20	3	10	40	40	50	8	8	45	0	42	1	13.3	1.5	9.5	1.1
MB250	WPB600x300x177.78	I	20	3	10	40	40	50	8	8	55	0	42	1	13.3	1.5	9.5	1.1
	WPB600x300x128.79	I	20	3	10	40	40	50	8	8	45	0	42	1	13.3	1.5	9.5	1.1
	WPB360x300x125.81	II	20	3	10	40	40	50	8	8	45	0	42	1	13.3	1.5	9.5	1.1
	WPB300x300x100.85	II	20	3	10	40	40	50	8	8	45	0	42	1	13.3	1.5	9.5	1.1
	WPB250x250x73.15	II	20	3	10	40	40	35	50	8	40	0	42	1	13.3	1.5	9.5	1.1
	MB600	I	20	3	10	40	40	50	8	8	45	0	42	1	13.3	1.5	9.5	1.1
	MB500	I	20	3	10	40	40	50	8	8	35	0	42	1	13.3	1.5	9.5	1.1
	MB450	II	20	3	10	40	40	50	8	8	35	0	42	1	13.3	1.5	9.5	1.1
	MB400	II	20	3	10	40	40	50	8	8	30	0	42	1	13.3	1.5	9.5	1.1
	MC400	II	20	3	10	40	40	50	8	8	30	0	34	1	10.8	1.5	7.7	1.1
MB250	MB300	II	20	3	10	40	40	50	8	6	30	0	42	1	13.3	1.5	9.5	1.1
	MC300	II	20	3	10	40	40	50	8	6	30	0	33	1	10.5	1.5	7.5	1.1
	MB250	III	20	3	10	40	40	50	8	6	30	30	42	1	13.3	1.5	9.5	1.1
	MC250	III	20	3	10	40	40	50	8	6	30	30	33	1	10.5	1.5	7.5	1.1
	MB200	III	20	2	10	40	40	40	70	8	5	75	28	1	8.9	1.5	6.3	1.1
	MC200	III	20	2	10	40	40	40	70	8	5	75	25	1	7.9	1.5	5.6	1.1

TABLE FOR CONNECTION SCHEDULE (CONT.)

(B2) Secondary Beam	(B1) Main Beam	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G _h) (mm)	Edge Dist. (E ₁) (mm)	End dist. (E ₂) (mm)	Bolt Spacing (P ₁) (mm)	Thk of Fin Plate (T _f) (mm)	Weld Size (W) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE E250		STEEL GRADE E250	
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)
	WPB900x300x291.46	I	20	2	10	40	40	55	8	8	65	0	29	1	6.1	1.0	4.4	0.7
	WPB800x300x262.34	I	20	2	10	40	40	55	8	8	65	0	29	1	6.1	1.0	4.4	0.7
	WPB700x300x240.51	I	20	2	10	40	40	60	8	8	60	0	31	1	6.5	1.0	4.7	0.7
	WPB700x300x204.48	I	20	2	10	40	40	60	8	8	55	0	34	1	7.1	1.0	5.1	0.7
	WPB700x300x149.89	I	20	2	10	40	40	60	8	8	45	0	34	1	7.1	1.0	5.1	0.7
	WPB600x300x177.78	I	20	2	10	40	40	60	8	8	55	0	34	1	7.1	1.0	5.1	0.7
	WPB600x300x128.79	I	20	2	10	40	40	60	8	8	45	0	34	1	7.1	1.0	5.1	0.7
	WPB360x300x125.81	II	20	2	10	40	40	60	8	8	45	0	37	1	7.7	1.0	5.6	0.7
	WPB300x300x100.85	II	20	2	10	40	40	60	8	8	45	0	39	1	8.2	1.0	5.9	0.7
	WPB250x250x73.15	II	20	2	10	40	40	60	8	8	40	0	39	1	8.2	1.0	5.9	0.7
MB200	WPB200x200x42.26	III	20	2	10	40	40	50	8	6	30	40	25	1	5.2	1.0	3.8	0.7
	MB600	I	20	2	10	40	40	60	8	8	45	0	34	1	7.1	1.0	5.1	0.7
	MB500	I	20	2	10	40	40	60	8	8	35	0	34	1	7.1	1.0	5.1	0.7
	MB450	I	20	2	10	40	40	60	8	8	35	0	34	1	7.1	1.0	5.1	0.7
	MB400	I	20	2	10	40	40	60	8	8	35	0	34	1	7.1	1.0	5.1	0.7
	MC400	I	20	2	10	40	40	60	8	8	30	0	34	1	7.1	1.0	5.1	0.7
	MB300	II	20	2	10	40	40	60	8	8	30	0	34	1	7.1	1.0	5.1	0.7
	MC300	II	20	2	10	40	40	60	8	6	30	0	34	1	7.1	1.0	5.1	0.7
	MB250	II	20	2	10	40	40	60	8	6	30	0	34	1	7.1	1.0	5.1	0.7
	MC250	II	20	2	10	40	40	60	8	6	30	0	34	1	7.1	1.0	5.1	0.7
	MB200	III	20	2	10	40	40	65	8	5	25	25	34	1	7.1	1.0	5.1	0.7
	MC200	III	20	2	10	40	40	65	8	5	25	25	34	1	7.1	1.0	5.1	0.7
MC400	WPB900x300x291.46	I	24	5	10	50	45	60	10	10	65	0	42	4	27.1	8.1	19.4	5.8
	WPB800x300x262.34	I	24	5	10	50	45	60	10	10	65	0	42	4	27.1	8.1	19.4	5.8

TABLE FOR CONNECTION SCHEDULE (CONT.)

Secondary Beam (B2)	Main Beam (B1)	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G _b) (mm)	Edge Dist. (E1) (mm)	End Dist. (E2) (mm)	Bolt Spacing (P1) (mm)	Thick. of End Plate (T _p) (mm)	Weld Size (w) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE S50		STEEL GRADE E250		
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)	
MC400	WPB700x300x240.51	II	24	5	10	50	45	60	10	8	60	0	42	4	27.2	8.1	19.4	5.8	
	WPB700x300x204.48	II	24	5	10	50	45	60	10	8	55	0	42	4	27.2	8.1	19.4	5.8	
	WPB700x300x149.89	II	24	5	10	50	45	60	10	8	45	0	42	4	27.2	8.1	19.4	5.8	
	WPB600x300x177.78	II	24	5	10	50	45	60	10	8	55	0	42	4	27.2	8.1	19.4	5.8	
	WPB600x300x128.79	II	24	5	10	50	45	60	10	8	45	0	42	4	27.2	8.1	19.4	5.8	
	WPB360x300x125.81	III	24	4	10	50	40	60	10	8	45	95	36	36	4	23.3	8.1	16.6	5.8
	MB600	II	24	5	10	50	50	60	10	8	45	0	44	44	4	28.5	8.1	20.3	5.8
	MB500	II	24	5	10	50	50	60	10	8	35	0	44	44	4	28.5	8.1	20.3	5.8
	MB450	II	24	5	10	50	50	60	10	8	35	0	44	44	4	28.5	8.1	20.3	5.8
	MB400	III	24	5	10	50	50	60	10	8	30	30	42	42	3	27.2	6.1	19.4	4.3
	MC400	III	24	5	10	50	50	60	10	8	30	30	42	42	3	27.2	6.1	19.4	4.3
	MB300	III	20	4	10	40	40	40	53	8	6	30	130	25	1	16.2	2.0	11.5	1.4
MC300	III	20	4	10	40	40	40	53	8	6	30	130	25	1	16.2	2.0	11.5	1.4	
MC300	WPB900x300x291.46	I	24	3	10	50	45	60	10	8	65	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB800x300x262.34	I	24	3	10	50	45	60	10	8	65	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB700x300x240.51	I	24	3	10	50	50	60	10	8	60	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB700x300x204.48	I	24	3	10	50	50	60	10	8	55	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB700x300x149.89	I	24	3	10	50	50	60	10	8	45	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB600x300x177.78	II	24	3	10	50	50	60	10	8	55	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB600x300x128.79	II	24	3	10	50	50	60	10	8	45	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB360x300x125.81	II	24	3	10	50	50	60	10	8	45	0	44	1.5	18.9	2.2	13.5	1.6	
	WPB300x300x100.85	III	24	3	10	50	40	60	10	8	45	50	28	28	1	12.0	1.5	8.6	1.1
	MB600	I	24	3	10	50	50	60	10	8	45	0	44	44	1.5	19.0	2.2	13.5	1.6
	MB500	II	24	3	10	50	50	60	10	8	35	0	44	44	1.5	19.0	2.2	13.5	1.6
	MB450	II	24	3	10	50	50	60	10	8	35	0	44	44	1.5	19.0	2.2	13.5	1.6
MB400	II	24	3	10	50	50	60	10	8	30	0	44	44	1.5	19.0	2.2	13.5	1.6	

TABLE FOR CONNECTION SCHEDULE (CONT.)

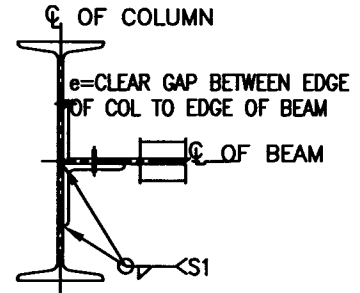
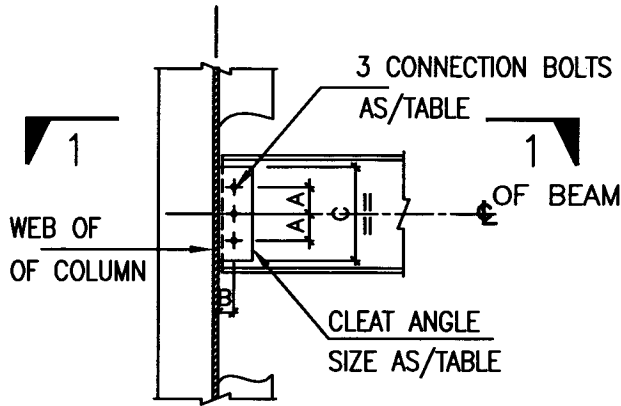
Secondary Beam (B2)	Main Beam (B1)	Connection Type	Bolt Dia (D _b) (mm)	No. of Bolt Rows	Gap (G ₁) (mm)	Edge Dist. (E ₁) (mm)	End dist. (E ₂) (mm)	Bolt Spacing (P ₁) (mm)	Thk of Rin Plate (T ₁) (mm)	Weld Size (w) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) ¹	Axial Capacity (%) ²	STEEL GRADE E250		STEEL GRADE E250	
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)
MC300	MC400	II	24	3	10	50	50	60	10	8	30	0	37	1.5	16.0	2.2	11.3	1.6
	MB300	III	20	4	10	40	40	50	8	6	30	30	37	1.5	16.0	2.2	11.3	1.6
	MC300	III	20	4	10	40	40	50	8	6	30	30	37	1.5	16.0	2.2	11.3	1.6
	MB250	III	20	3	10	40	40	50	8	6	30	80	20	0.5	8.6	0.7	6.1	0.5
	MC250	III	20	3	10	40	40	50	8	6	30	80	20	0.5	8.6	0.7	6.1	0.5
	WPB900x300x291.46	I	20	3	10	40	35	50	8	8	65	0	32	1	10.6	1.2	7.5	0.9
MC250	WPB800x300x262.34	I	20	3	10	40	35	50	8	8	65	0	32	1	10.6	1.2	7.5	0.9
	WPB700x300x240.51	I	20	3	10	40	40	50	8	8	60	0	32	1	10.6	1.2	7.5	0.9
	WPB700x300x204.48	I	20	3	10	40	40	50	8	8	55	0	32	1	10.6	1.2	7.5	0.9
	WPB700x300x149.89	I	20	3	10	40	40	50	8	8	45	0	32	1	10.6	1.2	7.5	0.9
	WPB600x300x177.78	I	20	3	10	40	40	50	8	8	55	0	32	1	10.6	1.2	7.5	0.9
	WPB600x300x128.79	I	20	3	10	40	40	50	8	8	45	0	32	1	10.6	1.2	7.5	0.9
	WPB350x300x125.81	II	20	3	10	40	40	50	8	8	45	0	32	1	10.6	1.2	7.5	0.9
	WPB300x300x100.85	II	20	3	10	40	40	50	8	8	45	0	32	1	10.6	1.2	7.5	0.9
	WPB250x250x73.15	II	20	3	10	40	35	50	8	8	40	0	32	1	10.6	1.2	7.5	0.9
	MB600	I	20	3	10	40	40	50	8	8	45	0	32	1	10.6	1.2	7.6	0.9
	MB500	I	20	3	10	40	40	50	8	8	35	0	32	1	10.6	1.2	7.6	0.9
	MB450	II	20	3	10	40	40	50	8	8	35	0	32	1	10.6	1.2	7.6	0.9
	MB400	II	20	3	10	40	40	50	8	8	30	0	32	1	10.6	1.2	7.6	0.9
	MC400	II	20	3	10	40	40	50	8	8	30	0	32	1	10.6	1.2	7.6	0.9
MB300	II	20	3	10	40	40	50	8	8	30	0	32	1	10.6	1.2	7.6	0.9	
MC300	II	20	3	10	40	40	50	8	8	30	0	32	1	10.6	1.2	7.6	0.9	
MB250	III	20	3	10	40	40	50	8	8	30	30	30	32	1	10.6	1.2	7.6	0.9
MC250	III	20	3	10	40	40	50	8	8	30	30	30	32	1	10.6	1.2	7.5	0.9
MB200	III	20	2	10	40	40	40	70	8	5	30	75	20	0.5	6.3	0.6	4.5	0.4
MC200	III	20	2	10	40	40	40	70	9	5	30	75	20	0.5	6.3	0.6	4.5	0.4

TABLE FOR CONNECTION SCHEDULE (CONT.)

Secondary Beam (R2)	Main Beam (B1)	Connection Type	Bolt Dia (Db)	No. of Bolt Rows	Gap (Gh)	Edge Dist. (E1)	End dist. (E2)	Bolt Spacing (P1)	Thk of Rin Plate (Tr)	Weld Size (W)	Top Notch (A)	Bottom Notch (B)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE E350		STEEL GRADE E250		
															Shear Capacity (MT)	Axial Capacity (MT)	Shear Capacity (MT)	Axial Capacity (MT)	
MC200	WPB500x300x291.46	I	20	2	10	40	30	60	8	6	65	0	28	1	6.4	0.9	4.6	0.6	
	WPB600x300x262.34	I	20	2	10	40	30	60	8	6	65	0	28	1	6.4	0.9	4.6	0.6	
	WPB700x300x240.51	I	20	2	10	40	35	60	8	6	60	0	30	1	6.8	0.9	4.9	0.6	
	WPB700x300x204.48	I	20	2	10	40	40	60	8	6	55	0	30	1	6.8	0.9	4.9	0.6	
	WPB700x300x149.89	I	20	2	10	40	40	60	8	6	45	0	30	1	6.8	0.9	4.9	0.6	
	WPB600x300x177.78	I	20	2	10	40	40	60	8	6	55	0	30	1	6.8	0.9	4.9	0.6	
	WPB600x300x128.79	I	20	2	10	40	40	60	8	6	45	0	34	1	7.8	0.9	5.5	0.6	
	WPB360x300x125.81	II	20	2	10	40	40	60	8	6	45	0	34	1	7.8	0.9	5.5	0.6	
	WPB300x300x100.85	II	20	2	10	40	40	60	8	6	45	0	34	1	7.8	0.9	5.5	0.6	
	WPB250x250x73.15	II	20	2	10	40	40	60	8	6	40	0	34	1	7.8	0.9	5.5	0.6	
	WPB200x200x42.26	III	20	2	10	40	35	60	8	6	30	40	0	25	1	5.7	0.9	4.1	0.6
	MB600	I	20	2	10	40	40	60	8	6	45	0	34	1	7.8	0.9	5.5	0.6	
	MB500	I	20	2	10	40	40	60	8	6	35	0	34	1	7.8	0.9	5.5	0.6	
	MB450	I	20	2	10	40	40	60	8	6	35	0	34	1	7.8	0.9	5.5	0.6	
	MB400	I	20	2	10	40	40	60	8	6	30	0	34	1	7.8	0.9	5.5	0.6	
	MB300	II	20	2	10	40	40	60	8	6	30	0	34	1	7.8	0.9	5.5	0.6	
MB250	II	20	2	10	40	40	60	8	6	25	0	34	1	7.8	0.9	5.5	0.6		
MC400	I	20	2	10	40	40	60	8	6	30	0	34	1	7.8	0.9	5.5	0.6		
MC300	II	20	2	10	40	40	60	8	6	30	0	34	1	7.8	0.9	5.5	0.6		
MC250	II	20	2	10	40	40	60	8	6	30	0	34	1	7.8	0.9	5.5	0.6		
MB200	III	20	2	10	40	40	60	8	6	5	25	25	34	1	7.8	0.9	5.5	0.6	
MC200	III	20	2	10	40	40	60	8	6	5	25	25	34	1	7.8	0.9	5.5	0.6	
MC150	WPB600x300x128.79	I	16	2	10	30	22	50	8	6	40	0	24	1	3.8	0.7	2.7	0.5	
	WPB300x300x100.85	II	16	2	10	30	25	50	8	6	43	0	24	1	3.8	0.7	2.7	0.5	
	WPB250x250x73.15	II	16	2	10	30	25	50	8	6	40	0	30	1	4.7	0.7	3.4	0.5	
	WPB200x200x42.26	II	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.6	0.5	

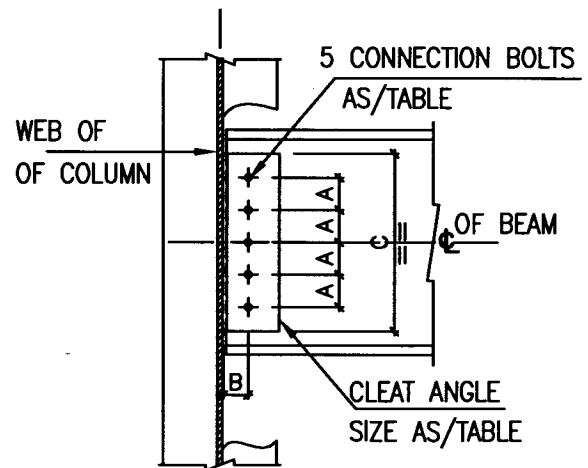
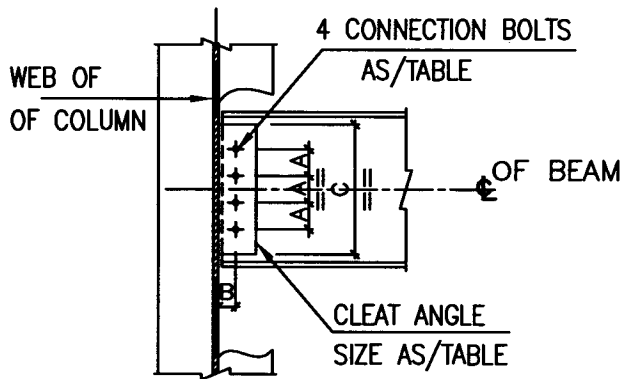
TABLE FOR CONNECTION SCHEDULE (CONT.)

(B2) Secondary Beam	(B1) Main Beam	Connection Type	Bolt Dia (Db) (mm)	No. of Bolt Rows	Gap (Gh) (mm)	Ridge Dist. (R1) (mm)	Rud dist. (R2) (mm)	Bolt Spacing (P1) (mm)	Thk of Rip Plate (TR) (mm)	Weld Size (W) (mm)	Top Notch (A) (mm)	Bottom Notch (B) (mm)	Shear Capacity (%) *	Axial Capacity (%) #	STEEL GRADE E250		STEEL GRADE E250	
															Shear Capacity (MT) (MT)	Axial Capacity (MT) (MT)	Shear Capacity (MT) (MT)	Axial Capacity (MT) (MT)
MC150	MB600	I	16	2	10	30	22	50	8	6	40	0	32	1	5.0	0.7	3.6	0.5
	MB500	I	16	2	10	30	25	50	8	6	35	0	32	1	5.0	0.7	3.8	0.5
	MB450	I	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.8	0.5
	MB400	I	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.8	0.5
	MC400	I	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.8	0.5
	MB300	I	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.8	0.5
	MC300	I	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.8	0.5
	MB250	II	16	2	10	30	25	50	8	6	25	0	32	1	5.0	0.7	3.8	0.5
	MC250	II	16	2	10	30	25	50	8	6	30	0	32	1	5.0	0.7	3.8	0.5
	MB200	II	16	2	10	30	25	50	8	5	25	0	32	1	5.0	0.7	3.6	0.5
	MC200	II	16	2	10	30	25	50	8	5	25	0	32	1	5.0	0.7	3.6	0.5
	MC150	III	16	2	10	30	25	50	8	5	20	20	32	1	5.0	0.7	3.6	0.5
MC100	MC400	I	12	2	10	20	16	30	6	5	30	0	25	1	2.3	0.4	1.7	0.3
	MC300	I	12	2	10	20	16	30	6	5	30	0	25	1	2.3	0.4	1.7	0.3
	MC250	I	12	2	10	20	16	30	6	5	30	0	25	1	2.3	0.4	1.7	0.3
	MC200	I	12	2	10	20	18	30	6	5	25	0	25	1	2.3	0.4	1.7	0.3
MC150	II	12	2	10	20	18	30	6	5	20	0	25	1	2.3	0.4	1.7	0.3	



TYPE-I

SECTION-1-1
(TYP FOR TYPE-I TO III)



TYPE-II

TYPE-III

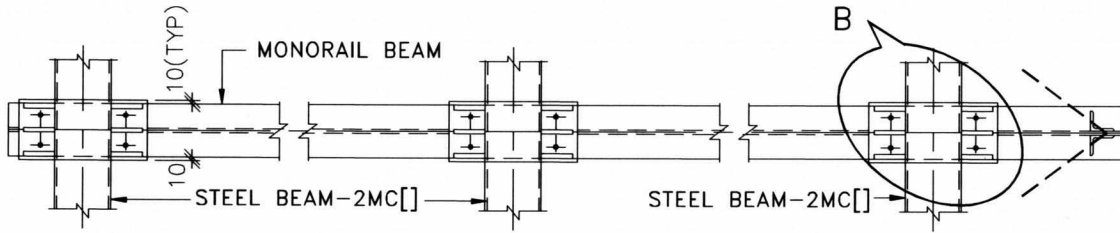
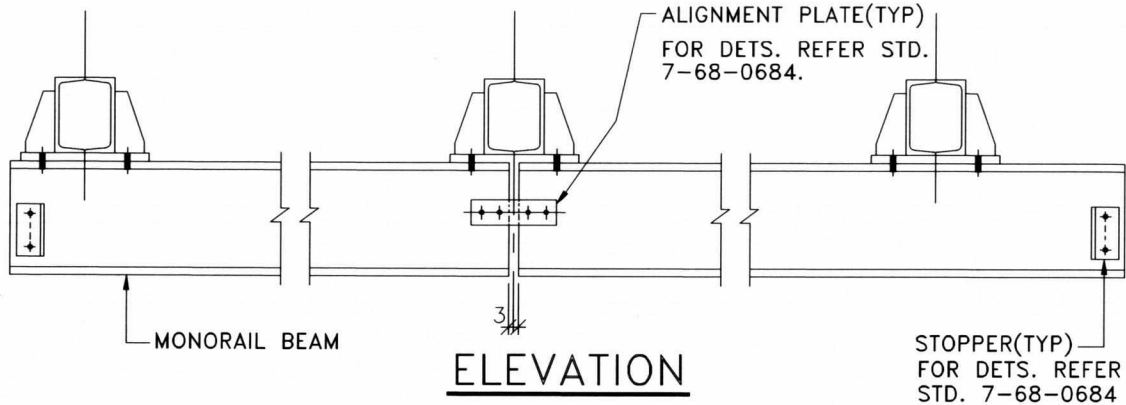
0	24.12.20	ISSUED AS STANDARD	GR	SS/PM	AS	SM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
Approved by						
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SHEAR CONNECTION BETWEEN BEAM AND COLUMN												
SL. NO	BEAM SIZE	TYPE	CLEAT ANGLE SIZE	NO OF BOLTS	DIA OF BOLTS	A	B	C	S1	e	% SHEAR CAPACITY OF THE CONNECTION WRT TO BEAM SHEAR CAPACITY	MINIMUM SHEAR CAPACITY (MT) OF THE CONNECTION
1	MB200	I	90x90x10	3	16	40	50	135	6	15	30	6.3
2	MB250	I	90x90x10	3	20	50	50	180	6	10	43	13.6
3	MB300	II	90x90x10	4	20	50	50	230	6	10	52	21.5
4	MB400	II	130x130x12	4	24	60	80	300	8	30	47	30.7
5	MB450	II	130x130x12	4	24	60	80	340	8	30	33	25.6
6	MB500	III	150x150x16	5	24	60	90	420	8	40	36	33.7
7	MB600	III	150x150x16	5	30	75	90	480	8	30	48	59.9

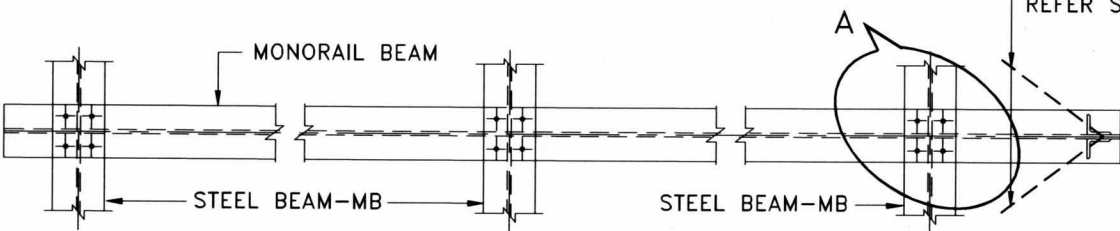
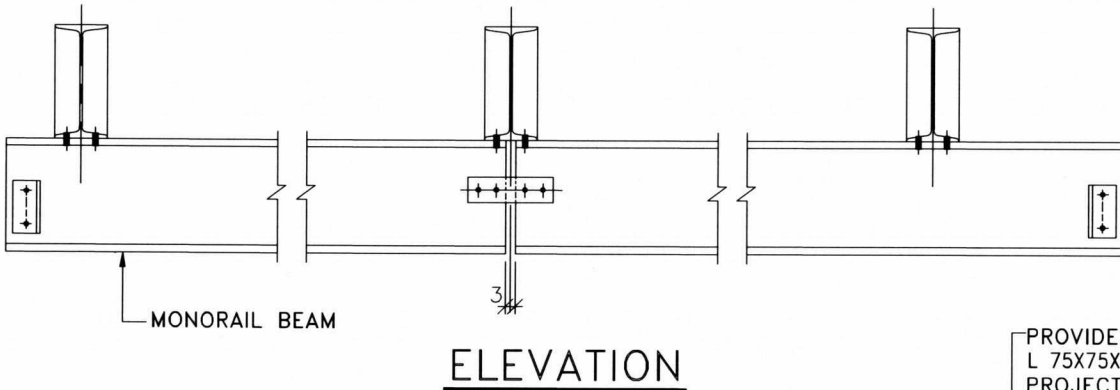
NOTES:-

1. ALL DIMENSIONS ARE IN mm.
2. THIS STANDARD IS VALID FOR STRUCTURAL STEEL OF GRADE E350 CONFIRMING TO IS:2062
3. COLUMN & BEAM SECTIONS SHALL CONFIRM TO IS:12778/IS:808
4. CONNECTION DESIGN IS AS PER CLAUSE 10.3 (BEARING TYPE BOLTS) OF IS:800-2007
5. ALL CONNECTION BOLTS SHALL BE OF PROPERTY CLASS 8.8 (AS PER TABLE) CONFIRMING TO IS:3757 & IS:4000
6. HEXAGONAL NUTS SHALL CONFIRM TO IS:6623
7. WASHERS SHALL CONFIRM TO IS:6649
8. ALL BOLTS, NUTS & WASHERS SHALL BE GALVANISED AS PER IS:1367, PART XIII.
9. WELDING ELECTRODE SHALL BE COMPATIBLE WITH E350 GRADE OF STEEL.
10. THIS STANDARD IS NOT APPLICABLE FOR EQUIPMENT SUPPORTING BEAMS.

0	24.12.20	ISSUED AS STANDARD	GR	SS/PM	AS	SM
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman



MONORAIL CONNECTION WITH 2 MC[]

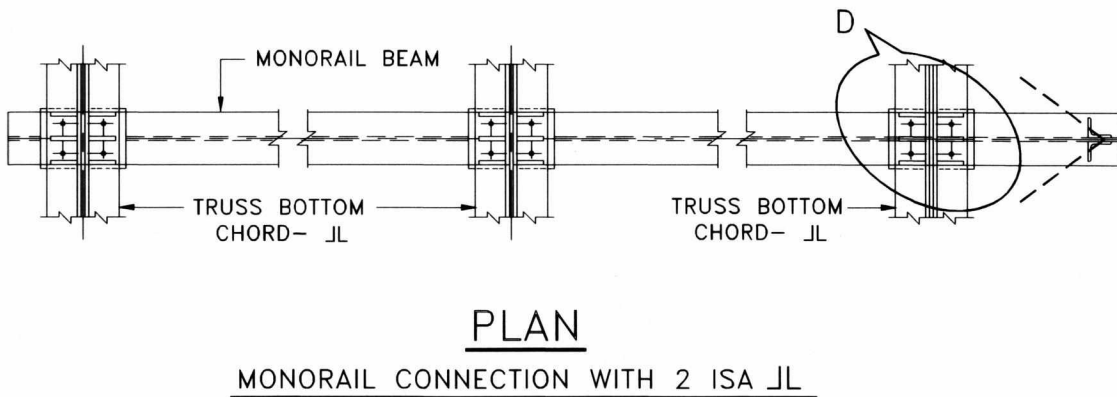
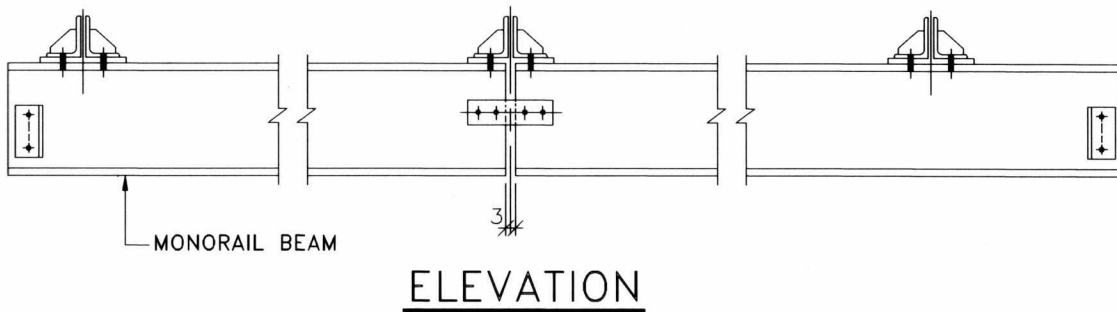
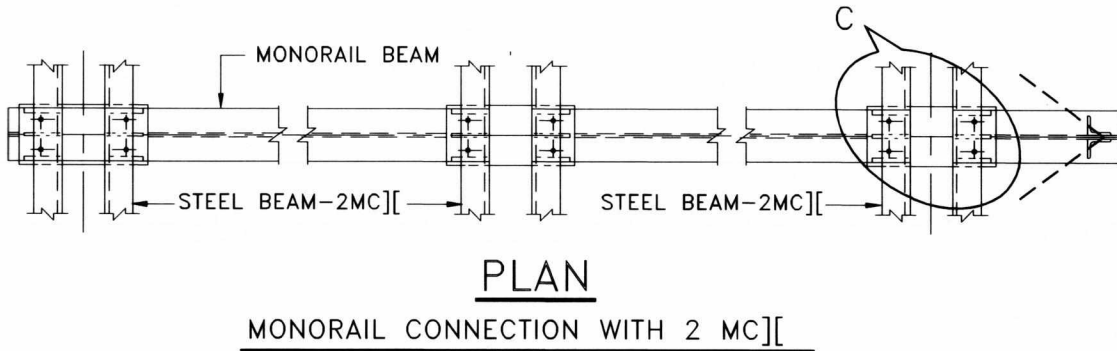
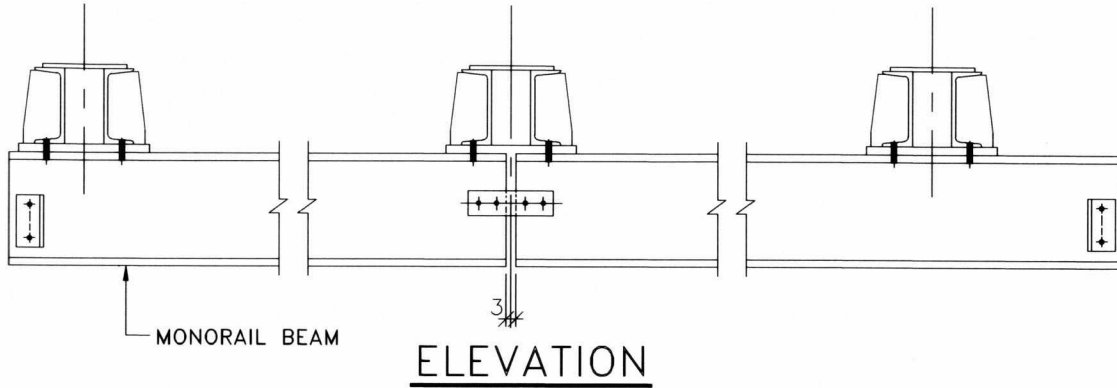


MONORAIL CONNECTION WITH MB

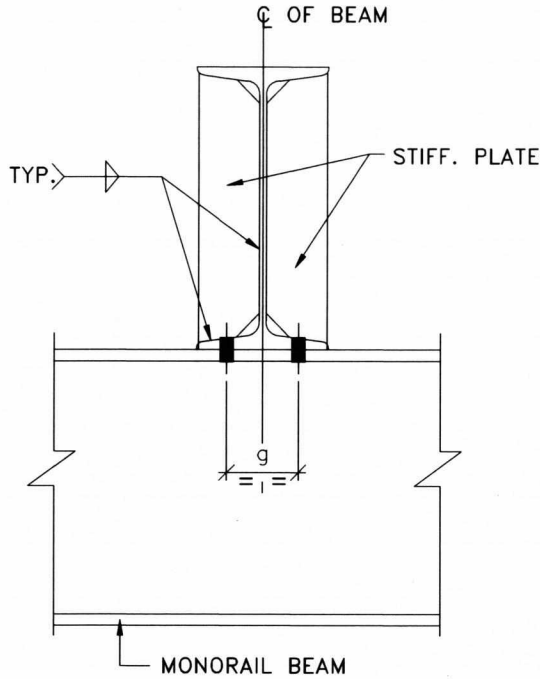
PROVIDE PLAN BRACING
 L 75X75X6 FOR CANTILEVER
 PROJECTION EXCEEDING
 1.5 m (TYP) FOR DET.
 REFER SHEET 8 OF 9

APPLICABLE FOR LIFT
 CAPACITY UPTO 4.0 T

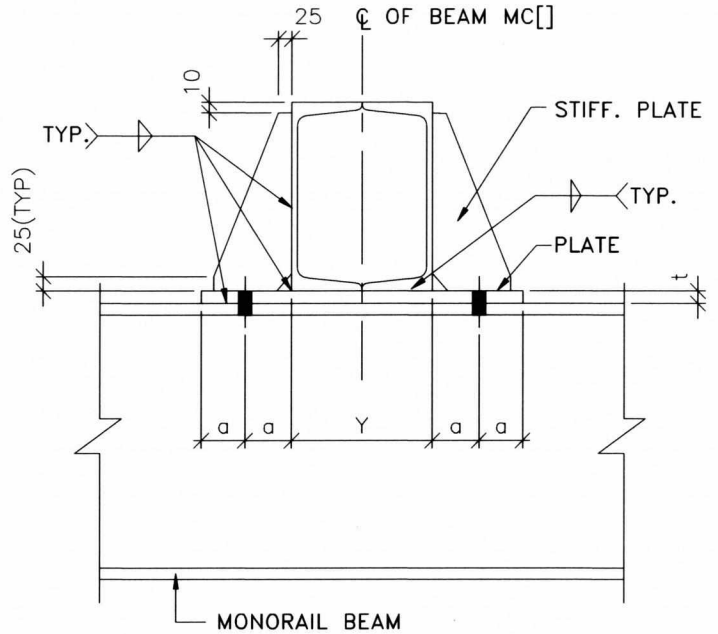
5	14-12-23	REVISED AND ISSUED AS STANDARD	AV	RM	ANURAG SINHA	MAINAK NANDI
4	06-06-18	REAFFIRMED AND ISSUED AS STANDARD	CS	AVM	R.SRVIVASTAVA	RK TRIVEDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman



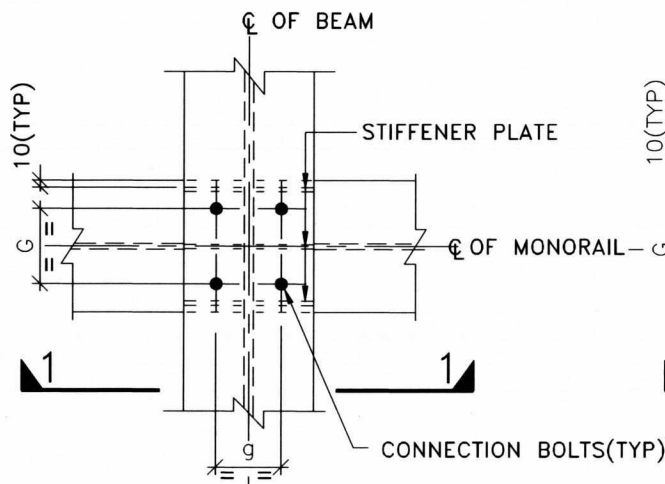
APPLICABLE FOR LIFT
CAPACITY UPTO 4.0 T



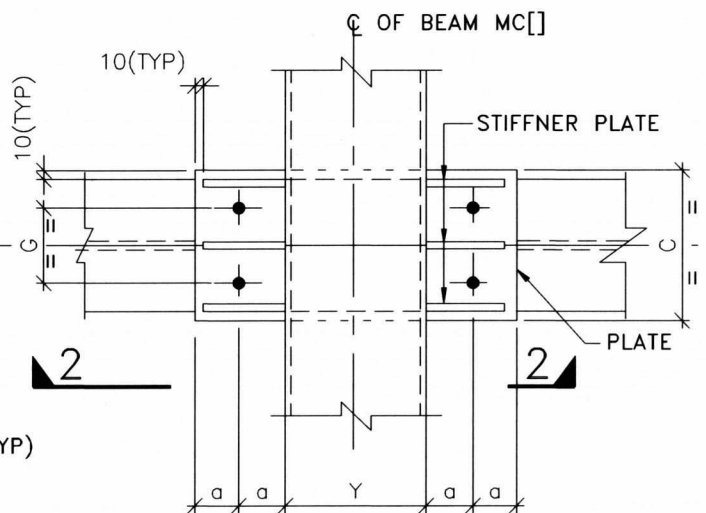
VIEW 1-1



VIEW 2-2

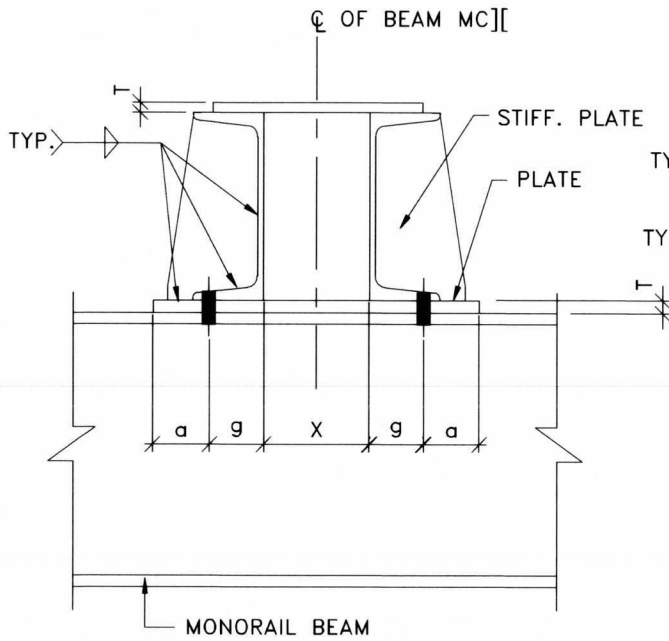


DETAIL-A

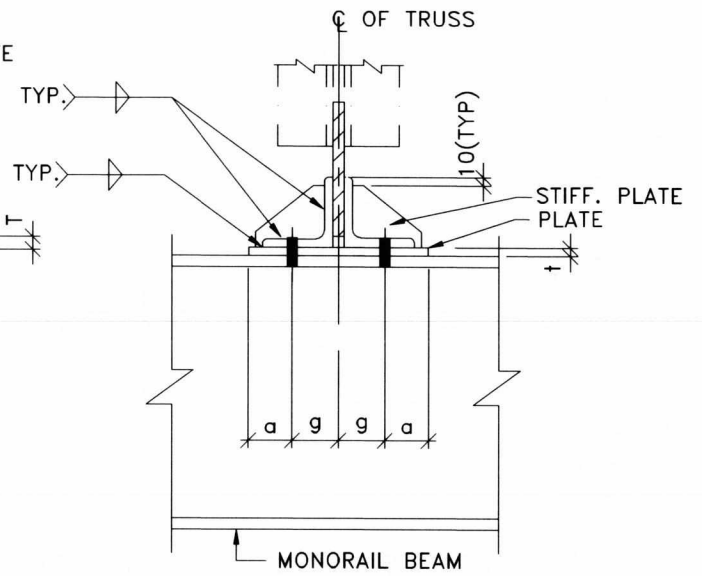


DETAIL-B

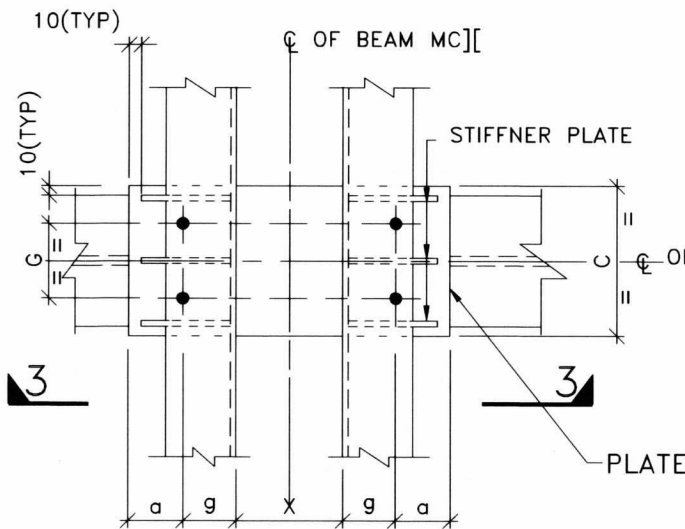
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CAPACITY UPTO 4.0 T



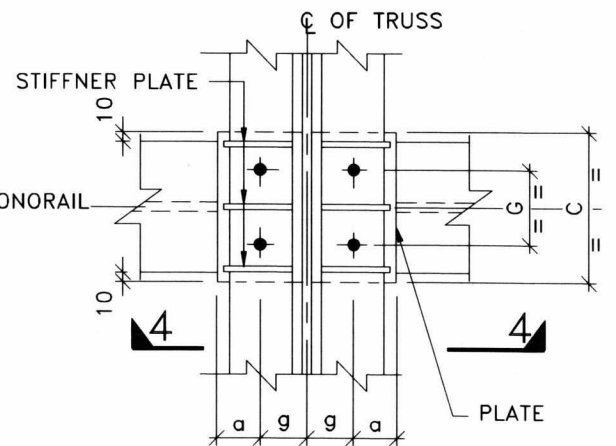
VIEW 3-3



VIEW 4-4

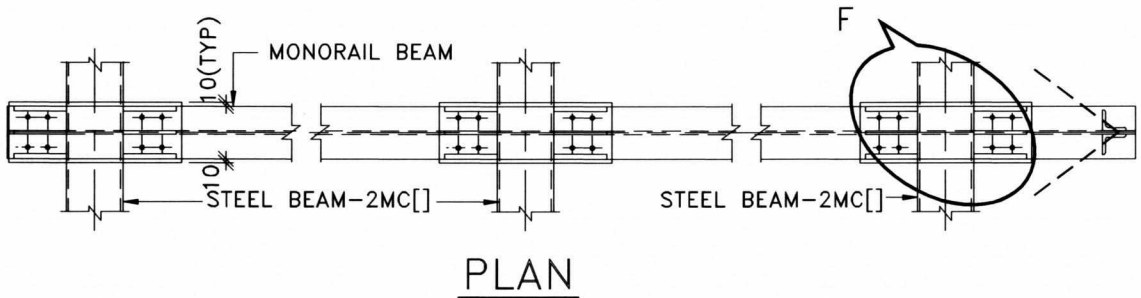
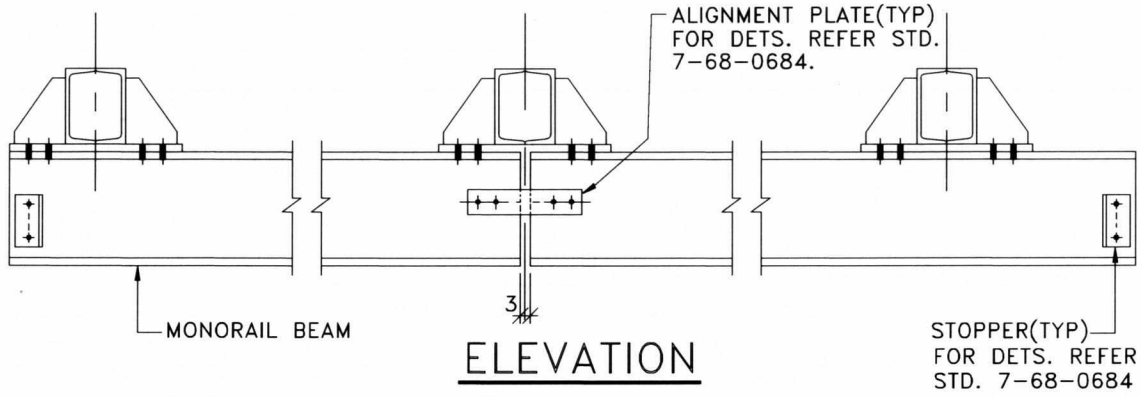


DETAIL-C

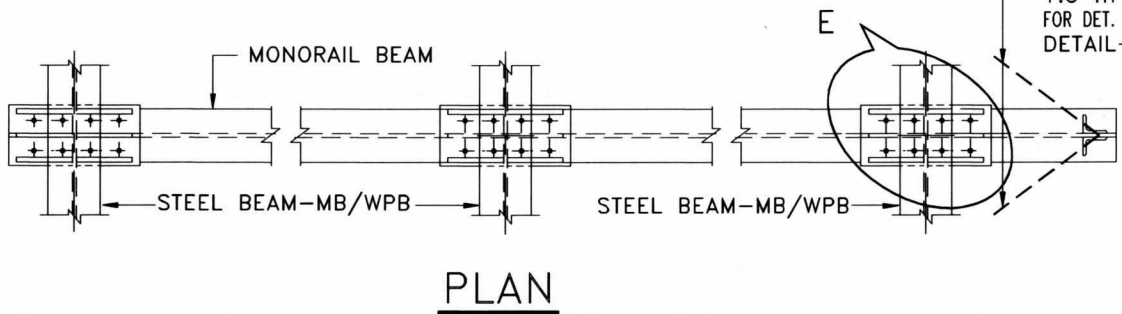
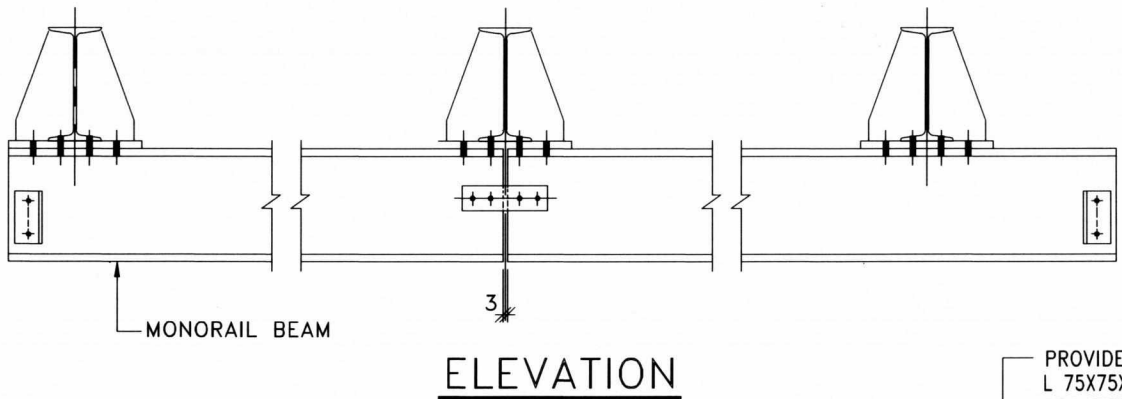


DETAIL-D

APPLICABLE FOR LIFT
 CAPACITY UPTO 4.0 T

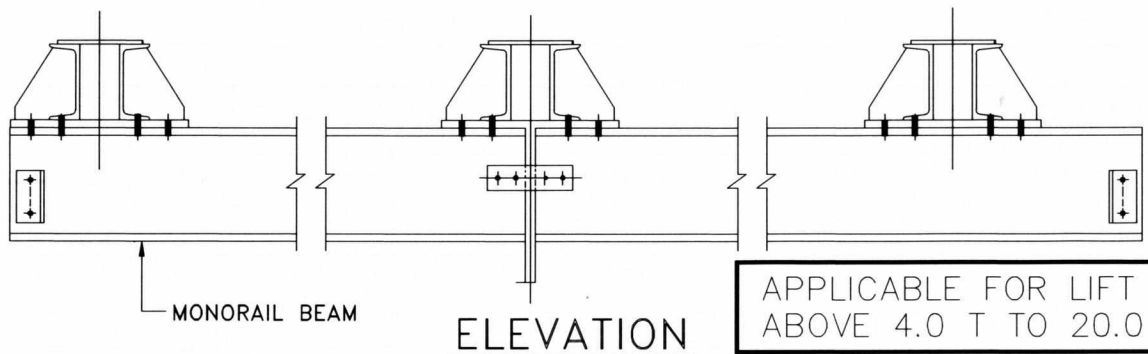


MONORAIL CONNECTION WITH 2 MC[]

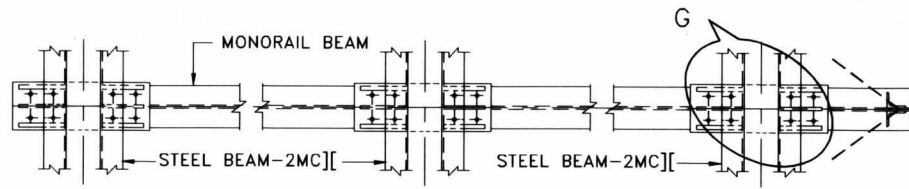


MONORAIL CONNECTION WITH MB/WPB

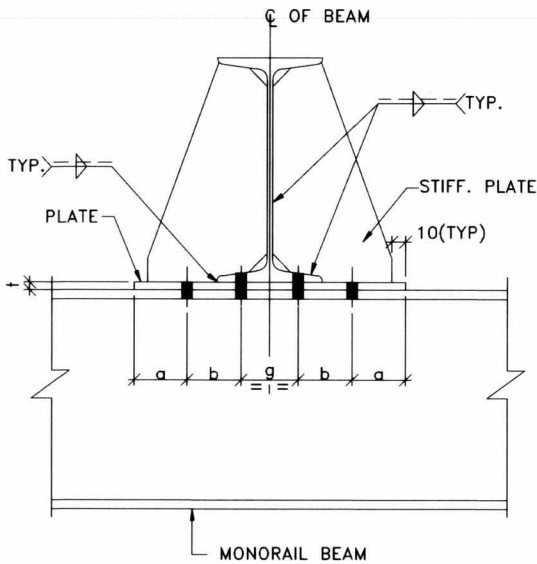
PROVIDE PLAN BRACING
L 75X75X6 FOR CANTILEVER
PROJECTION EXCEEDING
1.5 m (TYP)
FOR DET. REFER SHEET 8 OF 9
DETAIL-H (TYP)



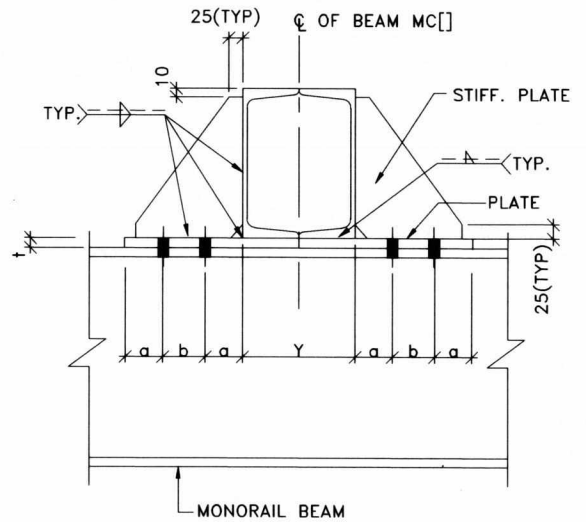
APPLICABLE FOR LIFT CAPACITY
ABOVE 4.0 T TO 20.0 T



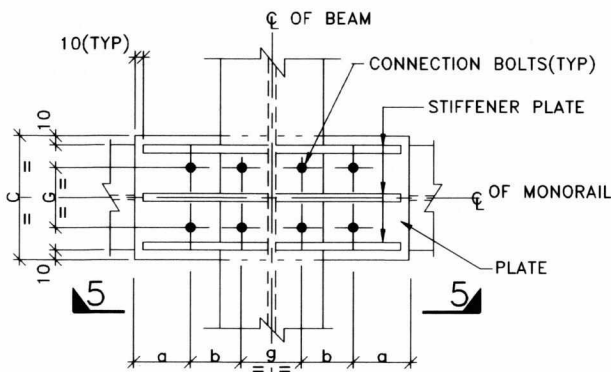
PLAN
MONORAIL CONNECTION WITH 2 MC



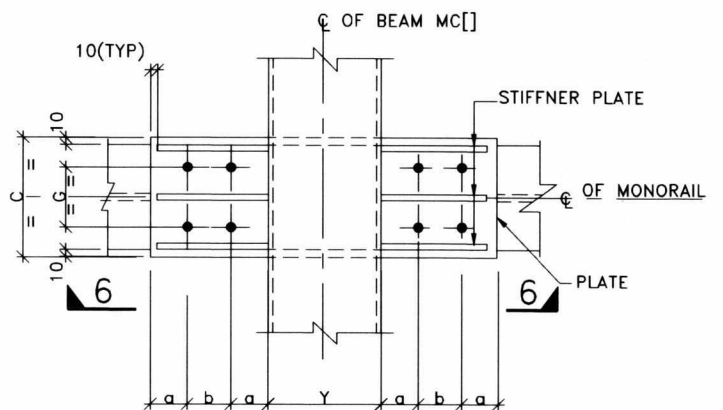
VIEW 5-5



VIEW 6-6

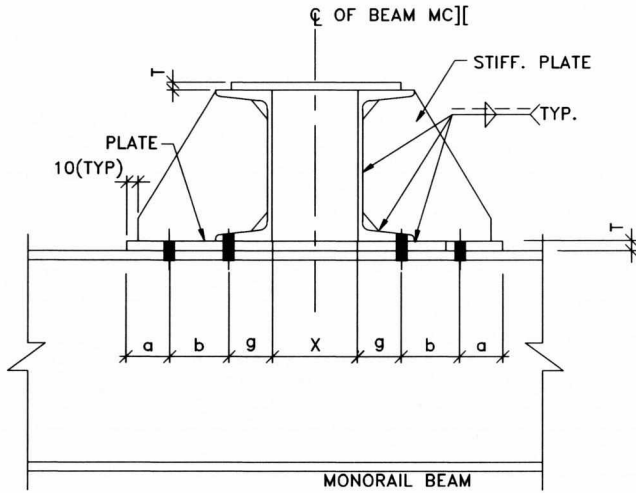


DETAIL-E

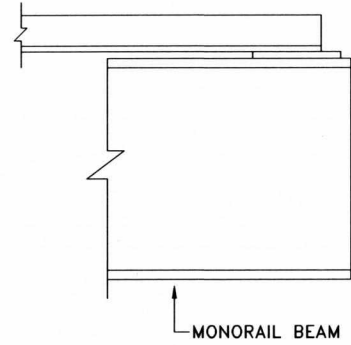


DETAIL-F

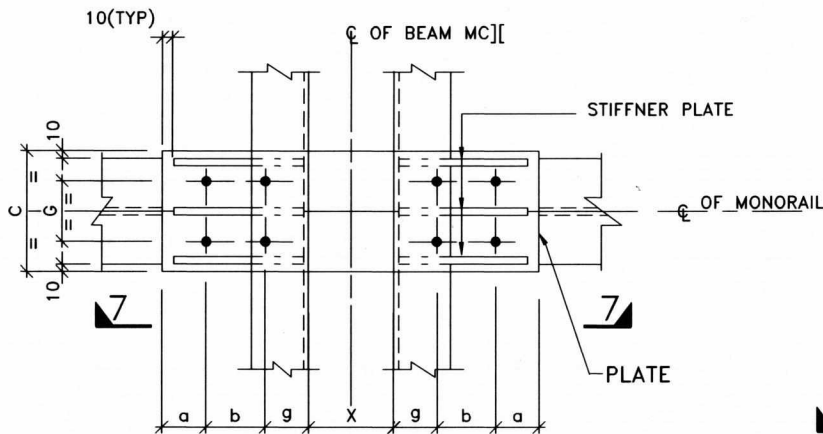
APPLICABLE FOR LIFT
CAPACITY ABOVE 4.0 T
TO 20.0 T



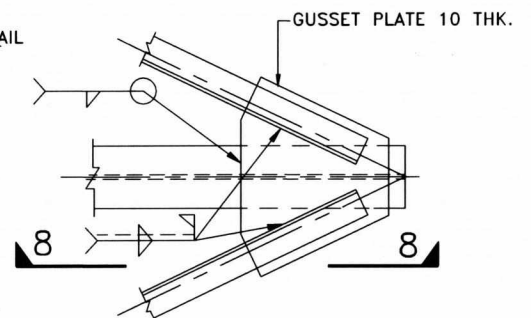
VIEW 7-7



VIEW 8-8



DETAIL-G



DETAIL-H
 (BRACING DETAIL)

APPLICABLE FOR LIFT
 CAPACITY ABOVE 4.0 T
 TO 20.0 T

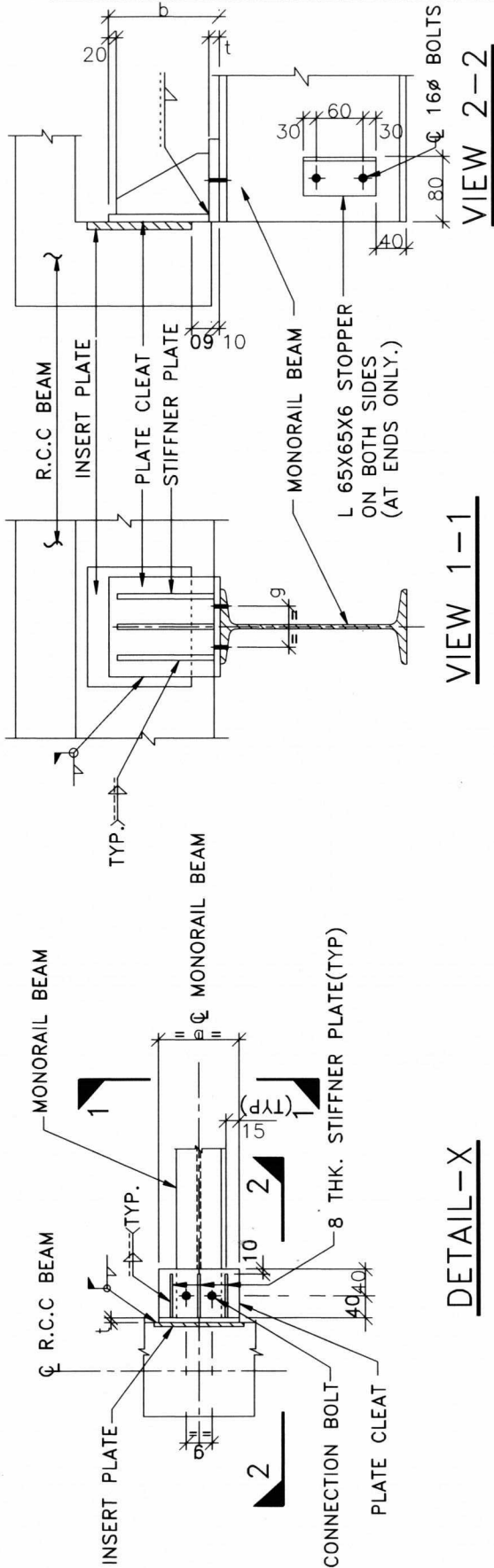
NOTES:-

1. ALL CONNECTIONS ARE 6 mm FILLET ALL ROUND WELDS, EXCEPT BETWEEN MONORAIL AND MONORAIL SUPPORTING BEAM WHICH IS BOLTED CONNECTION.
2. ALL STIFFENER PLATES SHALL BE 8 mm THK. FOR MONORAIL CAPACITY UPTO 4.0 T AND 10 mm THK. FOR MONORAIL CAPACITY ABOVE 4.0 T TO 20.0 T.
3. DIMENSIONS G AND g CORRESPOND TO GAUGE DISTANCE OF MONORAIL BEAM AND MONORAIL SUPPORTING BEAM RESPECTIVELY.
4. ALSO REFER GEN. NOTES OF THE PROJECT.

SCHEDULE OF MONORAIL BEAM CONNECTION

MONORAIL BEAM	NO. OF CONNECTION BOLTS	DIA OF CONNECTION BOLT(mm)	DIMENSION IN mm				
			a	b	c	G	t
MB 200	↑ PROVIDE 4 NOS. CONNECTION BOLTS UPTO 4.0 T LIFT CAP. ↓ PROVIDE 8 NOS. CONNECTION BOLTS ABOVE 4.0 T TO 20.0 T LIFT CAP.	M-16	25	-	150	55	10
MB 250		M-20	30	-	170	65	10
MB 350		M-20	35	60	200	80	16
MB 400		M-20	35	60	200	80	16
MB 450		M-20	40	65	220	90	16
MB 500		M-22	40	65	240	100	16
MB 600		M-22	40	65	240	140	16
WPB 600x300x128.8		M-24	50	65	320	150	16
WPB 600x300x177.8		M-24	50	65	320	150	16
WPB 700x300x149.9		M-24	50	80	320	150	16
WPB 800x300x224	M-24	50	80	320	150	16	

- DIMENSIONS ENCLOSED BY DOTTED LINES ARE APPLICABLE TO 8 BOLT CONNECTIONS ONLY (REFER SHEETS 6 AND 7.)

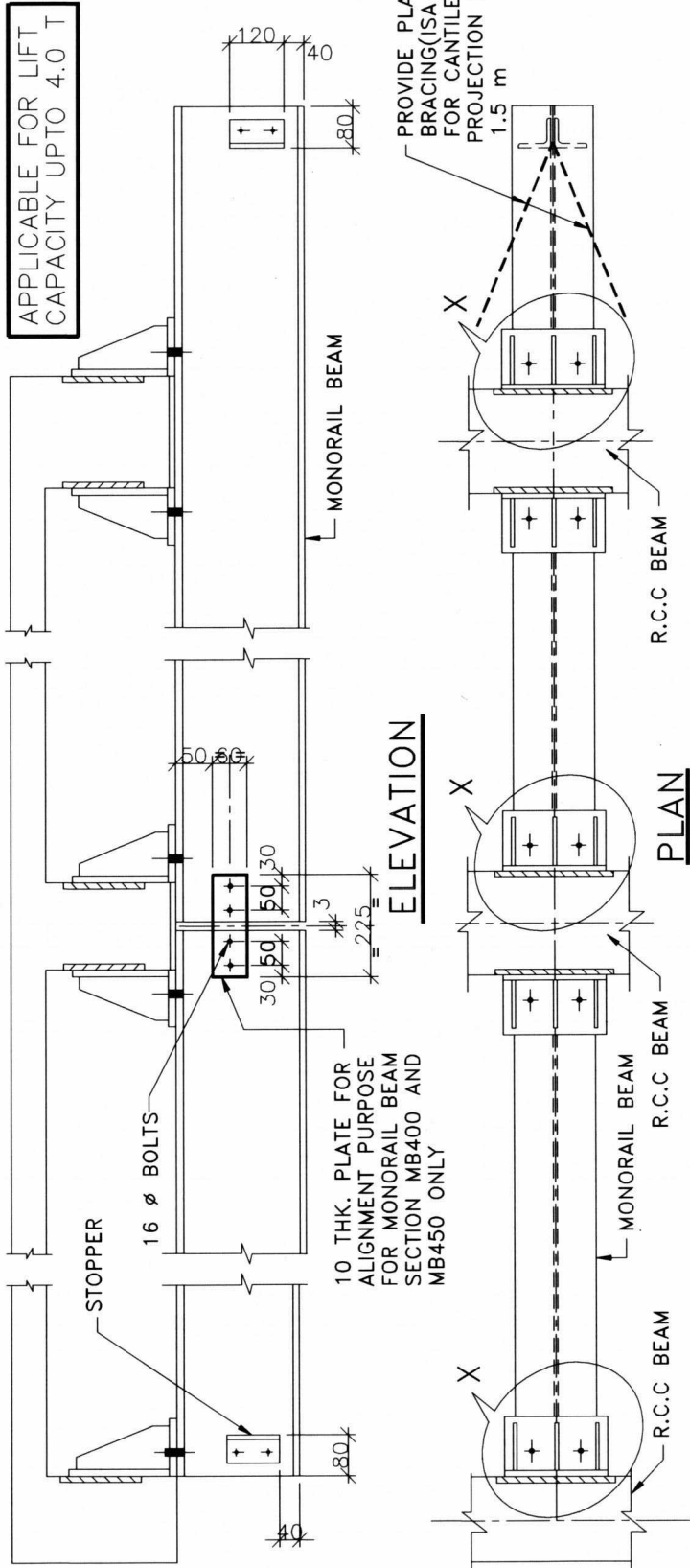


APPLICABLE FOR LIFT CAPACITY UPTO 4.0 T

VIEW 1-1

DETAIL-X

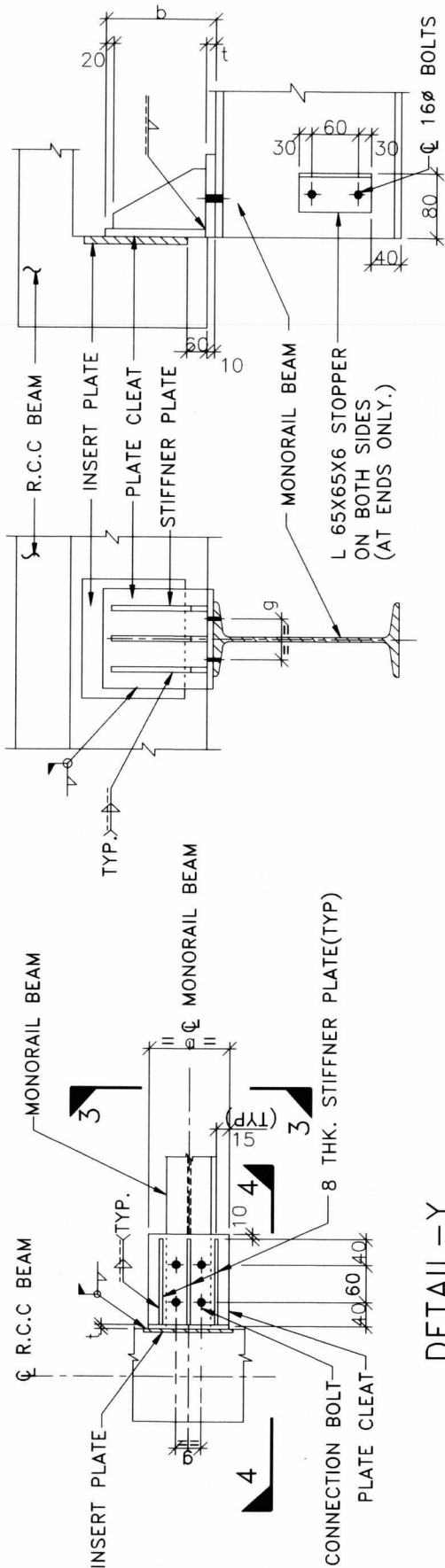
VIEW 2-2



ELEVATION

PLAN

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
5	14-12-23	REVISED AND ISSUED AS STANDARD	AV	RM	ANURAG SINHA	MAINAK NANDI
4	06-06-18	REAFFIRMED AND ISSUED AS STANDARD	CS	AVM	R.SRIVASTAVA	RK TRIVEDI

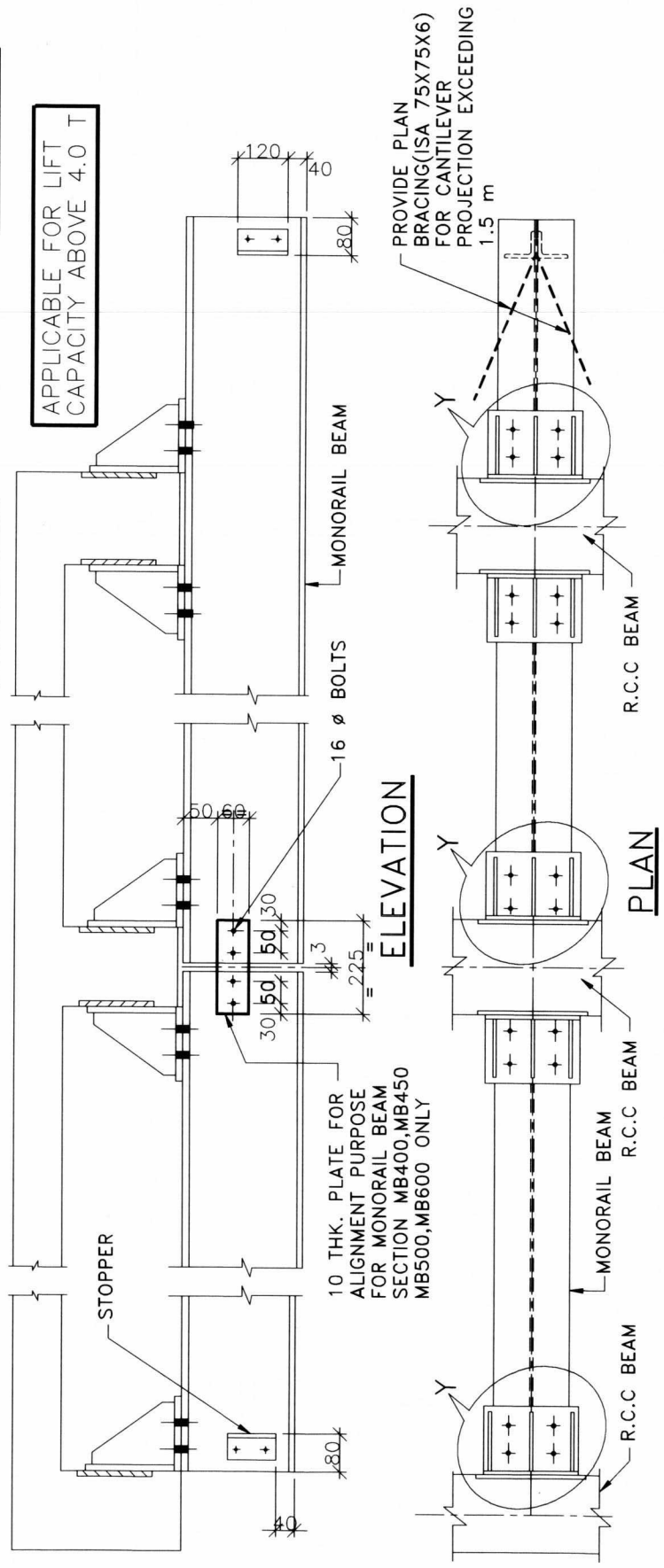


VIEW 4-4

VIEW 3-3

APPLICABLE FOR LIFT CAPACITY ABOVE 4.0 T

DETAIL-Y



ELEVATION

PLAN

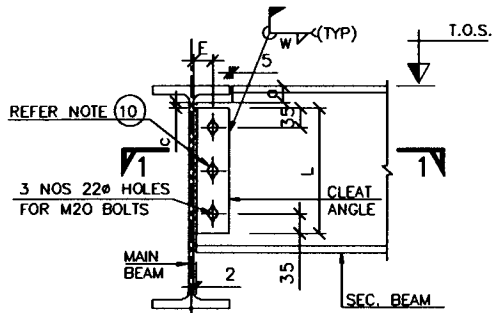
SCHEDULE OF MONORAIL BEAM CONNECTION

(FOR SKETCH, REFER SHT. 1 OF 3 AND 2 OF 3)

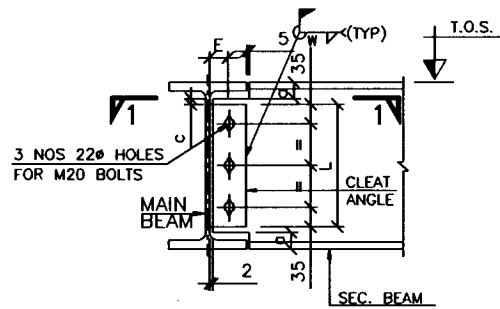
MONORAIL BEAM	DIA OF CONNECTION BOLT(mm)	DIMENSION IN mm			
		a	b	g	t
MB 200	M-16	150	200	55	10
MB 250	M-20	170	250	65	10
MB 300	M-20	200	250	80	12
MB 350	M-20	200	250	80	16
MB 400	M-20	200	250	80	16
MB 450	M-20	220	350	90	16
MB 500	M-22	240	350	100	16
MB 600	M-22	240	350	140	16

NOTES :

GENERAL NOTES OF THE PROJECT SHALL ALSO BE REFERRED.

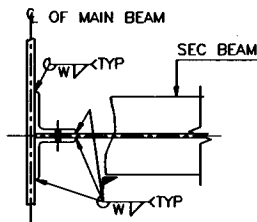


TYPE-I
(SECONDARY BEAM < MAIN BEAM)



TYPE-II
(SECONDARY BEAM = MAIN BEAM)

TYPICAL DETAILS OF SHEAR CONNECTION BETWEEN PARALLEL FLANGED BEAMS



SECTION 1-1

LEGENDS :-

- f_y = SHEAR STRENGTH OF STEEL.
- t = THICKNESS OF CLEAT ANGLE.
- d_w = BEAM DEPTH.
- t_w = WEB THICKNESS OF BEAM.

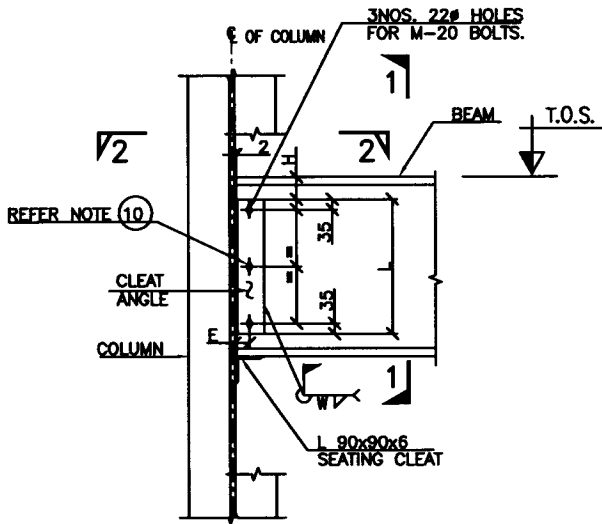
NOTES :-

1. ALL DIMENSIONS ARE IN mm.
2. PARALLEL FLANGE SECTIONS SHALL CONFORM TO IS:12778.
3. STRUCTURAL STEEL FOR CONNECTION PLATES SHALL BE OF SAME GRADE AS THAT OF THE CONNECTING MEMBERS.
4. CONNECTION DETAIL FOR SECONDARY BEAM > MAIN BEAM ARE NOT SHOWN HERE.
5. CONNECTION DETAILS SHOWN HERE ARE FOR FIELD CONNECTION ONLY, SAME SHALL BE FOLLOWED FOR SHOP CONNECTION ALSO.
6. ALL FIELD WELDS SHALL BE MINIMUM 6 mm FILLET WELD (UNO).
7. ALL HOLES ARE SHOWN THUS ϕ ARE 22Ø FOR M20 ERECTION BOLTS.
8. ERECTION BOLTS SHALL BE OF PROPERTY CLASS 4.6 CONFORMING TO IS:1367.
9. CENTRAL BOLT TO BE PROVIDED FOR BEAM DEPTH > 600.
10. FOR SHEAR CONNECTIONS OF ISMB SECTIONS, EIL STANDARD 7-68-0689 SHALL BE FOLLOWED.
11. SHEAR CAPACITY OF THE CONNECTION IS THE MINIMUM OF THE SHEAR CAPACITY FOR WELD, CLEAT ANGLE AND BEAM, WHICH HAS BEEN WORKED OUT AS FOLLOWS:
 - a. CLEAT CAPACITY = $2 \times L \times t \times 0.4 \times f_y$
 - b. BEAM CAPACITY = $d_w \times t_w \times 0.4 \times f_y$
 - c. WELD CAPACITY = BEAM CAPACITY x (WELD SIZE PROVIDED/WELD SIZE REQUIRED).

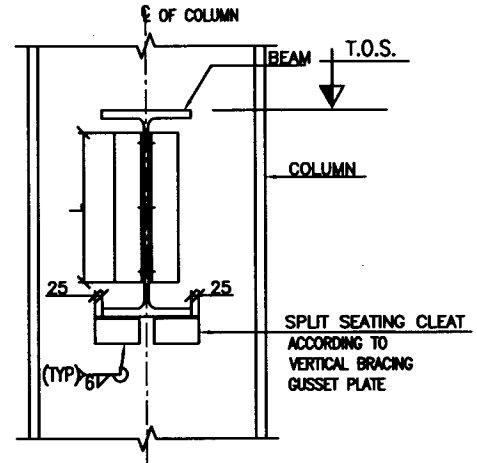
1	22.09.20	REAFFIRMED & ISSUED AS STANDARD	JEETU	AVM	AS	SM
0	15.07.14	ISSUED AS STANDARD	VPS	AS	PKM	SC
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

SHEAR CONNECTION BETWEEN PARALLEL FLANGE BEAMS											
SL. NO.	SEC. BEAM SIZE	MAIN BEAM SIZE	CLEAT SIZE	L	a	c	E	W	TYPE	MINIMUM SHEAR CAPACITY (MT) OF CONNECTION	% SHEAR CAPACITY OF CONNECTION WRT BEAM SHEAR CAPACITY
1	NPB 450x190x67.15	MAIN BEAM SIZE SAME OR HIGHER THAN SECONDARY BEAM SIZE	ISA 90x90x10	315	65	15	50	8	I	29	85
				350	35				II		
2	WPB 600x300x128.79		ISA 110x110x12	430	65	15	65	10	I	53	77
				450	45				II		
3	WPB 600x300x177.77		ISA 110x110x12	430	65	15	65	10	I	53	69
				450	55				II		
4	WPB 700x300x149.89		ISA 110x110x12	530	65	15	65	10	I	66	76
				550	45				II		
5	WPB 700x300x204.48		ISA 130x130x12	530	65	15	65	12	I	78	78
				550	55				II		
6	WPB 700x300x240.51		ISA 130x130x12	530	65	15	65	12	I	78	66
				550	60				II		
7	WPB 800x300x224.37	ISA 150x150x15	630	65	15	90	12	I	94	79	
			640	60				II			
8	WPB 800x300x262.33	ISA 150x150x15	630	65	15	90	12	I	94	67	
			640	65				II			
9	WPB 900x300x291.45	ISA 150x150x15	730	65	15	90	12	I	109	66	
			730	65				II			

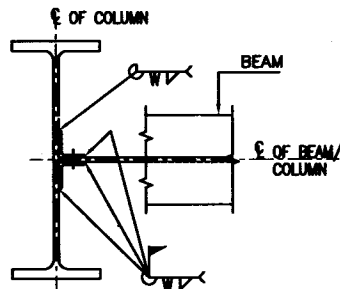
1	22.09.20	REAFFIRMED & ISSUED AS STANDARD	JEETU	AS	AS	SM
0	15.07.14	ISSUED AS STANDARD	VPS	AS	PKM	SC
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by



**TYP. DETAIL OF SHEAR CONNECTION
BETWEEN COLUMN & BEAM**



VIEW 1-1



VIEW 2-2

LEGENDS :-

- fy = SHEAR STRENGTH OF STEEL.
- t = THICKNESS OF CLEAT ANGLE.
- dW = BEAM DEPTH.
- tw = WEB THICKNESS OF BEAM.

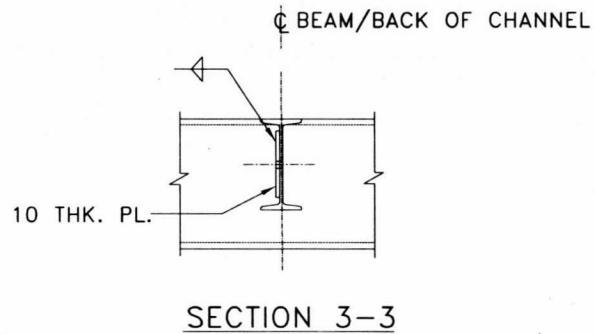
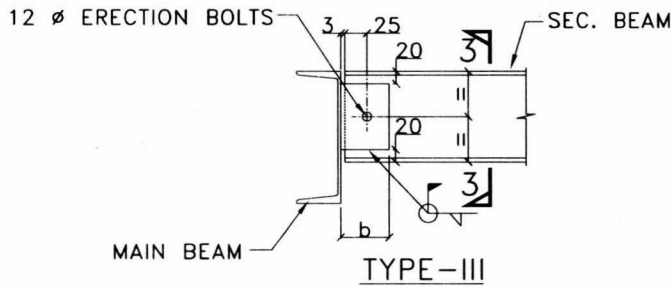
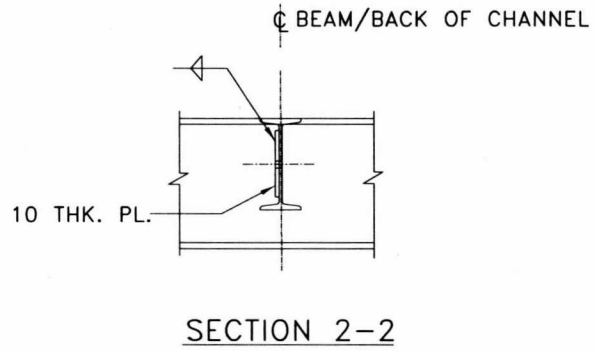
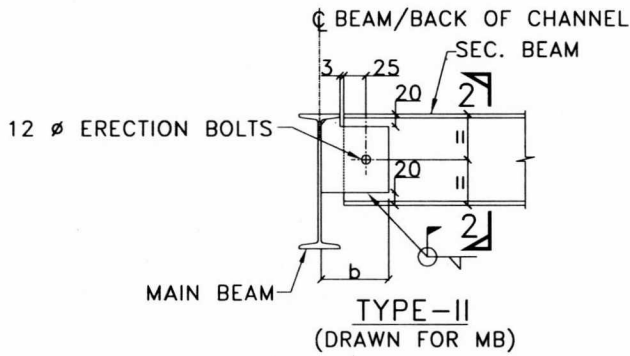
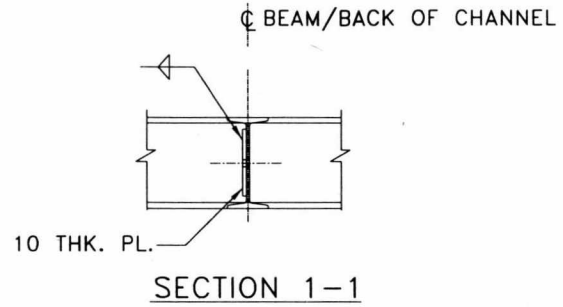
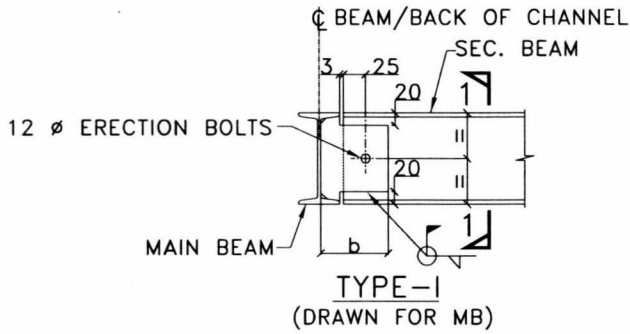
NOTES :-

1. ALL DIMENSIONS ARE IN mm.
2. PARALLEL FLANGE SECTIONS SHALL CONFORM TO IS:808
3. STRUCTURAL STEEL FOR CONNECTION PLATES SHALL BE OF SAME GRADE AS THAT OF THE CONNECTING MEMBERS.
4. CONNECTION DETAILS SHOWN HERE ARE FOR SHEAR CONNECTION WITH COLUMN WEB ONLY, HOWEVER SAME CAN SUITABLY BE FOLLOWED FOR SHEAR CONNECTION WITH COLUMN FLANGE ALSO.
5. CONNECTION DETAILS SHOWN HERE ARE FOR FIELD CONNECTION ONLY, SAME SHALL BE FOLLOWED FOR SHOP CONNECTION ALSO.
6. ALL FIELD WELDS SHALL BE MINIMUM 6 mm FILLET WELD (UNO).
7. ALL HOLES ARE SHOWN THUS ϕ ARE 22 ϕ FOR M20 ERECTION BOLTS.
8. ERECTION BOLTS SHALL BE OF PROPERTY CLASS 4.6 CONFORMING TO IS:1367.
9. CENTRAL BOLT TO BE PROVIDED FOR BEAM DEPTH > 600.
10. FOR SHEAR CONNECTIONS OF ISMB SECTIONS, EIL STANDARD 7-68-0689 SHALL BE FOLLOWED.
11. SHEAR CAPACITY OF THE CONNECTION IS THE MINIMUM OF THE SHEAR CAPACITY FOR WELD, CLEAT ANGLE AND BEAM, WHICH HAS BEEN WORKED OUT AS FOLLOWS:
 - a. CLEAT CAPACITY = $2 \times L \times t \times 0.4 \times fy$
 - b. BEAM CAPACITY = $dW \times tw \times 0.4 \times fy$
 - c. WELD CAPACITY = BEAM CAPACITY \times (WELD SIZE PROVIDED/WELD SIZE REQUIRED)

1	13.04.22	REVISED AND ISSUED AS STANDARD	<i>J. Anand</i> SS	<i>SP</i> SP	<i>AS</i> AS	<i>SM</i> SM
0	15.07.14	ISSUED AS STANDARD	VPS	AS	PKM	SC
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

SHEAR CONNECTION BETWEEN PARALLEL FLANGE BEAM AND COLUMN									
SL. NO	BEAM SIZE	CLEAT SIZE	L	E	H	W	MINIMUM SHEAR CAPACITY (MT) OF CONNECTION	% SHEAR CAPACITY OF CONNECTION WRT BEAM SHEAR CAPACITY	
1	NPB 450x190x67.16	ISA 90x90x10	350	50	35	8	34	100	
2	WPB 600x300x128.79	ISA 130x130x12	450	65	45	10	55	80	
3	WPB 600x300x177.78	ISA 130x130x12	450	65	55	10	55	72	
4	WPB 700x300x149.89	ISA 130x130x12	550	65	45	10	68	78	
5	WPB 700x300x204.48	ISA 150x150x15	550	90	55	12	81	81	
6	WPB 700x300x240.51	ISA 150x150x15	550	90	60	12	81	68	
7	WPB 800x300x224.38	ISA 150x150x15	640	90	60	12	95	80	
8	WPB 800x300x262.34	ISA 150x150x15	640	90	65	12	95	68	
9	WPB 900x300x291.46	ISA 150x150x15	730	90	65	12	109	66	

1	13.04.22	REVISED AND ISSUED AS STANDARD	SS	AS	SM
0	15.07.14	ISSUED AS STANDARD	VPS	AS	PKM SC
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor Stds. Bureau Chairman Approved by



SEC. BEAM	CONN TYPE	DIMENSION	MAIN BEAM																	
			MB100	MB125	MB150	MB200	MB250	MB300	MB350	MB400	MB450	MB500	MB600	MC100	MC125	MC150	MC200	MC250	MC300	MC400
MB100/ MC100	I	b	90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	b	-	90	95	105	115	125	125	125	130	145	160	-	-	-	-	-	-	-
	III	b	-	-	-	-	-	-	-	-	-	-	-	55	55	55	55	55	55	55
MB125/ MC125	I	b	-	105	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	II	b	-	-	110	120	130	140	140	140	145	160	175	-	-	-	-	-	-	-
	III	b	-	-	-	-	-	-	-	-	-	-	-	-	70	70	70	70	70	70

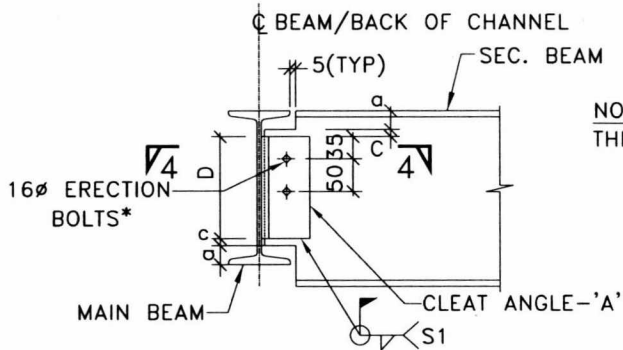
NOTES:-

1 CONNECTION HAS BEEN DESIGNED TO CATER FOR FOLLOWING SHEAR STRENGTH.

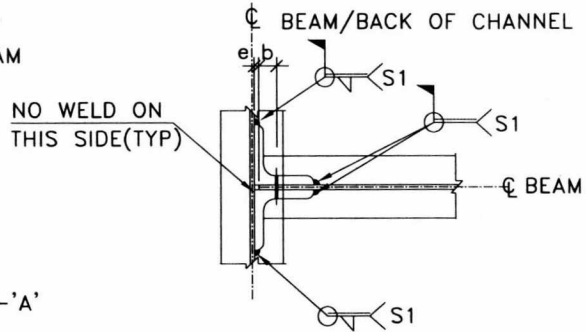
MB100/MC100 = 2.5 T.

MB125/MC125 = 3.5 T.

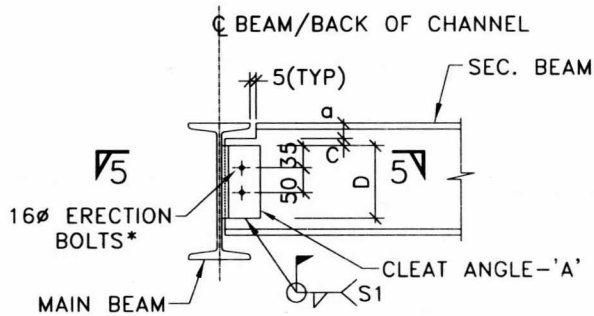
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
4	02.12.22	REAFFIRMED AND ISSUED AS STANDARD	HIMANSHU	VIKRAM GUPTA	ANURAG SINHA	S. MAZUMDAR
3	02.12.15	REVISED AND ISSUED AS STANDARD	JITENDER GUPTA	AMARJEET SINGH	RAJANJI SRIVASTAVA	S. CHANDA



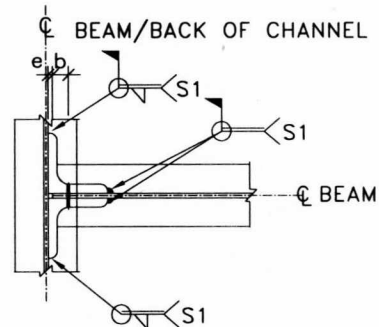
TYPE-IV



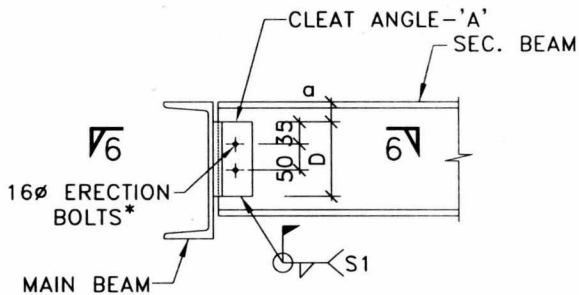
SECTION 4-4
(DRAWN FOR SEC. BEAM AS MB)



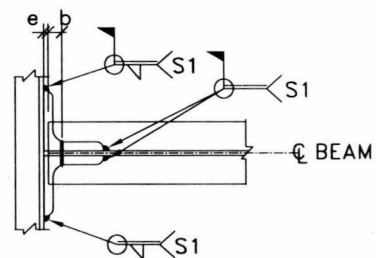
TYPE-V



SECTION 5-5
(DRAWN FOR SEC. BEAM AS MB)



TYPE-VI



SECTION 6-6
(DRAWN FOR SEC. BEAM AS MB)

c = 15 FOR SEC. BEAM MB600

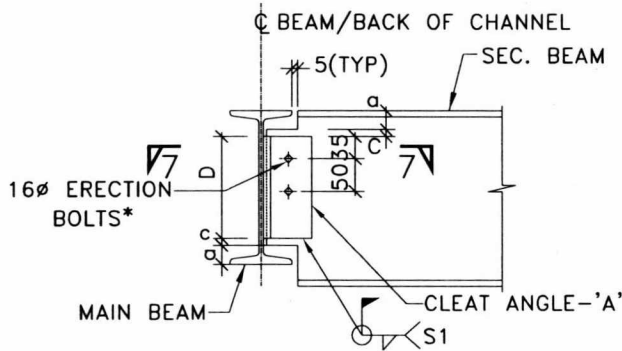
c = 10 FOR OTHERS

e = 2 mm CLEAR GAP

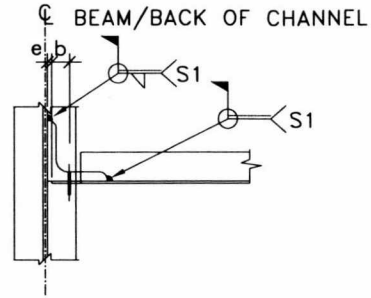
* 2 NOS. ERECTION BOLTS SHALL BE PROVIDED FOR SEC. BEAM \geq MB250 / MC250

CLEAT ANGLE SIZE	b
L 65x65x6	35
L 75x75x8	40
L 90x90x10	45
L 100x100x12	45

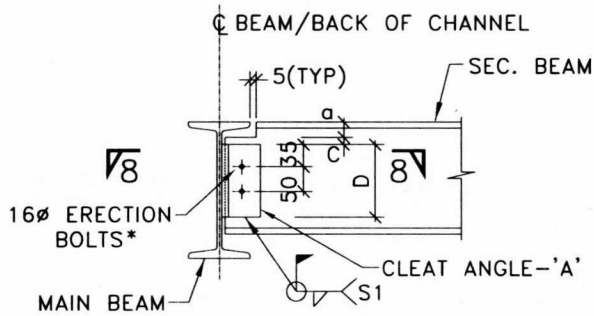
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
4	02.12.22	REAFFIRMED AND ISSUED AS STANDARD	HIMANSHU	VIKRAM GUPTA	ANURAG SINHA	S. MAZUMDAR
3	02.12.15	REVISED AND ISSUED AS STANDARD	JITENDER GUPTA	AMARJEET SINGH	RAJANJI SRIVASTAVA	S. CHANDA



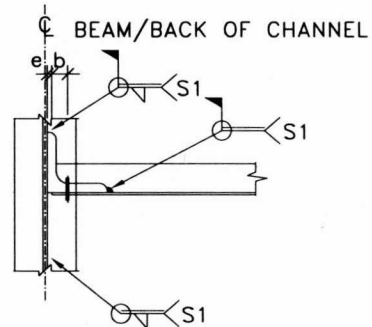
TYPE-VII



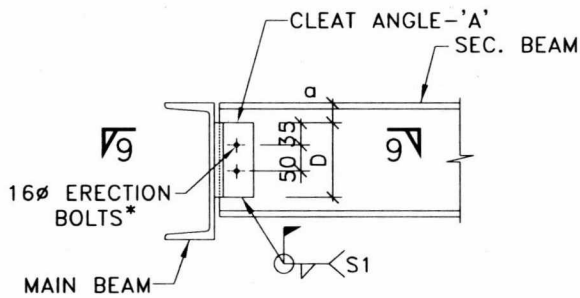
SECTION 7-7



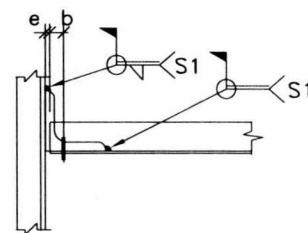
TYPE-VIII



SECTION 8-8



TYPE-IX



SECTION 9-9

e = 2 mm CLEAR GAP

* 2 NOS. ERECTION BOLTS SHALL BE PROVIDED FOR SEC. BEAM \geq MB250 / MC250

CLEAT ANGLE SIZE	b
L 65x65x6	35
L 75x75x8	40
L 90x90x10	45
L 100x100x12	45

VALID FOR SEC. BEAM AS CHANNELS ONLY

4	02.12.22	REAFFIRMED AND ISSUED AS STANDARD	HIMANSHU	VIKRAM GUPTA	ANURAG SINHA	S. MAZUMDAR
3	02.12.15	REVISED AND ISSUED AS STANDARD	JITENDER GUPTA	AMARJEET SINGH	RAJANJI SRIVASTAVA	S. CHANDA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

SCHEDULE OF CONNECTION

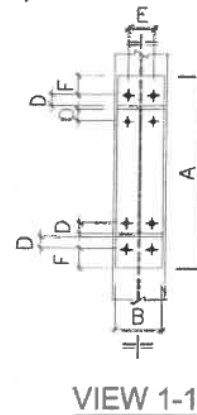
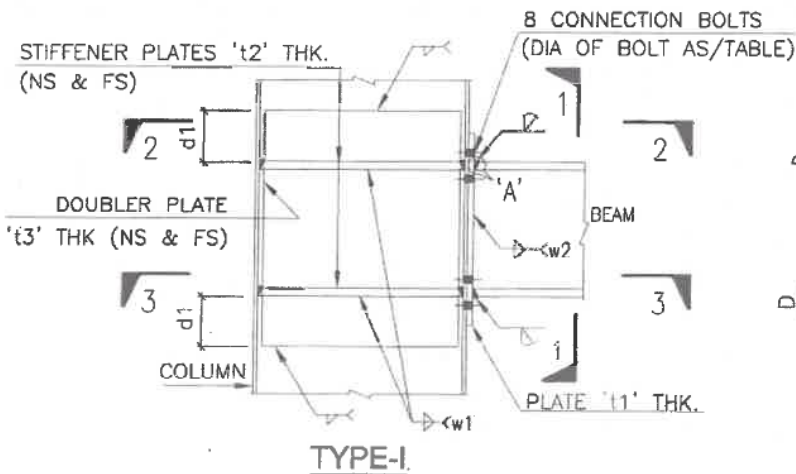
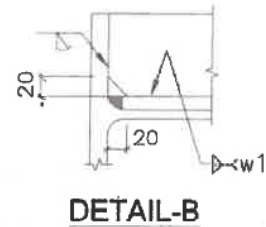
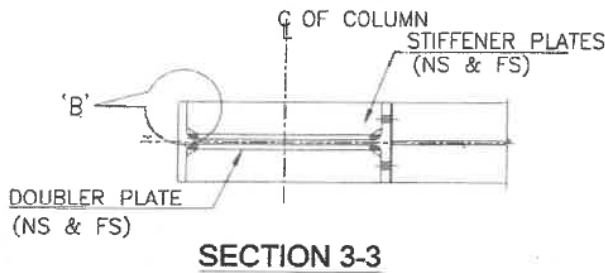
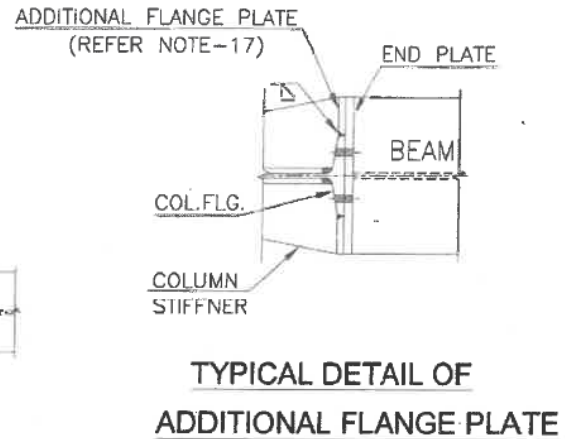
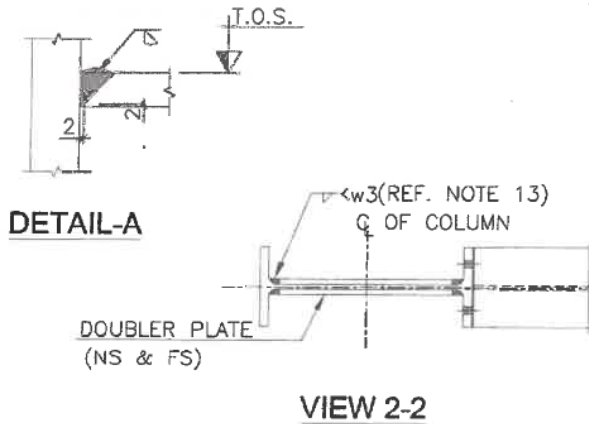
SEC. BEAM	CONN. TYPE	DIMENSION	MAIN BEAM													CLEAT ANGLE 'A'		WELD SIZE	MIN. SHEAR CAPACITY	
			MB150	MB200	MB250	MB300	MB350	MB400	MB450	MB500	MB600	MC150	MC200	MC250	MC300	MC400	D			SIZE
MB150	IV	a	25	-	-	-	-	-	-	-	25	-	-	-	-	80	L65x65x6	6	4.0	
	V	a	-	25	30	30	35	35	35	40	45	-	25	30	30	35			60	3.0
	VI	a	-	-	-	-	-	-	-	-	-	25	25	25	25	25			80	4.0
MB200	IV	a	25	25	-	-	-	-	-	-	-	25	25	-	-	80	L65x65x6	6	4.0	
	V	a	-	-	30	30	35	35	35	40	45	-	-	30	30	35			100	6.5
	VI	a	-	-	-	-	-	-	-	-	-	25	25	25	25	100			6.5	
MB250	IV	a	-	30	30	-	-	-	-	-	-	-	30	30	-	120	L75x75x8	6	7.5	
	V	a	-	-	-	30	35	35	35	40	45	-	-	-	30	35			150	10.0
	VI	a	-	-	-	-	-	-	-	-	-	30	30	30	30	150			10.0	
MB300	IV	a	-	-	30	30	-	-	-	-	-	-	-	30	30	170	L75x75x8	6	11.0	
	V	a	-	-	-	-	35	35	35	40	45	-	-	-	35	200			13.5	
	VI	a	-	-	-	-	-	-	-	-	-	-	30	30	30	200			13.5	
MB350	IV	a	-	-	-	35	35	-	-	-	-	-	-	35	-	210	L75x75x8	6	14.0	
	V	a	-	-	-	-	-	35	35	40	45	-	-	-	35	250			16.5	
	VI	a	-	-	-	-	-	-	-	-	-	-	35	35	250	16.5				
MB400	IV	a	-	-	-	35	35	35	-	-	-	-	-	35	35	210	L90x90x10	6	14.0	
	V	a	-	-	-	-	-	-	35	40	45	-	-	-	-	300		8	25.0	
	VI	a	-	-	-	-	-	-	-	-	-	-	35	35	250	6		16.5		
MB450	IV	a	-	-	-	-	35	35	35	-	-	-	-	-	35	260	L90x90x10	8	21.0	
	V	a	-	-	-	-	-	-	-	40	45	-	-	-	350	300			30.0	
	VI	a	-	-	-	-	-	-	-	-	-	-	-	35	350	300			30.0	
MB500	IV	a	-	-	-	-	-	40	40	40	-	-	-	-	40	300	L90x90x10	8	26.0	
	V	a	-	-	-	-	-	-	-	-	45	-	-	-	390	390			36.0	
	VI	a	-	-	-	-	-	-	-	-	-	-	-	40	300	300			26.0	
MB600	IV	a	-	-	-	-	-	-	45	-	-	-	-	-	-	380	L100x100x12	10	40.0	
	IV	a	-	-	-	-	-	-	-	45	-	-	-	-	-	480			50.0	
MC150	IV/VII	a	25	-	-	-	-	-	-	-	-	25	-	-	-	80	L65x65x6	6	4.0	
	V/VIII	a	-	25	30	30	35	35	35	40	45	-	25	30	30	35			60	3.0
	VI/IX	a	-	-	-	-	-	-	-	-	-	25	25	25	25	25			80	4.0
MC200	IV/VII	a	25	25	-	-	-	-	-	-	-	25	25	-	-	80	L65x65x6	6	4.0	
	V/VIII	a	-	-	30	30	35	35	35	40	45	-	-	30	30	35			100	6.5
	VI/IX	a	-	-	-	-	-	-	-	-	-	25	25	25	25	100			6.5	
MC250	IV/VII	a	-	30	30	-	-	-	-	-	-	-	30	30	-	120	L75x75x8	6	7.5	
	V/VIII	a	-	-	-	30	35	35	35	40	45	-	-	-	30	35			150	10.0
	VI/IX	a	-	-	-	-	-	-	-	-	-	30	30	30	30	150			10.0	
MC300	IV/VII	a	-	-	30	30	-	-	-	-	-	-	-	30	30	170	L75x75x8	6	11.0	
	V/VIII	a	-	-	-	-	35	35	35	40	45	-	-	-	35	200			13.5	
	VI/IX	a	-	-	-	-	-	-	-	-	-	-	30	30	30	200			13.5	
MC400	IV/VII	a	-	-	-	35	35	35	-	-	-	-	-	30	35	210	L90x90x10	6	13.5	
	V/VIII	a	-	-	-	-	-	-	35	40	45	-	-	-	-	300		8	25.0	
	VI/IX	a	-	-	-	-	-	-	-	-	-	-	35	35	210	6		13.5		

NOTES:

- 1 ALL WELDS SHALL BE 6 mm. THK. UNLESS NOTED OTHERWISE.
- 2 NO AXIAL FORCES ARE INCLUDED AND SHALL BE CHECKED AS PER ACTUAL DESIGN.
- 3 THIS STANDARD IS NOT APPLICABLE FOR COMBINATION OF BEAM MKD. □
- 4 SHEAR CAPACITY GIVEN IN THE TABLE IS FOR CONNECTION- TYPE IV, V & VI.

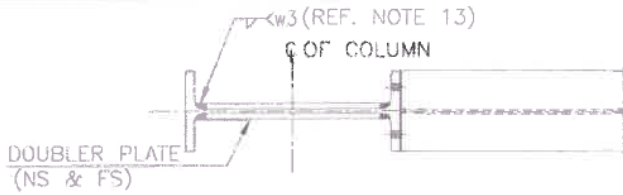
5 CONNECTION TYPE I, II, III, VII, VIII & IX SHALL NOT BE USED FOR EQUIPMENT SUPPORTING MEMBERS.

4	02.12.22	REAFFIRMED AND ISSUED AS STANDARD	HIMANSHU	VIKRAM GUPTA	ANURAG SINHA	S. MAZUMDAR
3	02.12.15	REVISED AND ISSUED AS STANDARD	JITENDER GUPTA	AMARJEET SINGH	RAJANJI SRIVASTAVA	S. CHANDA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
						Approved by

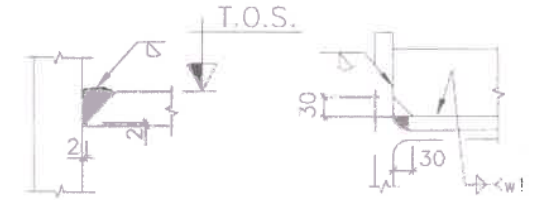


BEAM SIZE	TYPE	NO OF BOLTS	DIA OF BOLTS	A	B	C	D	E	F	t1	t2	t3	d1	w1	w2
ISMB300	1	8	24	520	140	NA	50	80	60	30	16	10	150	8	8
ISMB400	1	8	30	650	140	NA	55	80	70	30	20	10	150	8	8
ISMB450	1	8	30	720	150	NA	60	90	75	30	25	10	150	10	8
ISMB500	1	8	30	770	180	NA	60	100	75	30	25	10	150	10	10
ISMB600	1	8	36	930	210	NA	75	100	90	36	25	12	150	12	10

0	22.05.24	ISSUED AS STANDARD	AK	SP	ANURAG SINHA	MAINAK NANDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
Approved by						

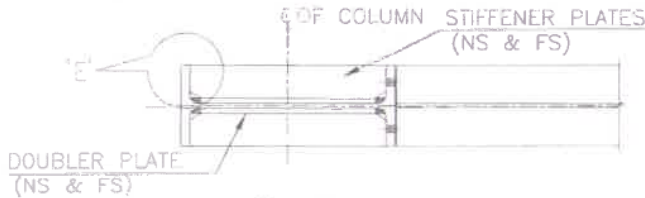


VIEW 5-5

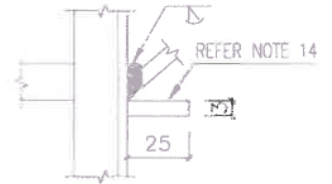


DETAIL-D

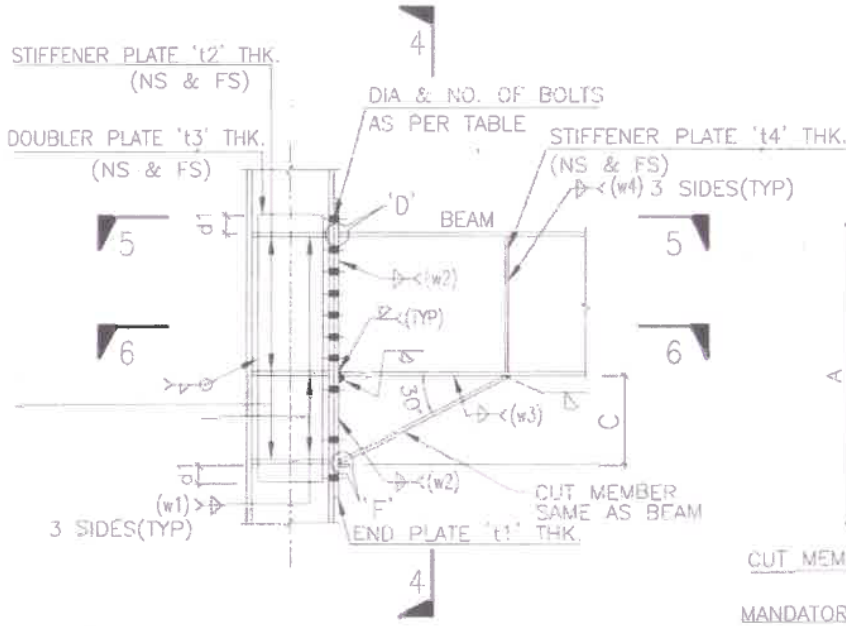
DETAIL-E



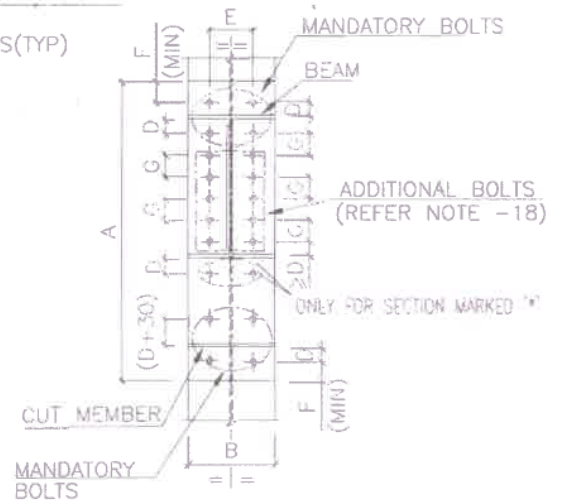
SECTION 6-6



DETAIL-F



TYPE-II

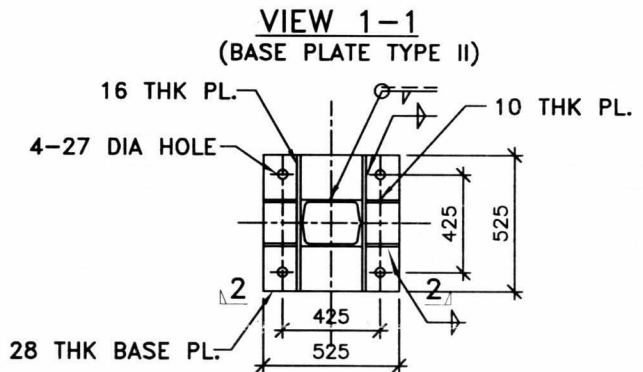
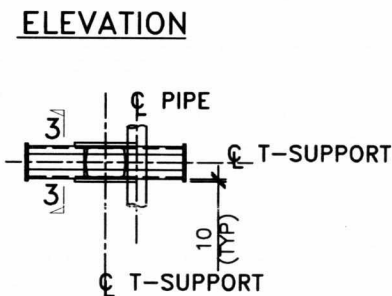
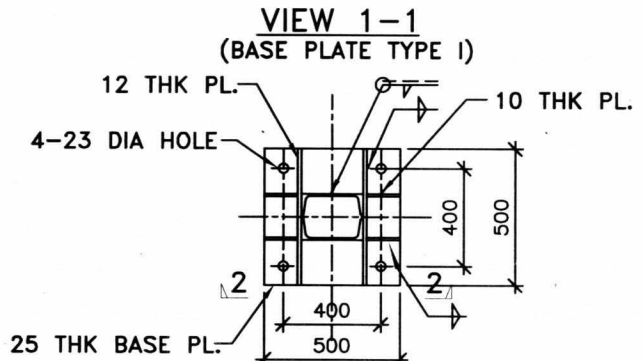
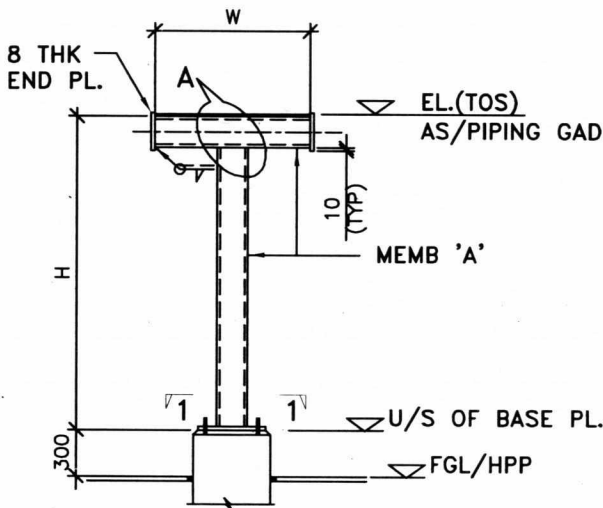
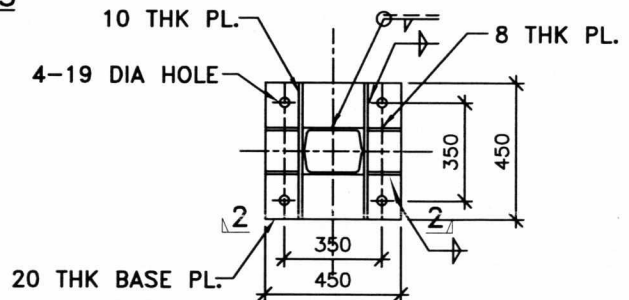
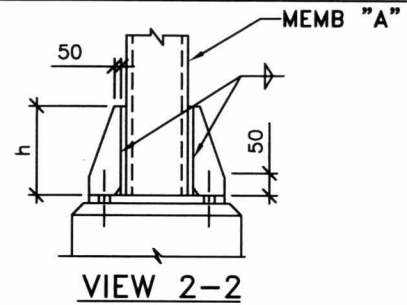
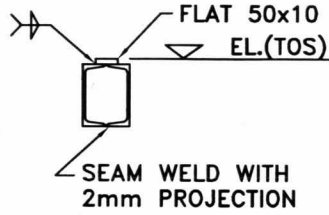
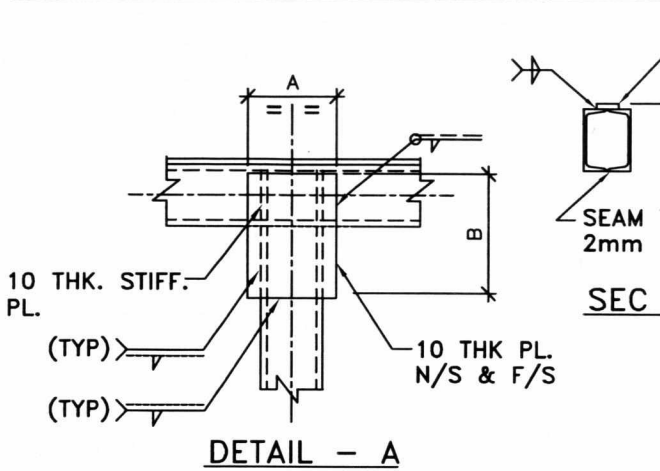


VIEW 4-4

BEAM SIZE	TYPE	NO OF BOLTS	BOLT GRADE	DIA OF BOLTS	A	B	C	D	E	F	G	t1	t2	t3	t4	d1	w1/w4/w3	w2
WPB200X200X61.3	II	8	8.8	30	515	220	105	50	120	50	80	30	10	10	16	100	8	8
WPB250X250X73.14	II	8	8.8	30	585	260	130	50	120	50	80	30	12	10	16	100	8	8
WPB300X300X100.8	II	10	8.8	36	705	300	155	60	180	60	90	30	16	10	20	100	8	8
WPB360X300X141.8	II	12	8.8	36	785	300	180	60	180	60	90	40	16	10	25	100	8	10
WPB600x300x128.8	II	12	8.8	36	1100	300	285	60	180	60	90	30	16	12	25	150	8	10
WPB600x300x177.8	II	16	8.8	36	1130	300	295	60	180	60	90	30	16	12	30	150	8	10
WPB700x300x204.5	II	18	8.8	36	1280	300	345	60	180	60	90	40	20	12	36	150	10	12
WPB700x300x240.5(*)	II	20	8.8	36	1295	300	350	60	180	60	90	45	20	12	36	150	10	12
WPB800x300x262.5(*)	II	22	8.8	36	1445	300	400	60	180	60	90	45	20	12	40	150	10	12
WPB900x300x291.4(*)	II	22	8.8	36	1595	300	450	60	180	60	90	50	25	12	45	150	10	16
WPB900x300x333.0(*)	II	24	8.8	36	1605	300	455	60	180	60	90	55	28	12	45	150	10	16

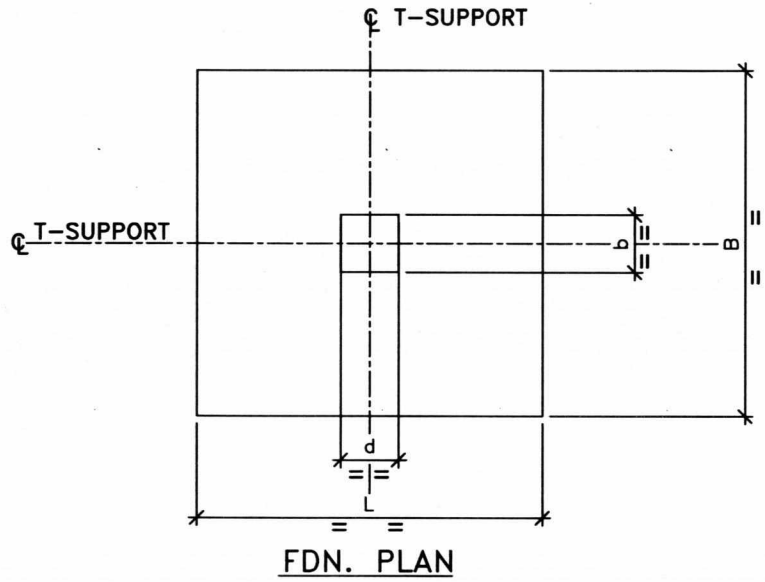
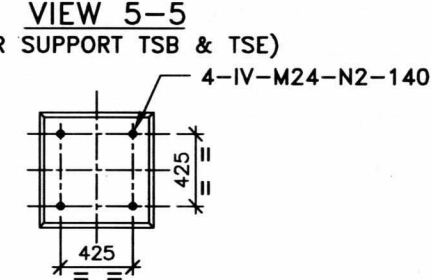
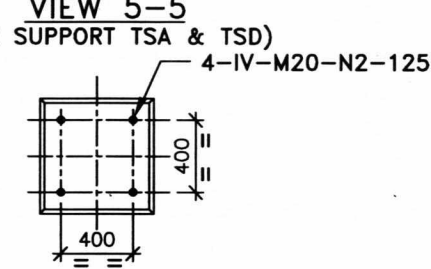
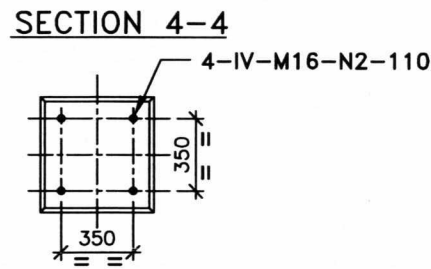
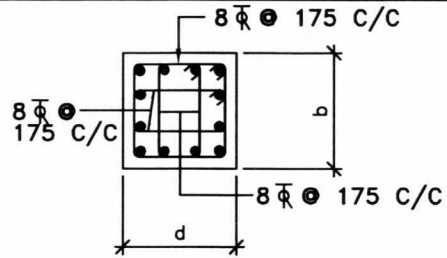
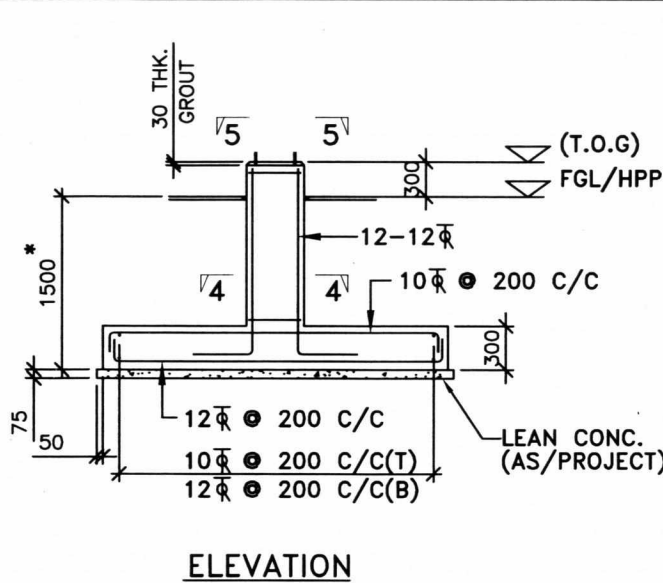
NOTES:-

1. ALL DIMENSIONS ARE IN MM.
2. THIS STANDARD IS VALID FOR STRUCTURAL STEEL OF GRADE E350 CONFIRMING TO IS2062.
3. COLUMN & BEAM SECTIONS SHALL CONFIRM TO IS808 & IS12778 (AS APPLICABLE).
4. BOLTED MOMENT CONNECTIONS ARE DESIGNED AS PER CLAUSE 10.3 (BEARING TYPE BOLTS) OF IS800-2007 (LSD).
5. ALL CONNECTION BOLTS SHALL BE OF PROPERTY CLASS 8.8 CONFORMING TO IS3757 & IS4000.
6. HEXAGONAL NUTS SHALL CONFIRM TO IS6623.
7. WASHERS SHALL CONFORM TO IS6649.
8. TIGHTENING OF NUTS SHALL BE AS PER IS4000. NUTS SHALL BE "SNUG TIGHT" i.e. THE LEVEL OF TIGHTNESS ATTAINED BY A FEW IMPACTS OF AN IMPACT WRENCH OR BY THE FULL EFFORTS OF A MAN USING A STANDARD/PODGER SPANNER OR A SPUD WRENCH.
9. ALL BOLTS, NUTS & WASHERS SHALL BE GALVANIZED AS PER IS1367, PART XIII.
10. THE CONNECTIONS ARE DESIGNED FOR 120% OF PLASTIC MOMENT CAPACITY OF CROSS-SECTIONS AS PER IS:800-2007 (LSD) CONNECTIONS HAVE BEEN DESIGNED FOR AT LEAST 70% OF ABOVE CAPACITY IN STRESS REVERSAL CASE.
11. THE CONNECTIONS ARE DESIGNED FOR 60% SHEAR CAPACITY OF THE MEMBERS.
12. THIS STANDARD IS VALID FOR COLUMN SIZES EQUAL OR HIGHER THAN BEAM SIZES.
13. WEB DOUBLER PLATE SHALL BE CONNECTED TO COLUMN FLANGE WITH FILLET WELD OF THICKNESS EQUAL TO DOUBLER PLATE THICKNESS(t_3) AS SHOWN IN VIEW 2-2 & 5-5.
14. THE ROOT OF ALL BUTT WELD/ GROOVE WELD SHOULD BE BACKED BY A 8 MM FILLET WELD. ALTERNATIVELY BACKING PLATE MAY BE PROVIDED. A TYPICAL DETAIL OF BACKING PLATE IS SHOWN IN DETAIL 'F'.
15. COMPATIBLE WELD BASE METAL OF STRENGTH HIGHER THAN YIELD STRENGTH OF STEEL SHALL BE USED.
16. WHEN MOMENT CONNECTION IS PROVIDED AT TOP PLATFORM, COLUMN SHALL BE EXTENDED AS PER CONNECTION REQUIREMENT. TO AVOID TRIPPING HAZARD, A CAP PLATE SHALL BE PROVIDED AT TOP WITH EASILY IDENTIFIABLE COLOR.
17. IN CASE WHERE END PLATE WIDTH IS MORE THAN COLUMN FLANGE WIDTH, ADDITIONAL PLATE SHALL BE ADDED TO COLUMN FLANGE, AS SHOWN ON PAGE-1. THICKNESS OF ADDITIONAL FLANGE PLATE SHALL BE EQUAL TO OR MORE THAN COLUMN FLANGE THICKNESS.
18. ADDITIONAL BOLTS SHALL BE PROVIDED FROM TOP (i.e. BELOW MANDATORY BOLTS).
19. STANDARD NO. 7-68-0657 FOR BOLTED MOMENT CONNECTION IS RENUMBERED AND ISSUED AS PRESENT STANDARD.



S. NO.	T-SUPPT. MKD.	WIDTH 'W'	HEIGHT 'H'	MEMB 'A'	BASE PLATE TYPE	h	CONN. PLATE		APPX. QTY IN KG
							A	B	
1	TSA	UPTO 750	UPTO 2000	ISMC150□	I	200	200	225	150
2	TSB	UPTO 750	2000 < H ≤ 3000	ISMC200□	II	275	250	300	260
3	TSC	UPTO 750	3000 < H ≤ 4000	ISMC250□	III	325	300	350	410
4	TSD	750 < W ≤ 1500	UPTO 1500	ISMC150□	I	200	200	225	160
5	TSE	750 < W ≤ 1500	1500 < H ≤ 2300	ISMC200□	II	275	250	300	260
6	TSF	750 < W ≤ 1500	2300 < H ≤ 3000	ISMC250□	III	325	300	350	400

4	12.04.23	REVISED AND ISSUED AS STANDARD	RKAUR	DK/BA	ANURAG SINHA	S.MAZUMDAR
3	15.04.17	REAFFIRMED & ISSUED AS STANDARD	Anju	ADITYA	RAJAN JI SRIVASTAVA	R.NANDA
2	27.06.11	REVISED AND ISSUED AS STANDARD	SUSHMA	P.K.MITTAL	S.CHATURVEDI	D.MALHOTRA
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman



S. NO.	T-SUPPORT MARKED	PED SIZE		5.0 ≤ S.B.C < 10.0 T/sqM			10.0 ≤ S.B.C < 15.0 T/sqM			S.B.C ≥ 15.0 T/sqM		
		d	b	L	B	QTY IN m³	L	B	QTY IN m³	L	B	QTY IN m³
1	TSA	600	600	1800	1800	1.51	1600	1600	1.31	1500	1500	1.22
2	TSB	650	650	2000	2000	1.83	1750	1750	1.55	1600	1600	1.40
3	TSC	700	700	2250	2250	2.25	1800	1800	1.71	1800	1800	1.71
4	TSD	600	600	2000	2000	1.74	1750	1750	1.46	1600	1600	1.31
5	TSE	650	650	2250	2250	2.15	1800	1800	1.60	1700	1700	1.50
6	TSF	700	700	2250	2250	2.25	1900	1900	1.82	1900	1900	1.82

NOTES:-

- FOLLOWING LOADS HAVE BEEN CONSIDERED IN DESIGN:
 - VERTICAL LOAD = 1.0 MT FOR 750 WIDTH
 = 2.0 MT FOR 1500 WIDTH
 - WIND INTENSITY = 150 Kg/sqm
 - WIND ON 24" PIPE HAS BEEN CONSIDERED
 - PIPE FRICTION COEFFICIENT IN EITHER DIRECTION = 0.30
- CONC GRADE SHALL BE AS PER GENERAL NOTES OF THE PROJECT BUT NOT LOWER THEN M20.

* DEPTH OF FDN. CAN BE INCREASED TO CLEAR U/G PIPING IF ANY.

Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman
4	12.04.23	REVISED AND ISSUED AS STANDARD	RKAUR	DK/DA	ANURAG SINHA	S.MAZUMDAR
3	15.04.17	REAFFIRMED & ISSUED AS STANDARD	Anju	ADITYA	RAJAN JI SRIVASTAVA	R.NANDA
2	27.06.11	REVISED AND ISSUED AS STANDARD	SUSHMA	P.K.MITTAL	S.CHATURVEDI	D.MALHOTRA

Approved by

**DETAIL OF
SLIDING T-SUPPORT
USING HOLLOW SECTIONS**

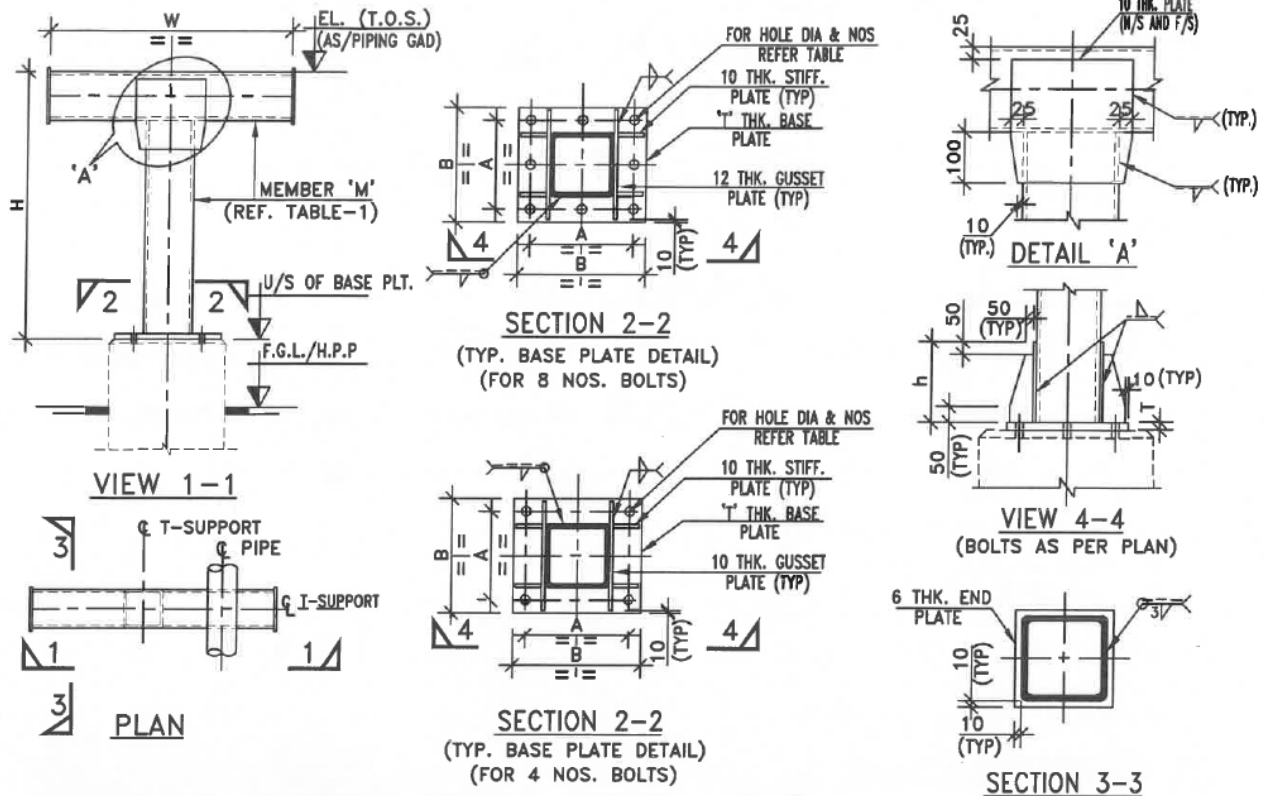
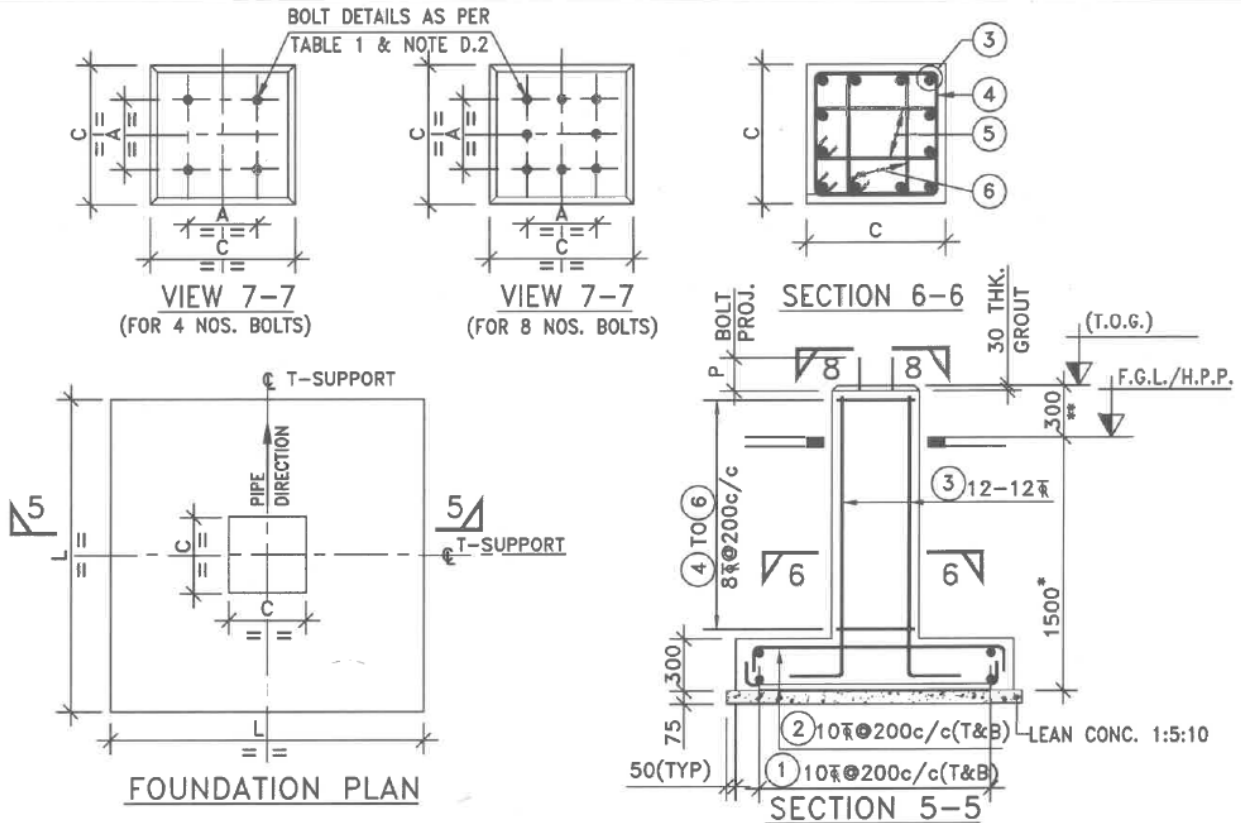


TABLE-1 (TABLE FOR SUPER STRUCTURE DETAIL OF T-SUPPORTS)

SL. NO.	T-SUPPT. MKD.	WIDTH 'W' (MM)	MAX. VERTICAL LOAD IN MT	HEIGHT 'H' (MM)	MEMBER 'M' (SHS)	BOLT (MM)			DIMENSIONS (MM)				APPX. QTY IN KG	
						DIA	HOLE	NOS	P	A	B	T		h
1	TS-01	UPTO 750	1.0	UPTO 2000	150X150X6	20	22	4	120	250	350	20	-	92
2	TS-02	UPTO 750	2.0		180X180X8	24	27	4	140	280	380	25	-	121
3	TS-03	UPTO 1000	1.5		180X180X8	24	27	4	140	280	380	25	-	121
4	TS-04	UPTO 750	1.0	2000<H<3000	180X180X8	24	27	4	140	280	380	25	-	164
5	TS-05	UPTO 750	2.0		220X220X10	24	27	4	140	320	420	25	-	234
6	TS-06	UPTO 1500	1.5		220X220X10	24	27	4	140	320	420	25	-	234
7	TS-07	UPTO 750	1.0	3000<H<4000	220X220X10	24	27	4	140	320	420	25	250	297
8	TS-08	UPTO 750	2.0		250X250X10	20	22	8	120	350	450	20	250	376
9	TS-09	UPTO 1500	1.5		250X250X10	20	22	8	120	350	450	20	250	376
10	TS-10	UPTO 750	1.0	4000<H<5000	250X250X10	20	22	8	120	350	450	20	250	449
11	TS-11	UPTO 750	2.5		300X300X12	24	27	8	140	400	500	25	250	647
12	TS-12	UPTO 1500	1.5		300X300X12	24	27	8	140	400	500	25	250	647
13	TS-13	UPTO 750	2.0	5000<H<6000	300X300X12	36	39	4	180	400	500	36	300	759
14	TS-14	UPTO 750	3.0		350X350X12	30	33	8	160	450	550	32	300	903
15	TS-15	UPTO 1500	2.5		350X350X12	30	33	8	160	450	550	32	300	903
16	TS-16	UPTO 1500	1.0	UPTO 1500	150X150X6	20	22	4	120	250	350	20	200	81
17	TS-17	UPTO 1500	2.0		180X180X8	20	22	8	120	280	380	20	200	120
18	TS-18	UPTO 2000	1.5		180X180X8	20	22	8	120	280	380	20	200	120
19	TS-19	UPTO 1500	1.0	1500<H<2300	180X180X8	24	27	4	140	280	380	25	250	155
20	TS-20	UPTO 1500	2.5		220X220X10	20	22	8	120	320	420	20	250	221
21	TS-21	UPTO 2000	1.5		220X220X10	20	22	8	120	320	420	20	250	221
22	TS-22	UPTO 1500	2.0	2300<H<3000	220X220X10	30	33	4	160	320	420	32	250	270
23	TS-23	UPTO 1500	2.5		250X250X10	30	33	4	160	350	450	32	250	308
24	TS-24	UPTO 2000	2.5		250X250X10	30	33	4	160	350	450	32	250	308
25	TS-25	UPTO 1500	1.0	3000<H<4000	220X220X10	20	22	8	120	320	420	20	300	334
26	TS-26	UPTO 1500	3.0		300X300X12	36	39	4	180	400	500	36	300	548
27	TS-27	UPTO 3000	2.0		300X300X12	36	39	4	180	400	500	36	300	548
28	TS-28	UPTO 1500	1.0	4000<H<5000	250X250X10	30	33	4	160	350	450	32	350	460
29	TS-29	UPTO 1500	3.5		350X350X12	30	33	8	160	450	550	32	350	784
30	TS-30	UPTO 3000	2.5		350X350X12	30	33	8	160	450	550	32	350	784
31	TS-31	UPTO 1500	1.0	5000<H<6000	300X300X12	30	33	4	160	400	500	32	400	758
32	TS-32	UPTO 1500	3.5		400X400X12	36	39	8	180	500	600	36	400	1067
33	TS-33	UPTO 3000	3.0		400X400X12	36	39	8	180	500	600	36	400	1067

3	30.12.25	REVISED AND ISSUED AS STANDARD	NR/SSS	YK/ALS	ANURAG SINHA	MAINAK NANDI
2	13.03.25	REAFFIRMED AND ISSUED AS STANDARD	JG	AVM	RAJANJI SRIVASTAVA	R.K.TRIVEDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convener	Stds. Bureau Chairman

DETAIL OF
SLIDING T-SUPPORT
USING HOLLOW SECTIONS



(* DEPTH OF FDN. CAN BE INCREASED TO CLEAR U/G PIPING IF ANY.)

(**MIN. HEIGHT OF PEDESTAL SHALL BE AS PER EDB)

TABLE-2 (FOUNDATION DETAILS)

SL. NO.	T-SUPPT. MKD.	PED SIZE C	5.0 < S.B.C < 10.0 T/sqM		10.0 < S.B.C < 15.0 T/sqM		S.B.C > 15.0 T/sqM	
			FDN. SIZE L	QTY IN m ³	FDN. SIZE L	QTY IN m ³	FDN. SIZE L	QTY IN m ³
1	TS-01	550		1.5		1.2		1.0
2	TS-02	600	1800	1.5	1600	1.3	1400	1.1
3	TS-03	600		1.5		1.3		1.1
4	TS-04	600		1.7		1.5		1.3
5	TS-05	650	2000	1.8	1800	1.6	1600	1.4
6	TS-06	650		1.8		1.6		1.4
7	TS-07	650		2.1		1.8		1.6
8	TS-08	650	2200	2.1	2000	1.8	1800	1.6
9	TS-09	650		2.1		1.8		1.6
10	TS-10	650		2.4		2.1		1.8
11	TS-11	700	2400	2.5	2200	2.2	2000	1.9
12	TS-12	700		2.5		2.2		1.9
13	TS-13	700		2.8		2.5		2.2
14	TS-14	750	2600	2.9	2400	2.6	2200	2.3
15	TS-15	750		2.9		2.6		2.3
16	TS-16	550		1.5		1.2		1.0
17	TS-17	600	1800	1.5	1600	1.3	1400	1.1
18	TS-18	600		1.5		1.3		1.1
19	TS-19	600		1.7		1.5		1.3
20	TS-20	650	2000	1.8	1800	1.6	1600	1.4
21	TS-21	650		1.8		1.6		1.4
22	TS-22	650		2.1		1.8		1.6
23	TS-23	650	2200	2.1	2000	1.8	1800	1.6
24	TS-24	650		2.1		1.8		1.6
25	TS-25	650		2.4		2.1		1.8
26	TS-26	700	2400	2.5	2200	2.2	2000	1.9
27	TS-27	700		2.5		2.2		1.9
28	TS-28	650		2.7		2.4		2.1
29	TS-29	750	2600	2.9	2400	2.6	2200	2.3
30	TS-30	750		2.9		2.6		2.3
31	TS-31	700		3.1		2.8		2.5
32	TS-32	800	2900	3.3	2600	3.0	2400	2.7
33	TS-33	800		3.3		3.0		2.7

NOTES:-

A. DESIGN PARAMETERS:-

1. THE FOLLOWING LOADS HAVE BEEN CONSIDERED IN DESIGN:
 - a) FOR VERTICAL LOAD (INCLUDING PIPE EMPTY WEIGHT) REFER TABLE-1
 - b) WIND LOAD = 150 Kg/sqM
 - c) PIPE FRICTION COEFFICIENT IN EITHER DIRECTION ACTING SIMULTANEOUSLY = 0.3
2. ALLOWABLE HORIZONTAL DEFLECTION = H/250

B. MATERIAL PROPERTIES:-

1. CONC GRADE SHALL BE AS PER GENERAL NOTES OF THE PROJECT BUT NOT LOWER THAN M25.
2. GRADE OF REINFORCEMENT STEEL SHALL BE AS PER GENERAL NOTES OF THE PROJECT BUT NOT LESS THAN Fe500D.
3. GRADE OF HOLLOW SECTIONS SHALL BE Yst 310 (MINIMUM) AS PER IS 4923.
4. ALL STRUCTURAL STEEL OTHER THAN HOLLOW SECTIONS SHALL BE AS PER IS 2062 GRADE E250 QUALITY BR/BO.

C. GEOTECHNICAL:-

1. NET SAFE BEARING CAPACITY (SBC) SHALL BE AS PER GEOTECH RECOMMENDATION FOR THE PROJECT.

D. GENERAL:-

1. ALL FILLET WELDS SHALL BE 6mm THK. (UPTO 3M HEIGHT) & 8mm THK. (ABOVE 3M & UPTO TO 6M HEIGHT).
2. ANCHOR BOLTS SHALL BE DOUBLE NUT TYPE IV AS PER EIL STANDARD NO. 7-68-0417.
3. GROUT SHALL BE NON-SHRINK TYPE.
4. SMART FABRICATION FOR BASE PLATE SHALL BE PREFERRED.

E. LEGEND:-

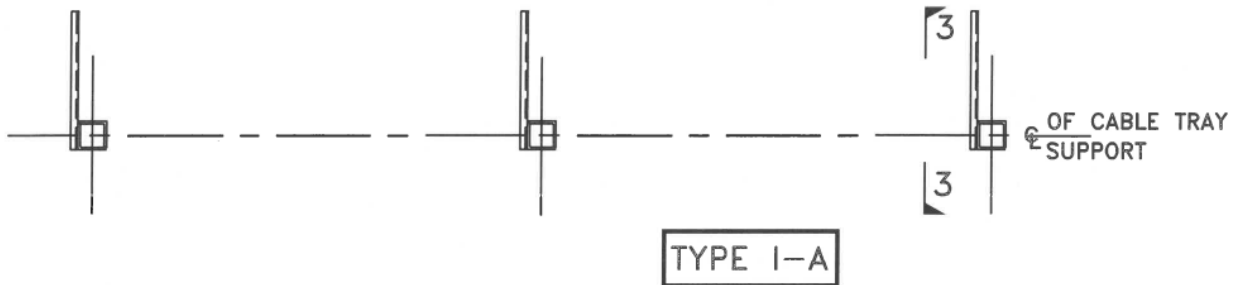
1. F.G.L. - FINISHED GROUND LEVEL
2. H.P.P. - HIGHEST PAVEMENT POINT
3. SHS - SQUARE HOLLOW SECTION
4. T.O.G - TOP OF GROUT
5. T.O.S - TOP OF STEEL

NOTES:

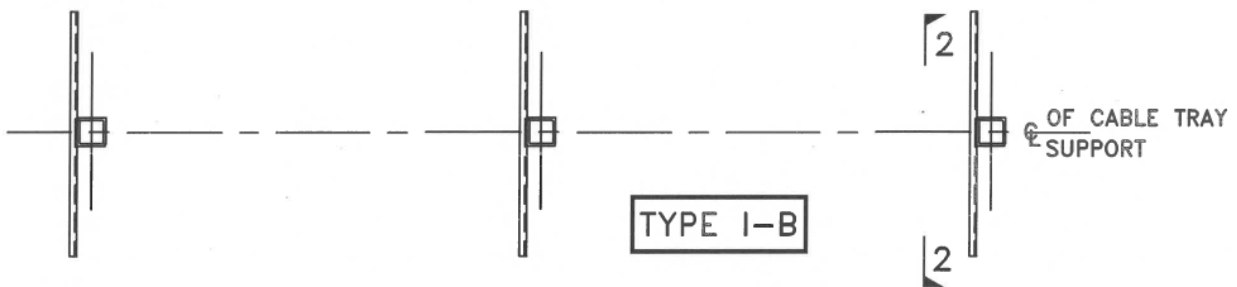
1. ALL DIMENSIONS ARE IN MILLIMETRES.
2. STRUCTURAL STEEL TO BE USED SHALL CONFORM TO IS:2062 GRADE-A/B.
3. R/F SHALL BE HIGH STRENGTH DEFORMED BARS OF GRADE Fe500D CONFORMING TO IS:1786.
4. CONCRETE WORKS SHALL BE AS PER GENERAL NOTES OF THE PROJECT.
5. GUSSET PLATES SHALL BE 8mm THICK UNO.
6. ALL CONNECTIONS SHALL BE WELDED USING 6mm THICK FILLET WELD.
7. ANCHOR BOLTS SHALL BE AS PER EIL STD. NO. 7-68-0417.
8. FOUNDATIONS SHOWN IN THIS STANDARD ARE VALID FOR S.B.C. OF 5T/Sqm OR MORE AT FOUNDATION LEVEL.
9. GROUT SHALL BE ORDINARY 1:2 CEMENT SAND MORTAR.
10. THE STRUCTURES ARE DESIGNED FOR ELECTRICAL CABLE & TRAY LOAD OF 85Kg/m.
11. LOCATION OF CENTRE OF CABLE TRAY SUPPORTS SHALL BE AS PER GEN. CIVIL & PIPING GADS.

4	13.03.25	REAFFIRMED AND ISSUED AS STANDARD	<i>Jitender</i> JITENDER	<i>Amarjeet</i> AMARJEET	<i>Anurag Sinha</i> ANURAG SINHA	<i>Mainak Nandi</i> MAINAK NANDI
3	15.07.19	REAFFIRMED AND ISSUED AS STANDARD	JG	AVM	RAJANJI SRIVASTAVA	R.K.TRIVEDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
						Approved by

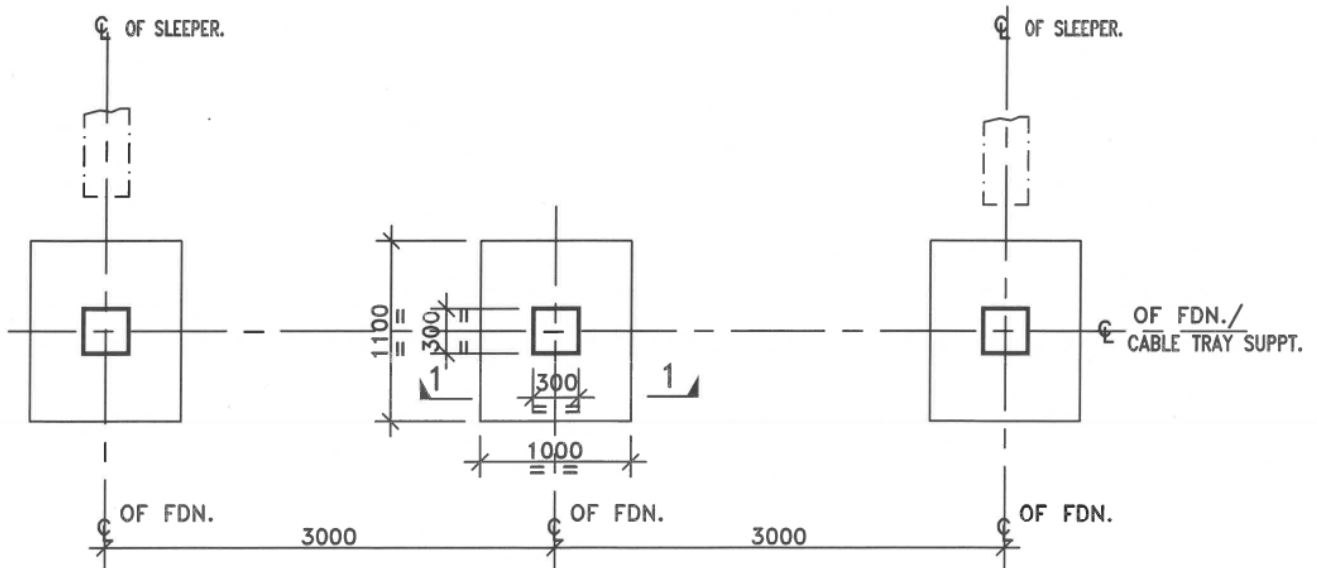
(A) 600mm WIDE TWO TIERED CABLE TRAY SUPPORTS TYPE-1



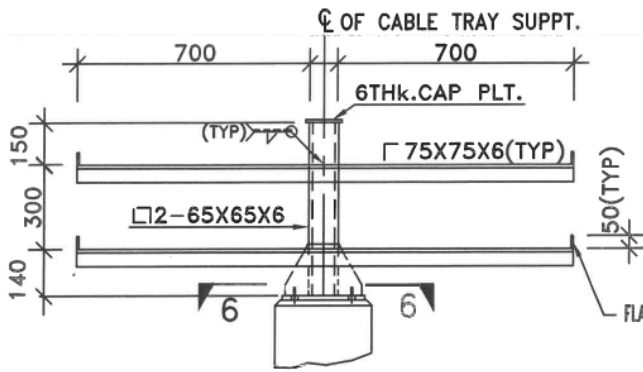
TYPICAL G.A.OF CABLE TRAY SUPPT.
(FOR 1 SIDE CABLE TRAY)



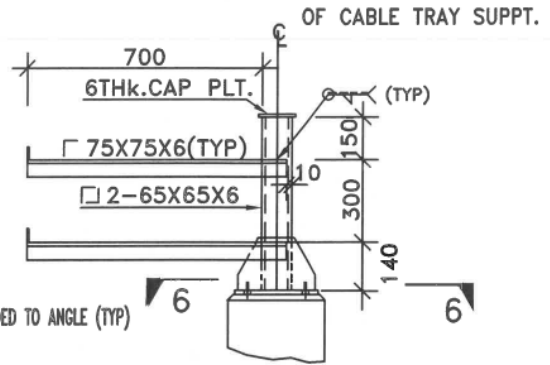
TYPICAL G.A.OF CABLE TRAY SUPPT.
(FOR 2 SIDE CABLE TRAY)



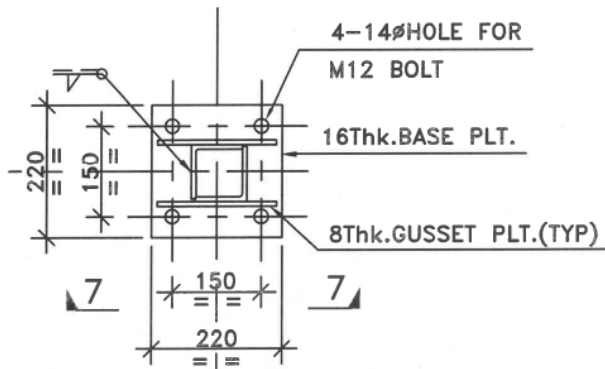
TYPICAL FDN. LAYOUT
(FOR 1 SIDE & 2 SIDE CABLE TRAY SUPPT.)



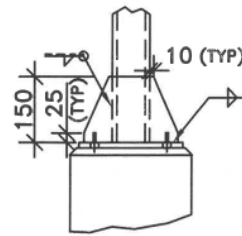
VIEW 2-2
(FOR 2 SIDE CABLE TRAY STR.)



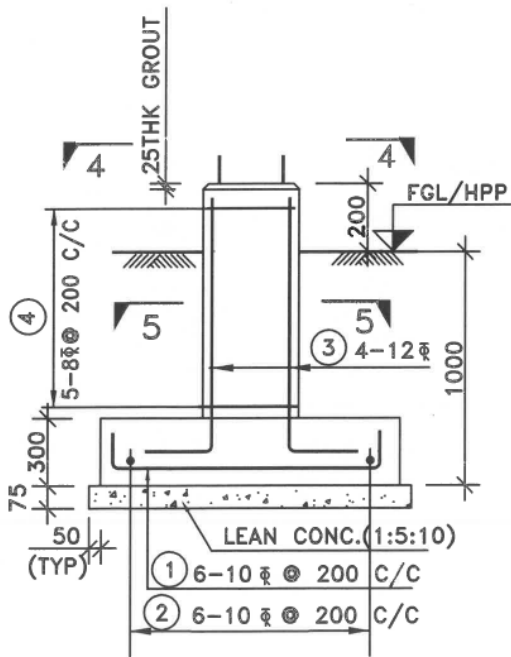
VIEW 3-3
(FOR 1 SIDE CABLE TRAY STR.)



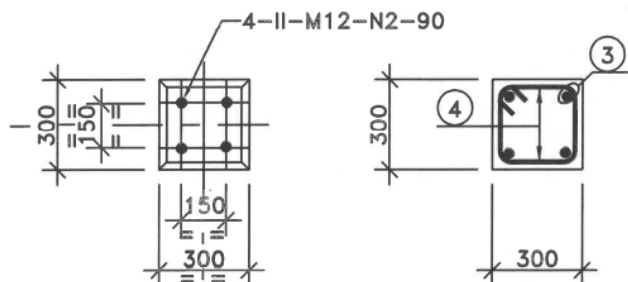
VIEW 6-6



VIEW 7-7



SECTION 1-1



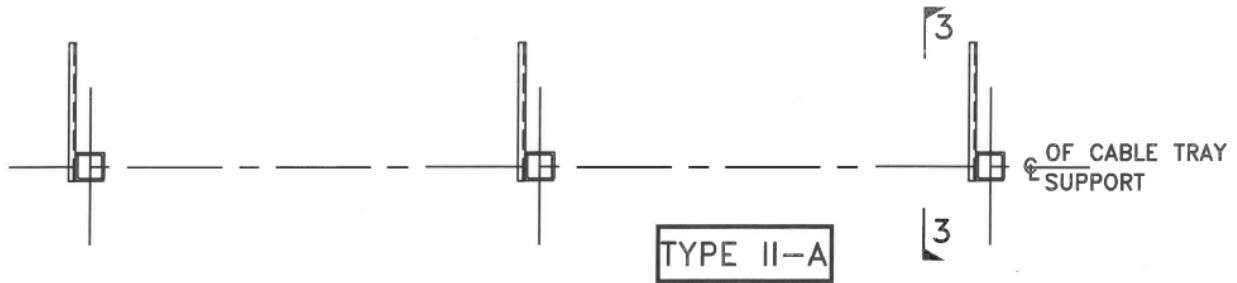
VIEW 4-4

SEC. 5-5

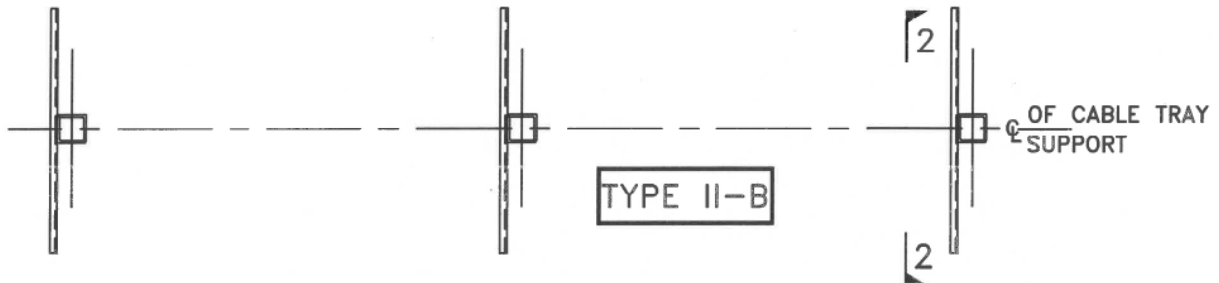
QUANTITIES (FOR EACH SUPPT.)	
PCC 1:5:10	= 0.10 CUM.
* CONC.	= 0.45 CUM.
STRL. STEEL	= 25 KG. (FOR 1 SIDE STR.)
	= 35 KG. (FOR 2 SIDE STR.)

(* GRADE OF CONC. SHALL BE AS PER GENERAL NOTES OF PROJECT.)

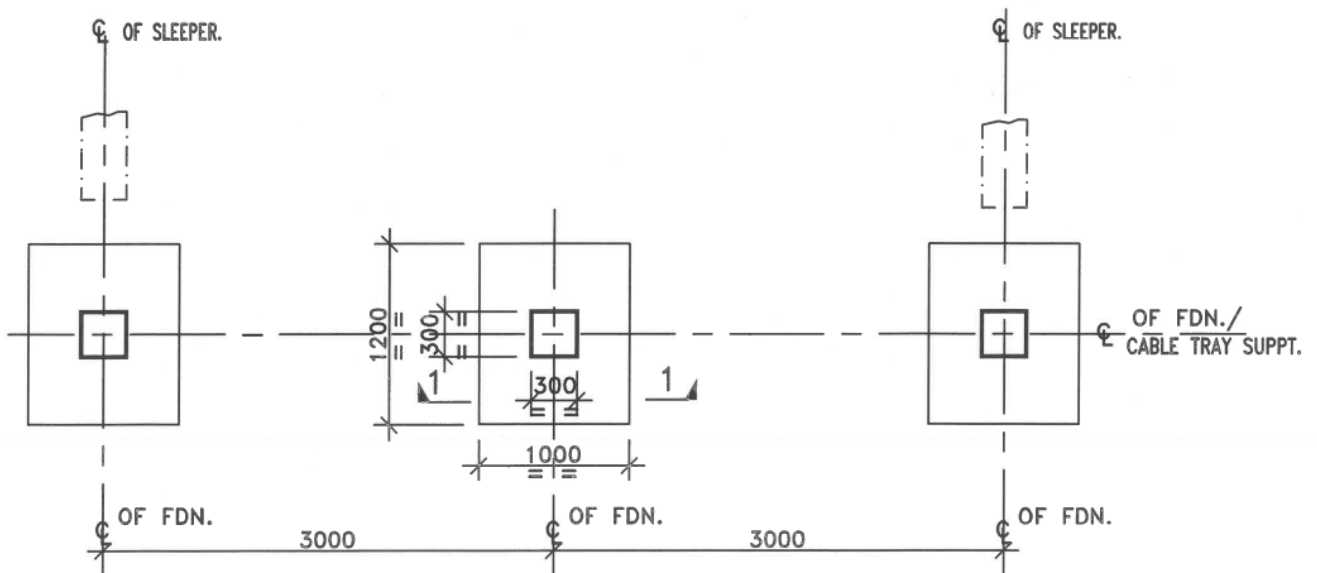
(B) 750mm WIDE TWO TIERED CABLE TRAY SUPPORTS TYPE-II



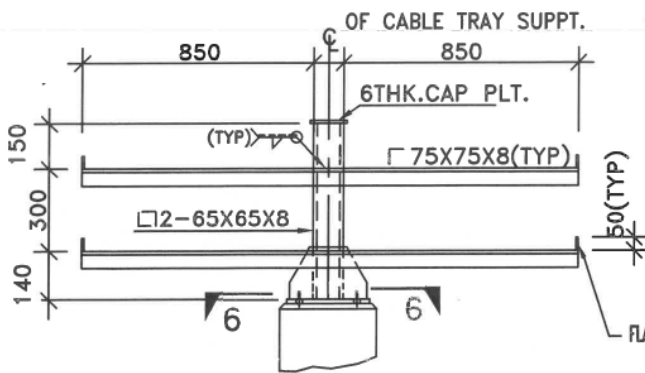
TYPICAL G.A. OF CABLE TRAY SUPPT.
(FOR 1 SIDE CABLE TRAY)



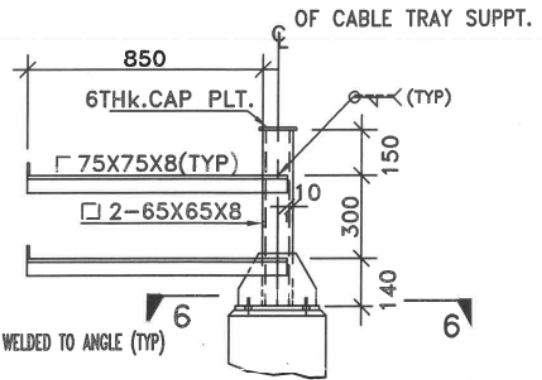
TYPICAL G.A. OF CABLE TRAY SUPPT.
(FOR 2 SIDE CABLE TRAY)



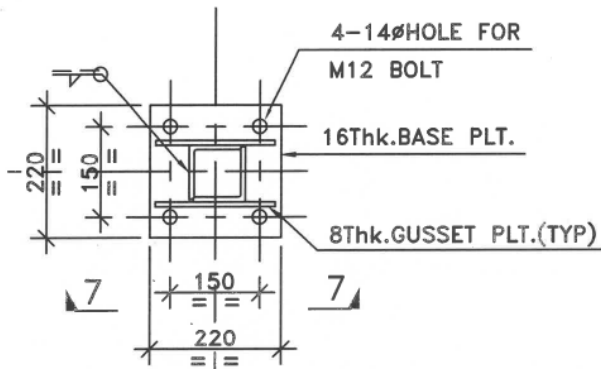
TYPICAL FDN. LAYOUT
(FOR 1 SIDE & 2 SIDE CABLE TRAY SUPPT.)



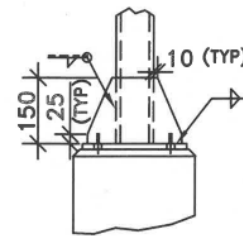
VIEW 2-2
(FOR 2 SIDE CABLE TRAY STR.)



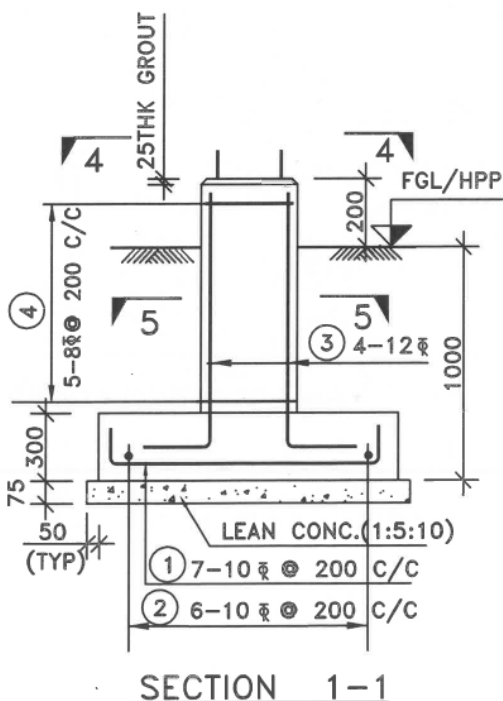
VIEW 3-3
(FOR 1 SIDE CABLE TRAY STR.)



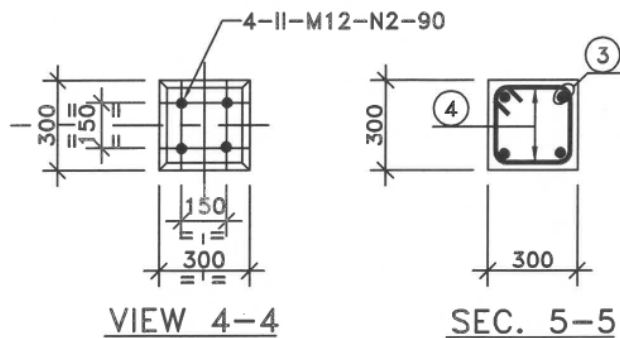
VIEW 6-6



VIEW 7-7



SECTION 1-1



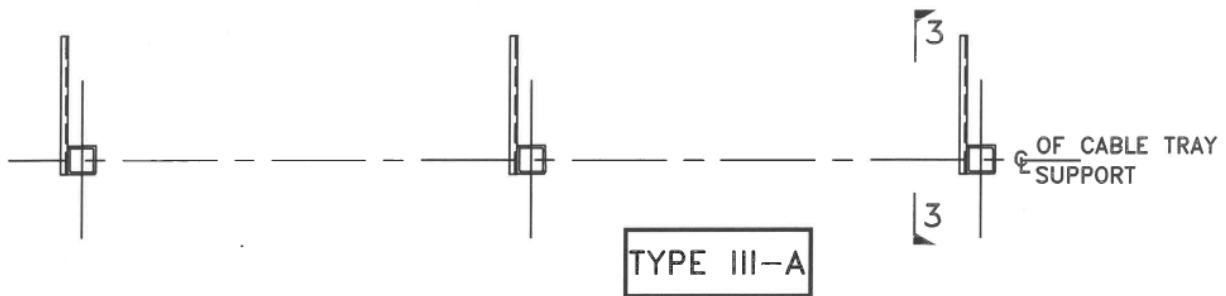
VIEW 4-4

SEC. 5-5

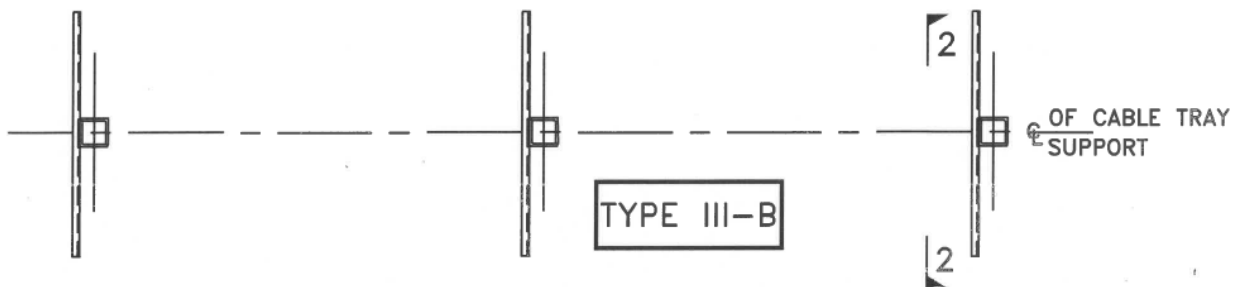
QUANTITIES (FOR EACH SUPPT.)	
PCC 1:5:10	= 0.11 CUM.
* CONC.	= 0.5 CUM.
STRL. STEEL	= 35 KG. (FOR 1 SIDE STR.)
	= 45 KG. (FOR 2 SIDE STR.)

(* GRADE OF CONC. SHALL BE AS PER GENERAL NOTES OF PROJECT.)

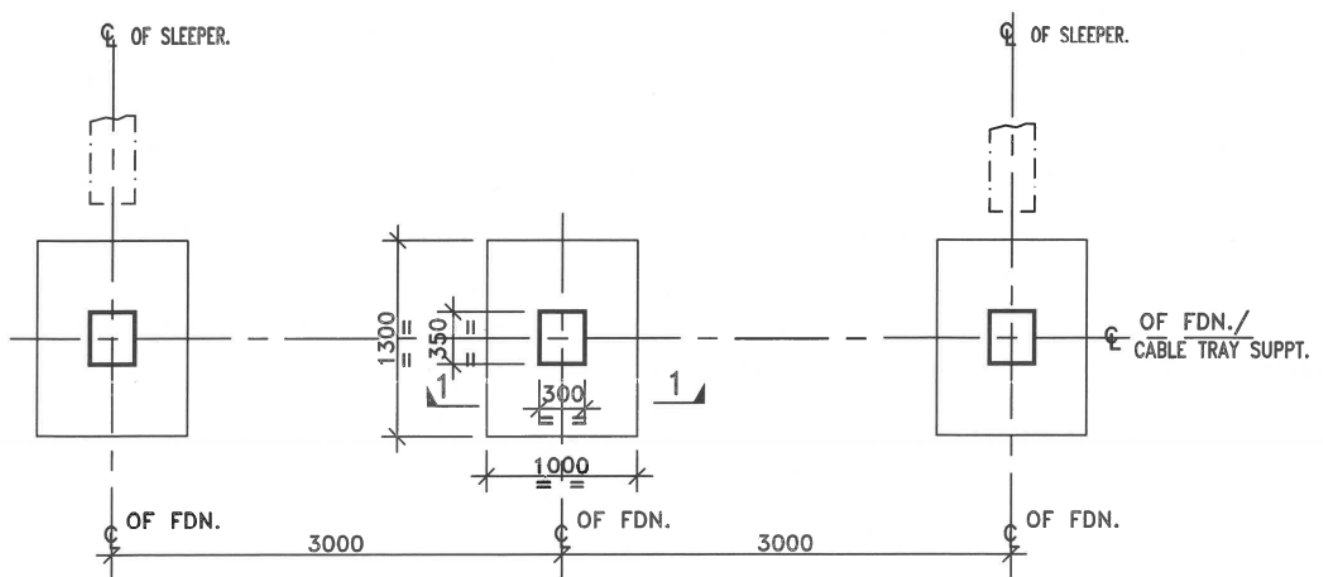
(C) 600mm WIDE THREE TIERED CABLE TRAY SUPPORTS TYPE-III



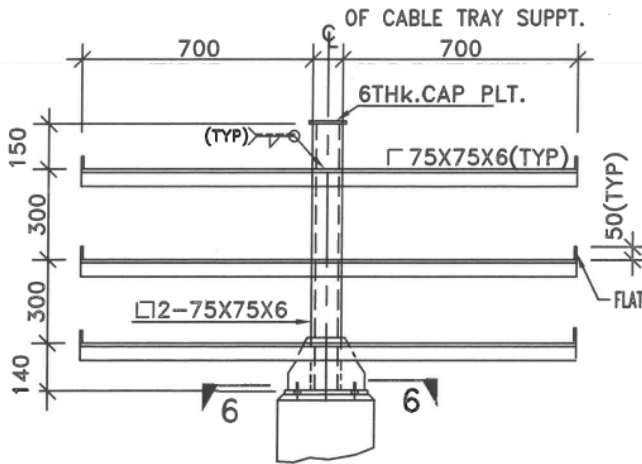
TYPICAL G.A. OF CABLE TRAY SUPPT.
(FOR 1 SIDE CABLE TRAY)



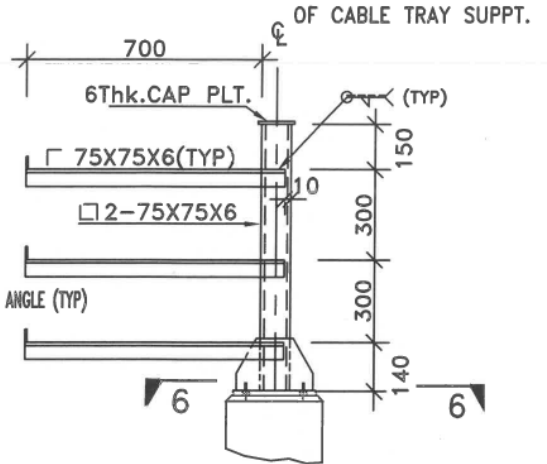
TYPICAL G.A. OF CABLE TRAY SUPPT.
(FOR 2 SIDE CABLE TRAY)



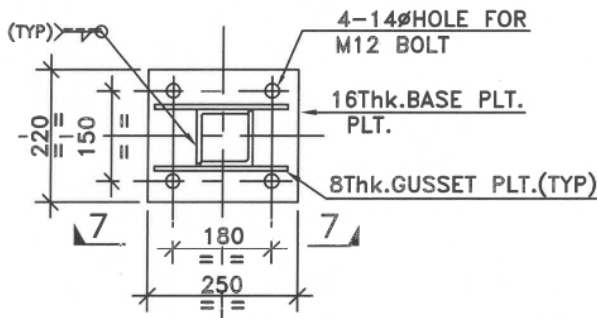
TYPICAL FDN. LAYOUT
(FOR 1 SIDE & 2 SIDE CABLE TRAY SUPPT.)



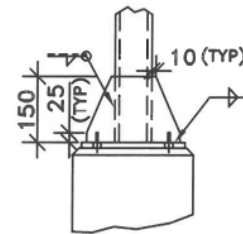
VIEW 2-2
(FOR 2 SIDE CABLE TRAY STR.)



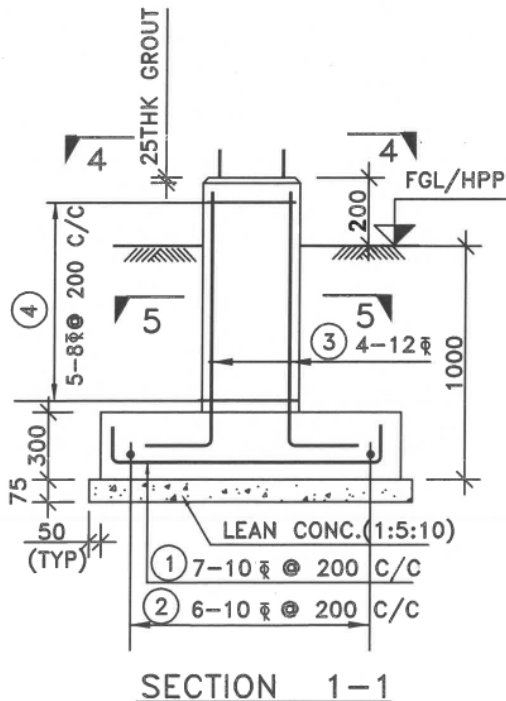
VIEW 3-3
(FOR 1 SIDE CABLE TRAY STR.)



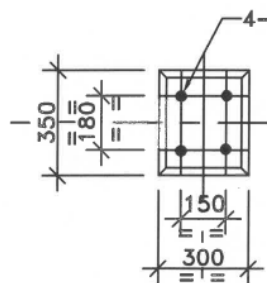
VIEW 6-6



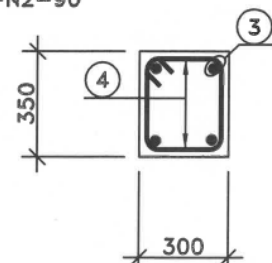
VIEW 7-7



SECTION 1-1



VIEW 4-4

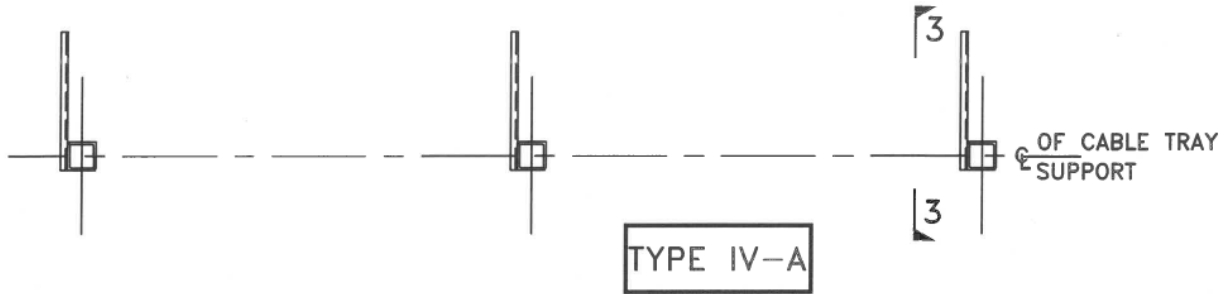


SEC. 5-5

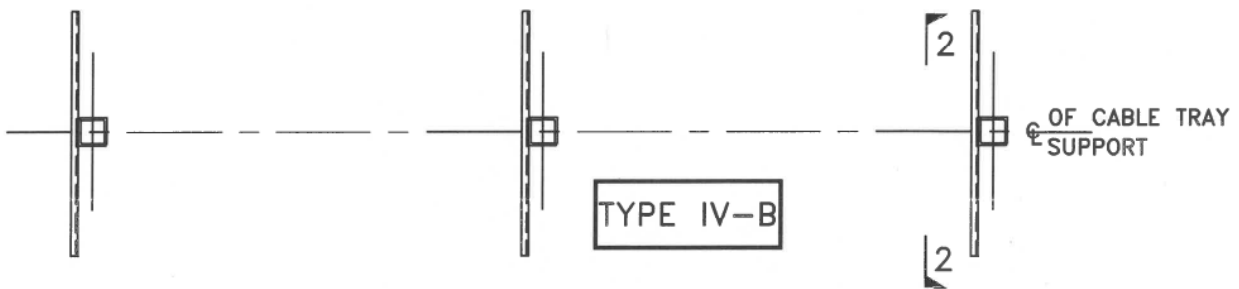
QUANTITIES (FOR EACH SUPPT.)	
PCC 1:5:10	= 0.12 CUM.
* CONC.	= 0.50 CUM.
STRL. STEEL	= 40 KG. (FOR 1 SIDE STR.)
	= 55 KG. (FOR 2 SIDE STR.)

(* GRADE OF CONC. SHALL BE AS PER GENERAL NOTES OF PROJECT.)

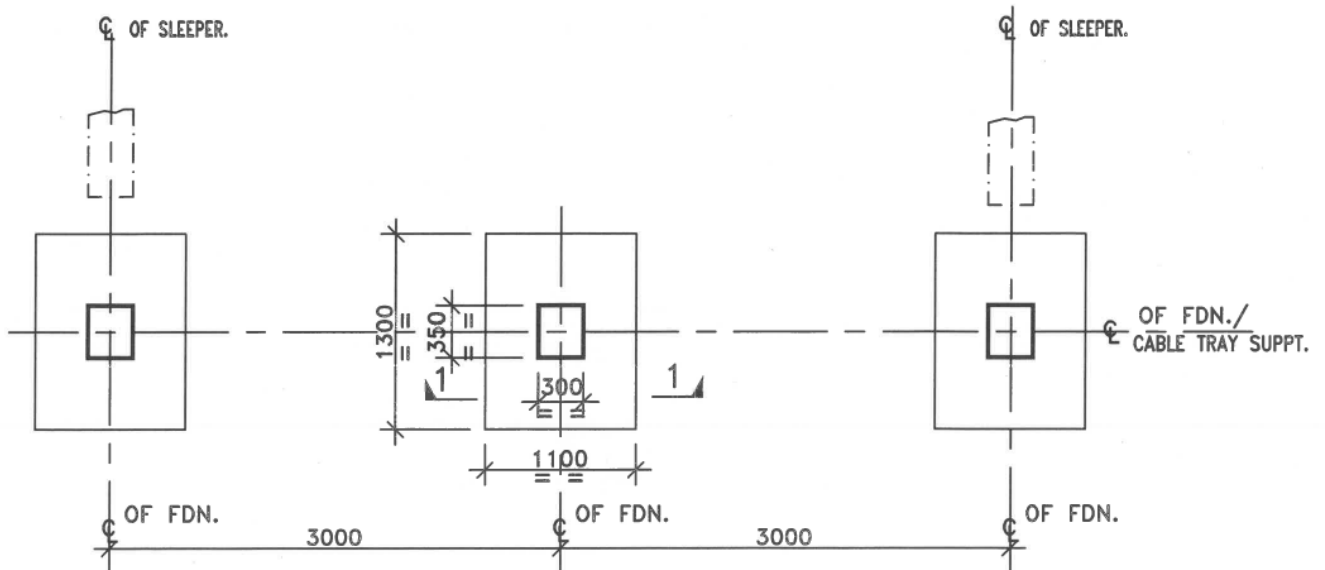
(D) 750mm WIDE THREE TIERED CABLE TRAY SUPPORTS TYPE-IV



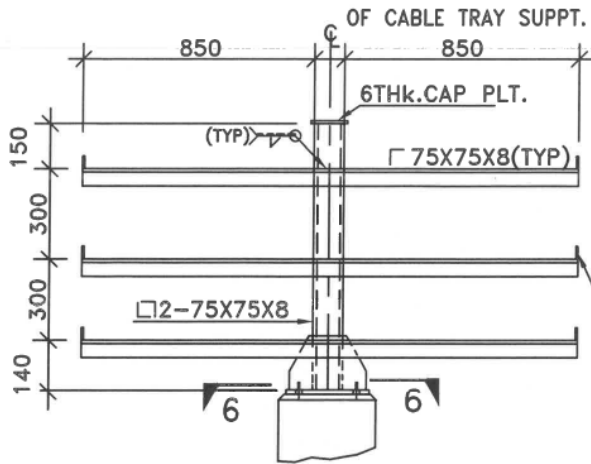
TYPICAL G.A. OF CABLE TRAY SUPPT.
 (FOR 1 SIDE CABLE TRAY)



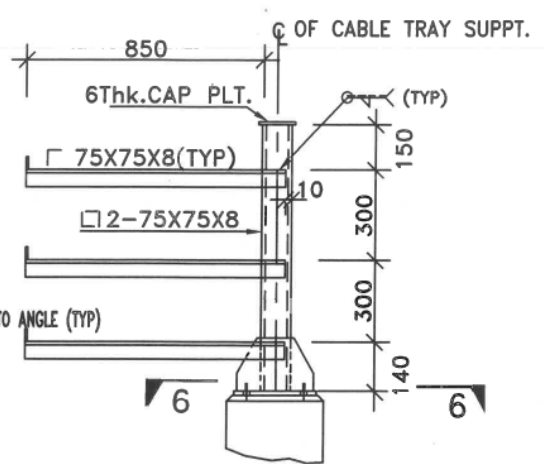
TYPICAL G.A. OF CABLE TRAY SUPPT.
 (FOR 2 SIDE CABLE TRAY)



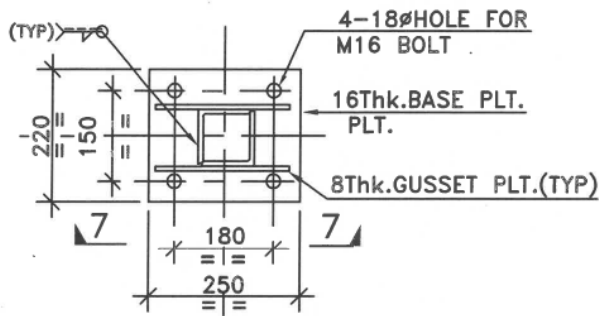
TYPICAL FDN. LAYOUT
 (FOR 1 SIDE & 2 SIDE CABLE TRAY SUPPT.)



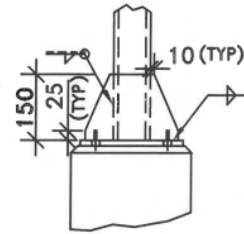
VIEW 2-2
 (FOR 2 SIDE CABLE TRAY STR.)



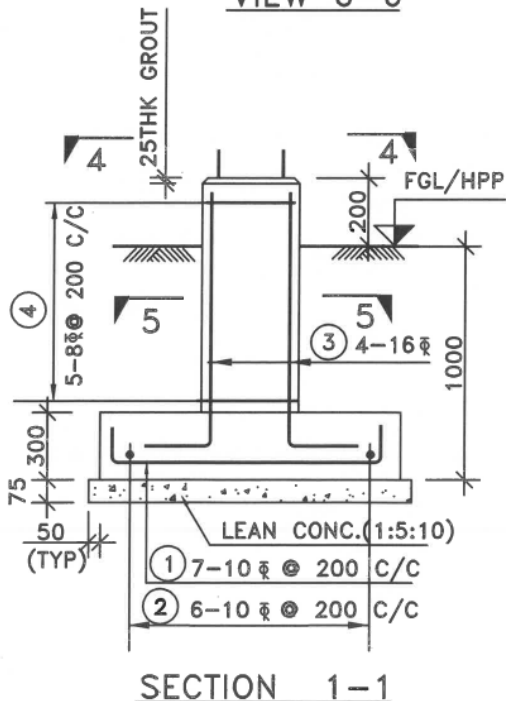
VIEW 3-3
 (FOR 1 SIDE CABLE TRAY STR.)



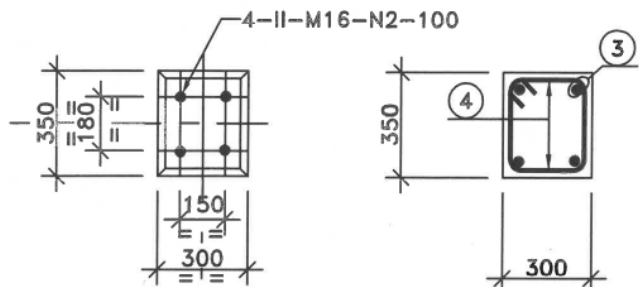
VIEW 6-6



VIEW 7-7



SECTION 1-1



VIEW 4-4

SEC. 5-5

QUANTITIES (FOR EACH SUPPT.)	
PCC1:5:10	= 0.12 CUM.
* CONC.	= 0.55 CUM.
STRL. STEEL	= 45 KG. (FOR 1 SIDE STR.)
	= 65 KG. (FOR 2 SIDE STR.)

(* GRADE OF CONC. SHALL BE AS PER GENERAL NOTES OF PROJECT.)

NOTES :-

- ALL DIMENSIONS ARE IN mm.
- THE TYPE OF GRATING TO BE USED SHALL BE CALLED OUT ON THE DESIGN DRAWING.
- MATERIAL FOR THE GRATING SHALL CONFORM TO FOLLOWING STANDARDS:

	CARBON STEEL (CS) GRATING	STAINLESS STEEL (SS) GRATING
(a) MAIN MEMBER & END FLAT	IS 2062 (GRADE E250) SUB QUALITY-A/BR/BO	GRADE 409M CONFORMING TO ASTM 240/480 (UNS S40977)
(b) CROSS MEMBER (SQ.TWISTED ACROSS BAR)	IS 7887	GRADE 409M CONFORMING TO ASTM 240/480 (UNS S40977) OR DESIGNATION X12Cr13 CONFORMING TO IS 6527/6528
(c) FLAT FOR CLAMP	IS 513	GRADE 409M CONFORMING TO ASTM 240/480 (UNS S40977) OR DESIGNATION X12Cr12 CONFORMING TO IS 6603
(d) DISC	CS 1038 GRADE	GRADE 1.4404 CONFORMING TO DIN EN 1.4404 OR GRADE 316/316L CONFORMING TO ASTM 240/480
(e) STUD	CS 1038 GRADE	GRADE 1.4462 CONFORMING TO DIN EN 1.4462 OR GRADE F51 CONFORMING TO ASTM A182

- ALL GRATINGS SHALL BE MANUFACTURED BY ELECTRO-FORGING PROCESS.
- CARBON STEEL GRATINGS INCLUDING TOE PLATES & FLATS (AROUND OPENINGS) AND CLAMPS SHALL BE HOT DIP GALVANISED IN ACCORDANCE WITH IS 2629 AND TESTED AS PER IS 2633 & IS 6745. QUANTITY OF ZINC COATING SHALL BE MINIMUM 900 gm/sqm OF SURFACE AREA (0.12 mm MINIMUM AVERAGE THICKNESS). CLAMP BOLTS & NUTS SHALL HAVE MINIMUM AVERAGE ZINC COATING OF 375 gm/sqm (0.054 mm MINIMUM AVERAGE THICKNESS).
- THE PANEL WIDTH SHOWN ON SUBSEQUENT SHEETS IS INDICATIVE. IT MAY BE INCREASED OR DECREASED AS REQUIRED TO SUIT THE GEOMETRY OF PLATFORM & CONVENIENCE OF HANDLING.
- GRATINGS SHALL NOT BE USED FOR SUPPORTING THE PIPES DIRECTLY. ADDITIONAL MEMBERS (MINIMUM MC125) SHALL BE PROVIDED UNDER THE GRATING FOR SUPPORTING THE PIPE HAVING A MAXIMUM LOAD OF 500 Kg. THIS MEMBER SHALL SPAN IN SAME DIRECTION AS GRATING.
- GRATING PANEL SHALL BE ALIGNED AND TACK WELDED TO THE SUPPORTING MEMBERS. FIXING OF GRATING PANEL WITH SUPPORTING MEMBERS SHALL EITHER BE DONE BY CLAMPS/ DISC (WITHOUT REMOVING TACK WELD) OR ALTERNATIVELY BY INTERMITTENT/STITCH WELDING 50(50).
REMOVABLE GRATING PANEL AS SHOWN IN DRAWINGS SHALL BE FIXED BY CLAMPS/ DISC ONLY.
- FOR GRATING PANELS WITH CUTOUTS/ OPENINGS; STRENGTHENING SHALL BE CARRIED OUT AS PER THE DETAILS GIVEN ON SHEET 6. ADDITIONAL MEMBERS WHEREVER SHOWN SHALL BE PROVIDED IN THE STRUCTURE.
- THE FABRICATED GRATING SHALL FULFILL THE FOLLOWING MINIMUM REQUIREMENTS:
 - UNFUSED JOINTS ARE NOT IN EXCESS OF 5% OF TOTAL JOINTS AND ARE WELDED BY SMAW/GMAW PROCESS.
 - THE JOINTS ARE ABLE TO SUSTAIN A MINIMUM PULL OUT LOAD OF 1.2 TIMES THE SHEAR CAPACITY OF THE CROSS MEMBER.
- EVERY FIFTH MAIN MEMBER SHALL NECESSARILY BE WELDED TO THE END FLAT FROM ONE SIDE. HOWEVER, THE END MAIN MEMBER SHALL ALWAYS BE WELDED TO THE END FLATS.
- OPENINGS UP TO 200 mm DIA ARE NOT SHOWN ON THE DRAWING. THE SAME SHALL BE MADE AT SITE DURING ERECTION OF PIPING.
- FOR CARBON STEEL GRATING, REPAIR TO THE DAMAGED AREA OF GALVANIZED COATING DUE TO WELDING AFTER ERECTION SHALL BE CARRIED OUT AS PER RECOMMENDED PRACTICE OF IS 11759 USING COLD GALVANIZING SPRAY PROCESS. ORGANIC PAINT SYSTEM IS NOT ACCEPTABLE.
- MAXIMUM LENGTH OF SINGLE CONTINUOUSLY SUPPORTED GRATING SHALL BE FIXED ON THE BASIS OF HANDLING. HOWEVER PREFERABLY LENGTH OF GRATING SHALL BE RESTRICTED TO 6 M.
- GRATING FASTENER DISC AND THREADED STUDS SHALL BE CERTIFIED BY EOTA (EUROPEAN ORGANIZATION FOR TECHNICAL ASSESSMENT). FOR INSTALLATION, PILOT HOLE SHALL BE DRILLED WITHOUT SELF-TAPPING. THE STUD WITH PRE-MOUNTED NEOPRENE (FOR CS)/ CHLOROPRENE (FOR SS) WASHER SHALL BE FASTENED INTO THE PILOT HOLE WITH PREDEFINED TORQUE VALUE BASED ON THE MANUFACTURER'S GUIDELINES. THE GRATING DISC SHALL THEN BE FIXED WITH ALLEN-TYPE BIT. VENDOR SHALL PROVIDE THE ENTIRE ARRANGEMENT INCLUDING THE SPECIALIZED TOOLS WITH INSTALLATION INSTRUCTIONS. VENDOR SHALL CARRY OUT PULL OUT LOAD TEST (WITH A LOAD VALUE SPECIFIED FOR THE GRATING PANEL) ON A SAMPLE STUD. THE VENDOR SHALL ALSO PROVIDE INSTALLATION TRAINING TO THE SITE WORKERS. HOT WORK PERMIT (NON-OPEN FLAME TYPE) MAY BE REQUIRED FOR INSTALLATION OF GRATING WITH DISC MECHANISM BASED ON HEAT DISSIPATION REPORT PROVIDED BY THE VENDOR.
CARBON STEEL STUDS & DISC SHALL BE HOT DIP GALVANIZED (MIN. 900 gm/sqm FOR DISC & MIN. AVERAGE 375 gm/sqm FOR STUDS) OR SHALL HAVE A COATING THAT CAN WITHSTAND NEUTRAL SALT SPRAY TEST OF 2000H AS PER DIN EN ISO 9227.
- STAINLESS STEEL GRATINGS INCLUDING LOCALIZED WELDING AREAS SHALL BE CHEMICALLY TREATED AS PER ASTM A380/A380M.
- FOR STAINLESS STEEL GRATINGS, ELECTRODE OF GRADE E309L SHALL BE USED.

6	04.07.24	REVISED & ISSUED AS STANDARD	<i>Jitender</i> JITENDER	<i>Amrjeet</i> AMARJEET	<i>Anurag Sinha</i> ANURAG SINHA	<i>Mainak Nandi</i> MAINAK NANDI
5	29.12.22	REVISED & ISSUED AS STANDARD	JITENDER	AMARJEET	ANURAG SINHA	S.MAZUMDAR
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman
						Approved by


TABLE-1

USE OF GRATING TYPE AT VARIOUS LOCATIONS &
NET SAFE WORKING LOADS FOR GRATING TYPE-I & II

TYPE	APPLICATION	l	500 TO 800	900	1000	1100	1250	1400
		EITHER OF w (UDL IN KN/SQM) OR P (LINEAR LOAD IN KN/M)						
I	1. EQUIPMENT PLATFORM 2. WALKWAY FOR CABLE TRAY IN PIPE RACK 3. OPERATING PLATFORM FROM GRADE/SUPER STRUCTURE 4. APPROACHES	w	19.60	14.80	10.80	8.10	5.30	3.40
		P	9.00	8.00	6.60	5.40	4.00	2.70
II	1. STAIRS 2. FLOOR GRATING FOR a) COMPRESSOR HOUSE b) TECHNOLOGICAL STRUCTURE c) PIPE RACK WITH VALVE / PIPE SUPPORTS d) MAINTENANCE PLATFORM	w	19.60		17.60	13.20	8.70	5.50
		P	14.60	13.00	10.70	8.80	6.30	4.40

NOTE:- THE NET SAFE WORKING LOADS GIVEN ON TABLE-1 ARE BASED ON LIMITING VERTICAL DEFLECTION OF SPAN/200 OR 6mm, WHICHEVER IS LESS.

SYMBOLS :-

- l = EFFECTIVE SPAN IN mm
 b = BEARING WIDTH IN mm
 w = UDL IN KN/SQM
 P = LINEAR LOAD IN KN/M AT MID SPAN ALONG PANEL WIDTH.
 = GRATING SPAN DIRECTION

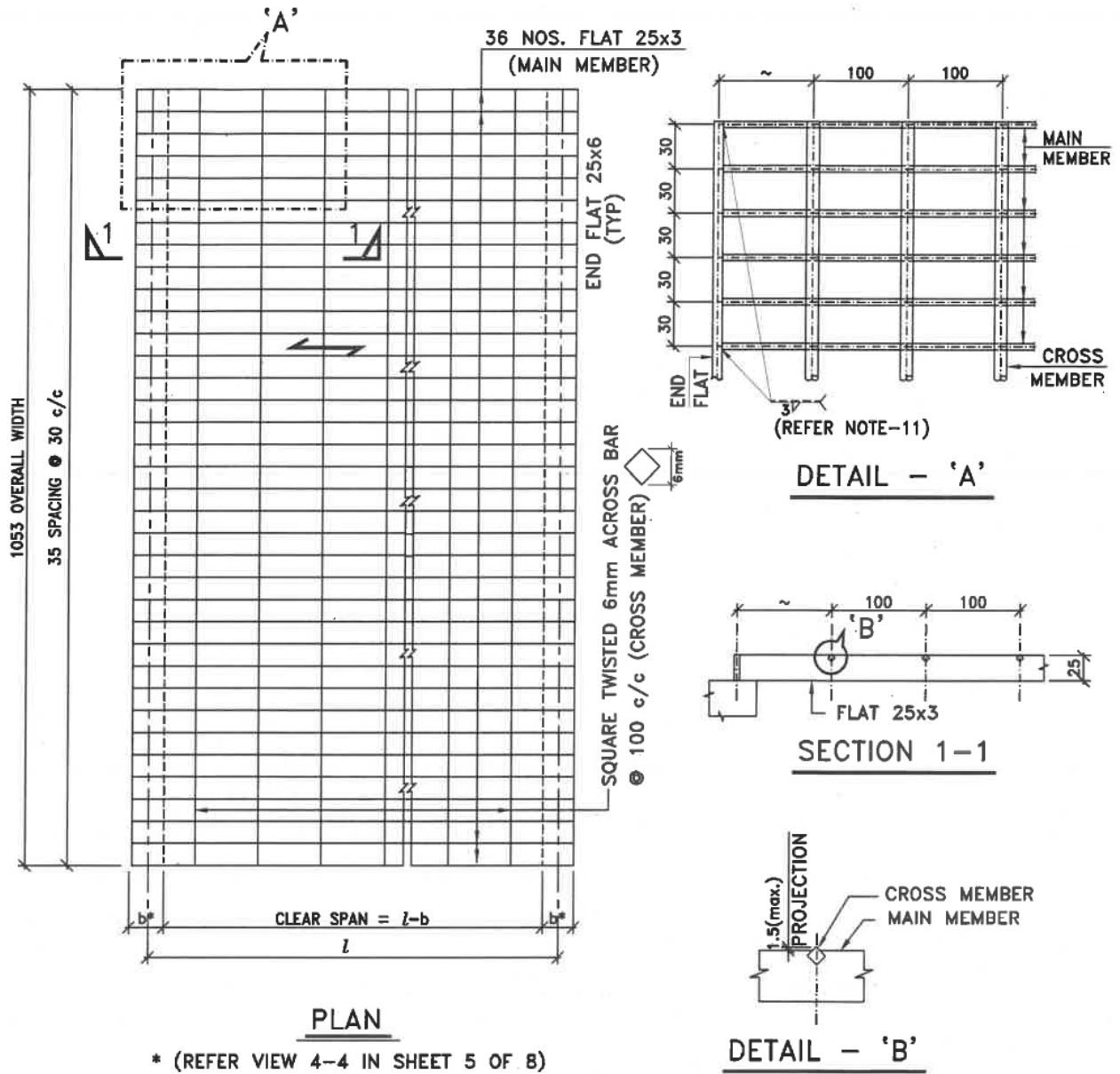


TABLE-2

WT. OF GRATING IN kg/m ² (INDICATIVE ONLY, NOT FOR PAYMENT)				PROPERTIES WIDTH = 1053mm			REMARKS
FLAT 25x6	FLAT 25x3	SQUARE TWISTED 6mm ACROSS BAR	TOTAL	I _{xx} cm ⁴	Z _{xx} cm ³	MR kgm	
2.35	19.89	1.80	24.04	14.84	11.87	195.94	WEIGHT OF WELD, CLAMPS/DISC, GALVANISATION, ETC. NOT CONSIDERED

GRATING TYPE - I

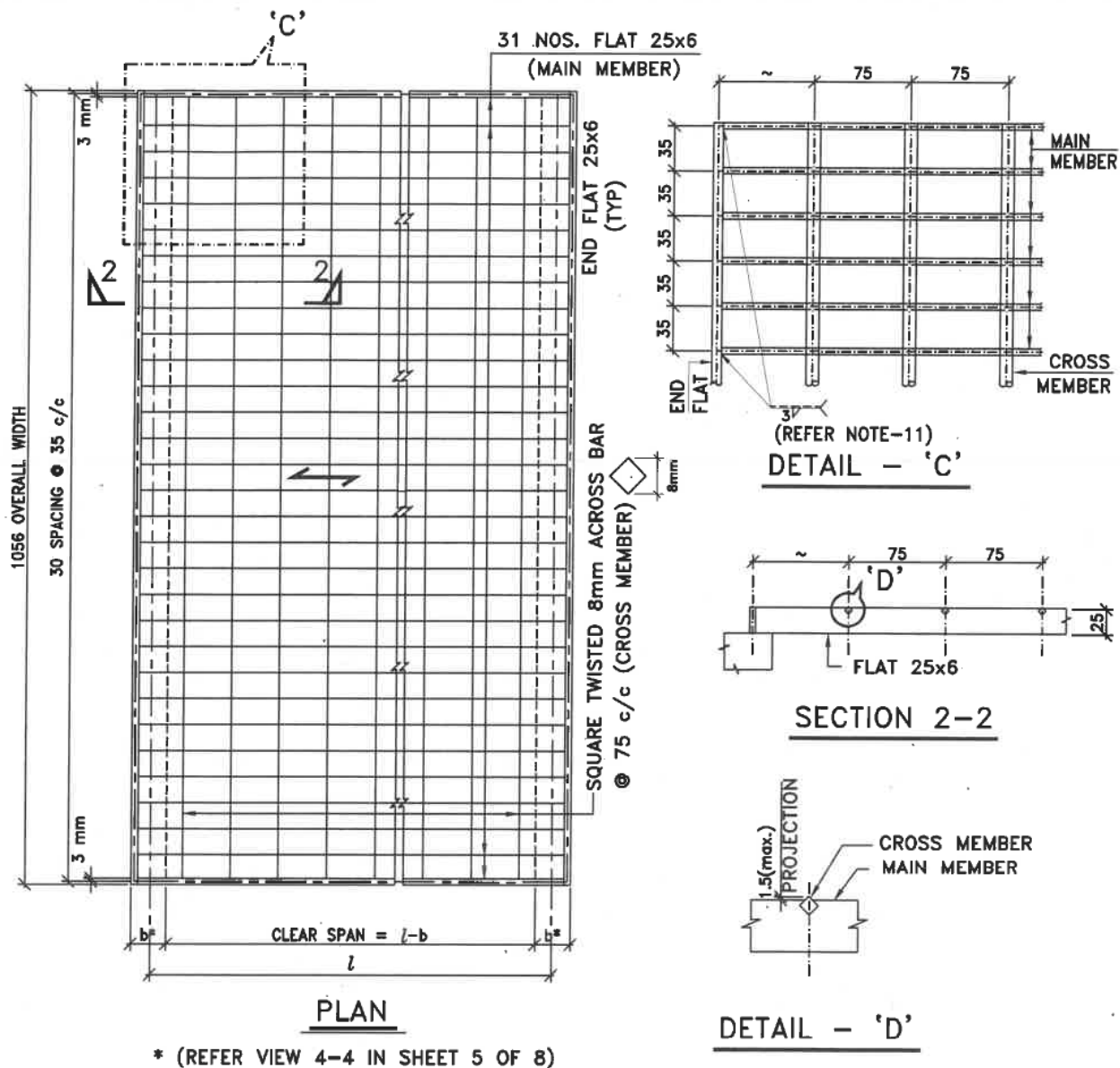
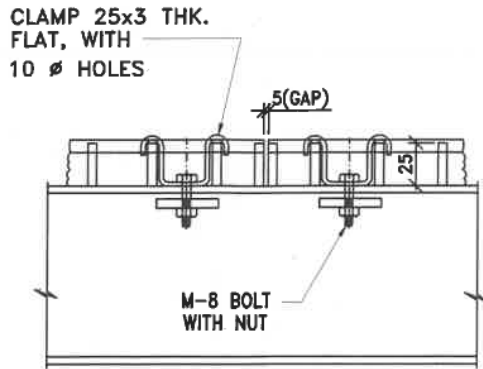


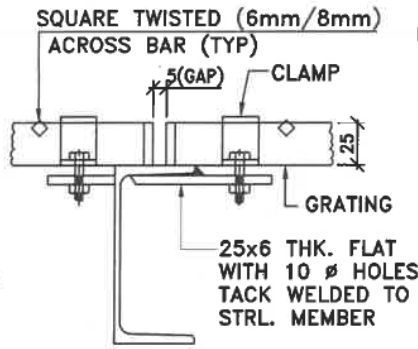
TABLE-3

WT. OF GRATING IN kg/sqm (INDICATIVE ONLY, NOT FOR PAYMENT)			PROPERTIES WIDTH = 1056mm			REMARKS
FLAT 25x6	SQUARE TWISTED 8mm ACROSS BAR	TOTAL	I_{xx} cm ⁴	Z_{xx} cm ³	MR kgm	
36.49	3.23	39.72	24.2	19.4	319.69	WEIGHT OF WELD, CLAMPS/DISC, GALVANISATION, ETC. NOT CONSIDERED

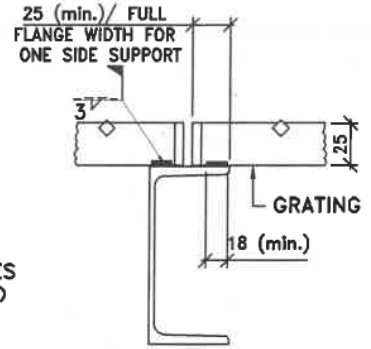
GRATING TYPE - II



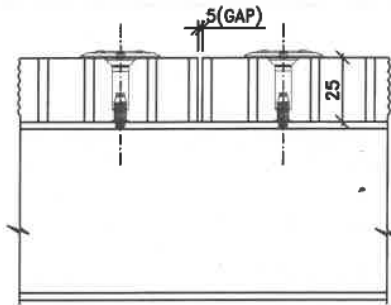
VIEW 3-3
GRATING FIXED WITH CLAMP



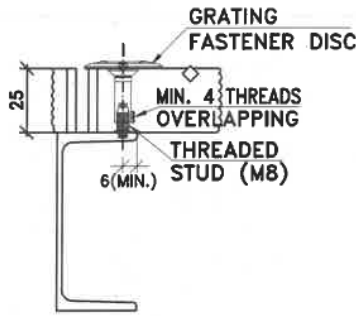
VIEW 4-4
GRATING FIXED WITH CLAMP
(REFER NOTE-8, 13 & 16)



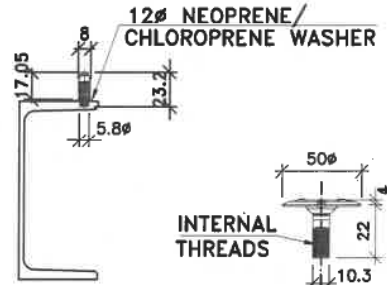
VIEW 4-4 / VIEW 4B-4B
GRATING FIXED WITH WELDING
(REFER NOTE-8, 13 & 16)



VIEW 4A-4A
GRATING FIXED WITH DISC

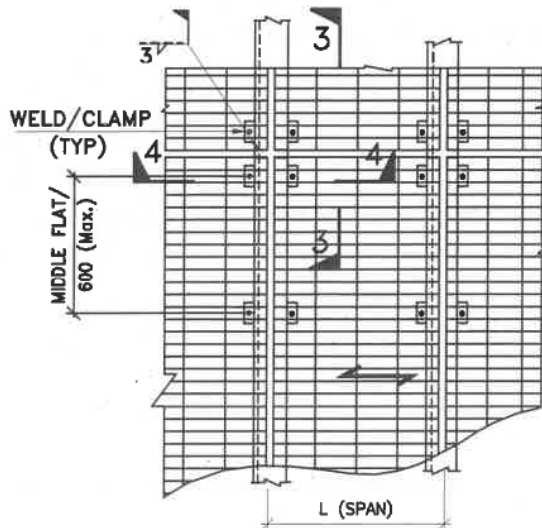


VIEW 4B-4B
GRATING FIXED WITH DISC
(REFER NOTE-8, 13, 15 & 16)

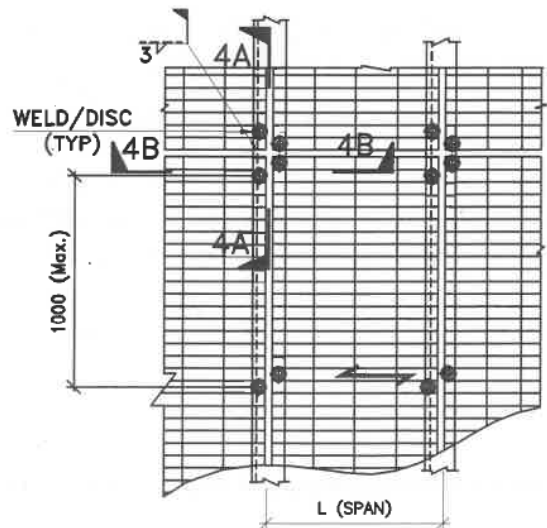


THREADED STUD
FIXING DETAILS
(REFER NOTE-15)

GRATING FASTENER
DISC DETAILS
(REFER NOTE-15)

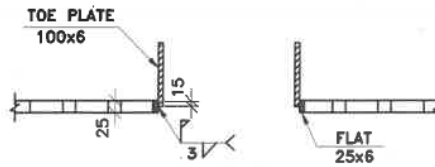


OPTION-1
(WITH CLAMP)



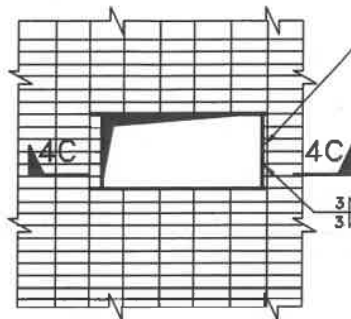
OPTION-2
(WITH DISC)

FIXING DETAIL OF GRATING PANELS



SEC. 4C-4C

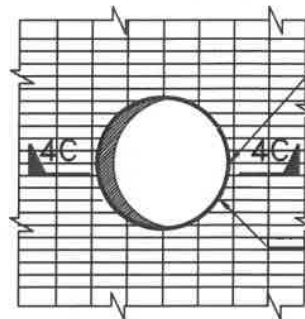
(REFER NOTE-5, 13 & 16)



FLAT 25x6 AROUND
WELDED TO GRATING
FLAT (TOE PLATE TO
BE WELDED AT SITE)

WELDING SHALL BE
DONE ON ALL THE
FLATS AND BARS

RECTANGULAR



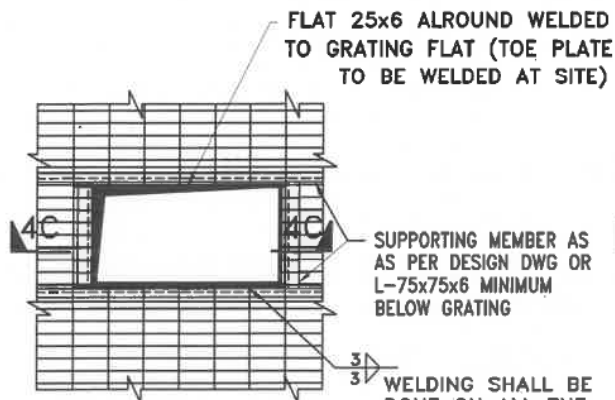
FLAT 25x6 AROUND
WELDED TO GRATING
FLAT (TOE PLATE TO
BE WELDED AT SITE)

WELDING SHALL BE
DONE ON ALL THE
FLATS AND BARS

CIRCULAR

(SIZE OF OPENING >200 & UP TO 400 mm)

(FOR OPENING UP TO 200 MM REFER NOTE-12)

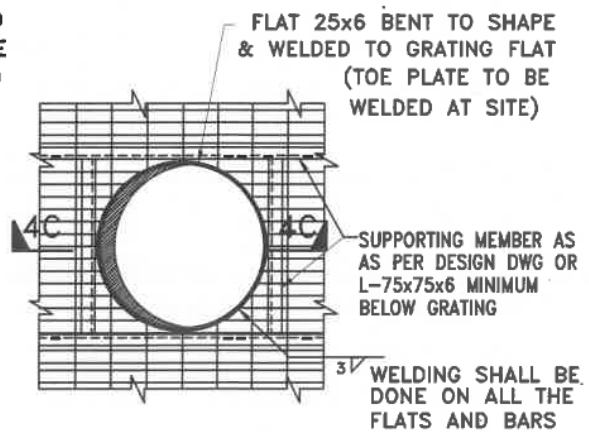


FLAT 25x6 AROUND WELDED
TO GRATING FLAT (TOE PLATE
TO BE WELDED AT SITE)

SUPPORTING MEMBER AS
AS PER DESIGN DWG OR
L-75x75x6 MINIMUM
BELOW GRATING

WELDING SHALL BE
DONE ON ALL THE
FLATS AND BARS

RECTANGULAR



FLAT 25x6 BENT TO SHAPE
& WELDED TO GRATING
(TOE PLATE TO BE
WELDED AT SITE)

SUPPORTING MEMBER AS
AS PER DESIGN DWG OR
L-75x75x6 MINIMUM
BELOW GRATING

WELDING SHALL BE
DONE ON ALL THE
FLATS AND BARS

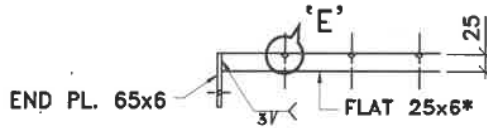
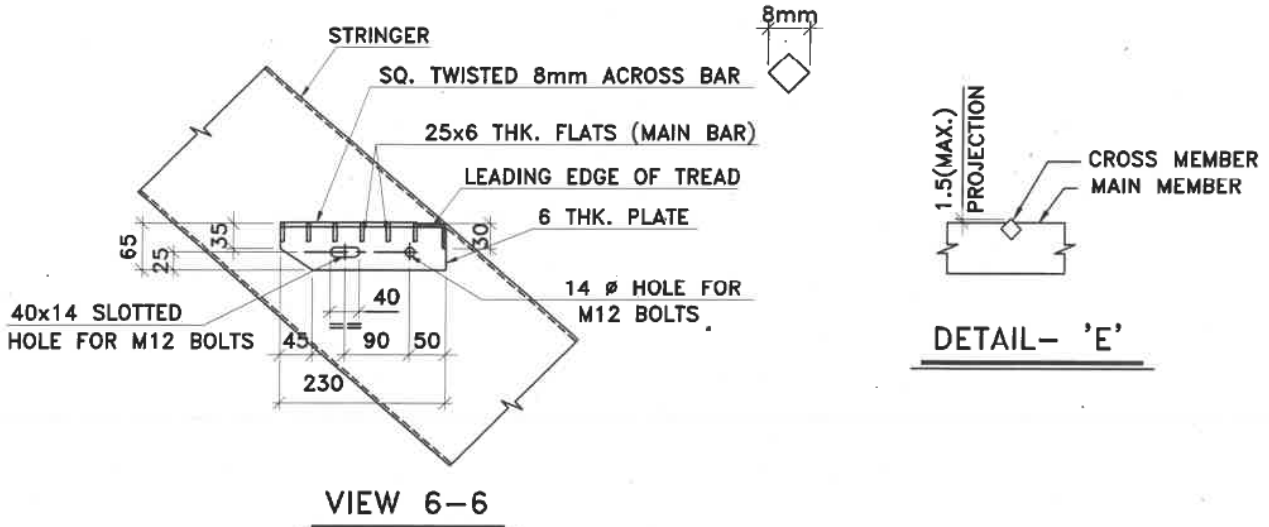
CIRCULAR

SIZE OF OPENING GREATER THAN 400 mm

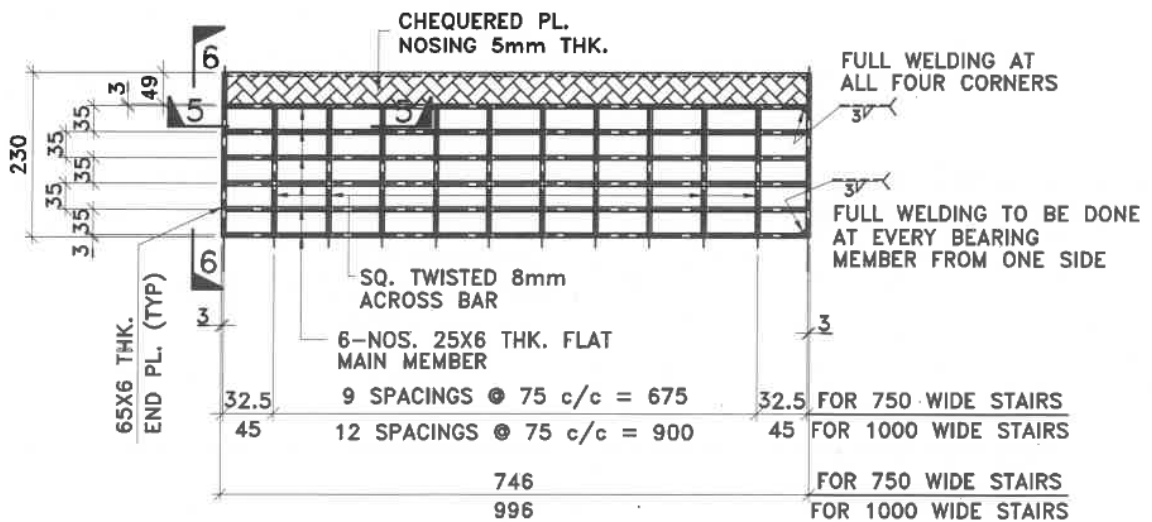
TYPICAL DETAIL OF GRATING STRENGTHENING AT OPENINGS

(REFER NOTE-9)

DET. OF 25 THK. GRATING STAIRCASE
TREAD FOR 750 & 1000 WIDE STAIR



*ALL THE FLATS TO BE WELDED TO THE END FLATS



(REFER NOTE-13 & 16)

TYP. DETAIL OF GRATING TO BE USED AS TREAD FOR 750/1000 WIDE STAIRS

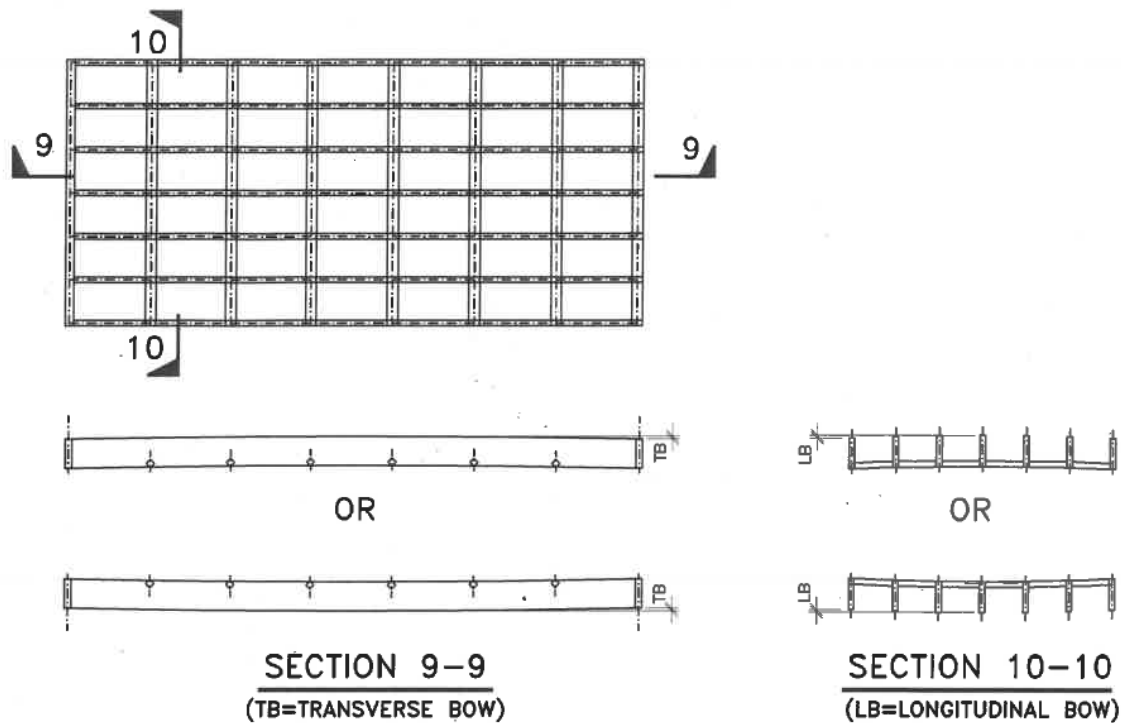


TABLE-4 (PERMISSIBLE AND MANUFACTURER TOLERANCES)

PERMISSIBLE TOLERANCES LOCATION	TOLERANCE (MM)
LENGTH OF GRATING PANEL OR INDIVIDUAL BEARING BAR	+0 / -5
WIDTH OF GRATING	+0 / -5
DEPTH OF BEARING BAR: FOR 25MM	+1 / -0.5
THICKNESS OF BEARING BAR:	±0.4
BINDING: TOP OF CROSS BAR ABOVE MAIN BAR	+0.5 / -0.5
MANUFACTURING TOLERANCES	
LOCATION	TOLERANCE (MM)
DIFFERENCE BETWEEN THE LENGTH OF DIAGONALS	±5 (OUT OF SQUARENESS OF GRATING PANEL)
CROSS BARS IN EITHER DIRECTION FROM PERPENDICULAR ALIGNMENT WITH MAIN BARS	1:100
CROSS BAR SPACING	±5 PER 1500 LENGTH OF BEARING BARS
BEARING BAR LEAN	1:10
TRANSVERSE BOW (TB) OF PANEL BEFORE FASTENING TO SUPPORTS	1:100
LONGITUDINAL BOW (LB) OF PANEL BEFORE FASTENING TO SUPPORTS	1:200

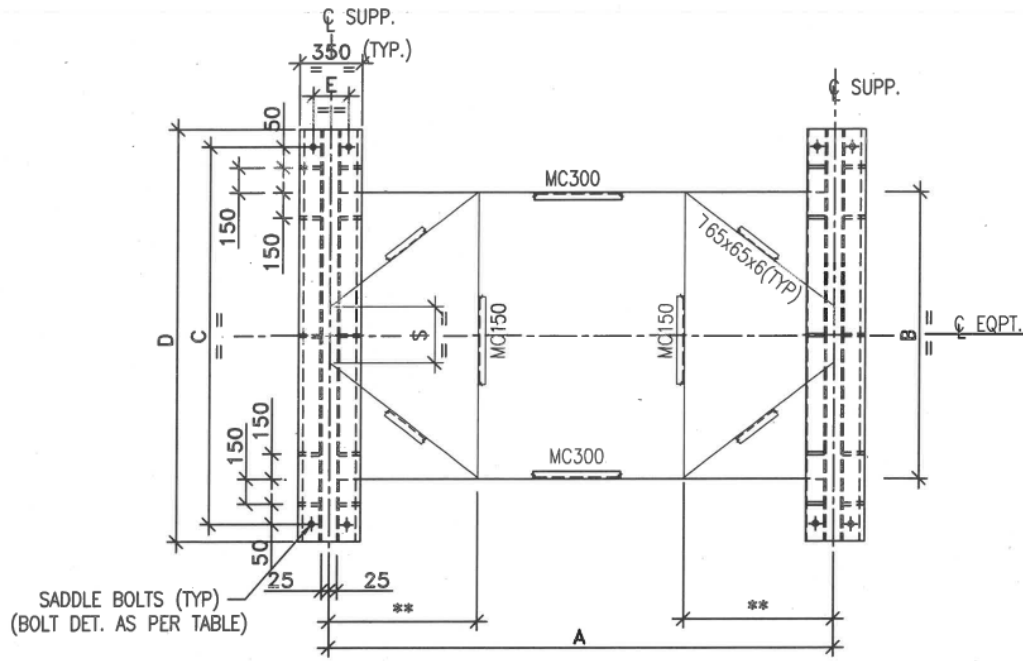
LOAD TABLE

SADDLE TYPE	MAX. EQPT. WT.	HORZ. FORCE (SL, WL, BP)	HT. (EL'Y' - EL'X')
TYPE-I	100 T	20 T	850-1500 mm (MAX.)
TYPE-II	50 T	10 T	850-1500 mm (MAX.)
TYPE-III	25 T	5 T	850-1500 mm (MAX.)

NOTES :

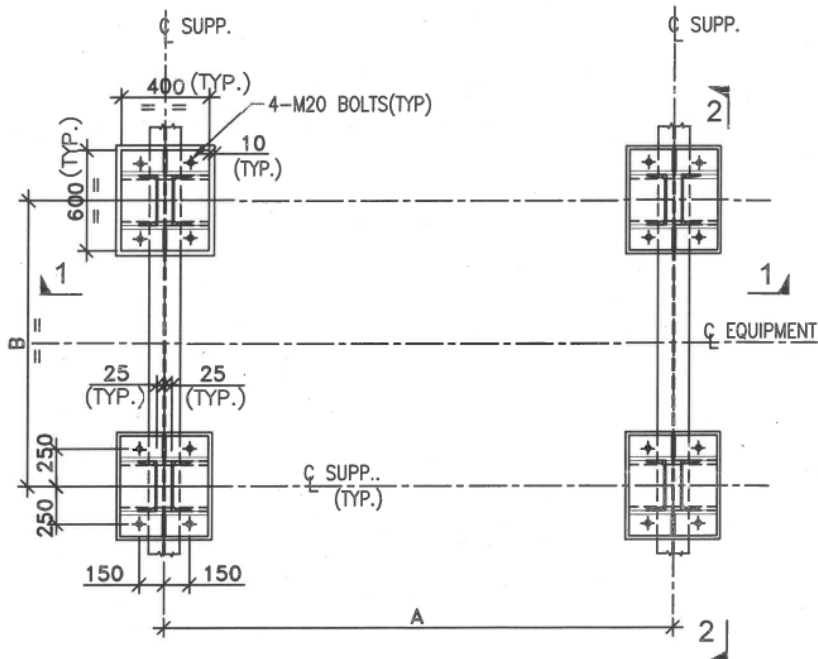
1. ALL DIMENSIONS ARE IN mm & LEVELS IN METRES.
2. THIS STANDARD SHALL FORM PART OF THE DRAWING WHICH BEARS REFERENCE TO IT.
3. FOR VARIABLES A TO E , θ , L, X & Y THE TABLE (REFER PAGE 8 OF 8) RELEASED FOR INDIVIDUAL STRUCTURES SHALL BE REFERRED.
4. LOCATION OF FLOOR BEAMS & SUPPORTS SHALL BE INDICATED IN THE FLOOR PLANS SHOWN IN GEN. ARRANGEMENT DRAWINGS.
5. GENERAL NOTES FOR THE JOB SHALL BE REFERRED FOR OTHER NOTES.

2	13.03.2025	REAFFIRMED AND ISSUED AS STANDARD	JG	AJS	ANURAG SINHA	M. NANDI
1	11.07.2019	REVISED AND ISSUED AS STANDARD	GULSHAN	AK/PAPIA	RAJANJI SRIVASTAVA	R.K. TRIVEDI
Rev. No.	Date	Purpose	Prepared by	Checked by	Stds. Committee Convenor	Stds. Bureau Chairman



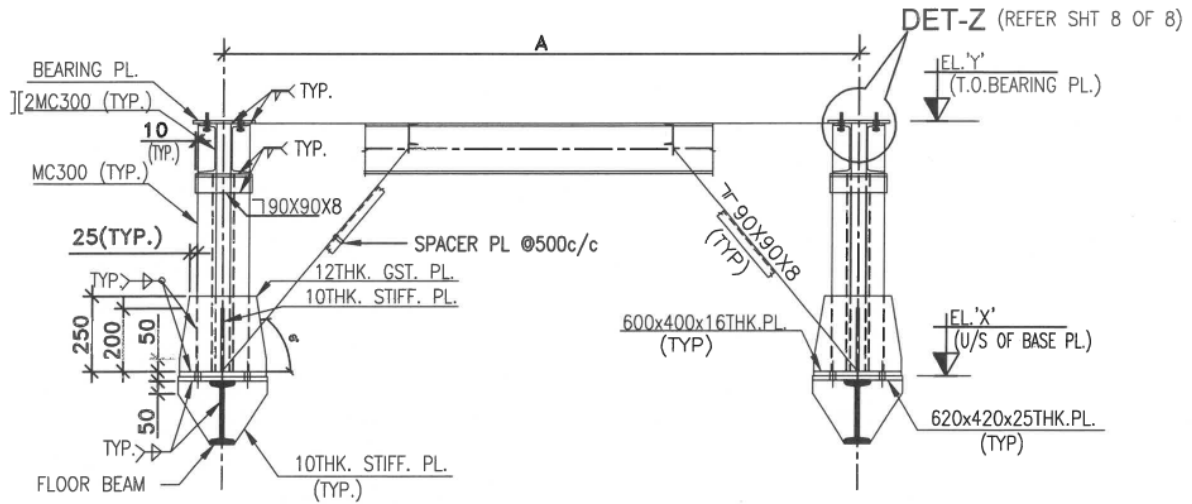
**TOP PLAN AT EQUIPMENT SUPPORTING LEVEL
TYPE-I**

($\$ = B/3$, ANY OTHER VALUE IF REQUIRED TO AVOID CLASH SHALL BE MENTIONED IN REMARKS)
(** FOR LOCATION REFER VIEW 1-1)



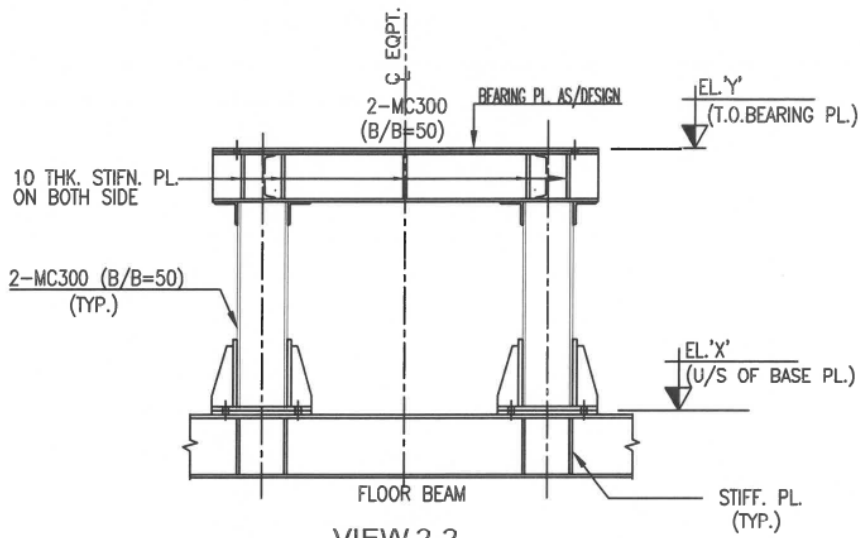
**PLAN OF EQUIPMENT SADDLE SUPPORTS AT BASE PLATE LEVEL
TYPE-I**

TYPE-I



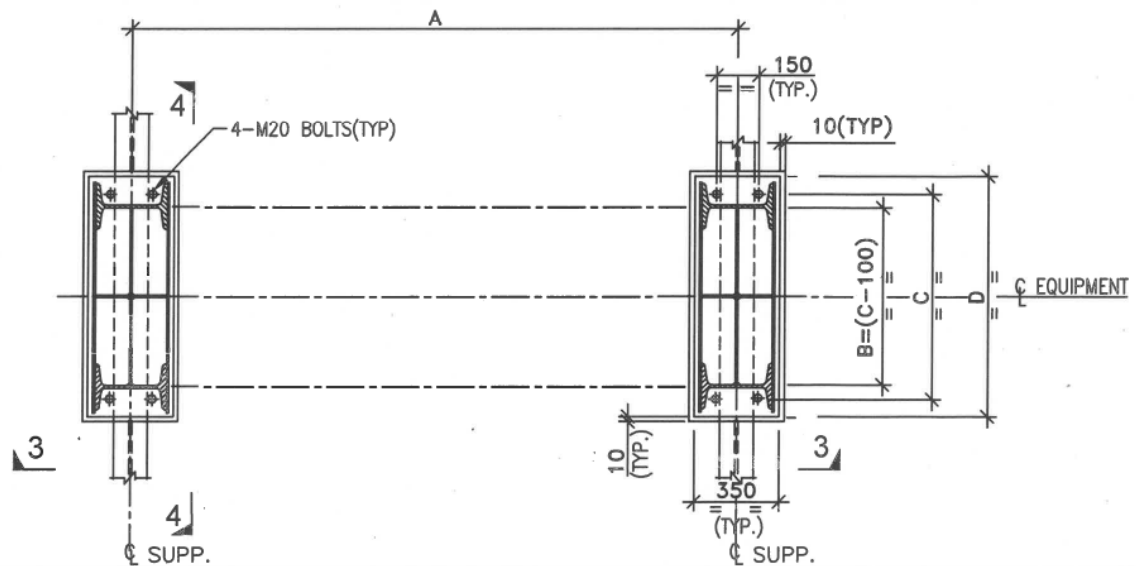
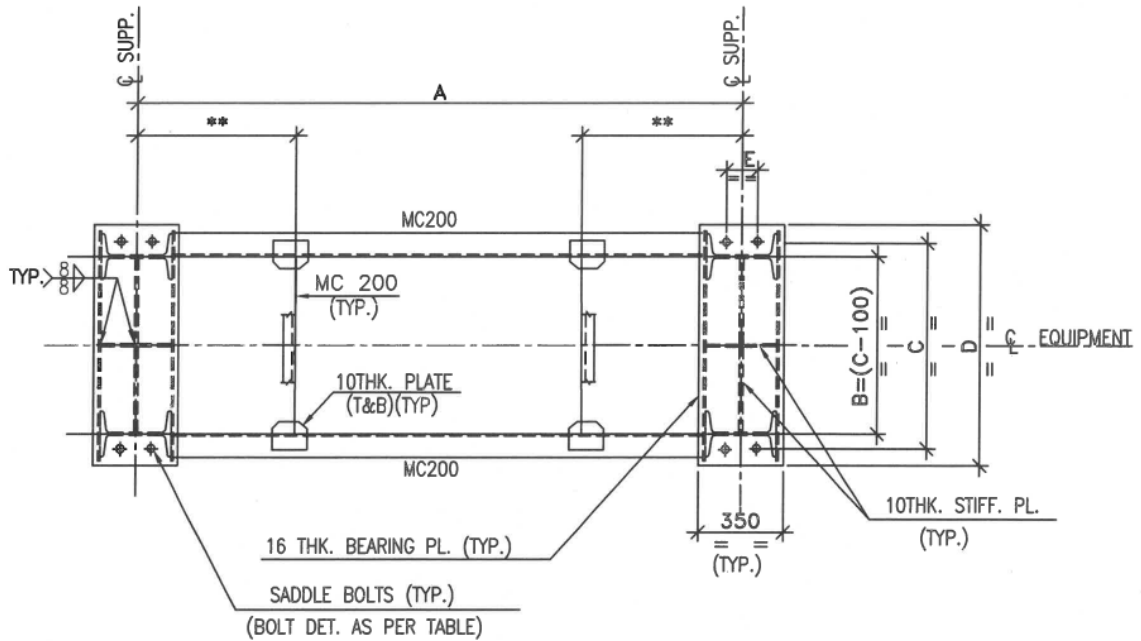
VIEW 1-1

(θ = PREFERABLY 45°, SHALL BE FINALIZED AFTER CLEARING CLASHES)

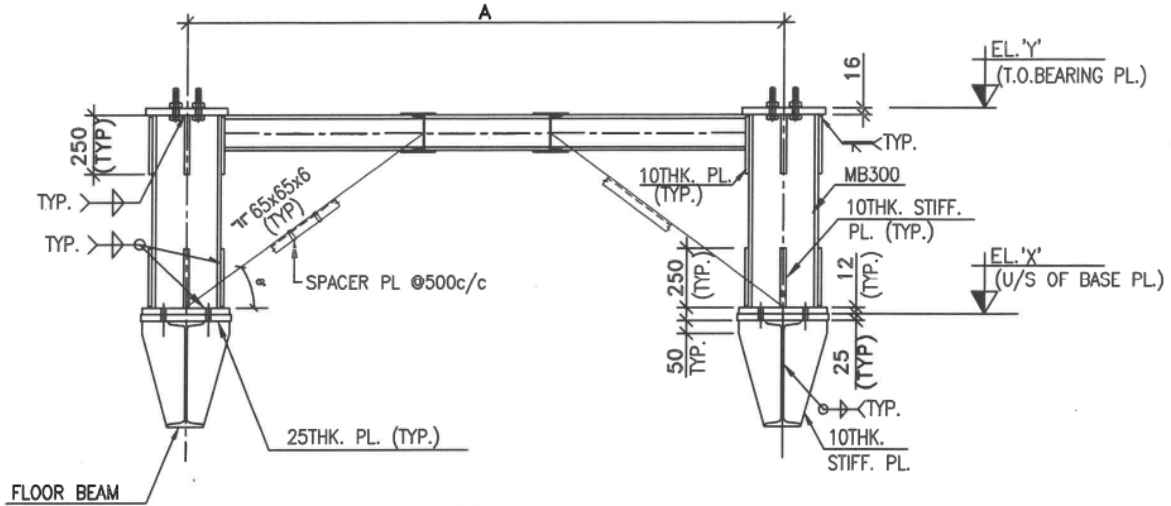


VIEW 2-2

TYPE-I

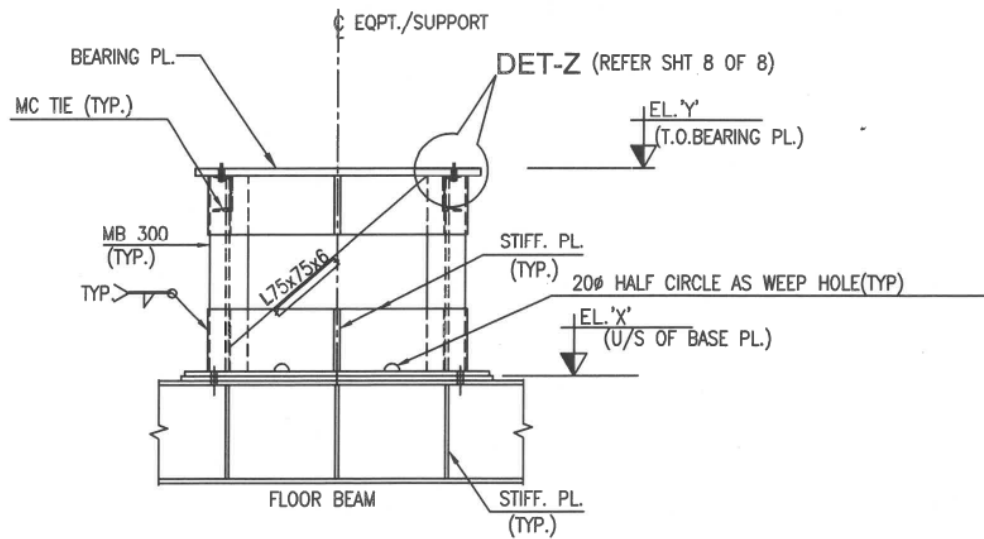


TYPE-II



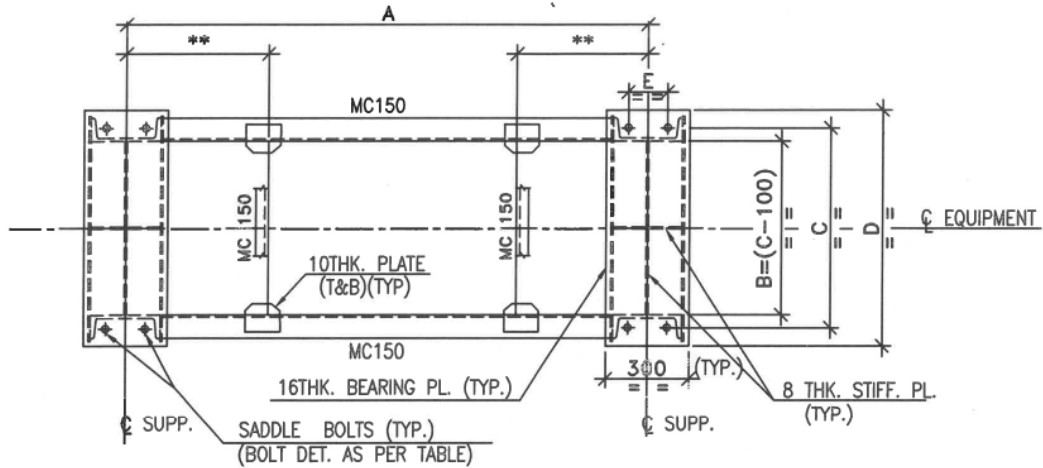
VIEW 3-3

(θ = PREFERABLY 45°, SHALL BE FINALIZED AFTER CLEARING CLASHES)



VIEW 4-4

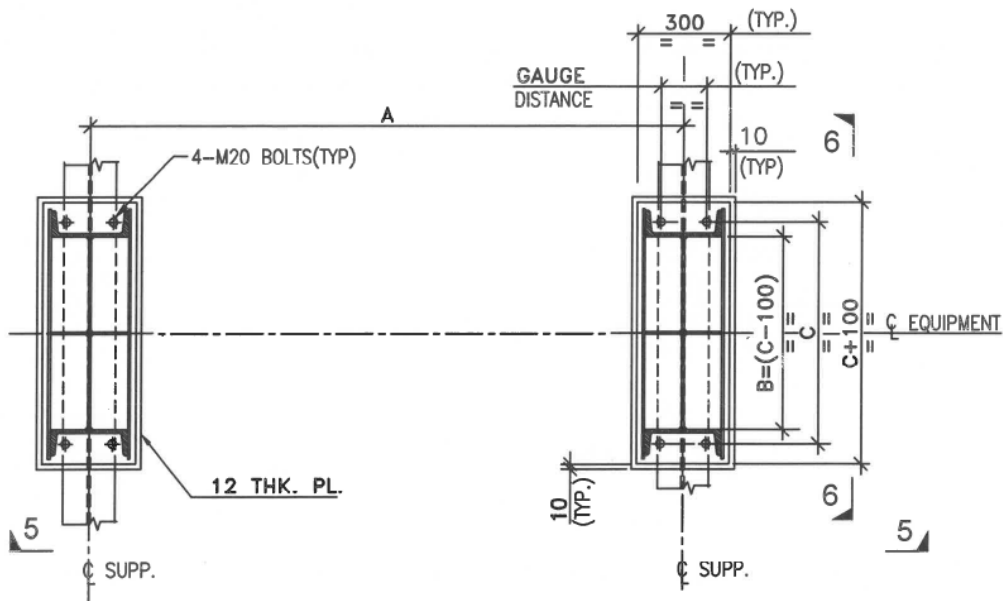
TYPE-II



NOTE: BEAM MC150 TO BE VERIFIED BY USER FOR DIMENSION $A > 6.0m$

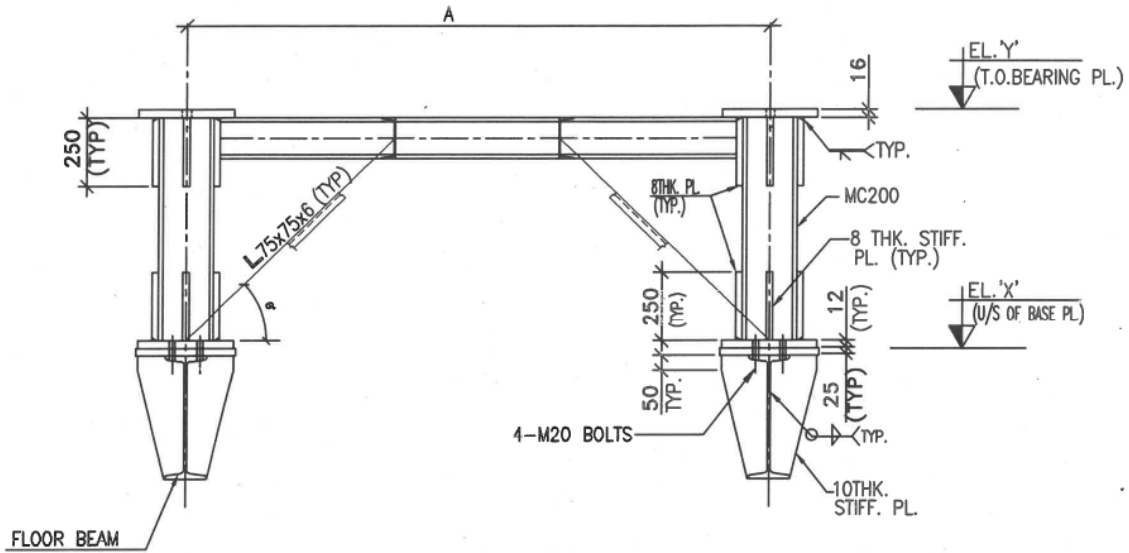
TOP PLAN AT EQUIPMENT SUPPORTING LEVEL

(**FOR LOCATION REFER VIEW 5-5)



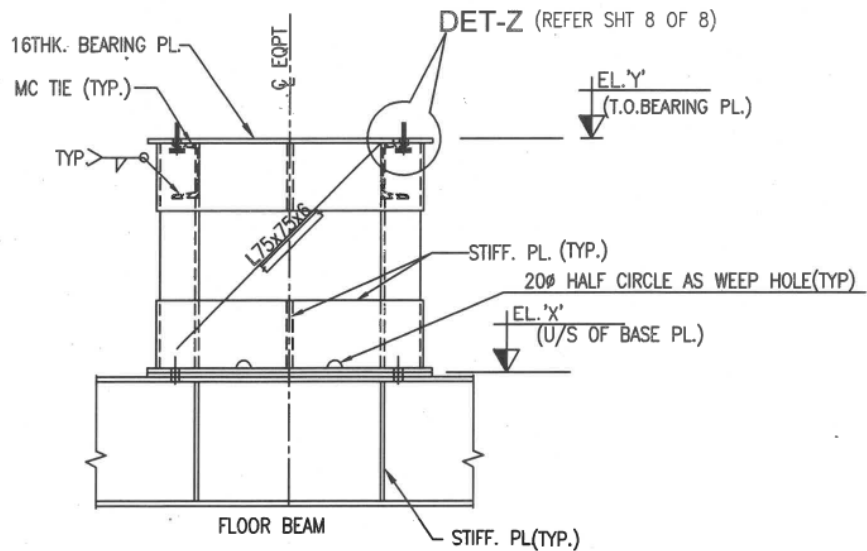
PLAN OF EQUIPMENT SADDLE SUPPORTS AT BASE PLATE LEVEL

TYPE- III



VIEW 5-5

(θ = PREFERABLY 45°, SHALL BE FINALIZED AFTER CLEARING CLASHES)



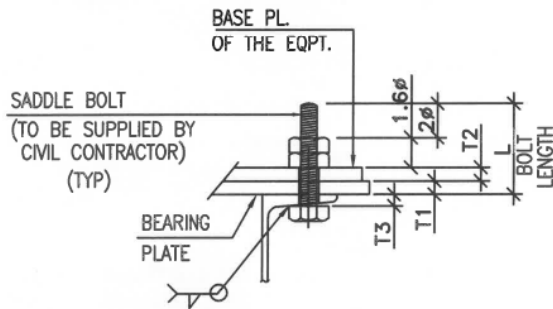
VIEW 6-6

TYPE- III

TABLE FOR SADDLE SUPPORT DETAILS FOR EQUIPMENTS:-

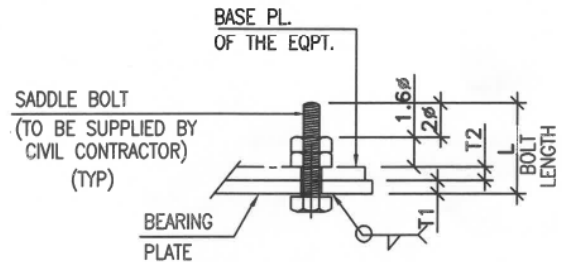
S.NO.	EQUIPMENT NO.	DIMENSIONS						BOLTS DETS				ELEVATION		REMARKS
		A	B	C	D	E	θ°	DIA	HOLE DIA	NOS	L	EL-X	EL-Y	

THIS TABLE WILL BE ISSUED AS A DWG FOR PROJECT



DETAIL- 'Z'(FOR TYPE-I)

ϕ =DIA OF BOLT
 T1=THICKNESS OF BEARING PLATE
 T2=THICKNESS OF EQPT BASE PLATE
 T3=FLANGE THICKNESS OF MC300



DETAIL- 'Z'(FOR TYPE-II & III)

ϕ =DIA OF BOLT
 T1=THICKNESS OF BEARING PLATE
 T2=THICKNESS OF EQPT BASE PLATE

ट्रे एवं टॉवर इंटरनल हेतु प्रतिस्थापना कार्यविधि

INSTALLATION PROCEDURE FOR TRAYS AND TOWER INTERNALS

Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
7	27.03.2026	REVISED AND RE-ISSUED AS STANDARD SPECIFICATION	VM/HD	PG	AK	NK Nalin
6	18.02.2021	REVISED AND RE-ISSUED AS STANDARD SPECIFICATION	PG	AK	NK	SM
5	29.10.2014	REVISED AND RE-ISSUED AS STANDARD SPECIFICATION	VDY	IK/ SKM	AP	SC
Approved by						

Abbreviations:

BB	Bolting Bar
D/C	Downcomer
M/W	Manway
TSR	Tray Support Ring
SCM	Supply Chain Management

SOME IMPORTANT GUIDELINES

SLOTS	Slots are provided for adjustments of the tray segments. Vessels are made to manufacturing tolerances which are fully accounted for in Distillation Tray design.
CLEARANCES	Clearances between Deck Beams/Downcomers from Support Rings are provided to ensure that the trays fit the vessels without modification to parts. POSITION tray deck beams and downcomers with equal clearances at each end.
SPACINGS	Spacings of loose beams or deck plates shown on drawings are TYPICAL for perfectly round and sized vessels. The vessels may not be perfect, so spacings will need to be ADJUSTED.

INSTALLATION INSTRUCTIONS ON THE FOLLOWING PAGES SHOULD BE READ CAREFULLY.

Mass Transfer Mechanical & System Standards Committee

Convenor: Mr. Arun Kumar (Convener)

Members: Mr. Inder Kumar
Mr. Pankaj Gandhi
Mr. Jeevan Agrawal (Coordinator)
Mr. Vinodkumar Yadav
Mr. Urmilesh Tiwari
Mr. Aasheesh Handa (Projects)
Mr. Prabhakar Choudhary (SMMS)
Mr. Avdhesh Agrawal (SCM)

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1.0 INTRODUCTION

The purpose of this specification is to help in effecting satisfactory installation of EIL-designed trays and tower internals in the minimum time.

Whether installation involves a small number of trays, tower internals or is a large complex involving thousands of components, it is vital that care is taken to ensure efficient handling and assembly of tray components.

This specification should be used only as a "General Guide". The work in each tower and for each tray/tower internal should be carried out in accordance with General Arrangement Drawings prepared for specific tray/tower internal.

An adequate number of components with installation spares, where applicable, are supplied for every assembly. Significant time and Cost can be saved by efficient storage and usage of such components.

2.0 ORDER OF INSTALLATION

These instructions are based upon the following order of installation:

- 2.1 Review the drawings provided for respective tray/tower internals. It is an important aid for installation. The drawings show the relative position of each component and corresponding item number. After all trays/tower internals are uncrated, identify each piece of the tray/tower internal with the item number w.r.t. its location on the General Arrangement Drawing.
- 2.2 Ensure that protective oil coating is removed from carbon steel tray/tower internal parts prior to initiating installation of trays and tower internals in the tower. (For suggested procedure for removal of Rust Preventive Coating, refer clause 14.0 of this specification).
- 2.3 Check levelness of tray support rings & various dimensions of bolting bar welded to the tower to ensure that these are as per relevant drawings and within specified tolerances. In case of any deviation observed, refer this to EIL-Specialist. Levelness of support ring and other dimensions of bolting bar shall be recorded in Format attached in EIL Specification No. 6-14-0016.
- 2.4 **Trays**
 - 2.4.1 Work upwards from lowest tray in tower.
 - 2.4.2 Fit/complete installation (including welding) of lattice girder, if any.
 - 2.4.3 Fit and leak test seal pan below bottom tray, if provided.
 - 2.4.4 Fit major beam, if any.
 - 2.4.5 Fit downcomer for bottom tray.
 - 2.4.6 Fit support beam (if any) for bottom tray.
 - 2.4.7 Fit deck plates for bottom tray except man way deck plate. (However proper fitment of man way decks plate shall be ensured).
 - 2.4.8 Leak test recessed seal pans, wherever provided.
 - 2.4.9 Fit/install lattice girder/major beam, if required, for tray above bottom tray.

- 2.4.10 Fit downcomers for tray above bottom tray.
- 2.4.11 Fit beams and decks for tray above bottom tray except man way deck plate. (However proper fitment of man way decks plate shall be ensured).
- 2.4.12 Fit each successive tray as above.
- 2.4.13 Remove all the foreign material and ensure that trays are clean and unobstructed for proper performance.

2.5 Tower Internals

- 2.5.1 Work upward from bottom most bed in the tower.
- 2.5.2 Fit/install lattice girder/major beam, if any.
- 2.5.3 Install (including welding and leak testing) vapour distributor/chimney tray/accumulator tray, if any.
- 2.5.4 Install support plate/support grid.
- 2.5.5 Pack the tower with random packings in accordance with EIL spec. 6-14-0011 titled "Standard Specification for Packing the Column".

In case bed is provided with proprietary packings/grid/structured packings, follow the instructions provided by the supplier. Successive layers of grid/structured packings may require to be rotated by specific angle as mentioned in supplier's drawings/procedure for installation.

- 2.5.6 Install the bed limiter/hold down plate wherever specified in drawings, in case of random packings.

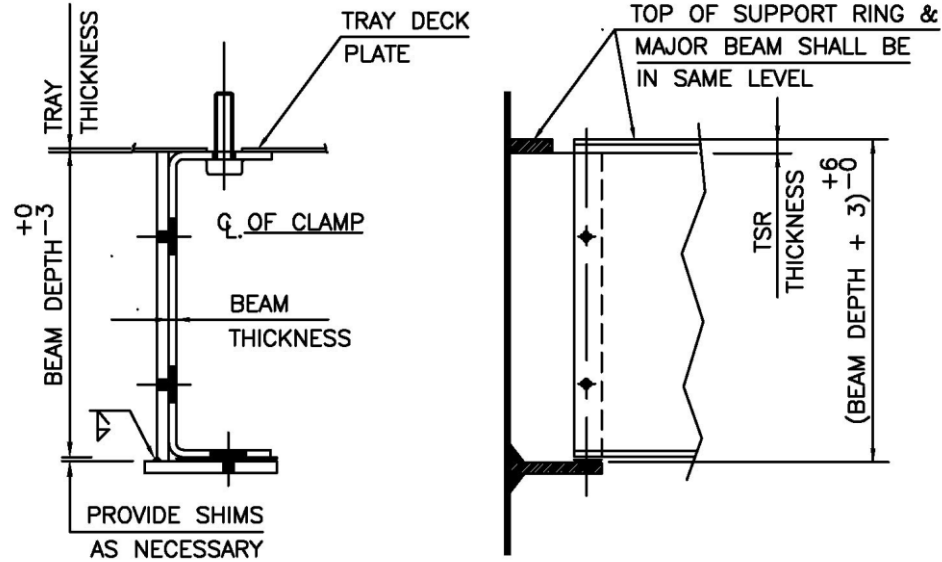
Install bed retainer / hold down grid / distributor support grid, in case of structured packings.

- 2.5.7 Install distributor/redistributor, Leak test pan/trough type distributor/redistributor and hydro test spray header, if specified, on the drawings.
- 2.5.8 Fit the pre-distributor/feed pipe.
- 2.5.9 Repeat from paragraph 2.5.2 to 2.5.8 above, for the next bed.
- 2.5.10 Remove all the foreign material from respective tower internal. Ensure that the same are clean and un-obstructed for proper performance.

3.0 FITTING MAJOR BEAMS

- 3.1 Carefully place shims, as necessary, under major beams to bring top of beam exactly in level with tray support ring (Refer sketch 3.1.1). Tack weld/bolt shims in position.

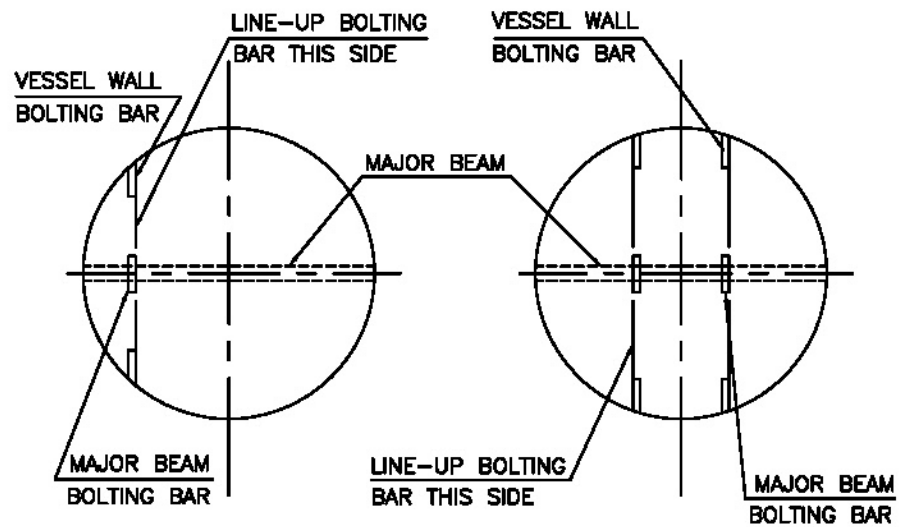
NOTE: Depth of stool is always designed to allow for minimum shim thickness of 3 mm (although this may be taken up in vessel or tray manufacturing tolerances).



SKETCH No. 3.1.1

(C BEAM SHOWN, MAJOR BEAM MAY BE OF OTHER SHAPES ALSO)

- 3.2 Line-up down comer bolting bars, if fitted, on beam with downcomer bolting bars attached to vessel wall. See sketch No. 3.2.1.

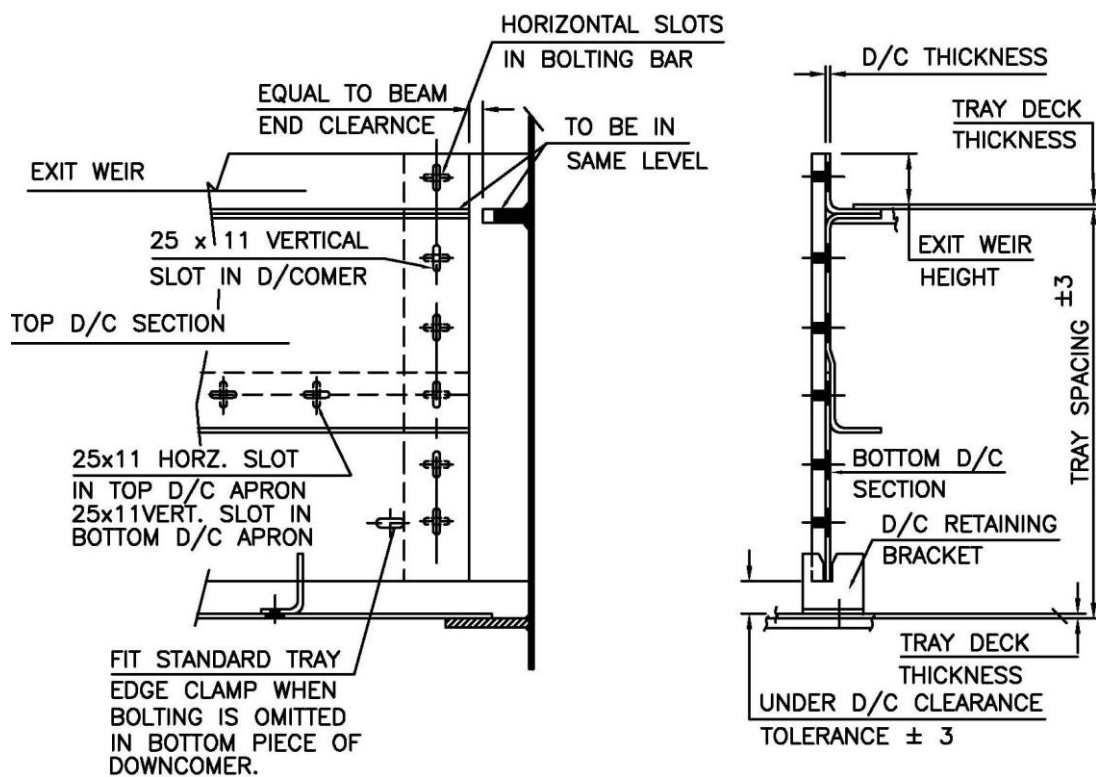


SKETCH No. 3.2.1

4.0 FITTING DOWNCOMERS & EXIT WEIRS

4.1 Where no down comer support stools are provided

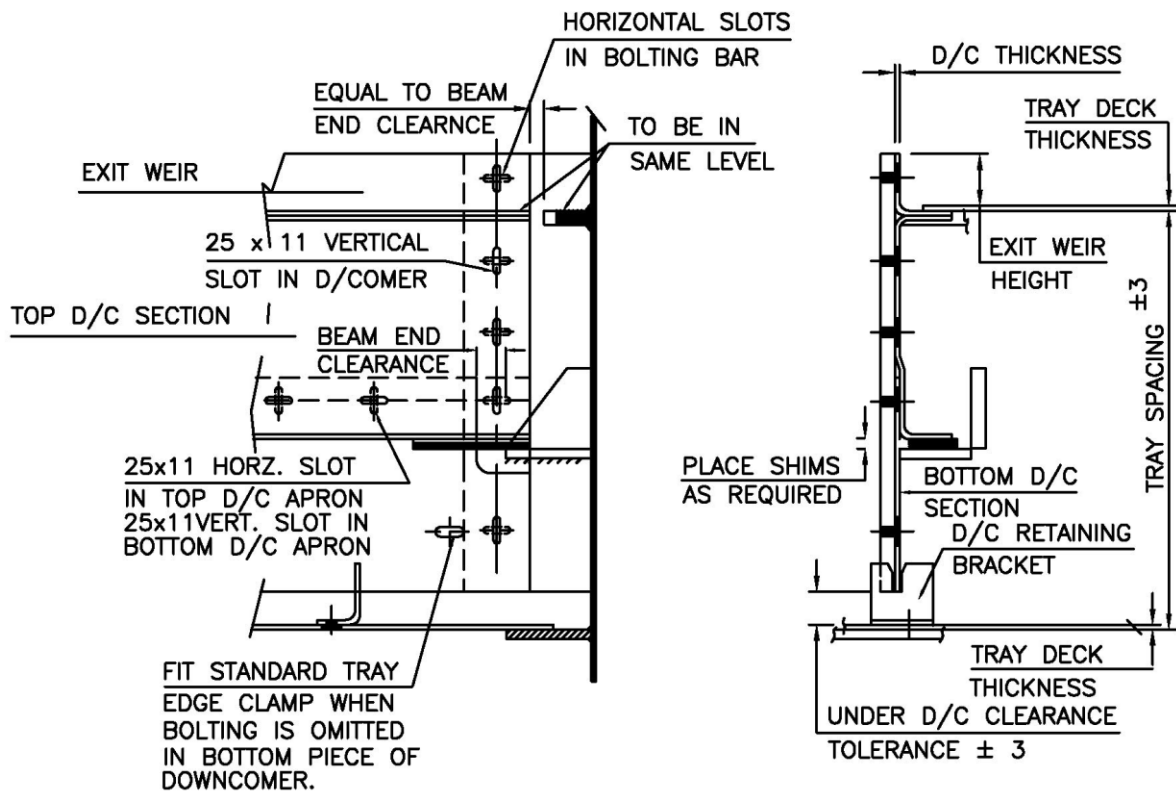
- (a) Top section of downcomers for one tray fitted by:
 - i) Level exit weir base (top) with top of support ring and/or support beam top surface.
 - ii) Bolting securely in position.
- (b) Fit bottom downcomer sliding plate into position, position bottom of plate in downcomer support bracket while fitting on tray below. Check clearance under downcomer bottom edge. See Sketch No. 4.1.1.



SKETCH No. 4.1.1

4.2 Where downcomer support stool is provided

- (a) Place shims, as necessary, under top downcomer section to bring exit weir base (top) exactly in level with support ring and/or lattice girder/major beam (if provided) and then bolt downcomer sections including exit weir securely. Tack weld/bolt shims in position.
- (b) Fit bottom-sliding plate of downcomer in position in downcomer support bracket, set clearance under downcomer plate within plus or minus 1/8" (3mm). The clearance obtained should be maintained as near constant across the width as possible (See Sketch No. 4.2.1).



SKETCH No. 4.2.1

4.3 Use of Washer & Location of Nut

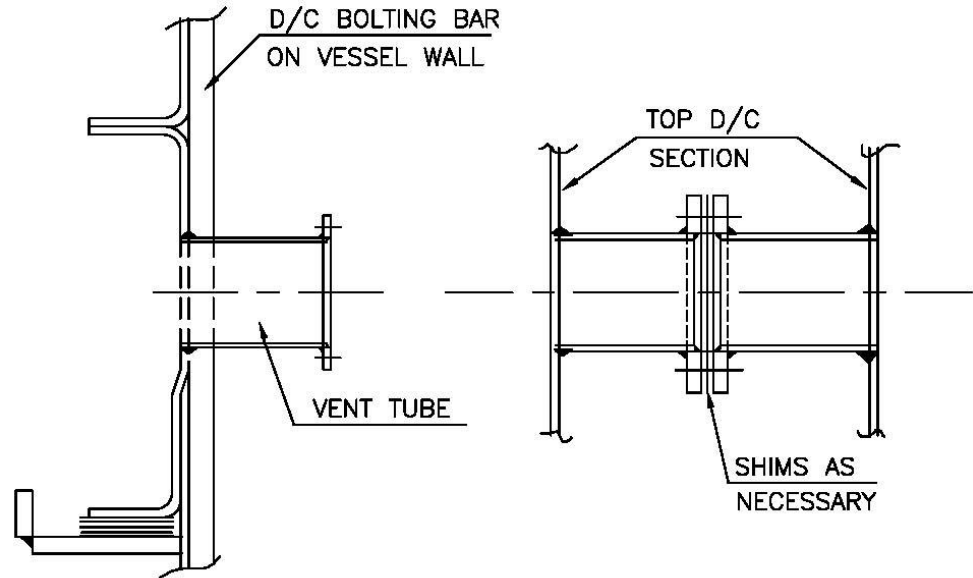
Unless otherwise specified on drawing, two washers (one on bolt head side & one on nut side) shall be used for every bolt. The nut shall be provided towards the side accessible from Tray man way. Lock nuts shall not be provided on clamp/bolting for Man way deck plate.

Nuts for supporting pipes (i.e. U clamps) shall be kept loose so as to have free movement/expansion of the pipe.

4.4 Downcomer Vent Tubes / Vapor Equalizers

Vent Tubes / Vapor Equalizers are standard feature in Three (3) / Four (4) pass trays.

- Fit one top section of center/off-center downcomer as in paragraph 4.1/4.2 and then position tube as shown in Sketch 4.4.1.
- Fit top section of opposite downcomer.
- Place shims, as necessary, between vent tube / vapor equalizer flanges and tighten the bolts.



SKETCH No. 4.4.1

4.5 Downcomer Bracer Panels

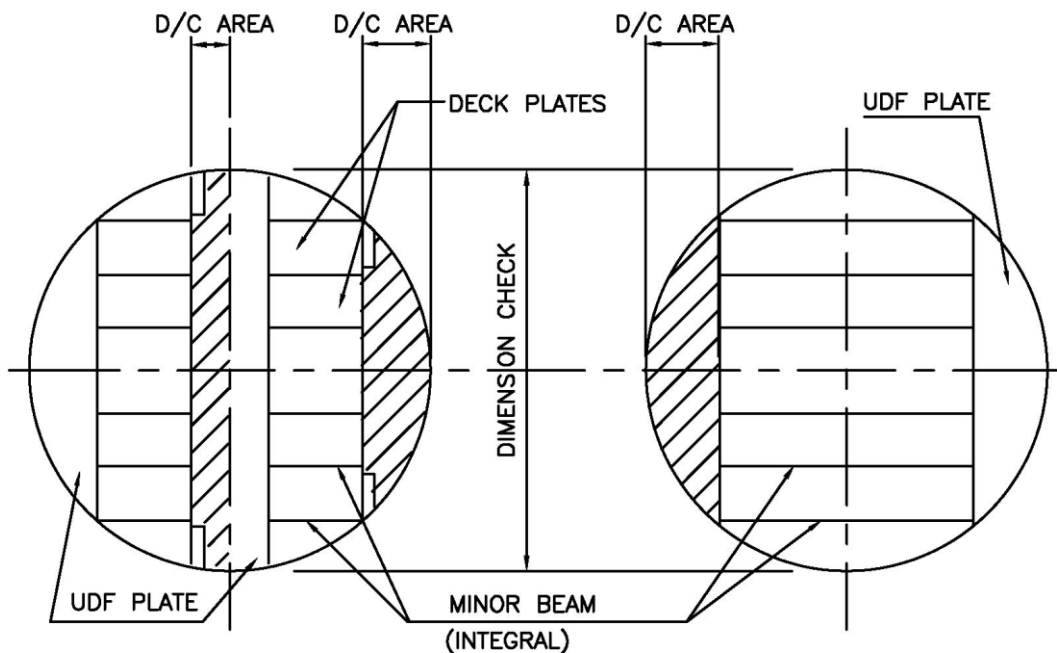
After downcomer sections have been fitted, position bracer panels and bolt securely.

4.6 Adjustable Exit Weirs

Bolt loosely into position after down comer has been leveled and tightly secure. Weir top edge then to be leveled upto desired height and bolts tightened securely. **Unless otherwise specified on the drawings, adjustable weirs to be set at mid point.**

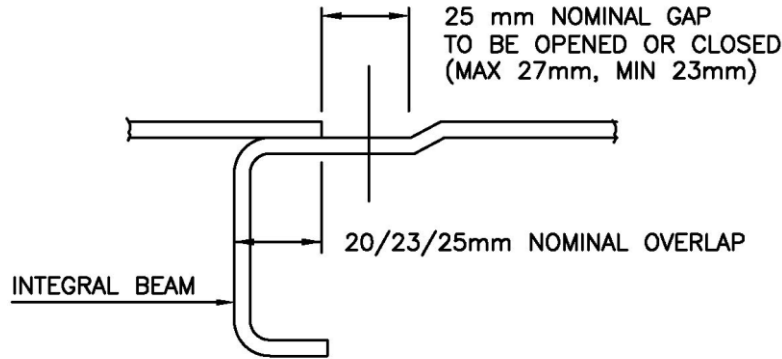
5.0 FITTING DECK PLATES: INTEGRAL BEAM DESIGN

5.1 Measure distance across area of deck to be installed at 90° to run of minor beams. See Sketch No. 5.1.1



SKETCH No. 5.1.1

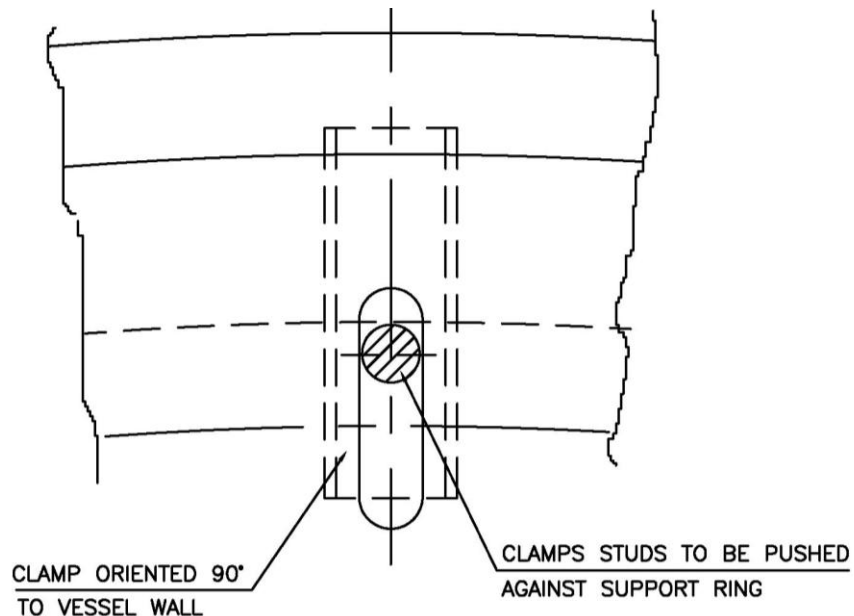
- 5.2 Compare measurement taken in paragraph 5.1 with dimensions stated on tray General Arrangement Drawings.
- 5.3 If comparison shows measured distance GREATER than shown on drawings, INCREASE 25 mm typical spacing difference - see Sketch No. 5.3.1.



SKETCH No. 5.3.1

- 5.4 If distance measured is SMALLER than shown on drawings, DECREASE 25mm typical spacing between the deck plates to absorb the difference - EXCEPT at each side of man way section, which must remain at 25 mm to allow man way clamps to operate properly. See Sketch No. 5.3.1.
- 5.5 Position deck plates as required from paragraph 5.3 to 5.4 on support ring and/or down comer top flange.
- 5.6 Position deck plates centrally along their length i.e. leave EQUAL clearance at each end.

NOTE: Edge clamps must be orientated correctly (see Sketch No. 5.6.1). Stud/pin of all tray edge clamps are provided with screwdriver slot and center punch mark as aid in installation and fitting of edge clamps properly. **Slot shall be in radial direction, while punch mark be towards center of the tower.**



SKETCH No. 5.6.1

- 5.7 Position man way plate in place to check that this can be put in position from top as well as bottom of tray without fouling or interfering with man way beam clamp or adjacent tray deck plate.
- 5.8 Remove man way plate and keep it on the tray or in downcomer area so that tray man ways are accessible for inspection of trays.
- 5.9 Bubble cap trays, seal pans, draw off etc. shall be leak tested to ensure that drop in water level does not exceed the specified limit mentioned in the drawing. In case the leakage exceeds the allowable limit, consult EIL-Specialist.
- 5.10 Proceed with installation of next tray.
- 5.11 Tray man way plate shall be clamped in position only after all the trays installed in the tower have been inspected, tested and approved by competent authority.

6.0 SUPPORT PLATES

6.1 Gas Distribution Support Plate

- 6.1.1 Start installation with the short piece of decking and work across the tower. When gasketing is specified, place the gasket on the support ring. If a mid span is required, place gasket on the mid span also. Install the support ring clamps in the deck sections; leave the clamps loose. Place the deck section on the support ring. Place the minor beam against the edge of the deck. Minor beams are not always required (see drawing). Install the adjacent deck section. Install the bolting through the deck section and through the minor beams when provided. When gasketing is required between the deck sections, the bolts should also go through the gasket. Tighten the bolting. Continue this procedure until all deck sections are installed.

For some applications, liquid downcomer tubes are provided which hang below the deck sections. The downcomer tubes may or may not be removable (check drawing provided).

- 6.1.2 When the tubes are removable they should be installed before the deck sections are installed on the support ring.
- 6.1.3 For various applications, riser tubes with covers are provided (which may or may not be removable). When the tubes or covers are removable, install the tubes with the gaskets and bolting provided as the deck sections are being installed. When the gas riser tube covers are removable, ensure that they are fastened firmly in place.
- 6.1.4 After all deck plates are installed; rotate clamps under support ring and tighten clamps. Ensure that all gasketing is in proper position.
- 6.1.5 Remove all foreign material so that the support plate is clean and unobstructed for proper performance.

6.2 Gas Injection Support Plate

- 6.2.1 Place the sections in position on top of the support ring starting with the shorter sections at one side of the tower. Proceed across the tower. Make sure all sections are making proper contact with the support ring. The sections shall be equally spaced so that the gap between sections is uniform.

Ensure that at any location on the support plate, gap is not large enough for the random packings to pass through.

6.2.2 When clamps are required, the clamps are to be assembled in position as the sections are set in place. Tighten clamps after sections are properly positioned.

6.2.3 Remove all foreign material so that the support plate is clean and unobstructed for proper performance.

7.0 BED LIMITERS

7.1 After the Bed Limiter is uncrated, identify each section of the Bed Limiter with the tag number. The tag numbers locate the relative position of the sections.

7.2 Install the packing in the tower upto the depth of the minor beams from the support ring, as shown on the drawing provided.

7.3 Install the minor beams to the support ring as shown on the drawing in their correct positions. Finish installing the tower packing such that packings level is same as the top of the minor beams and support ring/support cleats.

7.4 Install the screened Bed Limiters sections. Some of the sections may require tray clamps (see drawings). If tray clamps are required, install them in the sections before installing the sections on the support ring/support cleats.

7.5 Bolt all the sections with the hardware provided, as shown on the drawings.

7.6 Ensure removal of all foreign materials so that the bed limiter is clean and unobstructed for proper performance.

7.7 Ensure that the packings do not fly from the gaps. If so, adjust/reduce the gap.

8.0 DISTRIBUTOR/REDISTRIBUTOR

8.1 Orifice/Deck Type

8.1.1 Start installation with the short piece of deck and working across the tower. Place the gasket on the support ring. Install the support ring clamps in the deck sections; leave the clamps loose. Place the deck sections on the support ring. Place the minor beam, if provided, against the edge of the deck. Gasketing is to be installed on both sides of the minor beam. Install the bolting through the deck sections, gasketing and minor beams. Tighten the bolting. Continue this procedure until all deck sections are installed.

8.1.2 Some applications require covers or hats over the gas riser area. Install the same.

8.1.3 When specified, the distributor shall be leak tested after installation.

8.1.4 Ensure that all foreign materials are removed so that the distributor/redistributor is clean and unobstructed for proper performance

8.2 Trough Type Liquid Distributor/Redistributor

8.2.1 Review the drawing provided with the distributor/redistributor plate.

8.2.2 Install the tray clamps (wherever provided) loosely in the deck sections and the end closing plates. If the plate is equipped with a center sump (see drawing), install the center sump first.

8.2.3 For some low-flow applications, gasketing is provided with the plate. If gasketing is required (see drawing), place the gasket along with the support ring and sump top edges.

8.2.4 To install the main deck of the distributor/redistributor, begin by placing the short deck section in its proper position on the support ring. Using the tag numbers as a guide, place the adjacent deck section on the support ring. Bolt the deck sections together with the proper end closing plates. If gasketing is provided with the plate, ensure providing gaskets in the joints between the deck sections and the end closing plates. Tighten the bolting at these joints to minimize leakage.

Some applications require covers or hats over the gas riser area. If covers are required, install the same. Continue this, until the entire distributor/redistributor is installed.

8.2.5 After the plate is assembled on the support ring, rotate the tray clamps under the support ring and tighten the clamps. Ensure gasketing (if required) is in proper position.

8.2.6 If parting box(es) are provided with the distributor, install the parting box brackets to the parting box(es), then bolt this assembly in proper position on the distributor/redistributor.

8.2.7 Remove all foreign materials so that distributor/redistributor is clean and unobstructed to ensure proper performance.

8.2.8 For some applications, distributors are provided with leveling screws. Level the troughs wherever leveling screws are provided to bring within level as specified in the respective drawings.

8.2.9 Leak test the distributor, wherever specified on the drawing.

8.3 Lateral Type Distributor/Redistributors

8.3.1 If mounting clips have not been previously welded to the tower wall this is to be done before installing distributor. The drawing provided for the job will show the proper position of the mounting clips. Layout and weld the clips in position.

8.3.2 Place the laterals in position resting on top of the bed limiter.

8.3.3 If the tower is larger than 1250 mm I.D., support members are provided. When support members are provided, they are to be installed next. Loosely bolt the support members to the mounting clips. Lift laterals and loosely bolt laterals to support members.

8.3.4 Place the gasketing provided on top of the lateral flanges in the proper position.

8.3.5 Place header in position and loosely bolt header to clips. Then assemble bolting through header, gasket and lateral flange. Be sure to keep gasket in proper position. Tighten lateral flange bolting. Leave other bolting loose.

8.3.6 Install connecting pipe and flange gaskets to header and inlet nozzle. Tighten pipe flange bolting.

8.3.7 Tighten all bolting on support members.

8.3.8 Ensure to remove all foreign materials so that the distributor is clean and unobstructed for proper performance.

8.4 Spray Nozzle Distributor

8.4.1 Review the drawing provided with the distributor.

- 8.4.2 If mounting clips have not been previously welded to the tower wall, this is to be done before installing the distributor. The drawing provided for the job will show the proper position of the mounting clips layout. Weld the clips in position.
- 8.4.3 Check to see that all the piping is clean and unobstructed inside.
- 8.4.4 Place the laterals in position resting on top of the bed limiter.
- 8.4.5 Place header in position and loosely bolt to wall clip. Assemble the bolting and gasket at the inlet flange. Tighten inlet flange bolting.
- 8.4.6 Place the lateral pipes in position and loosely bolts to wall clips. Assemble the bolting and gasket at the flange end. Tighten the flange bolting.
- 8.4.7 Secure the wall clip bolting as shown on the drawing provided.
- 8.4.8 Hydro tests the spray header, without spray nozzles, if specified on the drawings.
- 8.4.9 Assemble the spray nozzles to the header and lateral assembly as shown on the drawing provided.
- If the spray nozzles are threaded, it is recommended that an anti seize pipe thread compound be used for installation.
- If the spray nozzles are flanges, use gaskets and tighten the bolting securely.
- 8.4.10 The bolting provided at end of pipe (i.e. for U clamps) shall be kept loose so as to have free movement/expansion of the pipe.
- 8.4.11 Check the spray pattern visually by running the pump with water. If spray pattern is defective, replace the spray nozzle with spare spray nozzles supplied.

9.0 FLASHING FEED GALLERY

- 9.1 Review the drawing provided with the Flashing Feed Gallery plate.
- 9.2 Install the tray clamps loosely in the sections that go on the support ring.
- 9.3 For most applications, gasketing is required and is provided with the plate. When gasketing is required, place the gasket along with the support ring.
- 9.4 Place the first section on the support ring and snug up the tray clamps enough to hold it in place. Place the adjacent section on the support ring with a gasket between the two sections. Bolt the two sections together. Install all the sections on the support ring in a similar manner. Tighten the tray clamps and the bolting to ensure leak free operation.

In some instances, where a high gallery wall is required, more sections are provided which need to be bolted on top of the first row of sections. If angle braces are provided, they are to be bolted to the first row of sections. It is advisable to bolt them in place before the upper sections are installed.

After all the sections are bolted tightly together and all the joints are gasketed, install all bracing when required, as shown on the drawing provided. Attach wall clips as shown on the drawing, when required.

Remove all foreign materials so that the Flashing Feed Gallery is clean and unobstructed to ensure proper performance.

10.0 LIQUID COLLECTOR/CHIMNEY/ACCUMULATOR TRAYS

10.1 Review the drawing provided with the collector plate.

10.2 Start installation with the short piece of decking and work across the tower.

10.3 Collector/Chimney/Accumulator trays may be provided with gaskets or may be of seal welded construction to achieve leak tight joints.

10.4 In case trays are provided with gaskets, place the gasketing on the support Ring. Install the support ring clamps in the deck sections and end closing plates. Leave the clamps loose. Attach the proper end closing plate with gasket to each end of the deck sections by bolting through the deck section, gaskets and end closing plate. Tighten the bolting. Continue this procedure until all sections are installed.

10.5 After deck plates are installed, rotate clamps under support ring and tighten clamps. Ensure all gasketing, when required, is in proper position.

10.6 In case of seal welding, welding to be completed after assembly of deck plates and before building the riser height. After completion of floor level assembly and seal welding, leak test the tray to locate deficiency of seal welding and ensure leak tightness.

Install next level of risers to build-up riser height, seal weld and leak test. Continue till tray assembly, seal welding and leak testing is complete.

10.7 Place gas riser covers in position and bolt covers to gas riser using the bolting provided. Tighten the bolts.

10.8 Install a vortex breaker in the draw off nozzle, if required.

10.9 Remove all foreign materials so that collector is clean and unobstructed to ensure proper performance.

11.0 LATTICE GIRDERS

Lattice girders, where utilized, will be of a special design to suit the job. Lattice girders are normally provided to support Two trays/internals (i.e. top lip/flange of each primary member supporting one tray/internal). Lattice girders are supplied in segments so as to enable individual segment pass through the tower manhole, for final installation and welding inside the tower.

It is to be ensured that out of levelness of primary members is within 2 mm and is in level with respective support rings.

Do not install tray, unless installation (including welding) of Lattice Girder is complete.

12.0 TIGHTENING OF BOLTS & CLAMPS

While tightening bolts & clamps, care should be exercised to apply proper force to avoid deformation in clamps. A spanner with a lever arm of 200 mm (8 inch) maximum should be employed so as to apply a torque of approximately 15 ft. Lbs. for tightening of bolts, studs & clamps of M10 size; torque of 18-22 ft. Lbs. for tightening of bolting/clamps of M12 size and torque of 24-36 ft. Lbs. for tightening of bolting/clamps of M16 size.

13.0 LEAK TESTING

(a) Preferred Method

Bubble caps, Collector/Accumulator trays, Distributors/Redistributors and other liquid holding portion of other trays such as seal pans, draw off pans, recessed seal pans etc. shall be leak tested with water. Drain holes/orifices shall be temporarily plugged during testing. These holes are to be kept open during operation (unless otherwise stated on the drawing). Leakage rate (i.e. fall in liquid level) shall not be more than the value specified on the drawing. If leakage rate is excessive or a small area has a leak rate which is appreciable, deck section shall be loosened and gasketing to be repositioned to stop leakage.

(b) Alternate Method

If filling the plate with water is not practical, spot leak testing should be done. Using a small stream of water from a hose, pour water on the joints and see if leakage occurs. The main joints to check are the joints at support ring. A small liquid pool will occur. If leakage occurs loosen the bolting and reposition the gasketing to stop the leakage.

If leak testing cannot be done, all gaskets should be closely inspected to assure proper gasket sealing. This can be done with a small diameter wire by probing the joint or by light testing the joint. If holes/gaps are found, loosen joints and reposition gasket to obtain proper sealing.

14.0 REMOVAL OF RUST PREVENTIVE COATING (eg. CASTROL RUSTILO DWX 32) FROM CARBON STEEL TRAYS AND TOWER INTERNALS

14.1 Rust Preventive Coating (eg. Castrol Rustilo DWX 32), can be easily removed by using moist cotton or petroleum solvent or vapour degreasing or suitable alkaline process cleaner.

15.0 INSTALLATION IN REVAMP COLUMN

15.1 TSR BB

15.1.1 In revamp columns, all existing TSR BB, Support Cleats etc. shall be utilized to the extent possible. It is intended to maximize the use of existing TSRBB to avoid welding with Column wall by using Adopter Bar / Z-bars etc. Only additional TSRBB (or Segment of TSR BB), Support Cleats, etc. if required, shall be supplied new & welded with Column Wall.

15.1.2 Modification (if essential) to the existing supports i.e. cutting / welding of TSRBB, etc. then same shall be carried out after removal of Packing / Trays & associated Internals from column.

15.1.3 Existing supports, wherever requires cutting shall be cut by leaving a projection of ~ 8-10 mm from column wall. Existing supports shall be ground flush only in case fouling with new supports. Utmost care must be taken to avoid damage to column wall.

(Note that new TSR BB/ support cleats etc. shall be of same material / thickness as existing unless otherwise stated.)

15.1.4 Following shall form the reference document for carrying out the work

- i) Tray Support Ring (TSR) & Bolting Bar (BB) Drawing
- ii) Specification for Fabrication of Support Rings & Bolting Bar for Trays & Tower Internals, Specification No. 6-14-0007.

iii) Standard Specification for Trays & Tower Internals , Specification No. 6-14-0008, 6-14-0015 etc.

15.2 HYDROGEN DIFFUSION TREATMENT

For all the locations where welding of new TSR, Bolting Bars and Support Cleats with the column shell is to be carried out in the Carbon Steel portions, Hydrogen Diffusion Treatment shall be carried out prior to welding of new TSR, Bolting Bar and Support Cleats as per following procedure:-

15.2.1 At the locations where welding has to be carried out, a thorough Mechanical cleaning shall be carried out on both sides of the column.

15.2.2 A band of 500 mm width all around the edge to be welded shall be chemically cleaned.

15.2.3 The heated bandwidth shall be min. 300 mm.

15.2.4 Heating shall be carried out under the cover of insulation provided both sides of column to a bandwidth of minimum 500 mm.

15.2.5 Hydrogen diffusion treatment shall be carried out by raising the temperature of band width to 300 degree C (min.). The rate of heating shall not exceed 150 degree C per Hour and holding time 3 Hours. Cooling to room temperature shall be done under cover of Insulation.

15.2.6 The thermocouples attachment and the insulation details for Hydrogen Diffusion Treatment shall be submitted to Engineer-in-Charge for review and approval before the operation is started.

15.3 After completion of the Hydrogen Diffusion Treatment, welding of the attachments shall be carried out as per following procedure:

15.3.1 Preheating shall be carried out upto a temperature of 100 degree C on the areas where welding is to be carried out.

15.3.2 Welding of the attachments shall be started after attaining the required temperature.

15.3.3 After completion of the welding, heating shall be carried out upto a temperature of 350 degree C and holding time on this temperature shall be 3 Hours.

15.3.4 Cooling the area to room temperature shall be done under cover Insulation.

15.4 Columns in which hot work such as welding of new TSR/Bolting Bars/Support Cleats is to be carried out and the existing columns are Stress Relieved, localized PWHT shall be carried out at all such locations where welding is carried out. Procedure for localized PWHT shall be prepared and shall be submitted for approval.

15.5 Trays / Tower Internals shall not be used as working platform inside the column. Removal of Existing Trays / Packing & Associated Internals shall be carried out prior to modification / welding of TSR, Bolting Bar, Support Cleats etc. Any damage / deformation / short falling caused due to revamp work shall be repaired / replaced & supplied wherever required.

15.6 Re-Installation of trays/tower internals shall be carried out as per General Arrangement Drawings & Procedure mentioned at above clauses.

15.7 **De-humidification and Air Conditioning of the Columns (If required by Client unless otherwise stated)**

De-humidification and Air-conditioning system for Columns shall be provided during modification of Tower attachments/ removal of existing trays and tower internals/ installation of new trays and column internals. System shall be designed to provide 40 air changes per hour & ensure a Temperature from 32 to 35 degree Celsius or 10-12 degree Celsius less than ambient temp. whichever is less with a Uniform humidity (RH) of 50-55% inside the column.

This system is required based on client requirement & shall be used by installation Agency during installation of Column Internals and various Inspection Agencies during the inspection of Internals inside the columns till the BOXUP of the Columns.

16.0 INSTALLATION CHECK LIST & REPORTING

After completion of Installation of each tray/tower internal, review the installation and report the same in accordance with EIL Standard Specification for Review of Site Installation of Column internals (Specification No. 6-14-0016).

कालम इंटरनल
के
निर्माण स्थल पर प्रतिष्ठापन के
पुनर्निरीक्षण के लिए मानक विनिर्देश

STANDARD SPECIFICATION
FOR
REVIEW OF SITE INSTALLATION
OF
COLUMN INTERNALS

6	27.03.26	REVISED AND REISSUED AS STANDARD SPECIFICATION	VKY	JA	AK	NK Nalin
5	08.03.21	REVISED AND REISSUED AS STANDARD SPECIFICATION	PG	AK	NK	SM
4	13.03.15	REVISED AND REISSUED AS STANDARD SPECIFICATION	ASHOK	SKM	AP	SC
3	30.03.10	REAFFIRMED AND REISSUED AS STANDARD SPECIFICATION	JA	SKM/DK	AKG	ND
Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
Approved by						

Abbreviations:

D/C	Downcomer
EW	Exit Weir
EW H	Exit Weir Height
MTMS	Mass Transfer Mechanical & System
SCM	Supply Chain Management
SMMS	Specialist Material & Maintenance Services
TSR	Tray Support Ring
TSRBB	Tray Support Ring & Bolting Bar
UDFC	Under Downcomer Flow Clearance

Mass Transfer Mechanical & System Standards Committee

Convenor: Mr. Arun Kumar (Convener)

Members: Mr. Inder Kumar
Mr. Pankaj Gandhi
Mr. Jeevan Agrawal (Coordinator)
Mr. Vinodkumar Yadav
Mr. Urmilesh Tiwari
Mr. Aasheesh Handa (Projects)
Mr. Prabhakar Choudhary (SMMS)
Mr. Avdhesh Agrawal (SCM)

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LIST OF ANNEXURES:

Site Installation Reporting Format for Trays & Tower Internals	3-0542-4001
Site Installation Review Check List	3-0542-4002

1.0 PURPOSE

This document outlines the requirements of site installation checking and review of installed trays and tower internals. This is necessary so as to ensure that the requirements as per approved drawings are met and equipment performs according to the design specification.

It is the responsibility of Installation Contractor to ensure that all components are fitted as per drawing/standards/specifications and 100 percent checked by Installation Contractor's Supervisor and Engineer-in-Charge. Records of installation and quality checks shall be maintained by Installation Contractor duly counter checked/signed by Engineer-in-Charge as per Format 3-0542-4001 attached.

Review by specialist shall be subsequently carried out.

2.0 REFERENCES

Following shall form the reference documents for carrying out the work:

- i) General Arrangement drawings of Trays and Tower Internals.
- ii) Tray Support Ring and Bolting Bar drawings of Column fabricator.
- iii) Vessel Design Data.
- iv) Nozzle Orientation Drawing.
- v) Installation Procedure for Trays & Tower Internals - No. 6-14-0003
- vi) Standard Specification for Packing the Column - No.6-14-0011
- vii) Construction Tolerance for Welded Supports for Trays/Tower Internals - No.7-14-0001
- viii) Typical detail of Trays - No.7-14-0202

3.0 DEFINITIONS

Column Internals

These are mechanical devices used inside the column or other process equipment to carry out desired process function and shall include trays, tower internals, tower packings, demisters, spray nozzles etc.

Revamp

The word is used for modifications being done to any process equipment or scheme so as to achieve higher throughput or better product quality or both.

Engineer-in-Charge

Authorised engineer either from client/or EIL site, responsible to interact with Installation Contractor & getting the jobs done under his/her surveillance & inspection.

Specialist

The Designer / nominated personnel of MTMS department, assigned to perform the review of the tray/internal installations after these are cleared by Engineer-in-Charge.

Set of Trays

Identical trays in a continuous bank having same chord heights, number and type of valves, exit weir heights, under down flow clearances, tray spacing etc.

Installation Contractor

Agency who has been assigned the job for carrying out the Installation of Column Internals.

Punch List

List of comments given by specialist at site which needs to be attended for necessary rectification by the Installation Contractor under direction of Engineer-in-Charge.

4.0

SCOPE

The scope of activities and responsibilities of Installation Contractor, Engineer-in-Charge and Specialist shall be as per para 4.1, 4.2 and 4.3 hereafter. These shall be carried out for all trays/tower internals in each column.

4.1

Installation Contractor

- i) Before Installation of Trays and Tower Internals, checking the distance between tray support rings, location of bolting bar and levelness of support rings.
- ii) Ensure Support Ring, Support Stools/Cleats, Bolting Bar, Column Interior wall are clean from scale, rust, dirt, debris etc. else shall be cleaned from the column before checking / inspection activity of TSRBB and Installation work of Trays and Tower Internals.
- iii) Modification (if essential) to the welded supports i.e. cutting / welding, drilling, grinding of TSRBB, etc. then same shall be reported to Engineer-In-Charge. If desired by Engineer-in-Charge, the same may have to be carried out by Installation contractor to the satisfaction of Engineer-in-Charge.
- iv) Recording the final levelness/dimensions measured in Format 3-0542-4001(sht. 1 & 2) and getting this counter checked by supplier's supervisor (as applicable) and Engineer-in-Charge.
- v) Modification (if essential) in the Trays and Tower Internals i.e. cutting / welding, drilling, bending, sealing, shimming etc. then same shall be reported to Engineer-In-Charge. If desired by Engineer-in-Charge, the same may have to be carried out by Installation contractor to the satisfaction of Engineer-in-Charge.
- vi) After installation of trays and tower internals under the supervision of internal supplier and stage-wise inspection of Engineer-in-Charge, recording important tray dimensions for all trays as per Format 3-0542-4001 (sht. 3 & 4) and getting this counter checked supplier's supervisor (as applicable) and Engineer-in-Charge.
- vii) Carrying out various checks /leak testing on fitted trays as per Format 3-0542-4001 (sht. 5) and recording the compliance duly counter checked by supplier's supervisor (as applicable) and Engineer-in-Charge.
- viii) In case of packed beds, after installation of various internals carrying out various checks/leak testing as per Format 3-0542-4001 (sht. 6 & 7) and recording the compliance duly counter checked by supplier's supervisor (as applicable) and Engineer-in-Charge.
- ix) Whenever Installation Contractor is other than the Supplier (i.e. Manufacturer in this case) of Trays & Tower Internals, signature of Supplier's supervisor is applicable.

4.2 Engineer-in-Charge

- i) Stage-wise and final inspection of installation of Trays and Tower Internals done by the Installation Contractor.
- ii) Counter checking the various dimensions/levelness/checks as recorded by Installation Contractor as per para 4.1. These records shall be maintained at site and shown to specialist for his/her review.
- iii) In case dimensions/levelness/location of support rings and bolting bars is not as per column drawings and also not within tolerances as per EIL Std. 7-14-0001, directions shall be provided to Installation Contractor/Column Fabricator/ Mechanical Contractor for necessary rectification/modification.
- iv) In case mismatch occurred in the fitment of trays & tower internals with respect to welded support inside the column, then directions shall be provided to "Installation Contractor" for necessary rectification/modification.
- v) Discrepancies/ Mismatches observed during installation work in the welded supports (i.e. TSRBB) / Trays and Tower Internals shall be reported to Specialist (if necessary) for decision.
- vi) Submit filled & signed format 3-0542-4001 to MTMS department for each column before calling for checking/review by specialist.
- vii) To ensure that Tray/Tower Internals Supplier's representative is present at site during Specialist visit at site.
- viii) Attending to Punch List provided by specialist at the end of his/her review and ensuring that these are carried out by Installation Contractor. Rectifications required as per Punch List shall be finally cleared by Engineer-in-Charge and no further review by specialist shall be required. Columns shall be cleared for boxing-up subsequently.

4.3 Specialist

- i) Review of readings/observations on site installation and leak testing recorded in format 3-0542-4001 before carrying out his/her own random checking.
- ii) The review of Trays & Tower Internals by Specialist shall always be based on System Requirement, Approved Drawings & as per format 3-0542-4002.
- iii) Carry out random check on installed trays. Number of trays selected for this shall depend upon the quality of work. However, as a minimum, 25 percent of trays (minimum 2 nos. per set) shall be checked. Trays so selected shall be true representative of the total tray bank. Record the findings in the form of punch list and handover to Engineer-in-charge for rectification/compliance.
- iv) Review of Installed Column Internals to the extent access is available. Record the findings in the form of punch list and handover to Engineer-in-charge for rectification/compliance.
- v) List out the discrepancies observed. If specialist finds it necessary to discuss with head office, it shall be referred to Head Office for decision. Jobs which need rectification shall be reported to Engineer-in-Charge through a Punch List. These shall be attended to by Engineer-in-Charge and no further review by specialist would be required.
- vi) Submit filled format 3-0542-4001(hard / soft copy), copy of Punch List for each column, Minutes of Meeting with Site / Client and Tour report (if required) to Head Office.

COLUMN NO.:	EIL/VENDOR'S DRG. NO.:
SERVICE:	JOB NO.:
PLANT:	CLIENT:

1. DISTANCE BETWEEN TRAY SUPPORT RING (BETWEEN CONSECUTIVE TRAYS)

TRAY NO.								
DRG. DIMENSION								
AS BUILT DIMENSION AT POINT	A							
	B							
	C							
	D							
	E							
	F							

DIMENSION TO BE TAKEN FROM TOP TO TOP OF TSR WITH POINTS MARKED ON THE SAME ORIENTATION FOR ALL TRAYS MINIMUM AT FOUR POINTS UPTO 2000Ø & MINIMUM SIX POINTS ABOVE 2000Ø

2. LOCATION OF BOLTING BAR

TRAY NO.	⇒							
G1	DRG.DIMENSION							
	ACTUAL							
G2	DRG.DIMENSION							
	ACTUAL							
G3	DRG.DIMENSION							
	ACTUAL							
G4	DRG.DIMENSION							
	ACTUAL							
G5	DRG.DIMENSION							
	ACTUAL							
G6	DRG.DIMENSION							
	ACTUAL							
G7	DRG.DIMENSION							
	ACTUAL							
G8	DRG.DIMENSION							
	ACTUAL							

<p>INSTALLATION CONTRACTOR:</p> <p>(SIGNATURE)</p> <p>NAME:</p> <p>DATE:</p> <p>SUPPLIER'S SUPERVISOR (As applicable):</p> <p>(SIGNATURE)</p> <p>NAME:</p> <p>DATE:</p>	<p>ENGINEER-IN-CHARGE:</p> <p>(SIGNATURE)</p> <p>NAME:</p> <p>DATE:</p>
---	--

Notes:

- (1) This format shall be filled for all **Trays** by Installation Contractor and counter checked by Engineer-in-Charge.
- (2) Tolerance on various drawing dimensions shall be as per applicable drawing/standard.
- (3) Refer Standard 7-14-0202 for abbreviations & typical detail of trays.

COLUMN NO.:	EIL/VENDOR'S DRG. NO.:
SERVICE:	JOB NO.:
PLANT:	CLIENT:

TRAY NO.										
A	DRG. DIMENSION	A1, A3, A4, A5, A7, A8								
		A2, A6								
HEIGHT OF EXIT WEIR (FROM TOP OF TRAY DECK TO TOP OF WEIR) (mm)		A1								
		A2								
		A3								
		A4								
		A5								
		A6								
		A7								
		A8								
B	DRG. DIMENSION	B1, B3, B4, B5, B7, B8								
		B2, B6								
UNDER DOWN FLOW CLEARANCE, (DISTANCE BETWEEN DOWNCOMER BOTTOM & TRAY DECK/RECESSED SEAL PAN PLATE) (mm)		B1								
		B2								
		B3								
		B4								
		B5								
		B6								
		B7								
		B8								
C	DRG. DIMENSION	C1, C3, C4, C5, C7, C8								
		C2, C6								
HORIZONTAL DISTANCE BETWEEN DOWNCOMER PLATE & RECESSED SEAL PAN (mm)		C1								
		C2								
		C3								
		C4								
		C5								
		C6								
		C7								
		C8								

<p>INSTALLATION CONTRACTOR:</p> <p>(SIGNATURE)</p> <p>NAME:</p> <p>DATE:</p> <p>SUPPLIER'S SUPERVISOR (As applicable):</p> <p>(SIGNATURE)</p> <p>NAME:</p> <p>DATE:</p>	<p>ENGINEER-IN-CHARGE:</p> <p>(SIGNATURE)</p> <p>NAME:</p> <p>DATE:</p>
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Notes:

- (1) This format shall be filled for all **Trays** by Installation Contractor and counter checked by Engineer-in-Charge.
- (2) Tolerance on various drawing dimensions shall be as per applicable drawing/standard.
- (3) Refer Standard 7-14-0202 for abbreviations & typical detail of trays.

COLUMN NO.:	EIL/VENDOR'S DRG. NO.:
SERVICE:	JOB NO.:
PLANT:	CLIENT:

TRAY NO.																
D	DRG. DIMENSION	D1, D3, D4, D5, D7, D8														
		D2, D6														
UNDER DOWN FLOW CLEARANCE (DISTANCE BETWEEN DOWNCOMER PLATE & SEAL PAN (mm))			D1													
			D2													
			D3													
			D4													
			D5													
			D6													
			D7													
			D8													
E	DRG. DIMENSION	E1, E3, E4, E5, E7, E8														
		E2, E6														
CLEAR DISTANCE BETWEEN DOWNCOMER PLATE & SEAL PAN (mm)			E1													
			E2													
			E3													
			E4													
			E5													
			E6													
			E7													
			E8													
INSTALLATION CONTRACTOR: (SIGNATURE) NAME: DATE:					ENGINEER-IN-CHARGE: (SIGNATURE) NAME: DATE:											
SUPPLIER'S SUPERVISOR (As applicable): (SIGNATURE) NAME: DATE:																

Notes:

- (1) This format shall be filled for all **Trays** by Installation Contractor and counter checked by Engineer-in-Charge.
- (2) Tolerance on various drawing dimensions shall be as per applicable drawing/standard.
- (3) Refer Standard 7-14-0202 for abbreviations & typical detail of trays.

COLUMN NO.:	EIL/VENDOR'S DRG. NO.:
SERVICE:	JOB NO.:
PLANT:	CLIENT:

CHECK THE FOLLOWING :	TRAY NO.						
CHECK EACH BOLT FOR TIGHTNESS							
CHECK ORIENTATION, PROPER MARK (TYPE) AND TIGHTNESS OF EACH CLAMP							
CHECK PROVISION OF LOCK NUTS AND SEAL PLATES WHEREVER SPECIFIED							
CHECK EACH TOP DOWNCOMER PIECE FOR CORRECT INSTALLATION OF SHIMMING INCLUDING TACK WELDING/BOLTING							
CHECK SEAL WELDING/GASKETING WHEREVER APPLICABLE							
CHECK LEAK TESTING OF SEAL PANS, RECESSED SEAL PAN, CHIMNEY TRAYS, DISTRIBUTOR, DRAW-OFF BOXES ETC. AS PER DRAWING							
CHECK OVERLAPPING OF DECKS							
CHECK FOR DAMAGED, MISSING VALVES AND VALVE MOVEMENT FOR ALL VALVES FOR VALVE TRAYS							
CHECK FOR FITTING OF PROPER VALVE COMBINATION (MR2, MR6 ETC.)							
CHECK FOR NOTICEABLE DAMAGE TO DECK COMPONENTS & MODIFICATION (as required)							
CHECK LEVELNESS AND ALIGNMENT OF INLET WEIR AND EXIT WEIR AND ADJUST IF NECESSARY							
CHECK BEAM & CLIPS ARE PROPERLY FITTED							
CHECK THAT TRAY MANWAY CAN BE OPENED FROM TOP AS WELL AS FROM BOTTOM							
CHECK THAT ALL SLOTS ON TRAY COMPONENTS ARE FULLY COVERED							
CHECK THAT GAPS AT DOWNCOMER ENDS AND OTHER PLACES ARE WITHIN SPECIFIED LIMITS							
CHECK ORIENTATION IN CASE OF RIPPLE TRAYS							
FOR LATTICE GIRDERS, CHECK THE LEVELNESS OF PRIMARY MEMBERS AND COMPLETENESS OF WELDING OF ALL THE BRACINGS AND SECONDARY MEMBERS							
CHECK TEMPORARY PLUGS WHEREVER PROVIDED FOR TESTING HAVE BEEN REMOVED							
CHECK THAT TRAYS HAVE BEEN CLEARED OFF ALL FOREIGN MATERIALS							
INSTALLATION CONTRACTOR: (SIGNATURE) NAME: DATE:				ENGINEER-IN-CHARGE: (SIGNATURE) NAME: DATE:			
SUPPLIER'S SUPERVISOR (As applicable): (SIGNATURE) NAME: DATE:							

Notes:

- (1) This format shall be filled for all **Trays** by Installation Contractor and counter checked by Engineer-in-Charge.
- (2) Tolerance on various drawing dimensions shall be as per applicable drawing/standard.
- (3) Refer Standard 7-14-0202 for abbreviations & typical detail of trays.

COLUMN NO.:	EIL/VENDOR'S DRG. NO.:
SERVICE:	JOB NO.:
PLANT:	CLIENT:

CHECK THE FOLLOWING :	BED NO.				
CHECK THAT MULTIBEAM SUPPORT PLATE SITS PROPERLY ON THE TSR WITH NO UNDESIRED GAPS. ALL SPACINGS AND GAPS ARE EVENLY DISTRIBUTED ACROSS THE VESSEL DIAMETER.					
CHECK FOR PROPER LEVELLING OF TOP OF BED AND GAP BETWEEN TOP OF BED AND BED LIMITER (NO GAPS PREFERRED, MAXIMUM GAP AT FEW LOCATIONS NOT TO EXCEED ONE PACKING SIZE).					
CHECK THAT BED LIMITER IS PROPERLY BOLTED AND THE GAP ON THE PERIPHERY IS UNIFORM AND NOT MORE THAN THAT SPECIFIED IN THE DRAWING. ALSO CHECK THAT PACKING IS NOT FREE TO COME OUT FROM ANY OPENING. ALSO CHECK THAT BED LIMITER MESH IS INTACT.					
CHECK LEVELNESS FOR DISTRIBUTOR/REDISTRIBUTORS/FLASH GALLERIES/SPRAY HEADER. SAME TO BE WITHIN TOLERANCE SPECIFIED IN THE DRAWINGS/STANDARDS AND TO BE RECORDED IN SHT.1.					
CHECK THAT THE DISTRIBUTOR/REDISTRIBUTORS/FLASH GALLERIES/SPRAY HEADERS ARE PROPERLY CLAMPED/BOLTED.					
CHECK THAT THE DISTRIBUTOR/REDISTRIBUTORS/FLASH GALLERIES (IF REQUIRED) ARE PROPERLY GASKETTED AS SPECIFIED IN THE DRAWING.					
CHECK LEAK TIGHTNESS OF THE DISTRIBUTOR/REDISTRIBUTOR/ FLASH GALLERY (IF REQUIRED), TO BE ENSURED BY FILLING WATER AND CHECKING LEAKAGES FROM GASKETTED JOINTS.					
FOR CHIMNEY/COLLECTOR TRAY, DRAW-OFF BOXES, WHEREVER APPLICABLE, CHECK COMPLETENESS OF SEAL WELDING, GASKETTING, PROPER FITMENT OF VAPOUR RISER COVERS AND REVIEW RECORD FOR LEAK TESTING.					
FOR SPRAY NOZZLE DISTRIBUTOR, CHECK FOR i) HYDROTEST FOR SPRAY HEADER ii) CLOGGING OF SPRAY NOZZLES, BY RUNNING PUMP, IF FEASIBLE iii) CHECK TIP DISTANCE FROM TOP OF THE BED (TOLERANCE TO BE WITHIN 25 mm) iv) CHECK GASKET AT FLANGE JOINT, THREAD SEALANT AT THREADED JOINTS v) ANY OBSTRUCTION IN THE UNIFORM SPRAY PATTERN					
REVIEW OF PROPER ORIENTATION OF VARIOUS TOWER INTERNALS LIKE BED LIMITER, FEED PIPE W.R.T. DISTRIBUTOR/ REDISTRIBUTORS, AS PER DETAIL SHOWN IN RESPECTIVE DRAWINGS.					
CHECK TEMPORARY PLUGS WHEREVER PROVIDED HAVE BEEN REMOVED AFTER TESTING					
INSTALLATION CONTRACTOR: (SIGNATURE) NAME: DATE: SUPPLIER'S SUPERVISOR (As applicable): (SIGNATURE) NAME: DATE:	ENGINEER-IN-CHARGE: (SIGNATURE) NAME: DATE:				

Notes:

(1) This format shall be filled for all **Tower Internals** by Contractor and counter checked by Engineer-in-Charge.

TRAY INSTALLATION REVIEW CHECK LIST
(To be followed by Specialist as a minimum check points)

- (1) Review of filled formats for Tray levelness and other tray installation data
Formats (3-0543-4001sht.1 to 7 of 7) to be completed by Contractor and duly certified
for 100% checking by EIL site.
If any dimension is out of permissible tolerances as per 7-14-0001. Specialist to
review and suggest remedial action, in consultation with Head Office (if required).
- (2) Provide clarification to site on any matter w.r.t. Installation of trays and tower
internals.
- (3) Random check minimum 25 % of trays (subject to minimum two trays per set)
(Trays selected shall be true representative).
- EWH & Adjustability (permissible deviation ± 1 mm)
 - UDFC (permissible deviation ± 3 mm, D/C bottom piece to rest on D/C bracket.
 - Gap at deck joints (max. gap 3 mm at deck joint, 5 mm at EW location).
 - Overlapping of tray decks (no overlapping allowed)
 - Valve movement, missing & damaged valves (check approx 5% of valves)
 - For bubble cap trays, check skirt height & locknuts on caps
(check approx 5% caps)
 - Check plugging of holes in case of sieve trays
 - Noticeable damage in Internal components, wooden hammers to be used in case
flattening is required.
 - Chord heights (acceptable limit \pm (Col. ID/200 + 4))
 - Check inlet weir/inlet weir seal plate at respective location
 - Check for proper fitting of gaskets for gasketed deck components.
 - Also check whether same has been leak tested or not. Also check that drain
holes are open unless specified otherwise in the drawings.
 - Light & heavy valve combination adopted at right place
 - Check provision of lock-nuts wherever specified
 - For Ripple trays, check relative orientation of trays
 - For Cartridge trays, check the top tray of each bundle orientation and removal
of lifting box.
 - Check the provision of anti-jump baffle wherever specified
 - Check for seal plates on recessed seal pans
 - Check temporary plugs wherever provided has been removed after testing
- (4) For Chimney/Collector Tray, Draw-off boxes, wherever applicable, check
completeness of seal welding, gasketing, proper fitment of vapour riser covers and
review record for leak testing.
- (5) Check arrangement for proper feeding & liquid withdrawal
- Reflux (Inlet deflector baffle / Feed Pipe arrangement) at top tray
 - Transition arrangement from one tray to other
 - Intermediate feed including direction/angle of vapour & liquid slots
 - Feed from bottom most seal pan to partitioned column bottom
 - Vapour/reboiler return, if flush, should be parallel to down comer of bottom
most tray.
 - Location/Orientation of withdrawal nozzle, if flush, shall be flushed with the
surface of internal. Also check provision of vortex breaker.
 - Location / Orientation of Instruments Nozzles like Level, Pressure, Temp.
Nozzles etc. w.r.t. Internals in Transition Zone, Chimney Tray, Seal Pans &
bottom partitioned baffle Zone etc. of the column.
 - Drain & vent holes wherever provided in the feed system shall be clear & open
- (6) List out all discrepancies in a punch list for individual column

TOWER INTERNALS INSTALLATION REVIEW CHECK LIST

(To be followed by Specialist as a minimum check points)

- | | | |
|----|---|--------------------------|
| 1. | Review site record for levelness for distributor/redistributors/flash galleries/spray header. Same to be within tolerance specified in the drawing/standards. | <input type="checkbox"/> |
| 2. | Check that the distributor/redistributors/flash galleries/spray headers are properly clamped / bolted. | <input type="checkbox"/> |
| 3. | Check that the distributor/redistributors/flash galleries (if required) are properly gasketed as specified in the drawing. | <input type="checkbox"/> |
| 4. | Review site record of leak tightness of the distributor/redistributors/flash gallery (if required), to be ensured by filling water and checking leakages from gasketed joints. | <input type="checkbox"/> |
| 5. | For Chimney/Collector Tray, wherever applicable, check, if possible, completeness of seal welding, gasketing, proper fitment of vapour riser covers and review record for leak testing. | <input type="checkbox"/> |
| 6. | For spray nozzle distributor, check for | |
| | i) Hydrotest record for spray header | |
| | ii) Clogging of spray nozzles, by running pump, if feasible | <input type="checkbox"/> |
| | iii) Sample check tip distance from top of the bed (to be within ± 25 mm) | <input type="checkbox"/> |
| | iv) Check proper gasket fitment at flange joint, thread sealant at threaded joints. | <input type="checkbox"/> |
| | v) Any obstruction in uniform spray pattern | <input type="checkbox"/> |
| 7. | Review of proper orientation of various tower internals like bed limiter w.r.t. Distributor/redistributors, as per detail shown in respective drawings is mandatory. | <input type="checkbox"/> |

अग्निरोधक लाइटिंग और पावर पैनलों के लिए विनिर्देश

SPECIFICATION FOR FLAMEPROOF LIGHTING AND POWER PANELS

7	09.04.26	REVISED AND ISSUED AS STANDARD SPECIFICATION	NNB/SAC	ANPS	HK	NK
6	22.03.21	REVISED AND ISSUED AS STANDARD SPECIFICATION	RKS	ANPS	PG	SM
5	24.02.16	REVISED AND ISSUED AS STANDARD SPECIFICATION	NNB/AK	ANPS	BRB	SC
4	11.04.11	REVISED AND ISSUED AS STANDARD SPECIFICATION	PS	ANPS	UAP	DM
3	24.08.07	REVISED AND ISSUED AS STANDARD SPECIFICATION	ANPS	UAP	JMS	VC
2	30.01.02	REVISED AND ISSUED AS STANDARD SPECIFICATION	UAP	AAN	VPS	GRR
Rev. No	Date	Purpose	Prepared by	Checked by	Standards Committee Convenor	Standards Bureau Chairman
						Approved by

Abbreviations:

AC	Alternating Current
BIS	Bureau of Indian Standards
CEA	Central Electricity Authority
DGMS	Directorate General of Mines Safety
EIL	Engineers India Limited
ELCB	Earth Leakage Circuit Breaker
FRLS	Flame Retardant Low Smoke
GI	Galvanized Iron
IEC	International Electro-technical Commission
IP	Ingress Protection
IS	Indian Standards
LV	Low Voltage
MCB	Miniature Circuit Breaker
MR	Material Requisition
NABL	National Accreditation Board for Testing and Calibration Laboratories
PESO	Petroleum and Explosives Safety Organisation
PO	Purchase Order
PVC	Poly Vinyl Chloride
SPN	Single Phase and Neutral
SS	Stainless Steel
TPN	Three Phases and Neutral
XLPE	Cross Linked Poly Ethylene

Electrical Standards Committee

Convenor: Mr. Harish Kumar

Members: Ms. Arvind N. P. Singh
Mr. Rajiv Kumar Saha
Mr. Vijay Kumar
Ms. Shirali Aggarwal
Ms. Rashmi Singh Rathaur
Mr. Supriya Talukder
Mr. Ayush Mathur (Projects)
Mr. Rajesh Sinha (PDD)
Mr. G. Suresh (Inspection)

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1.0 SCOPE

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

2.0 CODES AND STANDARDS

2.1 The equipment shall comply with the requirements of latest revision of the following standards issued by BIS:

IS-5	:	Colours for ready mixed paints and enamels
IS-12640	:	Residual current operated circuit breakers
IS / IEC 60079-0	:	Electrical apparatus for explosive gas atmospheres (General requirements)
IS / IEC 60079-1	:	Electrical apparatus for explosive gas atmospheres (Equipment Protection by Flameproof Enclosures "d")
IS / IEC 60529	:	Degree of protection provided by enclosures (IP Code)
IS / IEC 60898	:	Electrical Accessories - circuit breakers for over protection for household and similar installations
IS / IEC 60947	:	LV switchgear and control gear.
IS/16724-2018/ IEC-60079-14: 2003 (Ed 5.0)	:	Explosive atmospheres -Part 14: Electrical Installation design, selection and erection
IEC 61009-1	:	Residual current operated circuit breakers with integral over current protection for Household and similar uses.

2.2 In case of imported equipment, only IECEx (or equivalent, if more stringent than the applicable IEC) certified equipment shall be used.

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

2.4 In case Indian standards are not available for any equipment, standards issued by IEC or equivalent agency (if more stringent than IEC) shall be applicable.

2.5 In case of any conflict between requirements specified in various applicable documents for the project, the most stringent requirement shall govern. However, Owner's/ EIL's decision in this regard will be final and binding.

3.0 GENERAL REQUIREMENTS

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

3.2 Vendor shall ensure availability of spare parts and maintenance support services for the offered equipment for at least 10 years from the date of supply.

4.0 SITE CONDITIONS

The equipment shall be suitable for installation and satisfactory operation in classified hazardous locations in tropical, humid and corrosive atmosphere as prevalent in refineries, petrochemical and fertilizer plants. The lighting and power panels shall be designed to operate