

freyssinet-india

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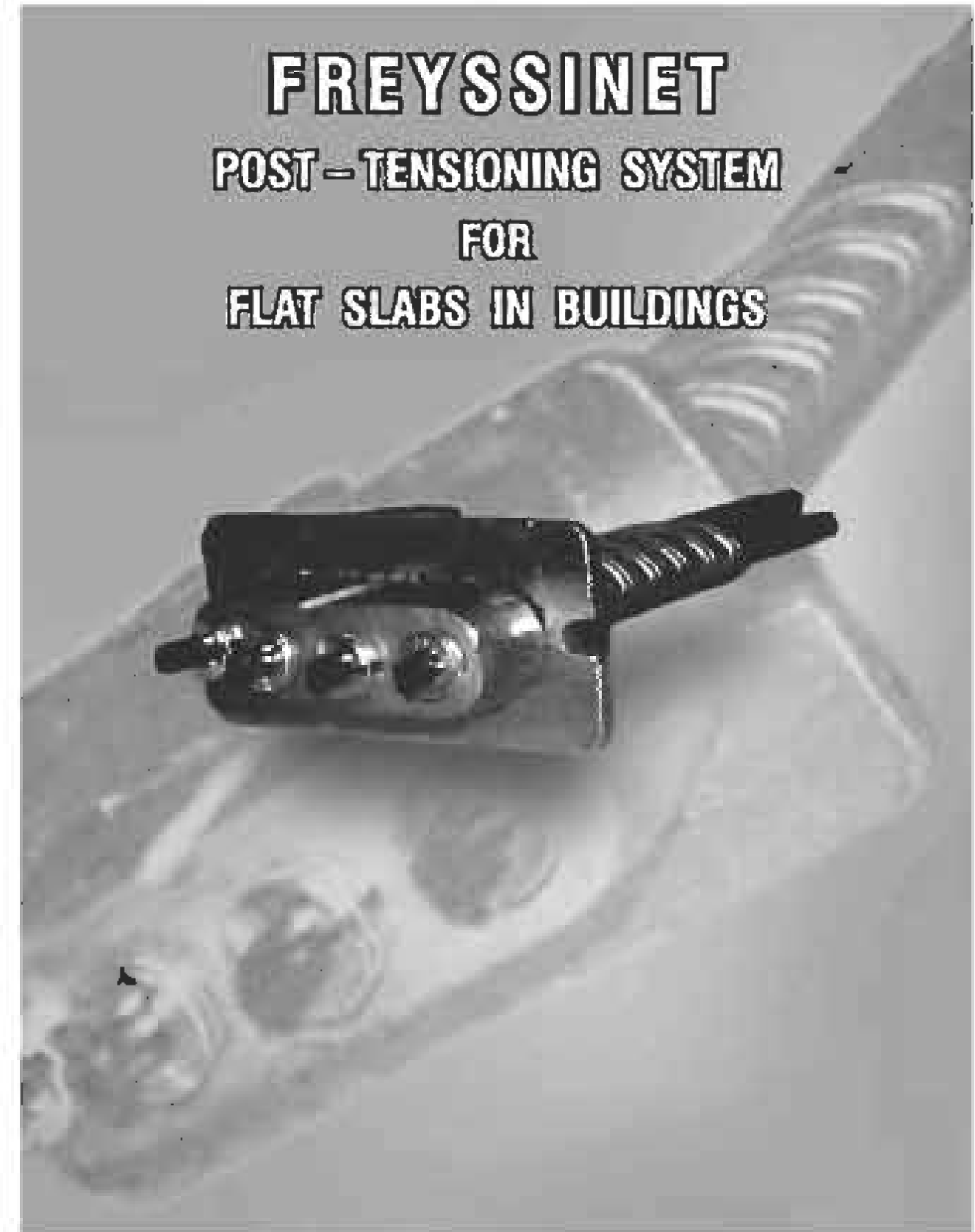
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FREYSSINET

POST-TENSIONING SYSTEM

FOR

FLAT SLABS IN BUILDINGS



**THE FREYSSINET PRESTRESSED
CONCRETE COMPANY LIMITED**

freyssinet-india

FPCCLTD.

SLAB STRESS SYSTEM FROM DESIGN TO COMPLETION

Post Tensioned Slab :

Instead of relying solely on conventional reinforcing steel or welded wire mesh to reinforce the slab, HT steel tendons are used in the slab running in both directions. Depending upon the load & column locations, the spacing of the tendons may vary. After the concrete has achieved required strength, the embedded tendons are stressed (thus the term "post-tensioned") to an effective force using hydraulic jacks. The internal forces that are generated, improve the response of the structure to external loading and load changes.

Need of Post Tensioned Slab :

Modern post-tensioning techniques produce thinner floors or larger spans that need fewer supporting columns. The result is larger uninterrupted floor spaces that greatly increase the use of the building to cater for the varying needs of different occupiers.

The post-tensioning reduces the basic structure to its simplest form. It is the highly economical way of designing the floors and roofs of industrial & commercial buildings such as multi-storey offices, apartments, warehouses, hospitals, schools, parking structures etc.

Advantages of Post-tensioned Flat Slab :

Economical replacement of traditional RCC slabs.

- Longer Spans - Spans of upto 50% longer than those using RCC can be constructed with fewer supporting columns.
- Thinner Slabs - PT flat slabs of thin concrete plates may be used.
- Flexibility - Internal layout flexibility is greatly increased making it much easier for architectural planning.
- Faster Construction Cycle - Simple formwork, early form striking, less steel & concrete enables construction completed earlier.
- Resistance to cracking & Water seepage - Due to limited deflections & highly compressive characteristics of prestressed concrete, cracking & water seepage are resisted.
- Lighter Structure - Resulting in lower support cost & reductions of foundation loading.

Performance :

Corrosion Protection

- Excellent corrosion protection is provided by well-proven cement grout technique.

Fire Resistance

- Minimum slab thickness & cover are generally governed by code provisions that provide excellent fire resistive properties.

SOME OF PROJECTS DONE BY : FREYSSINET PT - FLAT SLAB SYSTEMS

Client	: Fort House
Location	: Mumbai
Area	: 7350 m ²
Panel Size	: 6.5m x 6.5m x 9.5m x 10.5m
System	: 4S13
Loads	: DL - 7kN/m ² LL - 5kN/m ²
Main	: Shapoorji Pallonji
Contractor	
Consultant	: P.D. Mahajan, Mumbai.

Construction completed in the Year 1998



Client	: Sahara Hospitality Ltd.
Location	: Mumbai
Area	: 20,000 m ²
Panel Size	: 8.5 x 8.5 m
System	: 4S13
Loads	: DL - 7kN/m ² LL - 5kN/m ²
Status	: Under Construction
Main	: L & T
Contractor	
Consultant	: Design Excellence, Dombivli.



Client	: Silver Group of Co.
Location	: Mumbai
Area	: 25,000 m ²
Panel Size	: 8.0 x 8.0 m
System	: 4S13
Status	: Under Construction
Main	: Vishwakarma
Contractor	: Const. Co.
Consultant	: Vijay Bhave, Mumbai



SOME OF PROJECTS DONE BY : FREYSSINET PT - FLAT SLAB SYSTEMS



Client : Utsav Apartments
Location : Juhu, Mumbai
Area : 6500 m²
Panel Size : 8.0 x 8.0 m
System : 4S13
Architect : Ajit Bhuta & Asso.
Consultant : FPCC Ltd.

The first Post Tensioned Building in India in the Year 1994 - 1997



Client : Lakshma Fashion House
Location : Dhaka, Bangladesh
Area : 9800 m²
Panel Size : 9.8 x 9.8 m
System : 4S13
Architect : FE & A Partners
Consultant : FPCC Ltd.

Construction completed in the Year 2001



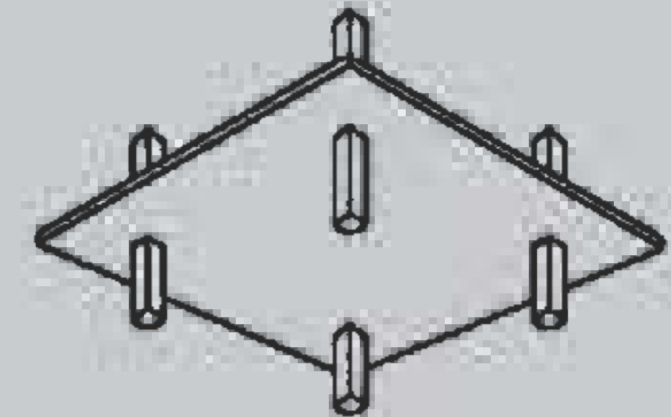
Client : SKS Garments
Location : Dhaka, Bangladesh
Area : 10,500 m²
Panel Size : 10.5 x 10.5 m
System : 4S13
Consultant : FPCC Ltd.

Construction completed in the Year 2003

TYPICAL APPLICATIONS

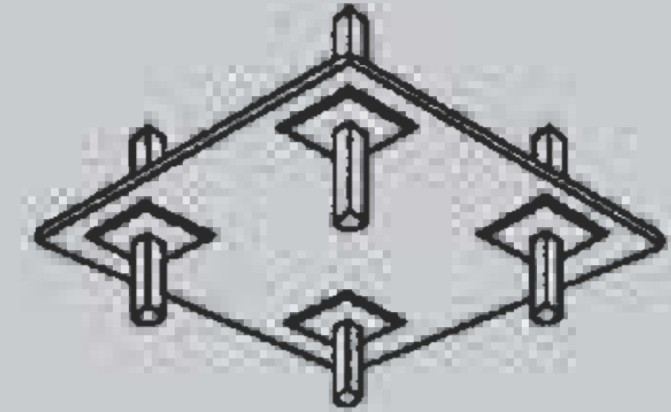
Flat Slab :

This type is generally employed for apartment blocks, office buildings, hospitals, hotels, etc. where spans are similar in both the directions. It is very economical for 5 to 8 m spans.



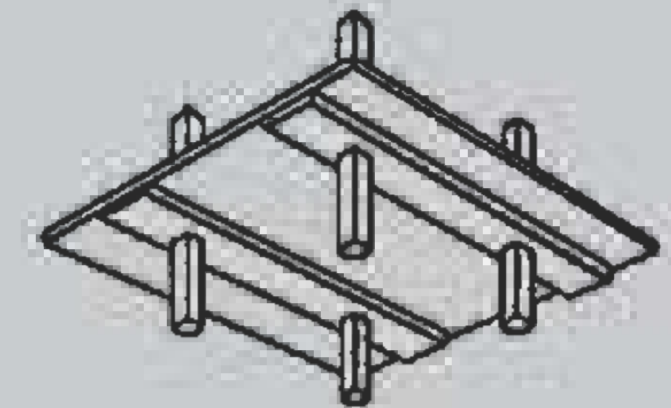
Drop Panel :

This type has similar applications to those described for flat slabs, when larger spans, up to 14m, are required.



Continuous Band :

This is used in car parks; shopping centers where spans in one direction are predominant and live loads are relatively light. Spans up to 15m are possible.



Above applications are the ones commonly used in PT Flat slabs. However applications like waffle or ribbed slabs can also be done using post-tensioning.

ANCHORAGE SYSTEM

The latest range of Freyssinet Anchorages meets the most stringent requirements of modern design & technology in the use of PT slabs by the construction industry. The range comprises of tendons of various combinations like 4S13, 5S13 & 4S15 & the details of most commonly used anchorage systems are given below in the table. It is also possible to use anchorage system with one, two or three strands depending upon design requirement, the details of which can be provided separately.

These anchorages are produced to the highest quality standards ensuring dimensional accuracy, strength & durability with full corrosion protection.

Technical Details of Anchorage System

	4S13	5S13	4S15
Type of strand (LRPC as per IS: 14268)	12.7mm dia	12.7mm dia	15.2mm dia
Number of strands	4	5	4
Nominal cross sectional area	394.8 mm ²	493.5 mm ²	560.0 mm ²
Nominal UTS of the cable	74.948 MT	93.685 MT	106.368 MT
Nominal weight of anchorage system	3.10 kg/m	3.875 kg/m	4.408 kg/m
Size of sheathing in mm	75x20	80x20	80x20

Type of jack to be used

: FREYSSINET SC-2 JACK

Extra length of strand required

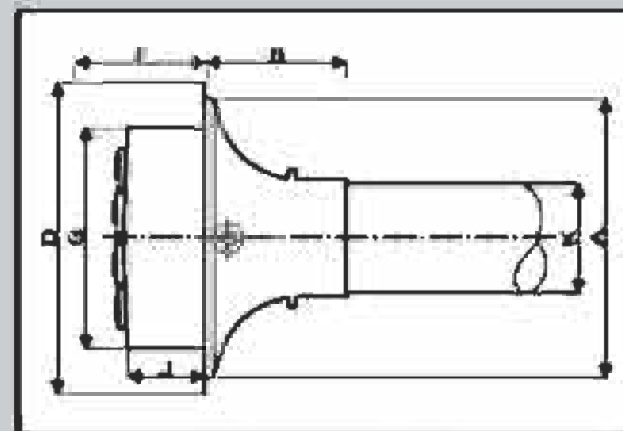
: 350 mm (SC-2 Jack)

Type of sheathing

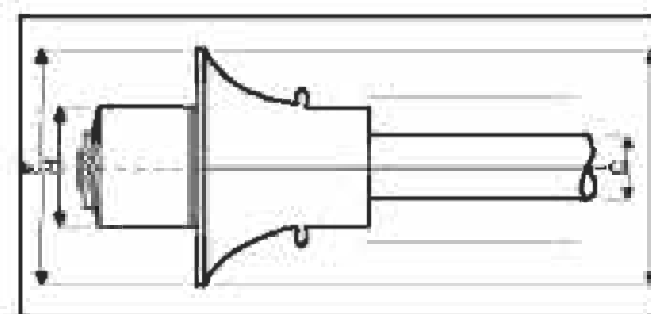
: Flat metallic duct

Average corrected pull-in of gripe

: 6 mm



PLAN OF ANCHORAGE

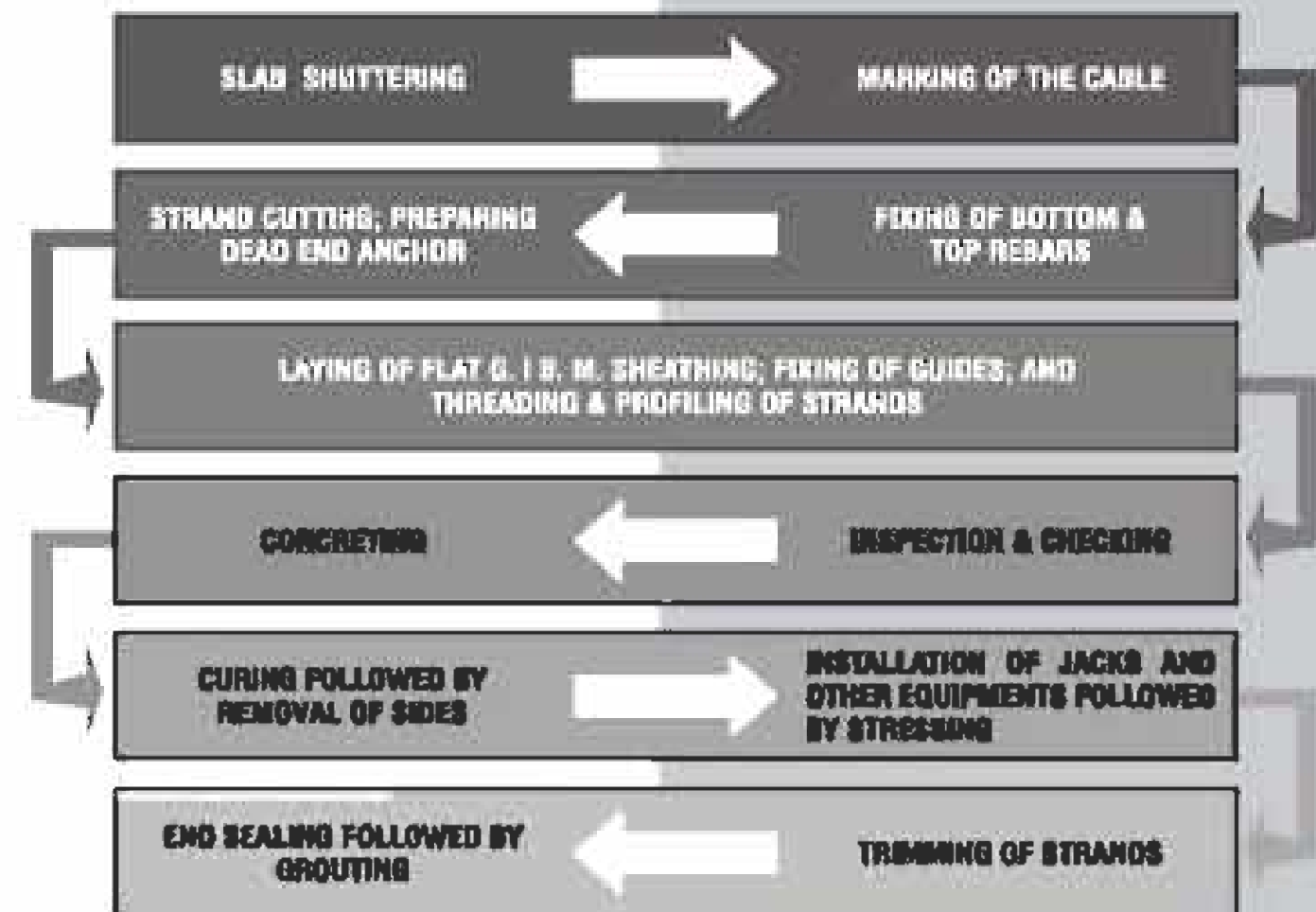


ELEVATION OF ANCHORAGE

DIMENSIONS OF ANCHORAGES IN mm

	A	B	C	D	E	F	G	H	J	K	L
4S13	192	96	88	215	90	90	152	46	54	75	25
5S13	220	220	80	245	90	130	205/210	65/65.5	50	85	25
4S15	215	210	100	235	90	120	174	55	54	85	30

TYPICAL SEQUENCE FOR CONSTRUCTION OF PT FLAT SLABS



FREYSSINET SERVICE FROM DESIGN TO COMPLETION

Freyssinet specializes in providing builders, consultants and architects with a fully comprehensive service right from design to completion of prestressing.

- > Preliminary design and estimate
- > Final design
- > Shop drawings
- > Approval procedures
- > Supply of post-tensioning materials
- > Installation of the tendons
- > Stressing of tendons
- > Cutting of protruding strands
- > Grouting

ANCHORAGE EQUIPMENTS

Stressing Equipments - It comprises of a prestressing jack an Electrically Operated Hydraulic Pump & rubber hose set.

SC-2 Monostrand Jack - The SC2 is a front pull jack, designed by Freyssinet for stressing monostrands with automatic wedging & dewedging of the temporary jaw.



CHARACTERISTICS OF SC-2 JACK

1] MAX JACKING FORCE	212 KN
2] TENSION CYCLE AREA	37.2 sq.cm
3] LOCKING OFF AREA	5.4 sq.cm
4] RETURN CYCLE AREA	6.8 sq.cm
5] MAX STROKE	180mm
6] MAX TENSIONING PRESSURE	600kg/sq.cm
7] MAX BLOCKING PRESSURE	250kg/sq.cm
8] OVERALL LENGTH OF JACK IN CLOSED POSITION	735 mm
9] WEIGHT OF JACK	39Kg

Bongation readings are taken directly on piston and a hydraulic locking off device minimizes pull in.

Electrically Operated Hydraulic Pump - It is a hydraulic pump driven by electric motor of 5 HP. It is equipped with pressure gauges for stressing and blocking purpose.

Grouting Equipment - The grouting equipment consists of a stirrer, an agitator, and a pump which can mix and pump the grout of 1 to 3 bags in colloidal state. Grouting will be done by power operated grout pump through the grout hole in the Guide. The grout is pumped till it comes out of the vent prefer on the end. The water cement ratio of its grout will be 0.4 to 0.45.

THE ANCHORAGE ELEMENTS

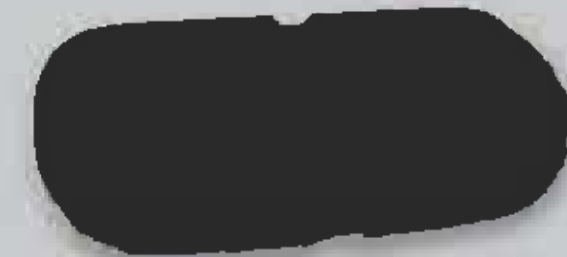
Guide :

It is embedded with the structure & distributes the tendon force to the slab. It is made of gray cast iron with the provision for grouting inlet & outlet.



Bearing Plate :

The specially forged bearing plate anchors the cable & transfers the prestressing force to guide 4 or 5 no. of conical holes are accurately drilled at required degrees & inclination for anchoring of the 4 or 5 no. of 12.7mm dia HT strands.



Grips & Circlip :

Individual strands are anchored by means of 3 segment conical grips clubbed together by circlips. 3 segment grips ensure superior gripping. The grips are made of which is tempered & case-hardened. Three piece grips ensures better control on draw in alloy steel.

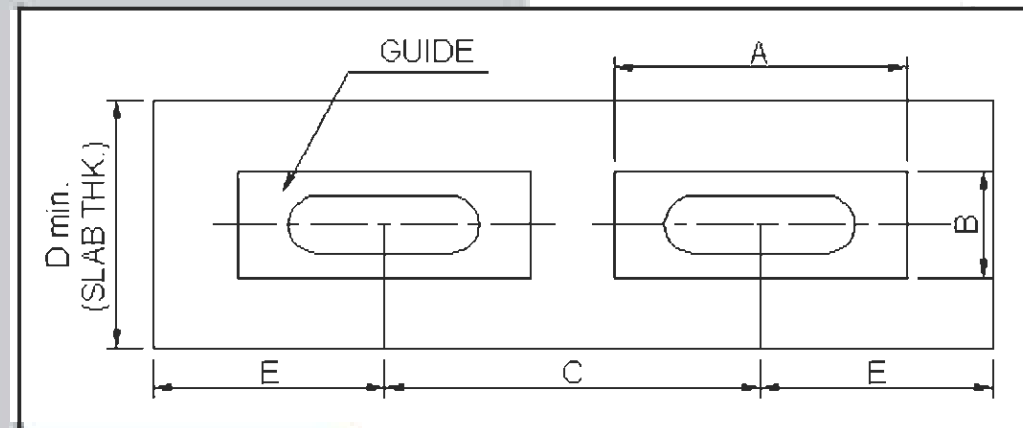


Placing of Anchorage :

The guides should be placed in position before concreting. The sheathing (made from galvanized/ bright metal strips of 0.3mm thick as per specification) should be inserted into guide mouth & the joint should be made leak proof to prevent grout leakage.



ANCHORAGE ARRANGEMENTS & SPACING

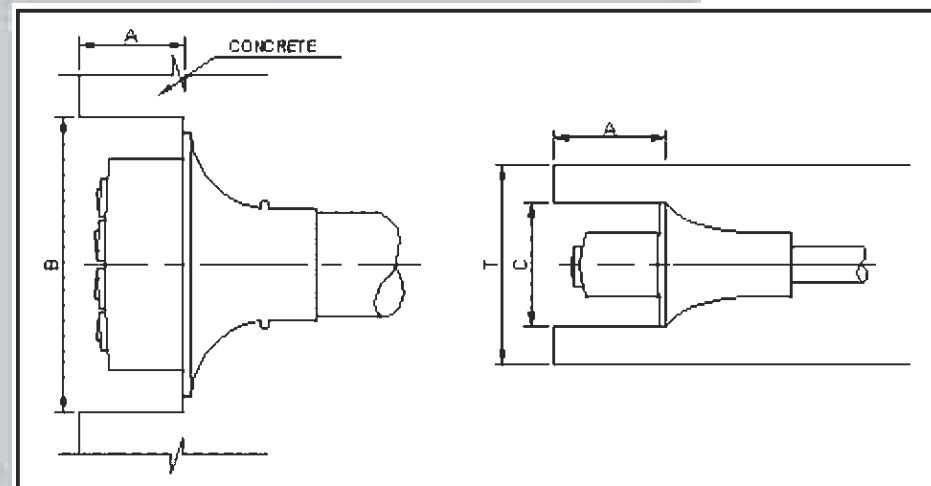


SPACING OF ANCHORAGES

Type of anchorage	4S13			5S13			4S15		
A in mm	192			215			220		
B in mm	88			80			100		
Concrete strength* →	20	25	30	20	25	30	20	25	30
Dim. in mm ↓									
C	325	295	280	365	340	325	380	355	350
E	200	180	175	225	210	200	235	220	215
D _{min}	225	200	180	250	220	190	280	240	200

Note : ** is the concrete cube strength at time of prestressing in N/mm²

Recess Required for positioning of Anchorages - The recesses are required for positioning of the SC-2 Jack for the stressing purpose & for free movement of the jack.



RECESSES REQUIRED FOR POSITIONING OF ANCHORAGE

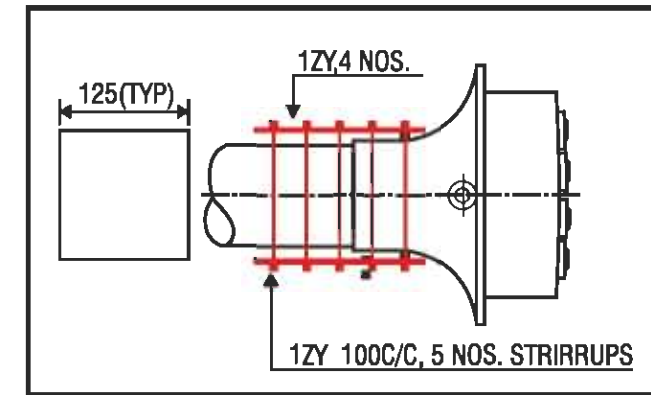
DIMENSIONS OF RECESS IN mm

	A	B	C
4S13	90	215	90
5S13	90	245	130
4S15	90	235	120

• T is the thickness of the PT slab

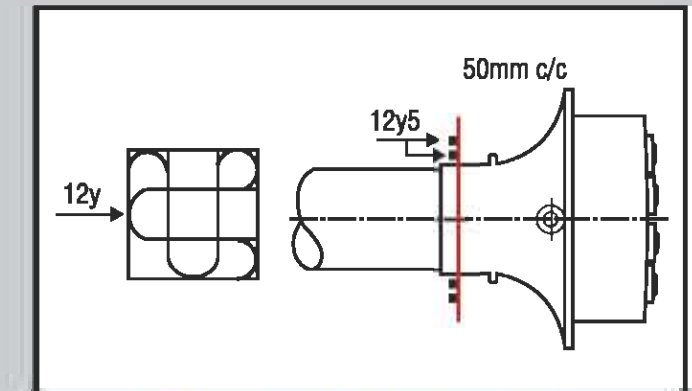
Bursting Reinforcement - There are two options, viz. spiral & mesh reinforcement as detailed below.

Any one can be used.



BURSTING REINFORCEMENT (STIRRUPS TYPE)

OR



BURSTING REINFORCEMENT (MESH TYPE)

Blind End Anchorages - The normal anchorage can be used in blind end positions, but for the situations where the anchorages are to be cast into the concrete or are inaccessible. A range of blind anchorages is provided.

DETAILS OF BLIND END ANCHORAGE

