



# TECHNO INDUSTRY

[ AN ISO 9001:2008 & ISO 14001:2004 COMPANY ]

[ Design, Manufacture, Marketing including Export, Supply, Services & Consultancy of Spring Supports, Pipe Supports, Hanger Supports & Allied Fitting and Fasteners of Pipe Suspension Equipment ]

## PRODUCT LIST

### MAIN ITEM

- ❖ VARIABLE SPRING SUPPORT
- ❖ CONSTANT SPRING SUPPORT
- ❖ HELICAL COMPRESSION SPRING
- ❖ RIGID HANGER SUPPORT
- ❖ SWAY BRACE SUPPORT
- ❖ RIGID STRUT SUPPORT
- ❖ DISC SPRING SUPPORT
- ❖ ROD END SUPPORT

### ANCILLARY ITEMS

- OFFSET PIPE CLAMP
- OFFSET HOOK
- WELDING LUG
- LUG TYPE BRACKET
- BEAM BRACKET
- EYE NUT
- TURN BUCKLE
- 2-BOLT PIPE CLAMP
- 3-BOLT PIPE CLAMP
- U-BOLT
- WELDED EYEROD
- HANGER ROD
- ROD COUPLING
- CLEVIS
- FASTENERS
- PIPE ROLLER ASSEMBLY
- CLEVIS HANGER
- BASE CLAMP SUPPORT
- RISER CLAMP
- SLIDING ASSEMBLY
- SPHERICAL WASHER
- SPREADER BEAM
- BEAM CLAMP

### SERVICE

WE ARE DOING STRESS ANALYSIS OF PIPING



## REGISTERED OFFICE

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Index				
Pipe Attachment				
Sl. No	Figure. No	Item Description	Page. No	PICTURE
1	10A	VARIABLE SPRING SUPPORT	14	
2	10B	CONSTANT SPRING SUPPORT	35	
3	10C	RIGID HANGER SUPPORT	52	
4	10D	SWAY BRACE SUPPORT	58	
5	10E	RIGID STRUT SUPPORT	60	
6	10F	DISC SPRING SUPPORT	62	
7	10G	PTFE Stainless Steel Slide Bearing	67	
8	11	OFFSET PIPE CLAMP	73	
9	12	OFFSET HOOK	73	
10	13	EXTENDED OFFSET PIPE CLAMP	74	

Index				
Pipe Attachment				
Sl. No	Figure. No	Item Description	Page. No	PICTURE
11	14	WELDING LUG ATTACHMENT	74	
12	15	LUG TYPE BEAM BRACKET	75	
13	16	BEAM BRACKET	75	
14	17	INVERTED BEAM BRACKET	76	
15	18	EYE NUT	76	
16	19	TURN BUCKLE	77	
17	20	LIGHT DUTY 2-BOLT PIPE CLAMP	77	
18	21	LIGHT DUTY 3-BOLT PIPE CLAMP	78	
19	22	HEAVY DUTY 2-BOLT PIPE CLAMP	78	
20	23	HEAVY DUTY 3-BOLT PIPE CLAMP	79	



Index					Index				
Pipe Attachment					Pipe Attachment				
Sl. No	Figure. No	Item Description	Page. No	PICTURE	Sl. No	Figure. No	Item Description	Page. No	PICTURE
21	24	U-Bolt Type I (Grip type)	79		31	34	CLEVIS HANGER	84	
22	25	U-Bolt Type II (Non Grip type)	80		32	35	Pipe Clamp Base Support (TYPE-I/II/III)	85	
23	26	WELDED EYEROD	80		33	36	RISER CLAMP	86	
24	27	FULL THREADED HANGER ROD	81		34	37	HARVARD ROLL HANGER	87	
25	28	ROD COUPLING	81		35	38	PIPE ROLL	87	
26	29	CLEVIS	82		36	39	ROD END SUPPORT	88	
27	30	HEX NUT	82		37	40	SPHERICAL WASHER	88	
28	31	LOCK NUT	83		38	41	SPREADER BEAM I - TYPE	89	
29	32	ROUND WASHER	83		39	42	SPREADER BEAM DOUBLE CHANEL TYPE	89	
30	33	PIPE ROLLER ASSEMBLY (TYPE-I)	84		40	43	BEAM CLAMP	90	



## DETAILS OF PRODUCT RANGE

1. ADJUSTABLE BEAM CLAMP.
2. ANCHOR CHAIR.
3. BEAM CLAMP.
4. BASE ANCHOR.
5. BRACKET STEEL.
6. BRACKET HEAVY.
7. BEAM WELDING ATTACHMENT.
8. BRACKET MEDIUM.
9. BEAM HOOK.
10. BAND CLAMP.
11. BEAM CLIP UNIVERSAL.
12. BELLOW: THICK WALL, THIN WALL, FABRIC, SLEEP TYPE.
13. BEARING: EASY SLIDE.
14. "C" CLAMP WITH NUT.
15. CLEVIS.
16. CLEVIS HANGER INSULATED PIPE.
17. CONNECTING PLATE.
18. CONECTING PLATE DOUBLE.
19. CLAMP: GALVANISED & NON GALVANISED, ALLOY STEEL, S.S, IS & BS SPECIFICATION FOR ANY TYPE.
20. CRYOGENIC SUPPORTS.
21. CONSTANT SPRING SUPPORTS.
22. CUSHION SPRING ASSEMBLY.
23. CLEVIS HANGER UNINSULATED PIPE.
24. CARRIER CLAMP.
25. CABLE CONNECTORS, STAY RODS, TRAY.
26. DUAL FACED ROCKER WASHER.
27. DEE SHACKLES.
28. EYE ROD UNWELDED.
29. EYE ROD WELDED.
30. EYE ROD COMPOSITE WITH EYE ROD.
31. EYE ROD COMPOSITE.
32. EYE ROD FORGED.
33. EYE ROD LINKED WELDED.
34. EYE ROD LINKED UNWELDED.
35. EYE NUT WELDLESS.
36. EYE ROD DOUBLE UNWELDED.
37. EYE ROD DOUBLE WELDED.
38. EXPANSION JOINT THIN WALL BELLOW, THICK WALL, FABRIC, SLIP TYPE, DOUBLE EXPANSION JOINTS, GIMBLE EXPANSION JOINT, HINGED EXPANSION JOINTS, INTERNALLY GUIDED EXPANSION JOINT, PRESSURE BALANCED EXPENSION JOINTS, SINGLE EXPANSION JOINTS, SEWING & UNIVERSAL EXPANSION JOINTS.
39. FLAT WASHER.
40. FLANGES FOR VARIOUS TABLES.
41. FASTENERS.
42. GALVANISED: HOT DEEP GALVANISED & ELECTRO GALVANISED- IS & BS SPECIFICATION AS PER REQUIREMENT OF THE CUSTOMER ANY TYPE.
43. HOOK BOLTS.
44. HOOKSTRAP COPPER AND STEEL.
45. HANGER RING.
46. HANGER RING EXTENSION.
47. HANGER ADJUSTABLE.
48. HYDRAULIC SHOCK ARRESTOR.
49. HIGH STIFFNESS STRUT.
50. HARDWOOD BLOCKS.
51. HEMISPHERICAL WASHER.
52. HEMISPHERICAL CUP.





## DETAILS OF PRODUCT RANGE

53. HEX NUT.
54. INSULATED 3, 2 BOLT PIPE CLAMP.
55. INSULATED U BOLT WITH PTFE (NOT TO GRIP).
56. INSULATED U BOLT (NOT TO GRIP).
57. INSULATED U BOLT (TO GRIP).
58. INSULATED PIPE SADDLE.
59. MECHANICAL SHOCK ARRESTOR.
60. MACHINING ITEMS.
61. ONE PIECE STRAP.
62. OVER STRAP FOR COPPER / ALLOY TUBES.
63. OVERSTRAP STEEL TO CAST IRON PIPES.
64. OVERSTRAP STEEL FOR STEEL PIPES.
65. OVER STRAP COPPER AND STEEL.
66. PIPE HANGING ACCESSORIES AND SUPPORTS.
67. PIPE FITTINGS FOR HIGH PRESSURE WATER & STEAM LINE.
68. PIPE CLIP FOR ALLOY STEEL PIPES MARINE.
69. PIPE CLIP FOR STEEL PIPES.
70. PIPE CLIP FOR COPPER / ALLOY TUBES.
71. PIPE CLIP FOR CAST IRON PIPES.
72. PIPE CLIP RESTRAINT ALLOY STEEL.
73. PIPE CLIP 3 BOLT ALLOY STEEL.
74. PIPE ROLL CAST IRON.
75. PIPE CLIP 2 BOLTS LIGHT.
76. PIPE CLAMP OFF SET.
77. PIPE COVERING PROTECTION. (SADDLE – 25, 65, 75, 40, 50, 100 MM INSULATION).
78. PIPE CLAMP MULTIPLE.
79. PIPE CLAMP EXTENDED.
80. PIPE CLIP 2 BOLTS HEAVY.
81. PIPE CLIP 3 BOLT CARBON STEEL.
82. PIPE CLIP RESTRAINT CARBON STEEL.
83. PIPE WHIP RESTRAINTS.
84. PIPE GUIDE.
85. PIPE ROLL.
86. PIPE SUPPORT ADJUSTABLE.
87. PIPE SADDLE WELDED.
88. PIPE SADDLE CLAMPED.
89. PIPE CHAIR.
90. RIGID BASE SUPPORT.
91. ROLLER TROLLEYS.
92. ROLLER HANGER TWO ROD.
93. ROLLER HANGER.
94. ROD MACHINE THREADED.
95. RISER CLAMP DYNAMIC.
96. RISER CLAMP.
97. ROD COUPLING.
98. ROLLER SUPPORT.
99. ROLLER SUPPORT ADJUSTABLE.
100. ROLLER AND STEEL CHAIR.
101. RISER CLAMP FOR PIPES.
102. RISER CLAMP FOR STEEL PIPE.
103. ROD ALL THREAD.
104. ROLLER CHAIR.
105. STRESS ANALYSIS OF ANY PIPING.
106. SADDLE GUIDE.
107. SADDLE ANCHOR.
108. SUPPORT BEARING.



## DETAILS OF PRODUCT RANGE

- 109. SLIDING BASE SUPPORT.
- 110. SLIDING SUPPORT WELDED.
- 111. SLIDING SUPPORT WELDED GUIDED.
- 112. SPRING (HELICAL, COMPRESSION, EXTENSION & DISC LEAF.
- 113. STRUCTURAL ATTACHMENTS.
- 114. SCAFFOLDINGS & ACCESSORIES.
- 115. SLIDER SUPPORTS LOW FRICTION.
- 116. SPRING HANGERLIGHT WEIGHT.
- 117. SPRING CAGE ROLLED STEEL JOIST.
- 118. SLING ROD CAGE ROLLED STEEL JOIST.
- 119. SLING ROD CAGE UNIVERSAL BEAM.
- 120. SPRING CAGE UNIVERSAL BEAM.
- 121. SLING ROD WITH HOT FORMED EYE.
- 122. SLING ROD WITH INTEGRAL FORGED EYE.
- 123. SLING ROD WITH WELDLESS EYE NUT.
- 124. SLING ROD WITH SCREWED MACHINED EYE.
- 125. SPHERICAL WASHER.
- 126. SQUARE PLATE.
- 127. SINGLE PLATE.
- 128. SPRING SWAY BRACES.
- 129. TRAPEZE BEAM WELDED.
- 130. TURNBUCKLE PROFILED.
- 131. TURNBUCKLE FORGED.
- 132. U- BOLT (TO GRIP).
- 133. U – BOLT (NOT TO GRIP).
- 134. U STRAP ALLOY STEEL FOR STEEL PIPES.
- 135. U BOLT TO GRIP PIPE.
- 136. U BOLT NOT TO GRIP.
- 137. VARIABLE SPRING SUPPORTS.
- 138. WELDING LUG.
- 139. WASHER.
- 140. YOKE CLAMP STANDARD.
- 141. YOKE CLAMP HEAVY DUTY.
- 142. YOKE RESTRAINTS CLAMP.



## **STANDARD DESIGN & SPECIFICATION AS PER INTERNATIONAL STANDARDS.**

- ➔ **ANSI B 31.1: POWER PIPING.**
- ➔ **ANSI B 31.3: PETROLEUM, REFINERY PIPING.**
- ➔ **ASME SECTION VIII PRESSURE VESSELS.**
- ➔ **BS 1726: PART I- GUIDE FOR THE DESIGN OF HELICAL COMPRESSION SPRINGS.**
- ➔ **BS 3974: PART-1, 2, & 3 PIPE SUPPORTS & ANCILLARIES.**
- ➔ **DIN 2092 & 2093 - DISC SPRING.**
- ➔ **MSS SP-58: PIPE HANGERS & SUPPORTS MATERIALS, DESIGN & MANUFACTURING.**
- ➔ **MSS SP-69: PIPE HANGERS & SUPPORTS SELECTION & APPLICATION.**
- ➔ **MSS SP-89: PIPE HANGERS & SUPPORTS - FABRICATION & INSTALLATION PRACTICES.**



## INTRODUCTION

- ⇒ **Techno Industry** is the specialist in the field of design and manufacture of Pipe Suspension Equipment. Our service includes the supply of wide range of standard pipe support components.
  
- ⇒ After intensive research and development work on hangers & supports for various range of temperature, pressure etc. we are able to meet the individual customer's requirements. Today we are among the top supplier in this field, undertaking planning, designing and manufacturing of all sorts of piping supports. Our product range & service covers a vast area, which are given in a separate sheet in this catalogue.
  
- ⇒ Experienced designers of our engineering departments are able to give practical advice and assistance in the design of pipe support system. A numbers of special designs have been developed indigenously to solve unique customer problem. We work on various engineering software that includes pipe stress analysis, determination of pipe hanger support, drafting etc. in the era of information technology, we are also equipped with the tools of modern technology to stay ahead in today's competitive market.
  
- ⇒ All the raw materials are subject to a great deal of quality control prior to manufacture by our Quality Assurance Department and all the products are manufactured under a scientific, statistical quality control system, which assures that the finished product, will conform to pre-determined standards highest in the industry.
  
- ⇒ Our personnel are committed to respond quickly to customer specify requirement & service with economical price and needs on both standard items & specialized application.





## INFORMATION

**TECHNO INDUSTRY** is one of the experienced organizations in the design and manufacturer of critical ancillary equipments for pipe suspension system in project piping. Our over all service includes the supply of a wide range of standard pipe support components. Availability exists for design and supply of pipe support fabrications and allied equipments in a wide range of materials with proper surface finish to suit the clients or customers specific requirement.

- **ACTIVITIES IN A BRIEF:**

The company was established in the year 1996 and since then to now, the company has been acquainted as one of the leading manufacturer of the following items.

1. **VARIABLE LOAD EFFORT SPRING HANGER SUPPORT.**
2. **CONSTANT LOAD EFFORT SPRING HANGER SUPPORT.**
3. **RIGID PIPE HANGER SUPPORT.**
4. **PIPE CLAMP BASE SUPPORT.**
5. **PIPE CLAMP VARIOUS TYPE –TWO BOLTS, THREE BOLTS & RISER TYPE.**
6. **SPRING SWAY BRACE.**
7. **ANCILLARY EQUIPMENTS OF PIPING.**
8. **BARE SPRINGS HELICAL, COMPRESSION & EXTENSION TYPE.**
9. **BELEVELLED / DISC SPRING.**
10. **ASSOCIATED STEEL WORK FABRICATION.**

**(KINDLY GO THROUGH OUR PRODUCT CATALOGUE FOR DETAIL DESCRIPTION).**

The design & detail of large / small order from customer can be handled in our engineering department by experienced designers who are capable of giving practical advised with active assistance in the design of pipe support system. We also offer complete pipe support overall site survey including analysis of new or existing pipe system.

- **QUALITY:**

All design with manufacturing procedures are controlled by formally documented system incorporated in our quality assurance plan and quality system manual in the line of ISO 9000 quality system based on accuracy and the dependability of our product which **TECHNO INDUSTRY** can provide an efficient service with economical price & prompt delivery to our customers for keeping long time good business relation in the industry.

- **QUALITY ASSURANCE:**

**TECHNO INDUSTRY'S** documentations over quality assurance & quality control manual are constantly used at the time of starting manufacture in its own shop or incoming materials are subject to receiving control by our quality assurance personal in the shop floor. All incoming materials are subjected in receiving control by quality assurance department & comprehensive materials traceability is the standing function of our full quality control procedures. **TECHNO INDUSTRY** has awarded ISO 9001:2008 & ISO14001:2004 Certificate & maintains a fixed programmed in process & manufacture of their product (pipe supports for pipe suspension system) based on the lines of ISO9000 system. Details of our programmed are described clearly in our **QUALITY SYSTEM MANUAL** book.

- **SITE SURVEYS & ENGINEERING INSPECTION:**

Techno engineers are available to carry out site survey of pipe work & support system. Stress analysis is also available within this service.



## **INFORMATION**

- **GENERAL INFORMATION REQUIREMENT AGAINST ORDERING SPRING SUPPORTS:**

1. Operating load in kg / N
2. Vertical travel in mm from the direction cold to hot position.
3. Typical arrangement/ type of supports required in the line.
4. Value of preset load / cold load in kg/N in the pipe line.
5. If complete assembly is required then installation height with pipe dia & temp (0°C) of pipe surface
6. Protective finished details,
7. Mark No of support.

- **CONTACT FOR INFORMATION:**

Interested customers are requested to contact with sales department under the following address for catalogue or for further information concerning our products & services according to the need of customer.

### **ADDRESS:**

## **TECHNO INDUSTRY**

Regd. Office: 8, G. T. ROAD ( S ), 2nd Floor,  
HOWRAH – 711 101

TEL: +91-33-2641-5952/2637 8887/26404461/4070,

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E-MAIL [info@technoindustry.in](mailto:info@technoindustry.in) / [sanabi@technoindustry.in](mailto:sanabi@technoindustry.in)

WEBSITE: [www.technoindustry.in](http://www.technoindustry.in)



## **SUMMARY OF PRODUCT RANGE**

1. SPRING SUPPORTS CONSTANT & VARIABLE EFFORT, PIPE SUPPORTS & RIGID HANGER. AS PER OUR CATALOGUE, OR REQUIREMENT OF THE CUSTOMER.
2. PIPE HANGING SUPPORT ACCESSORIES. AS PER REQUIREMENTS OF THE CUSTOMER.
3. STRESS ANALYSIS FOR ANY PIPING.
4. MECHANICAL FABRICATION AS PER DRAWING. SINGLE PIECE UPTO 5 TONNES.
5. MACHINING ITEMS AS PER DRAWING. SINGLE PIECE UPTO 3 TONNES.
6. PIPE FITTINGS FOR HIGH PRESSURE WATER & STEAM LINE.
7. FLANGES OF VARIOUS TABLES.
8. HOT DEEP GALVANISED/ ELECTRO GALVANISED & WITHOUT GALVANISED MATERIAL, IS/ BS SPECIFICATION AS PER CUSTOMER REQUIREMENTS.
9. HIGH TENSILE FASTENERS.
10. SPRINGS - HELICAL COMPRESSION, EXTENSION, DISC, AND LEAF.
11. CABLE CONNECTORS, STAY RODS, TRAY.
12. CASTING (FERROUS & NON FERROUS) SINGLE PIECE UPTO 1.5 TONNES.
13. FORGED / FABRICATED TURN BUCKLE.
14. EXPANSION JOINT USING METAL BELLOWS.
15. EASY SLIDE BEARING.
16. CLAMP.
17. SCAFFOLDINGS.
18. POLYURATHENE FOAM INSULATION FOR AMMONIA PIPING.
19. OTHER INSULATION FOR HOT & COLD PIPING.

**NOTE:** FOR DETAILS OF OUR PRODUCT EXPLAINED ALPHABETICALLY FROM THE NEXT PAGES. FOR MORE DETAILS OUR PRODUCT CATALOGUE WOULD BE SUPPLIED AS PER REQUEST OF THE CLIENT / CUSTOMERS.



## **Required data for customer's enquiry:**

### **Required data for spring support, rigid support, strut support, pipe support selection:**

- 1) Hot load or operating load.
- 2) Cold load or installation load.
- 3) Vertical travel or vertical movement.
- 4) Spring rate.
- 5) Installation clearance / total height/head room clearance.
- 6) Line pipe temperature.
- 7) Line Pipe size.
- 8) Type of support.
- 9) Line insulation thickness.

If any queries please log on at our WEBSITE: - [www.technoindustry.in](http://www.technoindustry.in)

E-Mail: [info@technoindustry.in](mailto:info@technoindustry.in) / [sanabi@technoindustry.in](mailto:sanabi@technoindustry.in)

MOB: 098300 24010/09433150422

TEL: +91-33-2641-5952/2640-4461/4070

TELE FAX: +91-33-2637 8887

### **Our service:**

We perform maintenance job as well as after sale and before sale. According to customer requirement our Commissioning engineers are visit their site to troubleshoot the problems in existing systems.

### **Special Separate Sale Service & Consultancy Department:**

- We will provide our service after sale.
- We provide our service at any fitting problem of pipe line.
- We furnish to supervise any existing old power plant, inspection, change supports dismantle or fitting with repair or supply against customer report of budgetary offer.
- We provide our service at any critical pipe line of power plant.
- We have a department of erection commissioning & supervision.
- In power plant when pipe line (Main Stem Line, Feed Water Line, Boiler Feed Water Line etc.) was shut down our special engineering team visit the site & supervise of proper installation of spring support & auxiliary support. And also rectify the existing support's installation & loading parameters.





We also perform pipe stress analysis on new and existing piping systems to accomplish the following:

- Verify that piping loads on rotating equipment are below industry standards (API-650/617, NEMA SM23, etc.)
- Verify that piping stresses are below code allowable values (ASME B31.1, ASME B31.3, etc)
- Verify that piping loads on vessels, tanks, heaters, etc, are below code allowable values (ASME Section VIII, API, etc.)
- Design spring supports.
- Design rigid pipe supports and restraints.
- Calculate thermal movements.
- Calculate forces and moments for failure analysis.

## STRESS ANALYSIS

### SOURCE & WORK IN THE LINE OF STRESS ANALYSIS:

We have a group of experienced piping designer who have got sufficient experience in this line. Details of soft ware packages used in the line of pipe stress analysis are given hereunder.



### CAD EXPERIENCE & USED OF SOFTWARE:

SL NO	SOFTWARE	APPLICATION
1	AUTOCAD	GENERAL PURPOSE DRAFTING.
2	AUTOPLANT	P I D, 3D, MODELLING, 2D DRAWINGS, ISO METRIC WITH BOQ
3	AUTOPIPE	PIPE STRESS ANALYSIS
4	CEASER II	PIPE STRESS ANALYSIS
5	PIPE PLUS	PIPE STRESS ANALYSIS
6	PLANT FLOW	PIPE FLOW ANALYSIS
7	PIPE NET	PIPE FLOW ANALYSIS
8	SOLIDWORKS 13	3D, MODELLING



### PRACTICAL EXPERIENCED OF OUR DESIGNERS IN STRESS ANALYSIS:

1. About 27 years industrial experienced in the design & details of engineering of industrial piping in steel, power, chemical, process & refinery piping as follows.
2. Selection of different piping materials for different service conditions as per IS / BS/ ASTM/ DIN standards.
3. Preparation of piping layout, GA drawings, isometric, bill of materials.
4. Pressure drop, pipe sizing, flow net work calculation for various compress able & incompressible fluids & steam.
5. Flexibility / Stress analysis of elevated temperature piping system as per ANSI / ASME / B31 / BS806 / IBR CODES.
6. Design & selection of pipe support & supporting elements.
7. Calculation of loads at supporting structure.
8. Design & selection of variable & constant load hanger support.
9. Calculation & checking of loads at connected equipments like pump, compressors & turbines as per API 650 / 617 & NEMA SM 23.
10. Design & selection of expansion joints as per EJMA.



## Selection of item

The selection of hanger rod , various hanger rod attachment, beam attachment, which are not in directly depending on pipe line temperature is referring to the Load capacity by different Load Group.

Our standard load group and load capacity for each hanger rod size are mentioned below.

LOAD GROUP	ROD SIZE	LOAD CAPACITY	
		KG	KN
1	M10	373	3.66
2	M12	545	5.35
3	M16	1040	10.20
4	M20	1631	16.00
5	M24	2355	23.10
6	M30	3792	37.20
7	M36	5556	54.50
8	M42	7666	75.20
9	M48	10112	99.20
10	M56	15189	149.00
11	M64	20387	200.00
12	M72	26300	258.00
13	M80	32926	323.00

**VARIABLE LOAD EFFORT SPRING SUPPORT**

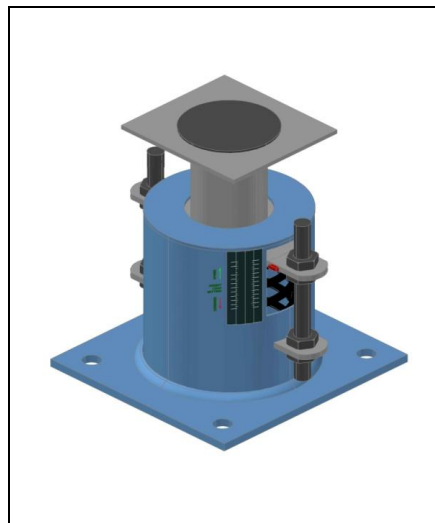
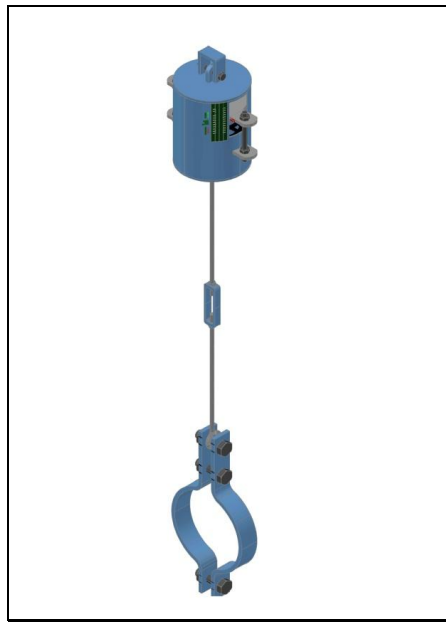
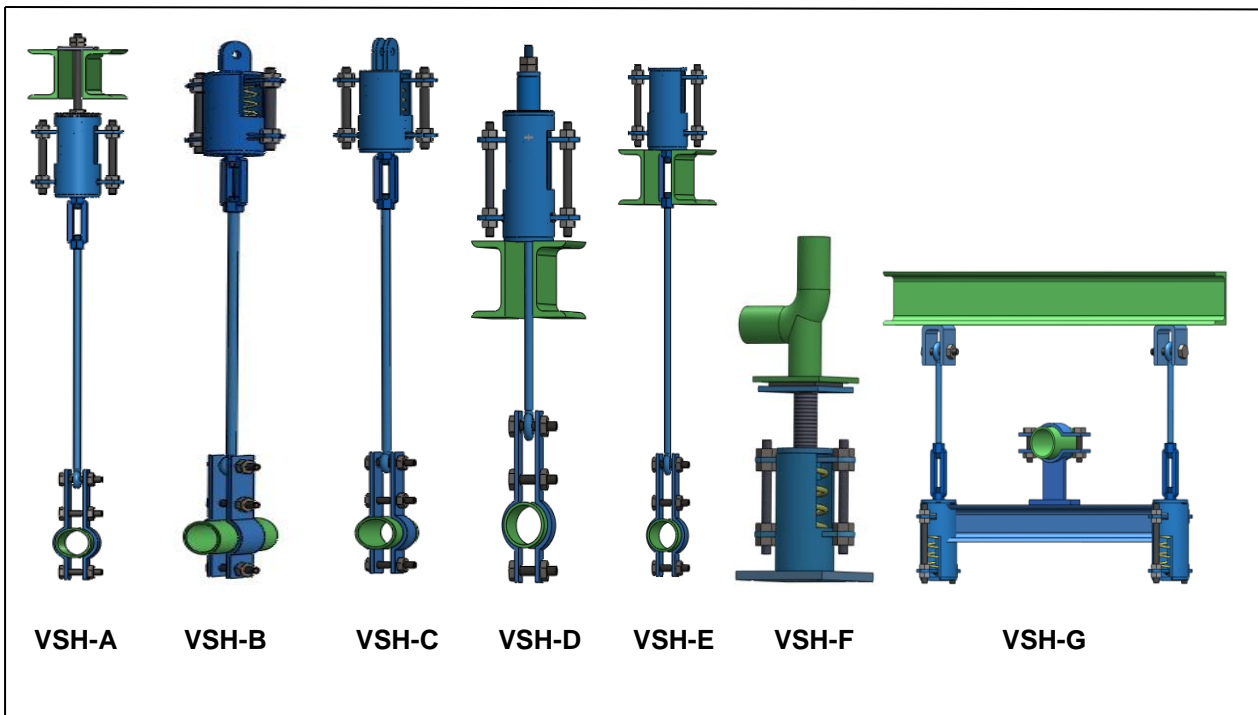
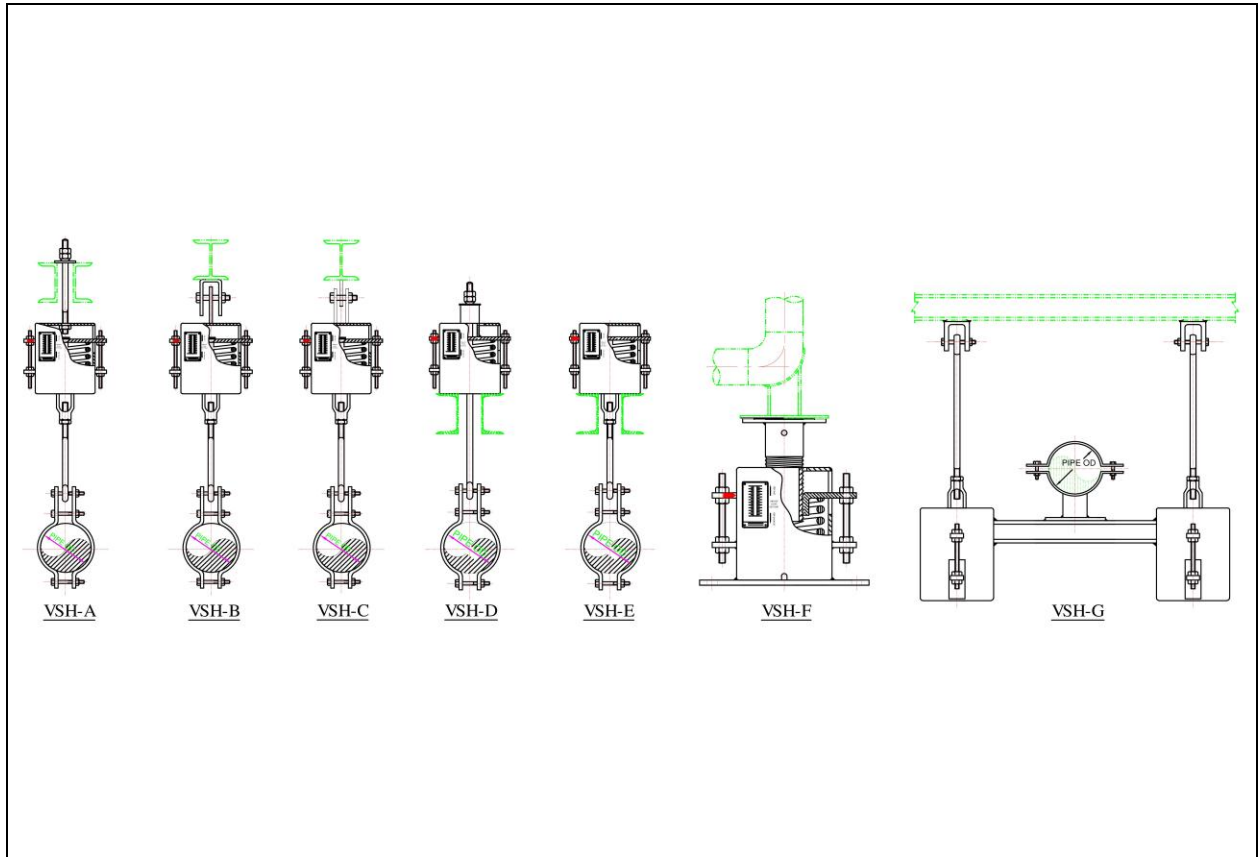


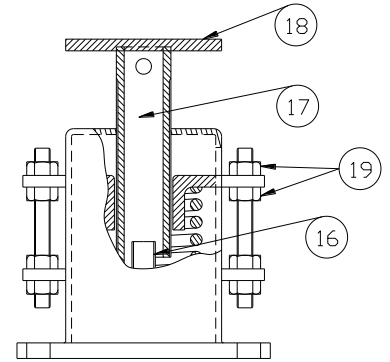
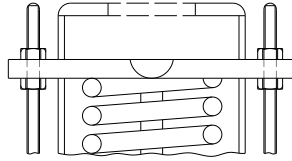
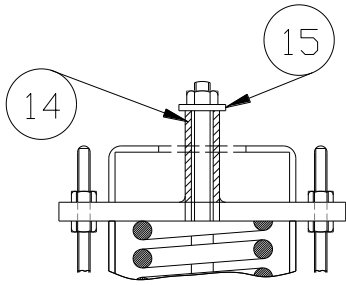
FIGURE – 10A



## VARIOUS TYPE OF VARIABLE SPRING SUPPORT





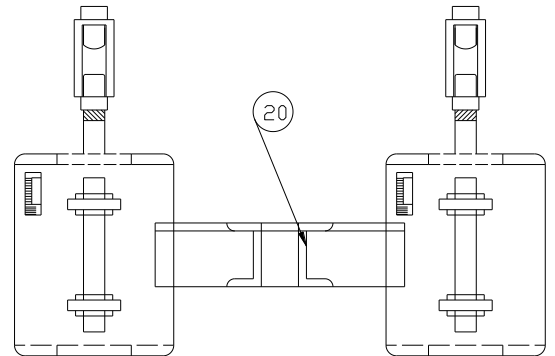


**TYPE - D**

**TYPE - E**

**TYPE - F**

20	Medium Channel	IS 2062 Gr A
19	Side Stud & Nut	IS 1363.CL8.8,8
18	Load Flange	IS 2062,Gr A/B
17	Load Column Pipe	IS 1239/3569.Med/Hvy
16	Guide Pipe	IS 1239/3569.Med/Hvy
15	Plain Washer	IS 2062,Gr A/B/C
14	Enclosing Load Pipe	IS 1239 Med./Hvy
13	Lug	IS 2062,Gr A/B
12	Name Plate	Al. Anodized/SS
11	Load Travel Scale	Al. Anodized/SS
10	Load Indicator	IS 2062,Gr A/B
9	Upper Hanger Rod	En 8/IS 2062 Gr A
8	Stopper Nut	En 8/IS 2062 Gr A
7	Turn Buckle	IS 1875/Sa 105
6	Hanger Rod	En 8/IS 2062 Gr A /SAE-1018
5	Piston plate / Block (For 'F' type)	IS 2062,Gr A/B
4	Top Plate of Spring Support	IS 2062,Gr A/B
3	Casing Pipe	IS 1239/3569.Med/Hvy
2	Bottom Plate or Spring Box	IS 2062,Gr A/B
1	Spring	EN-42/45/47 IS-4454/55Si7/60Si7
Item No.	Description	Matl. /Spec.



**TYPE - G**



## VARIABLE SPRING HANGER SUPPORTS

Usually coiled type springs are used in variable type support. During compression, the resistance of a coil to a load changes, so these types of supports are named as 'variables'. Actually pipe work under change in pressure & temperature results in vertical displacements. To accommodate/ absorb such vertical displacements, this type of support is recommended. They are generally used at points where stress due to transfer load does not have an adverse effect on the overall stress of the pipe work. A careful study is required for the piping system having a large flexibility because deflection is likely to occur even when there is only a small stress variation due to transfer load.

Variable Spring Support has a wide range of application and it is important to select the proper one for a specific purpose. There are different designs for variable supports and so TECHNO INDUSTRY provides particular nomenclature to identify them. As many as seven (A to G) different types of variable spring support are obtained at present and they are given below:

### ▶▶ 'A' TYPE

This type of support is suitable where there is sufficient installing space. It is mainly provided with a threaded bushing in the top plate, in order for a simple rod attachment for the upper connection.

### ▶▶ 'B' & 'C' TYPE

This type of support is mainly used where installing space is limited. It is generally furnished with one or two lugs welded to the top plate of the casing.

### ▶▶ 'D' & 'E' TYPE

This type of support is suitable where spring box/casing. For type 'D' a rod adjustment is permitted from the top. For type 'E' a rod adjustment is permitted from either above or below the spring.

### ▶▶ 'F' TYPE

This type of support is designed to support the piping upward, i.e. from below, directly from the base/ floor or supporting steel. An adjustment in height is available by turning the load column and for fastening four holes is drilled at the base plate.

### ▶▶ 'G' TYPE

This type of support is generally formed by welding two standard variable spring supports back to back at the ends of a pair of channels.



## OVERVIEW

The standard range of variable spring supports are obtained in three main categories, with the travel ranges are the following:

- **VS1 TRAVEL RANGE: 0- 40 MM.**
- **VS2 TRAVEL RANGE: 0-80 MM.**
- **VS3 TRAVEL RANGE: 0-160 MM.**

When a load is applied to the variable spring support, the responds of it depends on the coils of the spring. The most important part of the variable spring hanger support is the spring. So utmost care is provided during the selection of a particular spring. A spring is mainly designated by its spring rate, which is expressed in units of kg/mm. Coil size/Rod size of a spring is determined by the applied load & the no of coils is determined by the travel range / range of movement. As such a spring is placed in single & in series depending on the type of load & travel range.

## SELECTION:-

A good deal of calculation is needed prior to the selection of the standard variable spring support in order to ensure that the connecting equipment and pipe work can withstand the large load changes that occur during pipe movement. Generally load variation is limit to the maximum of 25 %( according to MSS SP-58). So it is quiet natural to select variable spring hanger support on this basis. Therefore during the selection of variable spring hanger support care must be taken to ensure that sufficient travel is available in the spring assembly to permit free travel of the pipe / vessel within the required pipe work movement range.

In order to select a variable spring hanger support, first of all you will have to select the type of support depending on the location of support, load, and available movement. Naturally you must know the actual load which the spring is suppose to be support, also the magnitude & direction of the pipe line movement. The next step for the selection of variable spring hanger support is to calculate the Cold Load. Cold Load is mainly calculated on the basis of the formulas given below:

$$\text{COLD LOAD} = \text{HOT LOAD} +_{-} (\text{MOVEMENT X SPRING RATE})$$

Here the sign (+) indicates the upward movement of the pipeline, and the sign (-) indicates the downward movement of the pipeline.

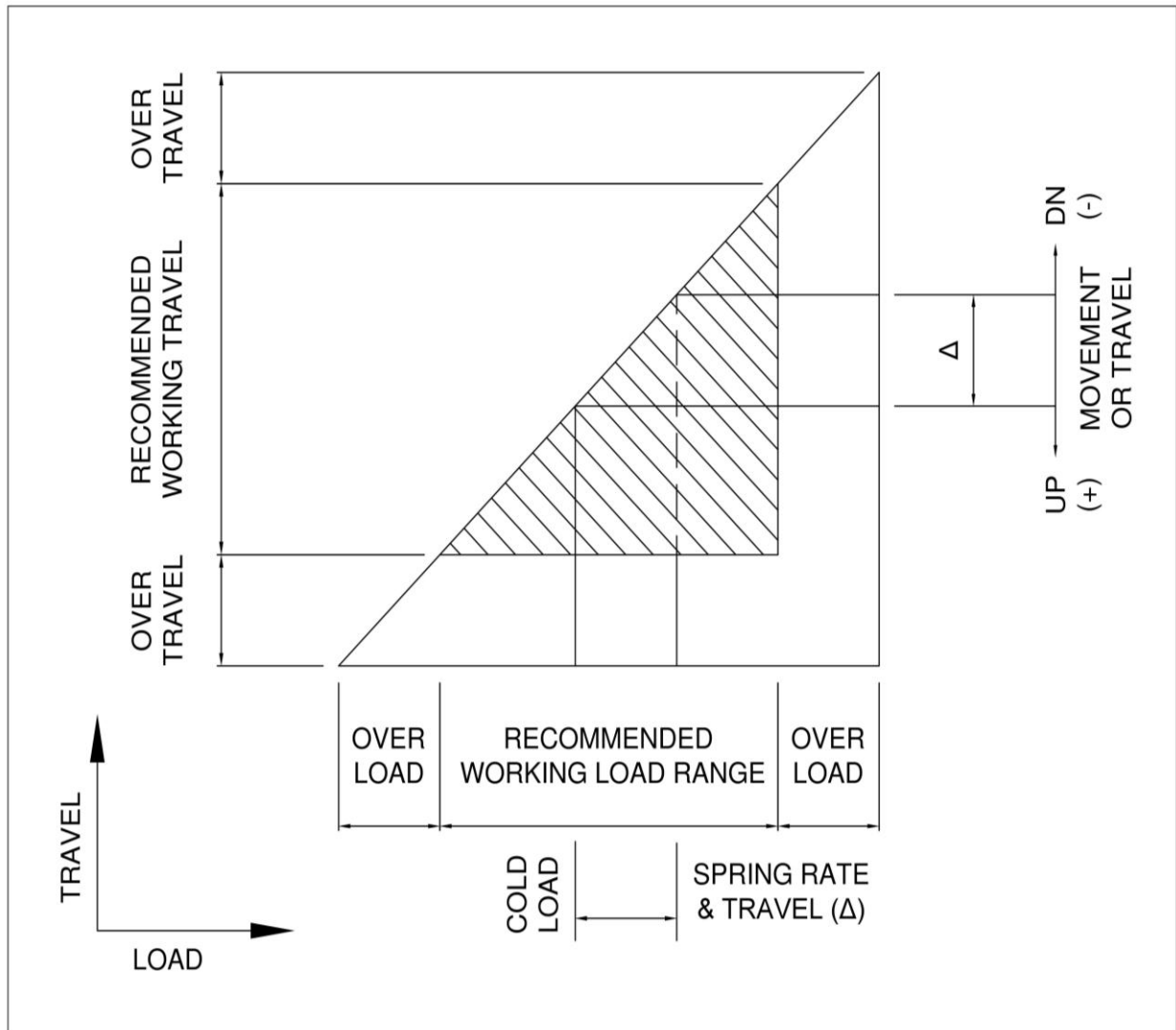
After being calculate the Cold Load, the next most important selection criteria is to know the variation of the load i.e. % load change. Variability is required to select the size and figure number. Variability is defined as the percentage of change in the supporting force between the Hot (Operating) load and Cold (Installed) load calculated as shown:

$$\text{VARIABILTY (V)} = \frac{(\text{COLD LOAD} - \text{HOT LOAD}) \times 100 \%}{\text{HOT LOAD}}$$

$$V = \frac{\text{MOVEMENT X SPRING RATE X 100 \%}}{\text{HOT LOAD}}$$



**A brief outline of the relation between loads & travels is given below:**





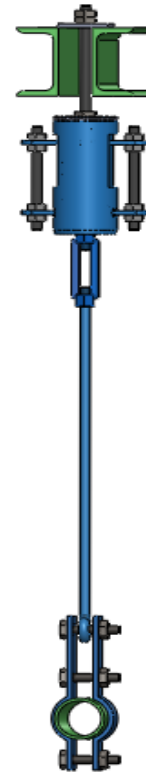
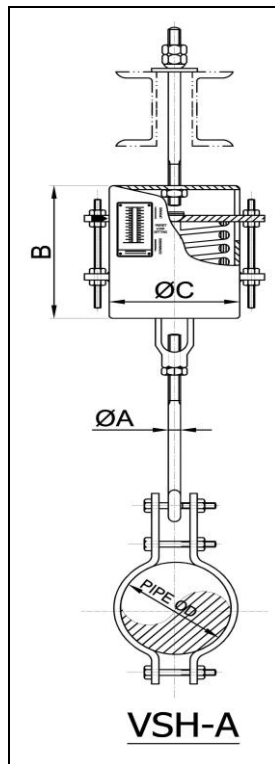


## SELECTION TABLE OF VARIABLE SPRING HANGER SUPPORT

### RECOMMENDED WORKING RANGE OF SPRINGS

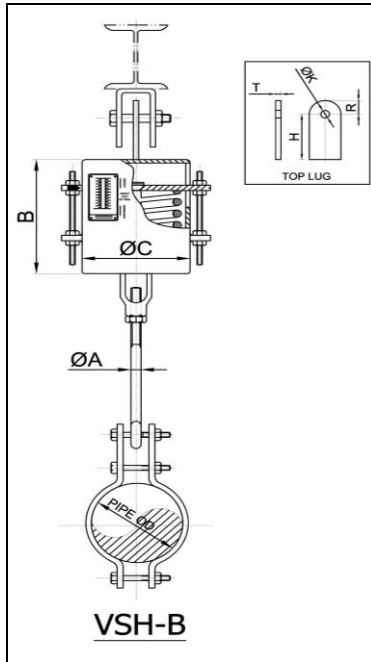
MODEL NOS/ TECHNO SPRING SIZE																											
VS3	VS2	VS1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
TRAVEL IN MM			LOAD IN KG																								
20	10	5	13.34	19.5	31.7	35.66	48.2	71.8	118.9	208	274.7	387	492	544	704	893	1181	1689	2313	2813	3230	4000	4992	6458	7800	8870	12385
0	0	0	15.04	22	35.2	40.16	54.2	80.3	133.4	233	308.2	432	552	612	784	1003	1326	1899	2593	3163	3630	4500	5602	7248	8750	9970	13910
20	10	5	16.5	24	38	43.6	59	88	145	253	335	470	600	666	848	1091	1442	2067	2817	3443	3950	4900	6090	7880	9510	10850	15130
40	20	10	18.1	26.5	41.5	47.9	65	97	159.5	273	368.5	518	660	734	928	1201	1587	2277	3097	3793	4350	5400	6700	8670	10460	11590	16655
60	30	15	19.3	29	45	52.2	71	106	174	303	402	566	720	802	1008	1311	1732	2487	3377	4143	4750	5900	7310	9460	11410	13050	18180
80	40	20	21.5	31.5	48.5	56.5	77	115	188.5	328	435.5	614	780	870	1088	1421	1877	2697	3657	4493	5150	6400	7920	10250	12360	14150	19750
100	50	25	23.2	34	52	60.8	83	124	203	353	469	662	840	938	1168	1531	2022	2907	3937	4843	5550	6900	8530	11040	13310	15250	21230
120	60	30	24.9	36.5	55.5	65.1	89	133	217.5	378	502.5	710	900	1006	1248	1641	2167	3117	4217	5193	5950	7400	9140	11830	14260	16350	22755
140	70	35	26.6	39	59	69.4	95	142	232	403	536	758	960	1074	1328	1751	2312	3327	4497	5543	6350	7900	9750	12620	15210	17450	24280
160	80	40	28.3	41.5	62.5	73.7	101	151	246.5	428	569.5	806	1020	1142	1408	1861	2457	3537	4777	5893	6750	8400	10360	13410	16160	18550	25805
180	90	45	31	44	66	78	107	160	261	453	603	854	1080	1210	1488	1971	2602	3747	5057	6243	7150	8900	10970	14200	17110	19650	27330
SPRING RATE IN KG/MM																											
			0.34	0.50	0.70	0.86	1.20	1.80	2.90	5.00	6.70	9.60	12.00	13.60	16.00	22.00	29.00	42.00	56.00	70.00	80.00	100.00	122.00	158.00	190.00	220.00	305.00
			0.17	0.25	0.35	0.43	0.60	0.90	1.45	2.50	3.35	4.80	6.00	6.80	8.00	11.00	14.50	21.00	28.00	35.00	40.00	50.00	61.00	79.00	95.00	110.00	153.00
			0.085	0.125	0.175	0.215	0.30	0.45	0.725	1.25	1.675	2.40	3.00	3.40	4.00	5.50	7.25	10.25	14.00	17.50	20.00	25.00	30.50	39.50	47.50	55.00	76.25

Note:- In above selection table we provide in briefly as per customer requirement we can provide verbosely.



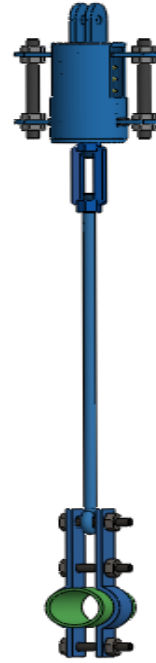
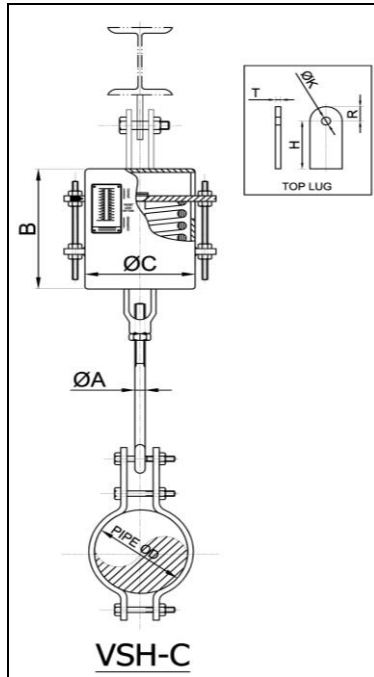
## DIMENSION TABLE OF TYPE 'A':

HANGER SIZE NO	HANGER THREAD 'ØA'	CASING LENGTH 'B'			CASING DIA. 'ØC'
		VS1	VS2	VS3	
1	M12	125	210	375	76
2	M12	130	212	380	89
3	M12	132	224	400	101
4	M12	140	224	420	101
5	M12	140	236	425	101
6	M12	150	250	450	101
7	M12	170	280	525	114
8	M12	190	335	630	114
9	M16	200	340	630	140
10	M16	224	380	710	140
11	M20	230	380	710	152
12	M20	260	450	880	152
13	M20	275	480	900	152
14	M24	320	560	1060	152
15	M27	320	590	1120	165
16	M30	330	590	1130	195
17	M36	330	560	1028	273
18	M42	335	560	1038	273
19	M45	400	680	1285	273
20	M48	400	680	1285	273
21	M56	440	730	1365	324
22	M64	471	790	1475	324
23	M64	530	880	1667	324
24	M68	590	990	1875	324
25	M72	750	1290	2475	324



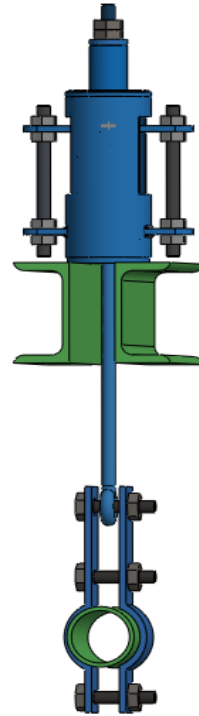
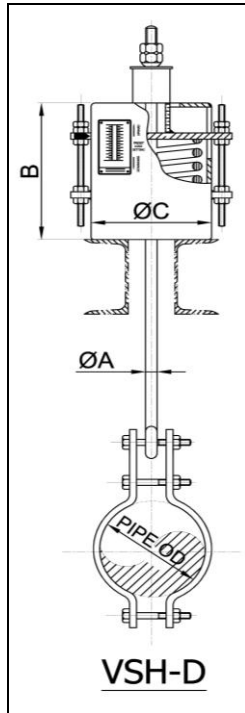
## DIMENSION TABLE OF TYPE 'B':

HANGER SIZE NO	HANGER THREAD 'ØA'	CASING LENGTH 'B'			CASING DIA. 'ØC'	HEIGHT OF PIN 'H'	LUG HOLE 'ØK'	'R'	THICK NESS 'T'
		VS1	VS2	VS3					
1	M12	125	210	375	76	35	14	25	6
2	M12	130	212	380	89	35	14	25	6
3	M12	132	224	400	101	35	14	25	6
4	M12	140	224	420	101	35	14	25	6
5	M12	140	236	425	101	35	14	25	6
6	M12	150	250	450	101	35	14	25	6
7	M12	170	280	525	114	35	14	25	10
8	M12	190	335	630	114	35	14	25	10
9	M16	200	340	630	140	35	18	25	12
10	M16	224	380	710	140	45	18	35	12
11	M20	230	380	710	152	45	22	35	12
12	M20	260	450	880	152	45	22	35	12
13	M20	275	480	900	152	45	22	35	16
14	M24	320	560	1060	152	45	26	35	16
15	M27	320	590	1120	165	45	30	35	16
16	M30	330	590	1130	195	60	34	50	16
17	M36	330	560	1028	273	70	40	60	20
18	M42	335	560	1038	273	80	45	65	25
19	M45	400	680	1285	273	80	50	65	25
20	M48	400	680	1285	273	80	50	65	25
21	M56	440	730	1365	324	95	60	80	25
22	M64	471	790	1475	324	95	68	80	25
23	M64	530	880	1667	324	95	68	80	25
24	M68	590	990	1875	324	95	75	80	30
25	M72	750	1290	2475	324	95	75	80	30



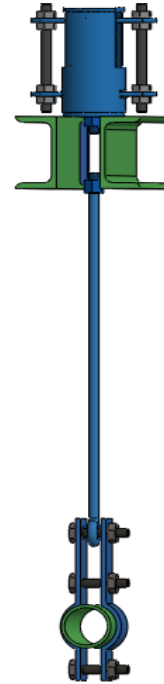
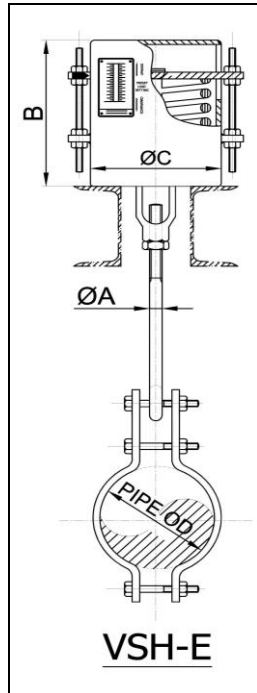
## DIMENSION TABLE OF TYPE 'C':

HANGER SIZE NO	HANGER THREAD 'ØA'	CASING LENGTH 'B'			CASING DIA. 'ØC'	HEIGHT OF PIN 'H'	LUG HOLE 'ØK'	'R'	THICK NESS 'T'
		VS1	VS2	VS3					
1	M12	125	210	375	76	35	14	25	6
2	M12	130	212	380	89	35	14	25	6
3	M12	132	224	400	101	35	14	25	6
4	M12	140	224	420	101	35	14	25	6
5	M12	140	236	425	101	35	14	25	6
6	M12	150	250	450	101	35	14	25	6
7	M12	170	280	525	114	35	14	25	6
8	M12	190	335	630	114	35	14	25	6
9	M16	200	340	630	140	35	18	25	10
10	M16	224	380	710	140	45	18	35	10
11	M20	230	380	710	152	45	22	35	10
12	M20	260	450	880	152	45	22	35	10
13	M20	275	480	900	152	45	22	35	10
14	M24	320	560	1060	152	45	26	35	12
15	M27	320	590	1120	165	45	30	35	12
16	M30	330	590	1130	195	60	34	50	12
17	M36	330	560	1028	273	70	40	60	16
18	M42	335	560	1038	273	80	45	65	16
19	M45	400	680	1285	273	80	50	65	20
20	M48	400	680	1285	273	80	50	65	20
21	M56	440	730	1365	324	95	60	80	20
22	M64	471	790	1475	324	95	68	80	20
23	M64	530	880	1667	324	95	68	80	20
24	M68	590	990	1875	324	95	75	80	20
25	M72	750	1290	2475	324	95	75	80	20



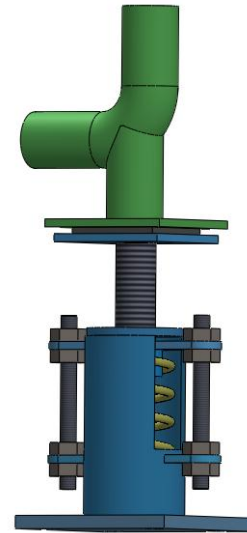
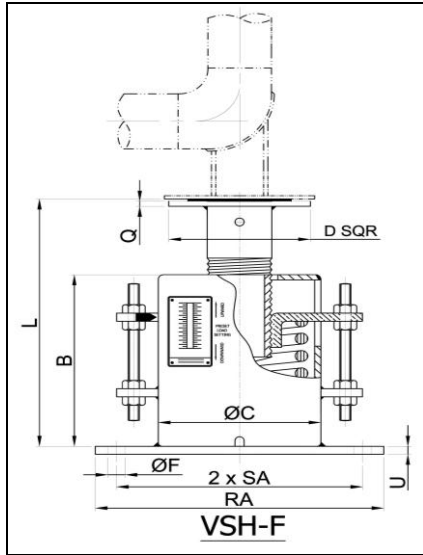
## DIMENSION TABLE OF TYPE 'D':

HANGER SIZE NO	HANGER THREAD 'ØA'	CASING LENGTH 'B'			CASING DIA. 'ØC'
		VS1	VS2	VS3	
1	M12	125	210	375	76
2	M12	130	212	380	89
3	M12	132	224	400	101
4	M12	140	224	420	101
5	M12	140	236	425	101
6	M12	150	250	450	101
7	M12	170	280	525	114
8	M12	190	335	630	114
9	M16	200	340	630	140
10	M16	224	380	710	140
11	M20	230	380	710	152
12	M20	260	450	880	152
13	M20	275	480	900	152
14	M24	320	560	1060	152
15	M27	320	590	1120	165
16	M30	330	590	1130	195
17	M36	330	560	1028	273
18	M42	335	560	1038	273
19	M45	400	680	1285	273
20	M48	400	680	1285	273
21	M56	440	730	1365	324
22	M64	471	790	1475	324
23	M64	530	880	1667	324
24	M68	590	990	1875	324
25	M72	750	1290	2475	324



## DIMENSION TABLE OF TYPE 'E':

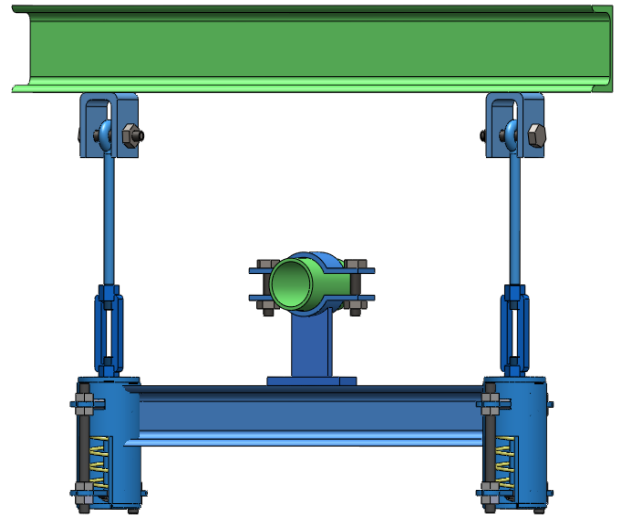
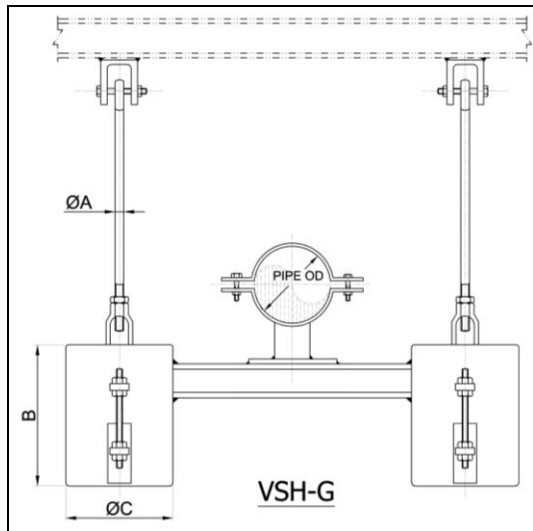
HANGER SIZE NO	HANGER THREAD 'ØA'	CASING LENGTH 'B'			CASING DIA. 'ØC'
		VS1	VS2	VS3	
1	M12	125	210	375	76
2	M12	130	212	380	89
3	M12	132	224	400	101
4	M12	140	224	420	101
5	M12	140	236	425	101
6	M12	150	250	450	101
7	M12	170	280	525	114
8	M12	190	335	630	114
9	M16	200	340	630	140
10	M16	224	380	710	140
11	M20	230	380	710	152
12	M20	260	450	880	152
13	M20	275	480	900	152
14	M24	320	560	1060	152
15	M27	320	590	1120	165
16	M30	330	590	1130	195
17	M36	330	560	1028	273
18	M42	335	560	1038	273
19	M45	400	680	1285	273
20	M48	400	680	1285	273
21	M56	440	730	1365	324
22	M64	471	790	1475	324
23	M64	530	880	1667	324
24	M68	590	990	1875	324
25	M72	750	1290	2475	324



## DIMENSION TABLE OF TYPE 'F':

HANGER SIZE NO.	CASING LENGTH 'B'			CASING DIA. 'ØC'	LOAD FLANGE		BOTTOM FLANGE				'L' FOR VS1		'L' FOR VS2		'L' FOR VS3	
	VS1	VS2	VS3		DØ	Q	RA	2*SA	U	FØ	MIN	MAX	MIN.	MAX	MIN.	MAX
1	125	210	375	76	70	6	130	90	6	14	165	205	250	330	415	575
2	130	212	380	89	70	6	150	100	6	14	170	210	252	332	420	580
3	132	224	400	101	90	6	150	100	6	14	172	212	264	344	440	600
4	140	224	420	101	90	6	150	100	6	14	180	220	264	344	460	620
5	140	236	425	101	90	6	150	100	6	14	180	220	276	356	465	625
6	150	250	450	101	90	6	150	100	6	14	190	230	290	370	490	650
7	170	280	525	114	100	10	190	130	8	18	210	250	390	400	565	725
8	190	335	630	114	100	10	190	130	8	18	230	280	375	455	670	830
9	200	340	630	140	110	12	210	150	8	18	240	280	380	460	670	830
10	224	380	710	140	110	12	210	150	8	18	264	304	420	500	750	910
11	230	380	710	152	130	12	230	160	8	22	270	310	420	500	750	910
12	260	450	880	152	130	12	230	160	8	22	300	340	490	570	920	1080
13	275	480	900	152	130	12	230	160	8	22	315	355	520	600	940	1100
14	320	560	1060	152	130	12	230	160	8	22	360	400	600	680	1100	1260
15	320	590	1120	165	140	16	240	170	10	22	360	400	630	710	1160	1320
16	330	590	1130	195	175	16	260	190	10	22	370	410	630	710	1170	1330
17	330	560	1028	273	250	16	320	250	10	22	370	410	600	680	1068	1228
18	335	560	1038	273	250	16	320	250	12	22	375	415	600	680	1078	1238
19	400	680	1285	273	250	20	350	260	12	27	440	480	720	800	1325	1485
20	400	680	1285	273	250	20	350	260	12	27	440	480	720	800	1325	1485
21	440	730	1365	324	270	20	390	300	16	27	480	520	770	850	1405	1565
22	471	790	1475	324	270	20	390	300	16	27	511	551	830	910	1515	1675
23	530	880	1667	324	270	22	390	300	16	27	570	610	920	1000	1707	1867
24	590	990	1875	324	270	22	410	315	20	30	630	370	1030	1110	1915	2075
25	750	1290	2475	324	270	22	410	315	20	30	790	830	1330	1410	2515	2675





## DIMENSION TABLE OF TYPE 'G':

HANGER SIZE NO	HANGER THREAD 'ØA'	CASING LENGTH			CASING DIA. 'ØC'
		VS1	VS2	VS3	
1	M12	125	210	375	76
2	M12	130	212	380	89
3	M12	132	224	400	101
4	M12	140	224	420	101
5	M12	140	236	425	101
6	M12	150	250	450	101
7	M16	170	280	525	114
8	M16	190	335	630	114
9	M16	200	340	630	140
10	M20	224	380	710	140
11	M20	230	380	710	152
12	M24	260	450	880	152
13	M24	275	480	900	152
14	M27	320	560	1060	152
15	M30	320	590	1120	165
16	M30	330	590	1130	195
17	M36	330	560	1028	273
18	M42	335	560	1038	273
19	M45	400	680	1285	273
20	M48	400	680	1285	273
21	M56	440	730	1365	324
22	M64	471	790	1475	324
23	M64	530	880	1667	324
24	M68	590	990	1875	324
25	M72	750	1290	2475	324



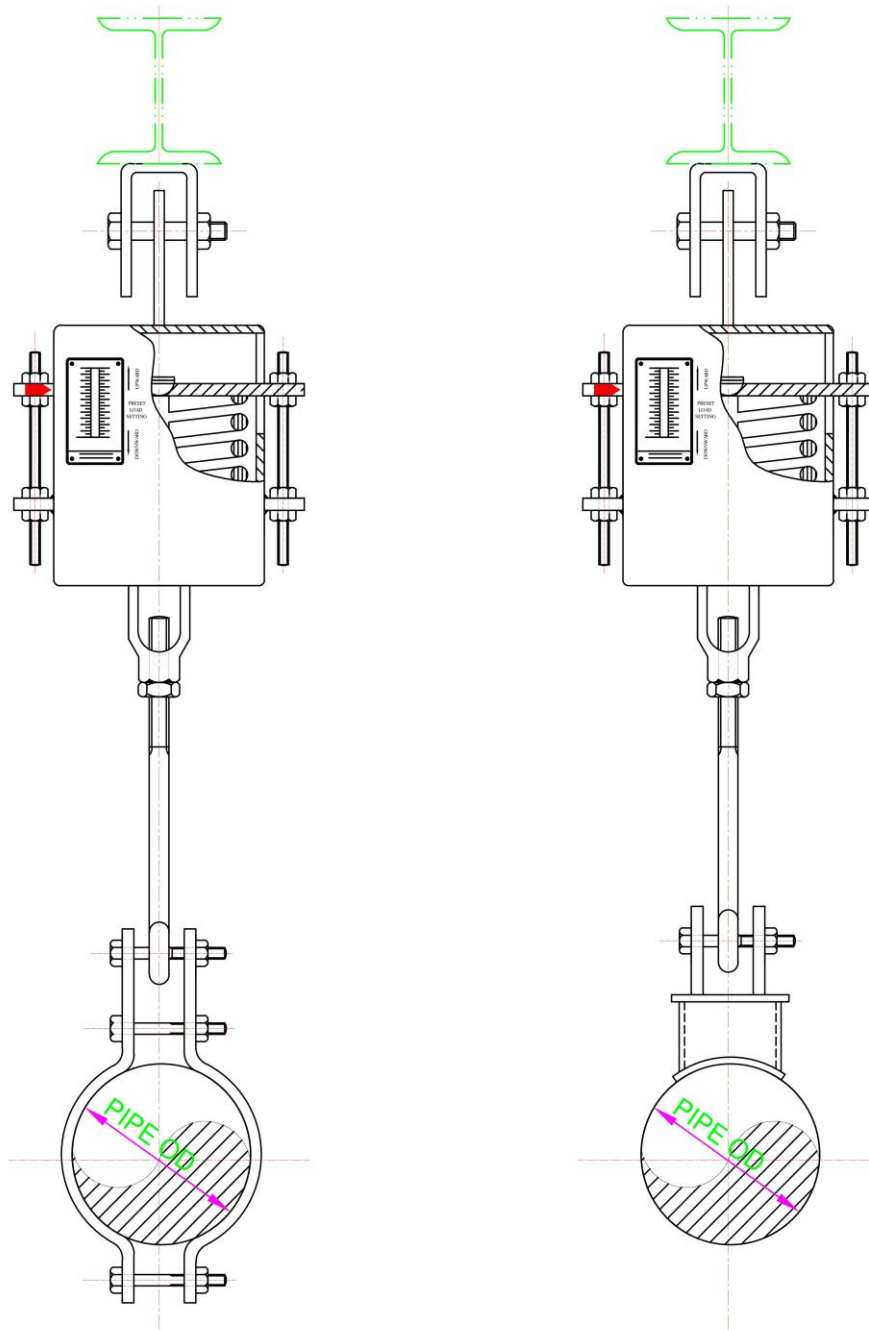
## MATERIAL SPECIFICATION

SL NO	PRODUCT	MATERIAL SPECIFICATION
1	SPRING	EN-42 UPTO 12 MM Ø OR IS 4454 PART-1 Gr. II & ABOVE 12 MM Ø EN-45/45A/47 OR EQUIVALENT.
2	CASING	IS-1239/3589 (MEDIUM) FOR VARIABLE SUPPORT & IS 2062 GR.A, R & W FOR CONSTANT SUPPORT.
3	HANGER ROD	CARBON STEEL TO IS 2062 GR A/B.
4	TOP LUG	CARBON STEEL TO IS 2062 GR A/B.
5	BEAM ATTACHMENT	CARBON STEEL TO IS 2062 GR A/B.
6	TURN BUCKLE	CARBON STEEL TO IS1875 CL-2 (FORGED) UPTO M30, SA 105 ON CLIENTS REQUEST. CARBON STEEL TO IS 2062 GR.A/B (MACHINED) ABOVE M30.(FABRICATED PIPE TYPE )
7	PIPE CLAMP, SHOE & U-BOLT	CARBON STEEL TO IS 2062 GR A/B. UPTO TEMPERATURE 400°C. ALLOY STEEL TO 1.0% CR, 0.5% Mo (ASTM A 182) & ASTM A 387 GR.11/12 CL.2 UPTO TEMPERATURE 401°C TO 530°C. ASTM A 387 GR 22 CL-2 OR ALLOY STEEL 2.0 % CR. 1.0% MO (ASTM A 182). UPTO TEMP 531°C TO 600°C. STAINLESS STEEL AISI 304 / 316/ 321 ABOVE TEMP 530°C.
8	BOLT / STUD & NUT.	CARBON STEEL TO IS 1363 / 67 CL-4.6 / 4.0 UPTO TEMP 340°C. ALLOY STEEL TO A 193 GR. B7/ A194 GR. 2 H UPTO TEMP 470°C. ALLOY STEEL TO A 193 B16/ A194 GR.4 UPTO TEMP 550°C. STAINLESS STEEL TO A 193 B8 / A194 GR 8 ABOVE TEMP 550°C.
9	PLATE	CARBON STEEL TO IS 2062 GR A/B.
10	LOW FRICTION PAD	PTFE TEFLON UPTO TEMP 210°C. GRAPHITE UPTO TEMP 550°C.
11	PIVOT PIN BUSH	PHOSPHOROUS BRONZE OR PTFE.
12	STEEL BALL	CARBON STEEL UPTO TEMP 350°C. STAINLESS STEEL UPTO TEMP 550°C.
13	SURFACE PREPARATION	<ol style="list-style-type: none"><li>1. BODY OF THE SUPPORTS AND ALL ALLIED COMPONENTS ARE CLEANED BY SAND BLAST, SANDERS WHEEL (ANGLE GRINDING), EMERGENCY CLOTH APPLICATION ETC. (TO REMOVE ALL DIRTS FROM THE SURFACE).</li><li>2. SPRINGS ARE CLEANED BY SHORT PINNED PROCESS.</li></ol>
14	NAME PLATE & LOAD TRAVEL SCALE	ALUMINIUM ANODIZED, BRASS, STAINLESS STEEL ANODIZED ON CLIENT REQUEST.
15	PAINTING 1. OUR STANDARD  2. CLIENT REQUEST	TWO COATS OF ZINC CHROMATE RED / GREY OXIDE PRIMER IS: 2074 AND ONE COAT OF FINISH ENAMEL PAINT TO IS-5: 1973 (ALUMINIUM / HAMMERTON GREEN). HOT DEEP GALVANISED, ZINC PLATED, ZINC PHOSPHATE PRIMER, ZINC SILICATE PRIMER, CORROSION RESISTANT PAINT FURNISH TO CUSTOMER SPECIFICATION
16	THREAD	ALL THREADED COMPONENTS ARE SUPPLIED ISO METRIC COURSE UNLESS OTHERWISE STATED.
17	MARKING	ALL THE VARIABLE/CONSTANT SUPPORT ARE FITTED WITH A METTALIC LOAD TRAVEL SCALE CUM NAME PLATE ON WHICH ALL REFERENCE ARE PUNCHED SUCH AS COLD & HOT LOAD, TRAVEL, SUPPORT TAG NO, SIZE ETC.
18	PACKING	SPRING SUPPORTS & ITS ACCESSORIES ARE SECURELY PACKED IN WOODEN BOX / CRATE, IN DISMANTLED CONDITION AND ACCORDINGLY PACKING LIST IS PREPARED.

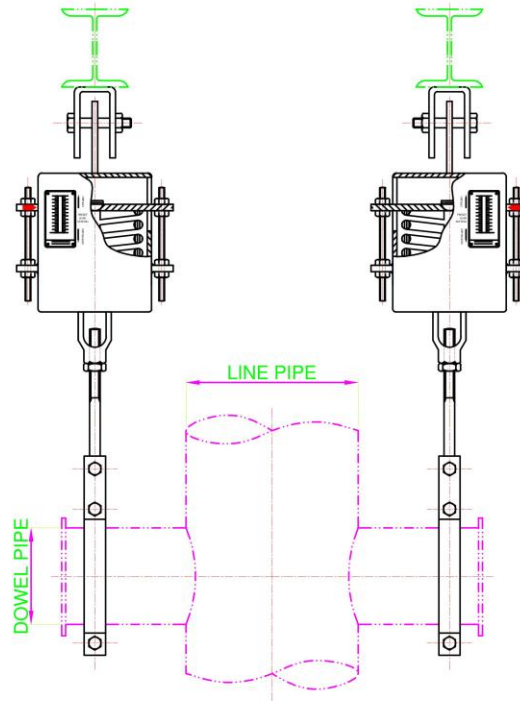


## **DESIGN FEATURES**

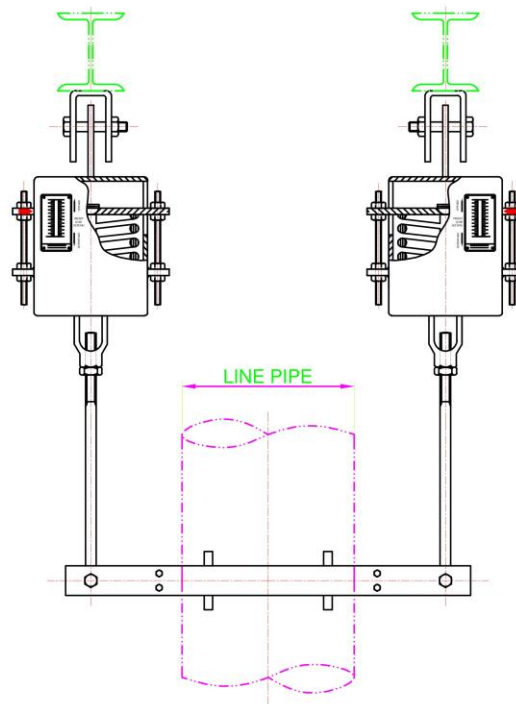
1. Pre compression - In order to save the headroom & erection time the spring coil is pre compressed.
2. For each series, there is a reserve travel at the upper & lower limits of the working range of the support.
3. For allowable stress of the coil spring we follow MSS SP-58.
4. All steel construction containing spring & casing are rugged & compact.
5. Load indicators are so placed that it is clearly visible.
6. Load flanges are associated with all 'F' type supports.
7. Mainly anti- corrosive materials (Aluminum-anodized) are used for the nameplate & scale plate. But if required we also maintain the above according to the need of the customer.
8. In order to maintain the spring concentricity under eccentric loads, the piston plate serves as a centering device or guide.
9. Finish: We provide standard synthetic enamel paint on the body of the supports and bitumen black on the spring. If required we also provide with the specialized coatings, according to the need of the customer.
10. Any other design features other than our standard design are also provided on particular request of the client, defined as specially designed support. Specially designed support may increase the price & the time required for delivery.



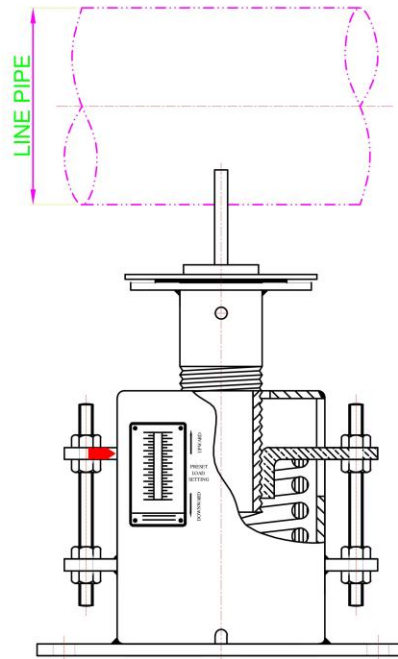
**TYPICAL ARRANGEMENT OF  
SINGLE VARIABLE SUPPORT**



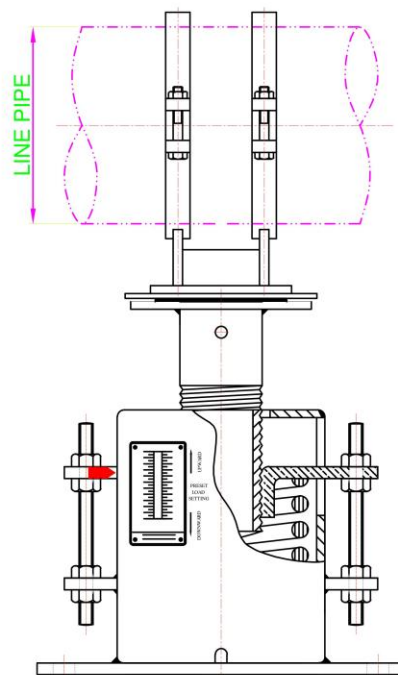
TYPICAL ARRANGEMENT OF  
DOUBLE VARIABLE SUPPORT  
(BY THREE BOLT CLAMP)



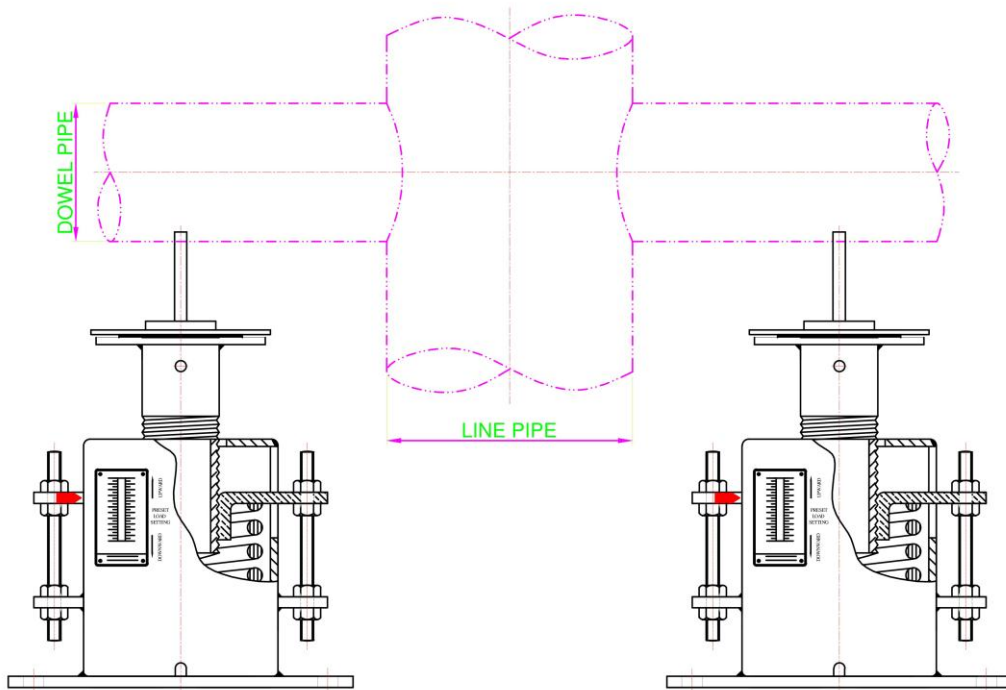
TYPICAL ARRANGEMENT OF  
DOUBLE VARIABLE SUPPORT  
(BY RISER CLAMP)



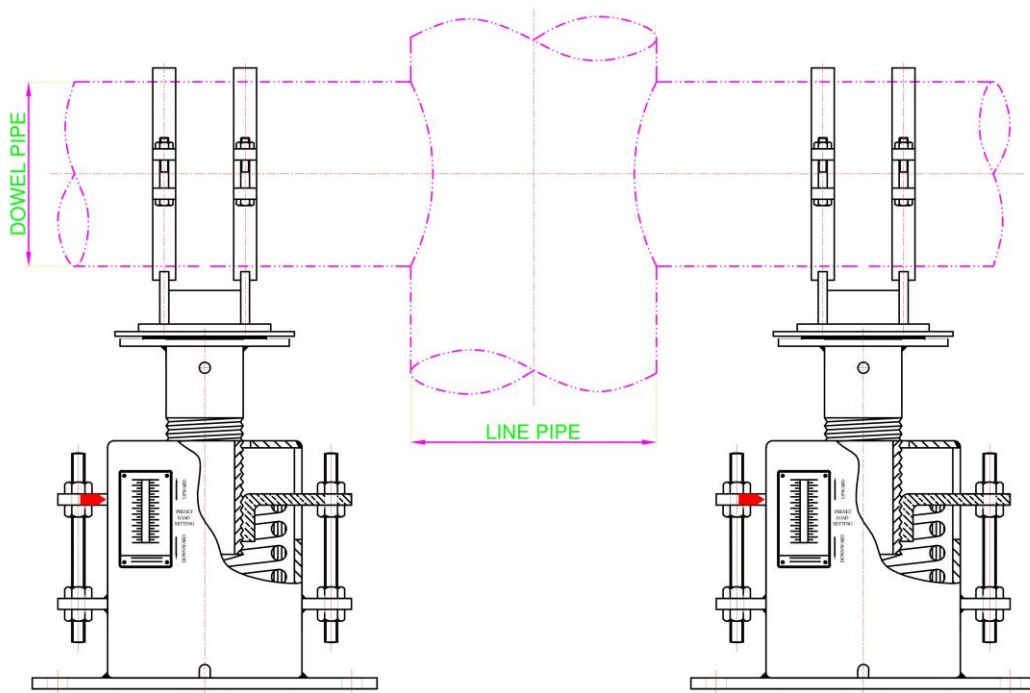
TYPICAL ARRANGEMENT OF  
SINGLE VARIABLE BASE  
MOUNTED SUPPORT



TYPICAL ARRANGEMENT OF  
SINGLE VARIABLE BASE  
MOUNTED SUPPORT



TYPICAL ARRANGEMENT OF  
DOUBLE VARIABLE BASE  
MOUNTED SUPPORT



TYPICAL ARRANGEMENT OF  
DOUBLE VARIABLE BASE  
MOUNTED SUPPORT

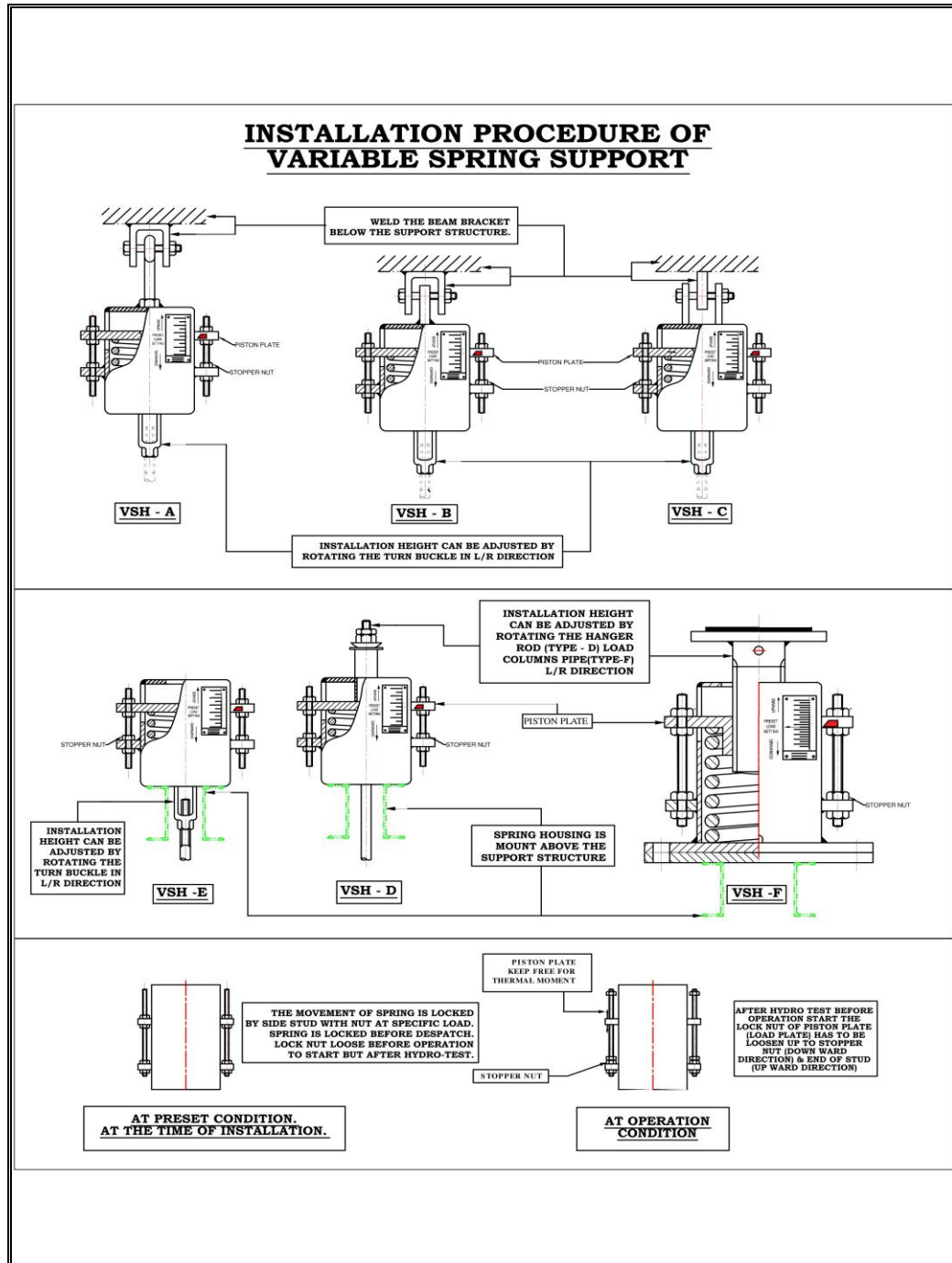




## Instruction for installation:

### Variable spring Support:

- 1) At the preset condition of spring is locked by universal locking arrangement (side stud with nut) at the specific load. Spring is locked before despatch.
- 2) At operation condition after hydro test before operation start, locknut of piston plate has to be loosening up to stopper nut (down ward direction) and end of stud (up ward direction).





**CONSTANT SPRING SUPPORT**

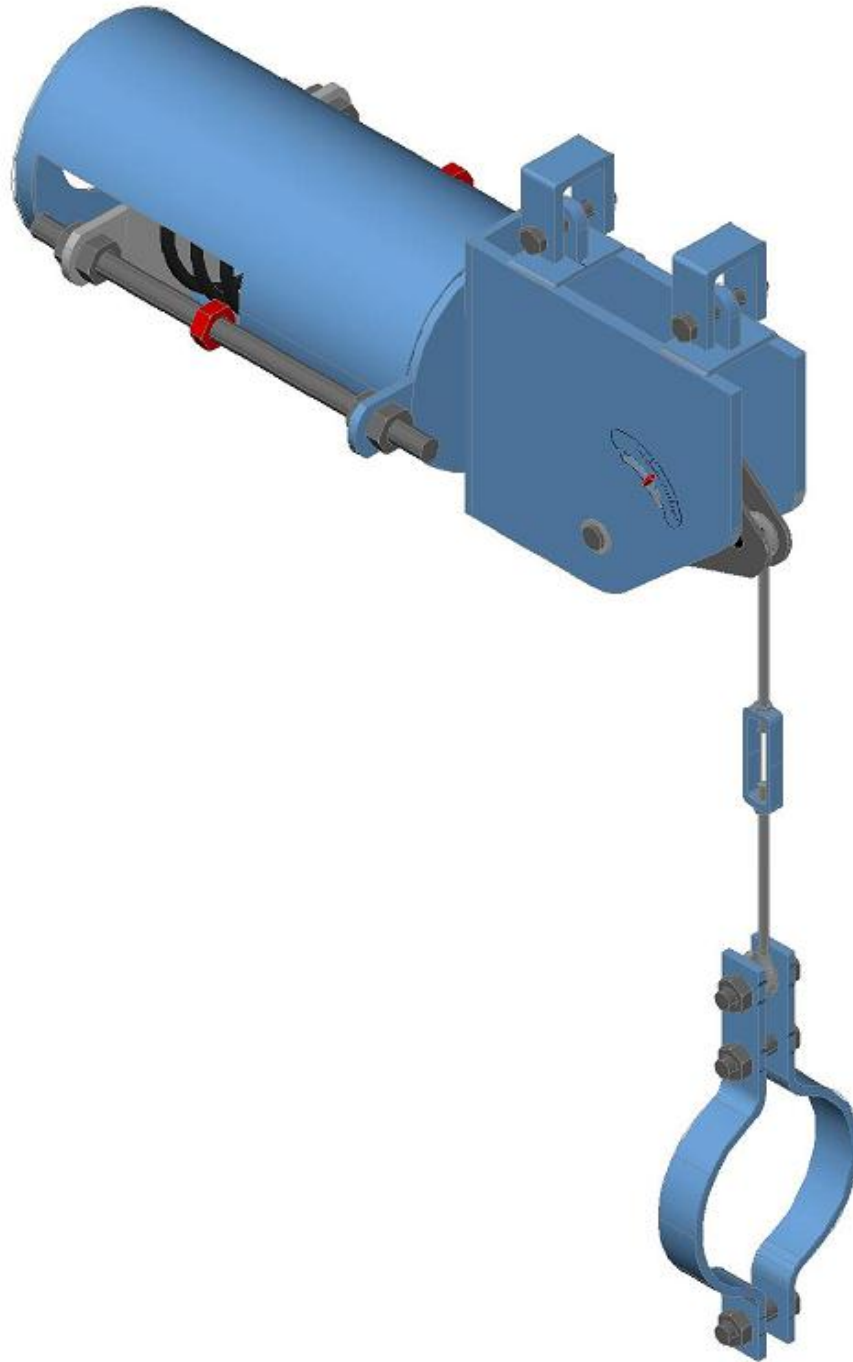


FIGURE – 10B

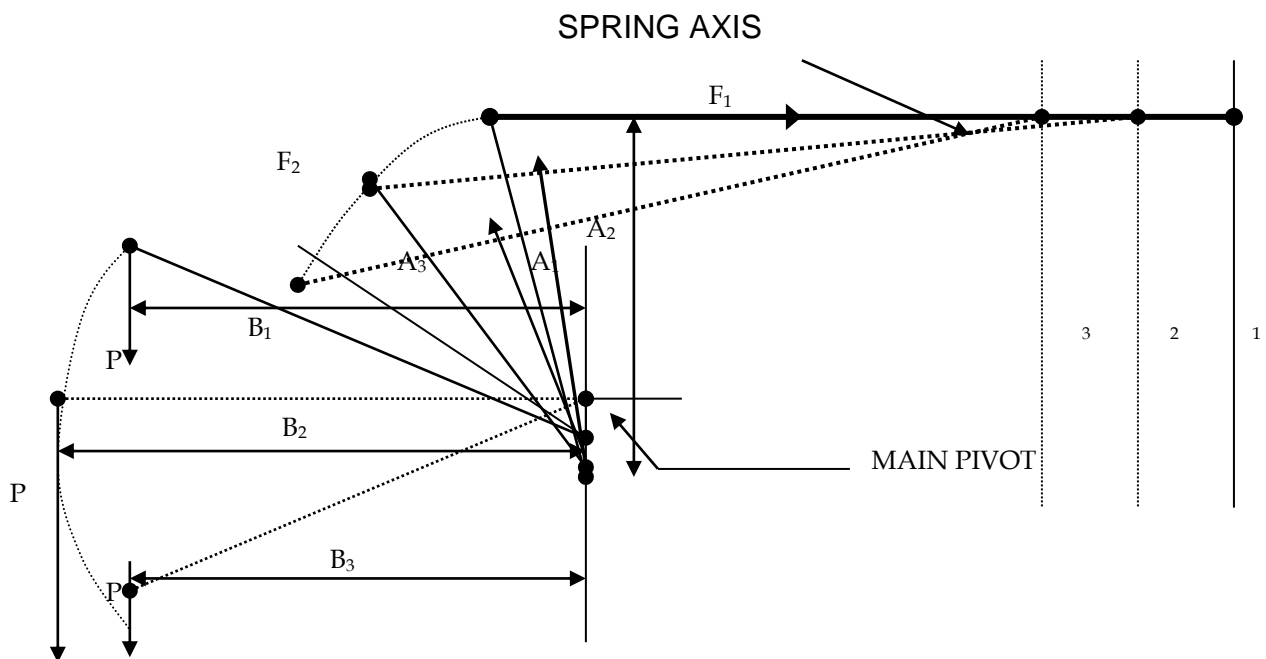


## CONSTANT SPRING HANGER SUPPORTS

The Constant Spring Hanger Supports are principally used to support pipes & ancillary equipments subjected to vertical movement due to the thermal expansion at locations where transfer of stress to other supports or equipment can be critical. Techno Industry incorporates the latest design concepts, in order to manufacture the Constant Spring Hanger Supports according to the needs of modern industry. According to MSS, the maximum recommended variation from the operating load for variable spring hangers is 25 %. Constant Spring Hanger Supports are use when this variation exceeds 25%.

The working of Constant Spring Hanger Support is based on a simple mechanical principle, which is given below:

To produce a constant supporting effect the load moment about the main pivot must be counter- balanced by an equal spring moment throughout the travel range.



Referring to the diagram, take three positions of the load travel- Top, Middle, Bottom, and then equate the moments of these points about the main pivot.

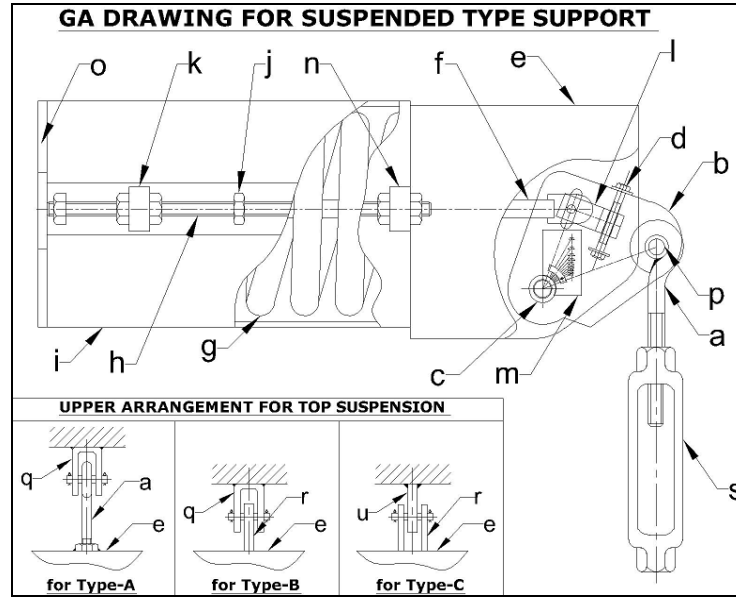
The equations are given below:

$$\begin{aligned}
 F_1 A_1 &= P B_1 \\
 F_2 A_2 &= P B_2 \\
 F_3 A_3 &= P B_3 \\
 \frac{F_1 A_1}{B_1} &= \frac{F_2 A_2}{B_2} = \frac{F_3 A_3}{B_3} = P
 \end{aligned}$$

The constant resistance to a given load is achieved by combining a spring coil with a bell crank lever, which rotates about a main pivot point. The bell crank lever is designed such that the distances from the main pivot change to compensate for the variable resistance during compression of the coil. Standard tolerances provides for the constant load through the travel range is 6%, according to the MSS.



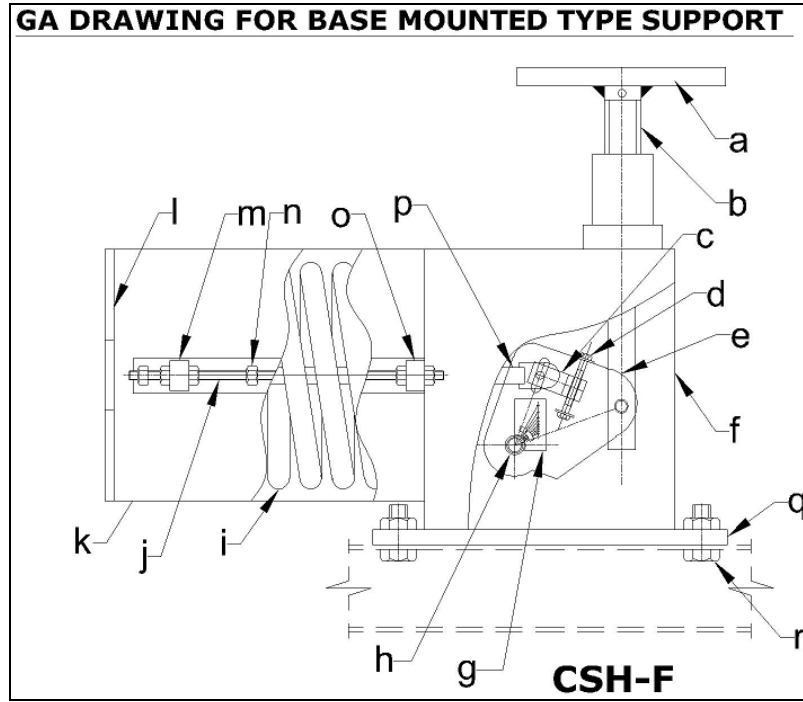
## MATERIAL SPECIFICATION OF TOP SUSPENDED CONSTANT SUPPORT



MATERIAL SPECIFICATION OF TOP SUSPENDED CONSTANT SUPPORT				
SL NO	ITEM	MATERIAL	QTY/SET	UOM
a	Hanger rod	IS-2062 Gr.A/B	1	nos
b	Lever	IS-2062 Gr.A/B	1	set
c	Pivot pin	SS-304	1	nos
d	Load adjusting bolt	IS-2062 Gr.A/B	1	nos
e	Frame	IS-2062 Gr.A/B	1	set
f	Tie rod	IS-2062 Gr.A/B	1	nos
g	Spring	IS-4454/IS-50Si7/IS-55Si7	1	nos
h	Side stud	IS-2062 Gr.A/B	2	nos
i	Spring casing	IS-1239/3589	1	nos
j	Stopper nut	IS-1367,CL 4	4	nos
k	Piston plate	IS-2062 Gr.A/B	1	nos
l	Fork	IS-2062 Gr.A/B	1	nos
m	Load travel scale	Al-Anodised	2	nos
n	Seat plate	IS-2062 Gr.A/B	1	nos
o	Cap plate	IS-2062 Gr.A/B	1	nos
p	Load pin	IS-2062 Gr.A/B	1	nos
q	Beam attachment	IS-2062 Gr.A/B	2	nos
r	Lug (type-B)	IS-2062 Gr.A/B	2	nos
s	Lug (type-C)	IS-2062 Gr.A/B	4	nos
t	Turn buckle	IS-1875,CI-II / IS-1239	1	nos
u	Top plate	IS-2062 Gr.A/B	1	nos



## MATERIAL SPECIFICATION OF BOTTOM MOUNTED CONSTANT SUPPORT



<b>MATERIAL SPECIFICATION OF TOP SUSPENDED CONSTANT SUPPORT</b>				
<b>SL NO</b>	<b>ITEM</b>	<b>MATERIAL</b>	<b>QTY/SET</b>	<b>UOM</b>
a	Load plate	IS-2062 Gr.A/B	1	nos
b	Load coloumn pipe	IS-1239	1	nos
c	Fork	IS-2062 Gr.A/B	1	nos
d	Load adjusting bolt	IS-2062 Gr.A/B	1	nos
e	Lever	IS-2062 Gr.A/B	1	set
f	Frame	IS-2062 Gr.A/B	1	set
g	Load adjusting bolt	IS-2062 Gr.A/B	1	nos
h	Pivot pin	SS-304	1	nos
i	Spring	IS-4454/IS-50Si7/IS-55Si7	1	nos
j	Side stud	IS-2062 Gr.A/B	2	nos
k	Spring casing	IS-1239/3589	1	nos
l	Cap plate	IS-2062 Gr.A/B	1	nos
m	Piston plate	IS-2062 Gr.A/B	1	nos
n	Stopper nut	IS-1367 ,CL 4	4	nos
o	Seat plate	IS-2062 Gr.A/B	1	nos
p	Tie rod	IS-2062 Gr.A/B	1	nos
q	Base plate	IS-2062 Gr.A/B	1	nos
r	Base fastener	IS-1367 ,CL 4.6 & 4	4	set



## **Constant Effort Supports**

### **Selection of Constant Effort Supports**

A mechanical device called constant local support is applied in the piping system, where the pipes undergo through a large vertical displacement due to variation in temperature. This equipment avoids critical vending stresses in pipe system and avoids transfer to stresses from support to support and to critical terminal like turbines, compressors and pumps etc.

Constant hanger is designed in such a manner that it provides constant supporting force for piping throughout its full range of vertical expansion and contraction.

### **Function**

The constant support ensures that the actual load is bearded in any position, so that the hanger does not cause any tension. The use of compression type springs, Bell crank lever arm moves from the high to low position, the spring is compressed and the resulting increasing force acting on decreasing spring arm created a turning moment about the main pivot, which is exactly equal to the turning moment on the load arm.

If the lever arm moves from low to high position, the spring is increasing in length and resulting decreasing force acting on the increasing spring arm created a turning moment about the main-pivot, which is exactly equal to the turning moment on the load arm.

### **Construction & Feature**

Top connections and spring housing direction vary with the respective types. The Hanger fittings are first welded or bottled to the supporting structure, and then the hanger and its accessories are installed. The system presents easy field assembly work.

### **Standard Range**

T.I. Constant effort supports are constructed to accommodate loads between 16 kg. and 20,000 kg. with a standard range of travels from 40 mm to 410 mm. in 10mm, increments. Upper and lower travel stops are incorporate in all units to prevent excessive over travel.

### **Presetting**

All constant supports are fitted with preset pins which are painted red. On completion of installation and prior to removal of pins, the pipe work system can be hydraulically tested or acid cleaned. The preset pins must be removed before commissioning the system.

### **Tolerance**

The tolerance of consistency and operation of support is kept with in 6% and each support is tested in our shop prior to dispatch.

### **Load adjustment**

The provision is made in every support for site adjustment to the extent of +20%.

### **Maintenance**

PTFE bearing are used on all pivoting components thus eliminating the requirement of maintenance and lubrication.

### **Travel Indicator**

Travel indicator is provided to indicate the position of pipeline.

### **PEFERENCE MARK**

Each side plate is stamped with appropriate customer mark to avoid the problem in distinguish the hanger.

### **MANEUVERABILITY**

Our design can give a swivel of 4 degree to the turnbuckle in all direction & is therefore maneuverable without difficulty.

### **PINS**

Stainless steel is used for the material of pivot pins.



## SELECTION OF SUITABLE SUPPORTS

The following data is required to select the proper hanger

- ❖ No required
- ❖ Operating load
- ❖ Total travel
- ❖ Travel Direction (up/down)
- ❖ Preset position
- ❖ Hydro test load
- ❖ Matching mounting arrangement
- ❖ Type of support Horizontal or Vertical

## SELECTION FOR LONG TRAVEL CONSTANT

Sometime it is found total travel-which exceeds the standard travel range as shown in our selection table. To determine the size of the support with a total travel larger than the standard range, calculate the revised load, which is equal to operating load x total travel.

Example:

Operating load = 300 kg.

Total travel = 270 kg.

Revised travel =  $(300 \times 270) \div 100 = 810$  kg.

Select unit from 100 total travel column Unit size = 17

Unit require = size 17, total travel 270, operating load 300 kg.

## SELECTION - GENERAL

Find the correct travel either by adding 20% or 25 mm. to the specified travel whichever is more, i.e. add, 25 mm. for travel up to 125 mm. and 20% of travel for travel excess of 125 mm. The travel given in the selection table is total travel this being maximum vertical travel the unit will accommodate.

Example:

Operating load = 1050 kg.

Actual movement = 80 mm.

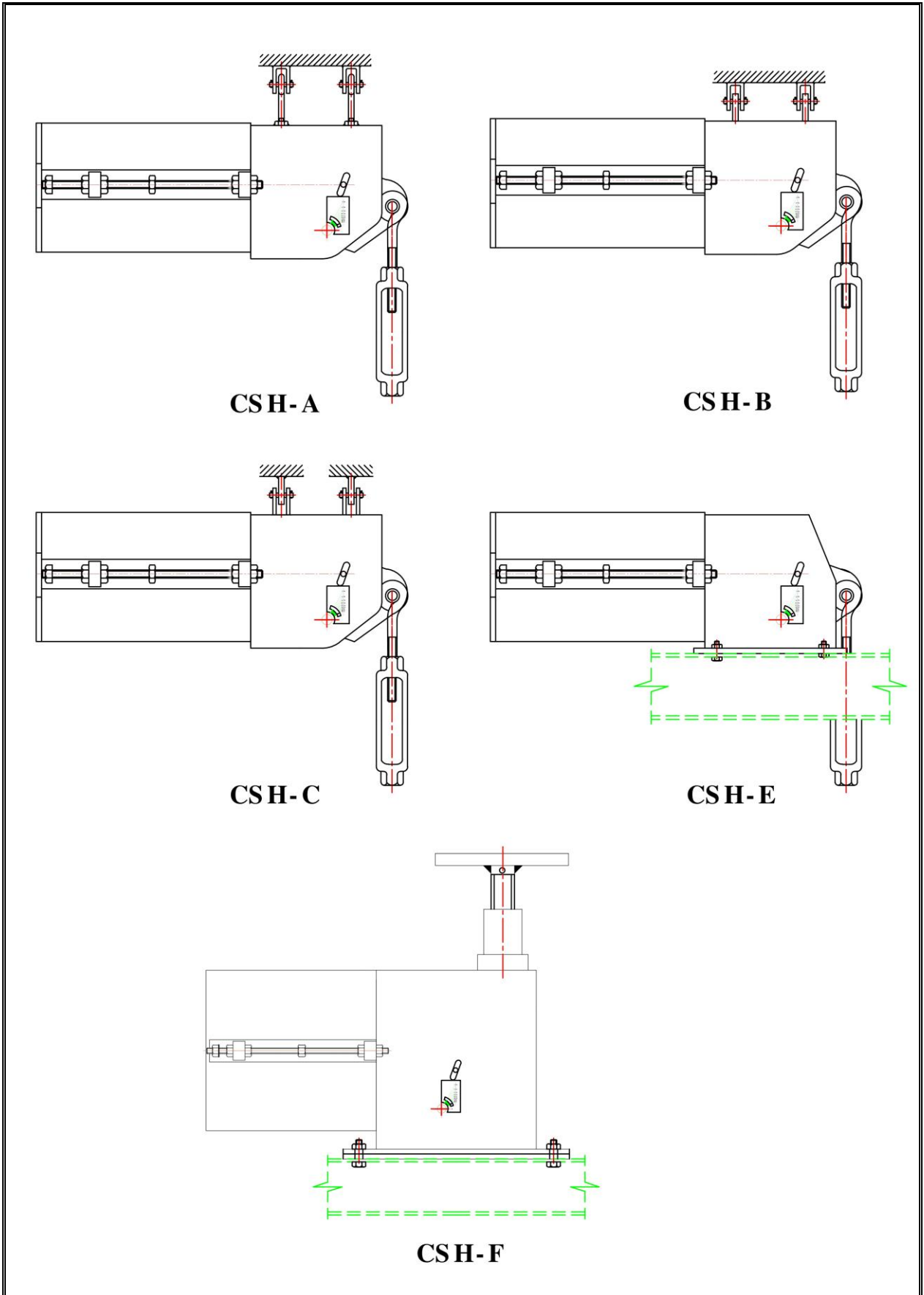
Total travel =  $80 + 25 = 105$  mm.

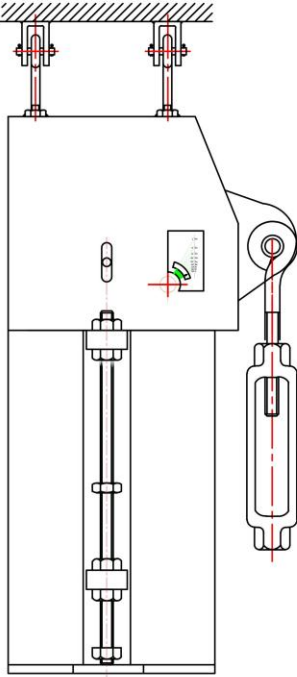
~ 110 mm. (rounded up to next & nearest travel shown in table)



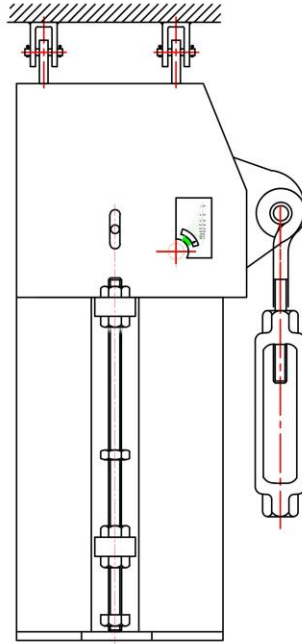


## TYPES OF CONSTANT SPRING SUPPORT

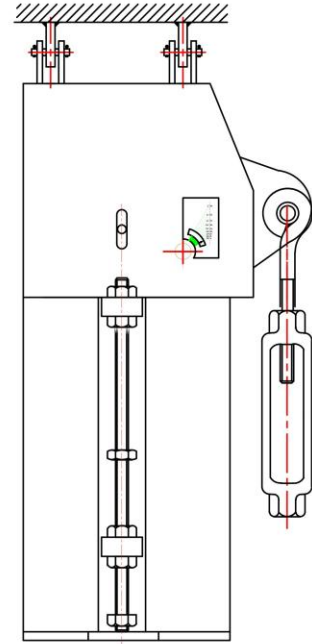




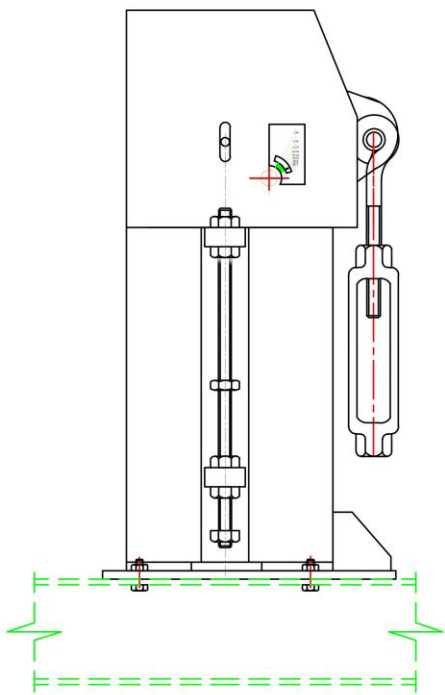
**CSV-A**



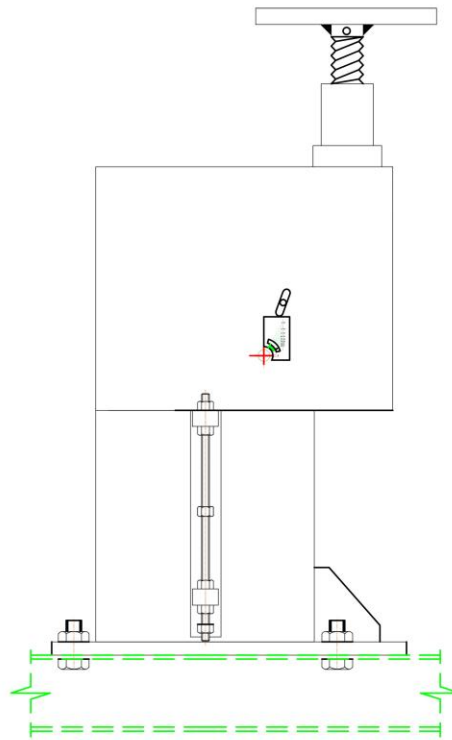
**CSV-B**



**CSV-C**



**CSV-E**



**CSV-F**



## CONSTANT SUPPORTS SELECTION TABLE

SELECTION TABLE											
TRAVEL	50	60	70	80	90	100	120	150	180	250	size
20											1
26											2
33											3
43	32	27	23								4
55	41	35	30								5
70	52	44	40								6
90	67	56	50	40	32	30					7
115	86	72	60	50	41	35					8
150	110	92	80	65	52	45					9
180	140	120	100	82	67	55					10
240	180	147	125	105	85	70	48				11
310	230	188	160	135	108	90	60				12
400	295	243	200	170	138	115	80	45			13
500	378	310	260	215	176	145	100	55			14
645	485	395	330	275	229	190	125	70			15
825	620	504	420	345	285	235	160	85			16
1025	793	642	540	440	364	330	205	115			17
1346	1015	820	680	565	464	385	260	150	85		18
1800	1300	1044	870	720	591	490	332	190	105		19
2198	1700	1330	1100	920	754	625	425	240	135		20
2700	2150	1665	1420	1090	962	800	540	300	170		21
3600	2650	2164	1805	1490	1227	1015	690	390	220		22
4600	3488	2660	2300	2000	1565	1290	880	500	280		23
6000	4461	3518	2935	2420	1995	1645	1120	630	355		24
7500	5688	4500	3740	3085	2544	2100	1430	800	450		25
	7247	5730	4200	3935	3800	2675	1810	1025	575		26
	9200	7500	6000	4700	4216	3415	2325	1300	735		27
				6200	5543	4350	2700	1665	935		28
				7800	6730	5550	3775	2120	1190		29
				10000	8000	7200	4815	2600	1520		30
						8600	6140	3445	1940		31
						9100	7300	4390	2470		32
						10700	9500	5600	3150		33
								7140	4020		34
								9100	5125		35
								11600	7250		36
								13500	8330		37
								10700			38
								13536			39
								16500			40
											41
											42
											43
											44
											45

**DESIGNATION**

CS	H/V	A/B/C/E/F	20
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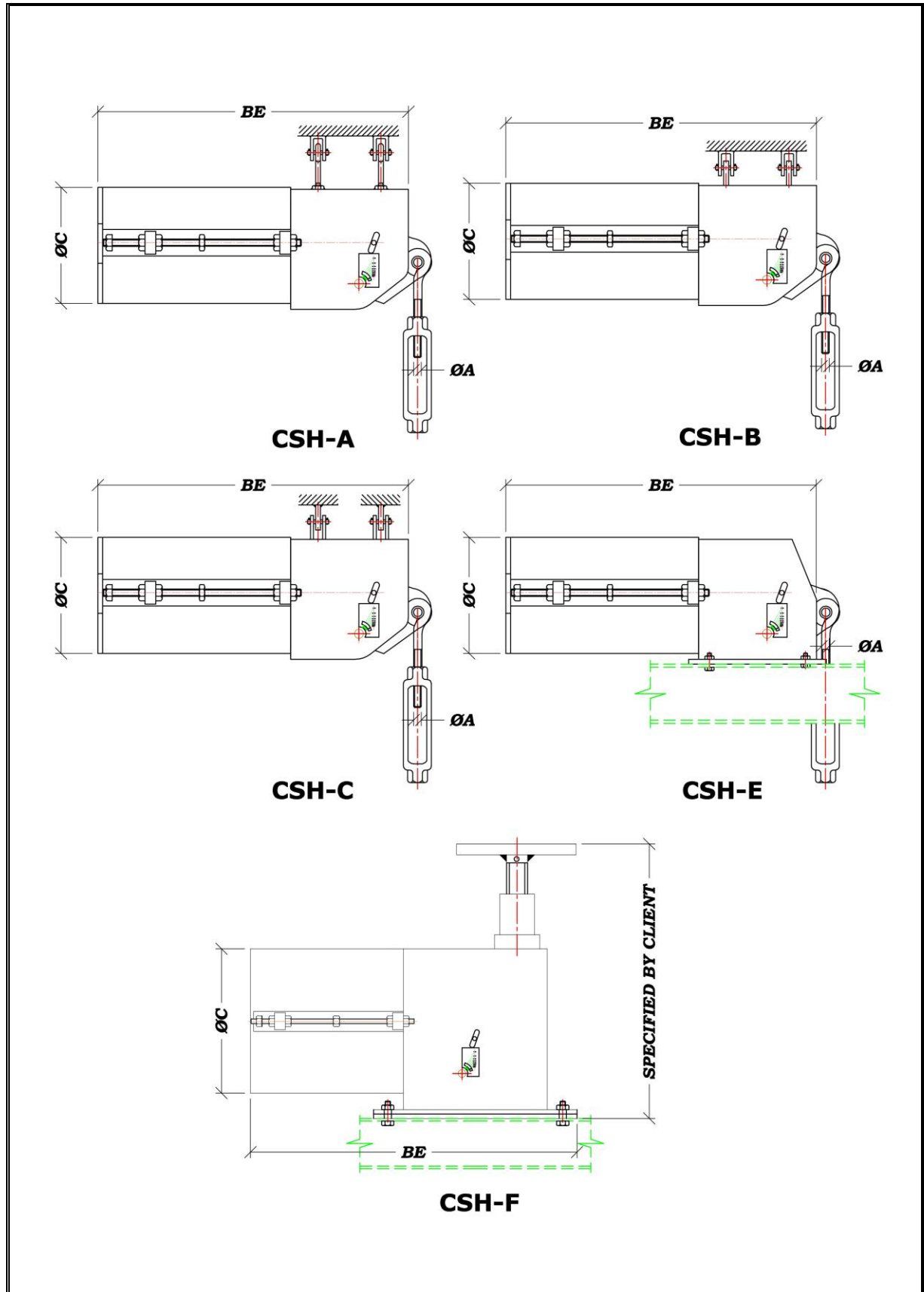
→ SIZE  
 → TYPE  
 → ORIENTAION (HORIZONTAL / VERTICAL)  
 → CONSTANT SPRING

\* **SELECTION PROCEDURE** :- 1. LOAD AS SAME AS SP. LOAD , 2. TOTAL TRAVEL = SP. TRAVEL+(25 MM / 25% OF SP. TRAVEL), [ALLOWENCE IN TRAVEL IS +5 MM FOR ALL SIZE'S.]

Note:- In above selection table we provide in briefly as per customer requirement we can provide verbosely.

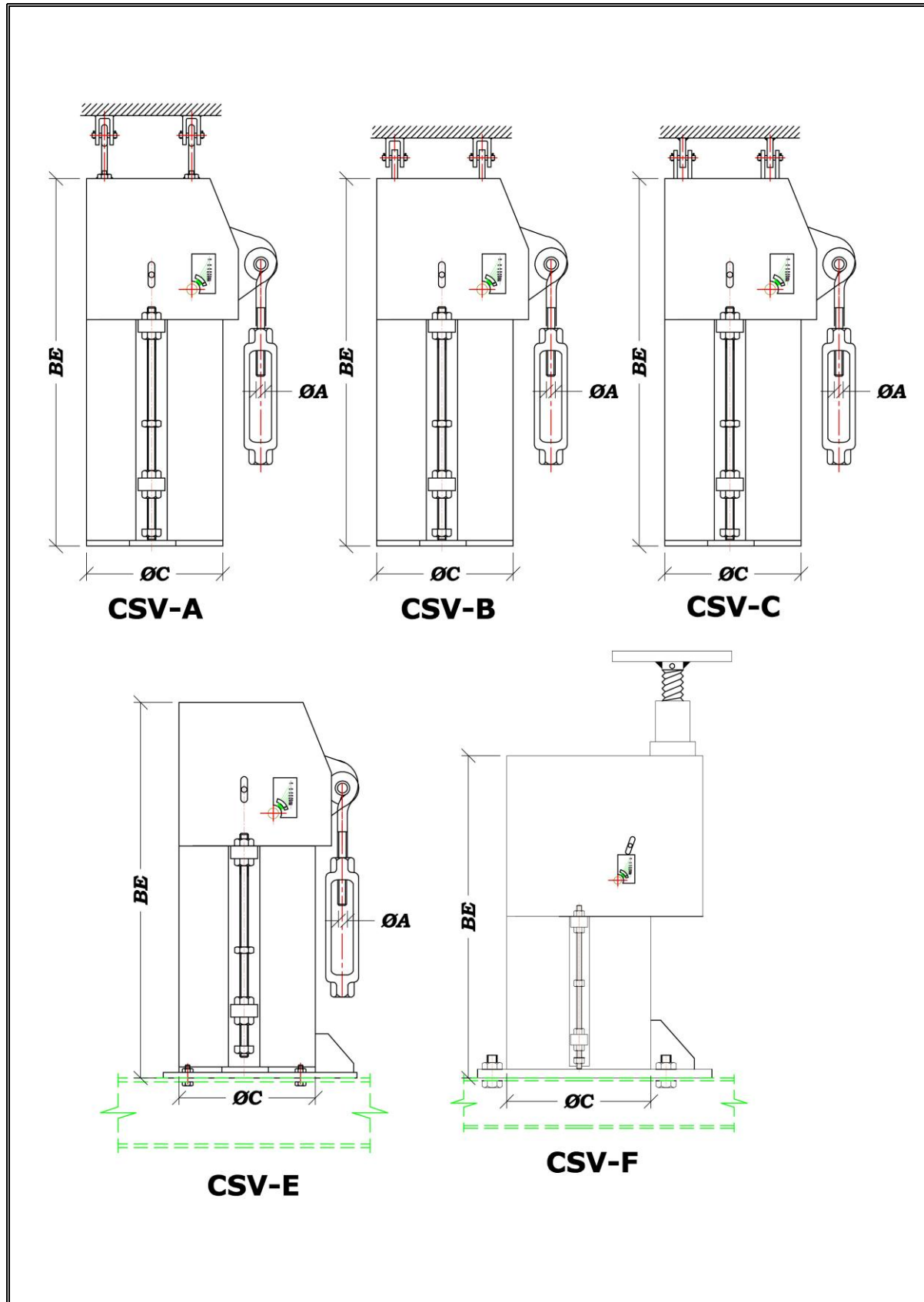


## DIMENSIONAL SKETCHES OF CONSTANT EFFORT SUPPORT (HORIZONTAL)



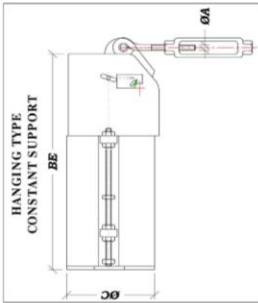


## DIMENSIONAL SKETCHES OF CONSTANT EFFORT SUPPORT (VERTICAL)

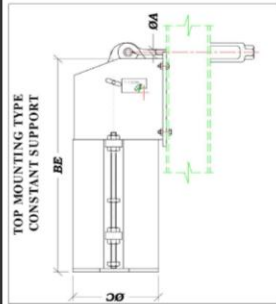




SUPPORT SIZE	TOTAL TRAVEL RANGE																							
	50		60		70		80		90		100		120		150		180		250					
	ØA	BE	ØC	ØA	BE	ØC	ØA	BE	ØC	ØA	BE	ØC	ØA	BE	ØC	ØA	BE	ØC	ØA	BE	ØC			
01	M12	470	101	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
02	M12	470	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
03	M12	470	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		
04	M12	470	114	*	*	*	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140
05	M12	470	114	*	*	*	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140
06	M12	470	140	*	*	*	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140
07	M12	470	140	*	*	*	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140
08	M12	500	168	*	*	*	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140
09	M12	500	168	*	*	*	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140	M12	500	140
10	M12	500	168	*	*	*	M12	500	168	M12	500	168	M12	500	168	M12	500	168	M12	500	168	M12	500	168
11	M12	500	168	*	*	*	M12	500	168	M12	500	168	M12	500	168	M12	500	168	M12	500	168	M12	500	168
12	M12	530	195	*	*	*	M12	530	195	M12	530	195	M12	530	195	M12	530	195	M12	530	195	M12	530	195
13	M12	530	195	*	*	*	M12	530	195	M12	530	195	M12	530	195	M12	530	195	M12	530	195	M12	530	195
14	M12	570	195	*	*	*	M12	550	195	M12	570	195	M12	550	195	M12	570	195	M12	550	195	M12	570	195
15	M16	570	195	*	*	*	M12	550	195	M12	570	195	M12	550	195	M12	570	195	M12	550	195	M12	570	195
16	M16	780	219	*	*	*	M16	580	195	M16	580	195	M16	580	195	M16	580	195	M16	580	195	M16	580	195
17	M20	805	219	*	*	*	M16	680	219	M16	680	219	M16	680	219	M16	680	219	M16	680	219	M16	680	219
18	M24	805	273	*	*	*	M16	820	219	M16	820	219	M16	820	219	M16	820	219	M16	820	219	M16	820	219
19	M24	825	273	*	*	*	M20	845	219	M16	680	273	M16	720	273	M16	720	273	M16	720	273	M16	720	273
20	M30	1000	273	*	*	*	M24	845	273	M20	775	273	M16	720	273	M16	720	273	M16	720	273	M16	720	273
21	M30	1000	273	*	*	*	M24	875	273	M24	875	273	M20	775	273	M16	720	273	M16	720	273	M16	720	273
22	M36	1125	273	*	*	*	M30	990	273	M24	905	273	M20	785	273	M20	785	273	M20	785	273	M20	785	273
23	M36	1125	273	*	*	*	M30	1000	273	M30	925	273	M24	885	273	M24	885	273	M24	885	273	M24	885	273
24	M42	1120	324	*	*	*	M36	1025	324	M30	975	273	M24	825	324	M24	825	324	M24	825	324	M24	825	324
25	M48	1270	356	*	*	*	M36	1050	324	M30	1095	273	M30	850	324	M24	1055	273	M24	1055	273	M24	1055	273
26	*	*	*	*	*	*	M42	1150	356	M36	1095	273	M30	950	324	M30	1055	273	M30	1055	273	M30	1055	273
27	*	*	*	*	*	*	M48	1300	356	M42	1120	324	M36	1035	356	M36	1095	273	M30	995	273	M24	1070	324
28	*	*	*	*	*	*	M48	1300	406	M48	1300	356	M42	1240	324	M42	1120	356	M36	1044	324	M30	1180	324
29	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
30	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
31	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
32	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
33	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
34	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
35	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
36	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
37	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
38	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
39	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
40	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*



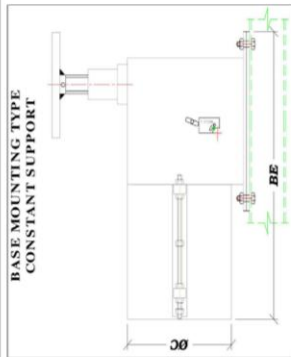




DIMENSIONAL DETAILS FOR TOP MOUNTING TYPE CONSTANT SUPPORT

SUPPORT SIZE	TOTAL TRAVEL RANGE																					
	50		60		70		80		90		100		120		150		180		250			
	ØA	BE	ØA	BE	ØA	BE	ØA	BE	ØA	BE	ØA	BE	ØA	BE	ØA	BE	ØA	BE	ØA	BE		
01	M12	520	101	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
02	M12	520	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
03	M12	520	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
04	M12	520	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
05	M12	520	114	M12	520	101	M12	550	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	
06	M12	520	140	M12	520	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	
07	M12	520	140	M12	520	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	
08	M12	550	140	M12	520	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	M12	550	140	
09	M12	550	168	M12	560	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	
10	M12	550	168	M12	560	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	
11	M12	550	168	M12	560	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	
12	M12	580	195	M12	560	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	
13	M12	580	195	M12	560	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	M12	550	168	
14	M12	620	195	M12	600	195	M12	580	195	M12	580	195	M12	580	195	M12	580	195	M12	580	195	
15	M16	620	195	M12	600	195	M12	580	195	M12	580	195	M12	580	195	M12	580	195	M12	580	195	
16	M16	830	219	M16	620	195	M12	580	195	M12	580	195	M12	580	195	M12	580	195	M12	580	195	
17	M20	805	219	M16	870	219	M16	730	219	M12	730	219	M12	730	219	M12	730	219	M12	730	219	
18	M24	805	273	M20	870	219	M16	730	219	M12	730	219	M12	730	219	M12	730	219	M12	730	219	
19	M24	875	273	M20	925	273	M20	870	219	M16	730	219	M12	730	219	M12	730	219	M12	730	219	
20	M30	1050	273	M24	925	273	M24	870	273	M20	825	273	M20	825	273	M16	850	219	M16	850	219	
21	M36	1175	273	M30	1050	273	M24	955	273	M24	855	273	M24	855	273	M16	910	219	M16	910	219	
22	M36	1175	324	M36	1025	324	M30	955	324	M24	975	273	M24	975	273	M20	910	273	M20	910	273	
23	M36	1175	324	M36	1025	324	M30	955	324	M24	975	324	M24	975	324	M20	910	273	M20	910	273	
24	M48	1270	324	M36	1025	324	M36	1125	324	M30	1130	273	M30	1130	273	M24	910	273	M24	910	273	
25	M48	1270	356	M42	1200	356	M36	1200	324	M36	1130	273	M30	1130	273	M24	910	273	M24	910	273	
26	*	*	*	M48	1350	356	M42	1200	356	M36	1170	324	M36	1085	356	M30	1145	273	M30	1145	273	
27	*	*	*	M48	1350	406	M48	1350	356	M42	1290	324	M42	1110	356	M36	1145	324	M36	1145	324	
28	*	*	*	*	*	*	*	*	*	*	*	*	M42	1170	356	M42	1170	356	M42	1170	356	
29	*	*	*	*	*	*	*	*	*	M48	1430	356	M48	1450	356	M48	1450	356	M48	1450	356	
30	*	*	*	*	*	*	*	*	*	M56	1650	356	M56	1650	356	M48	1450	356	M48	1450	356	
31	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	M48	1740	356	M48	1740	356	
32	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	M48	1740	356	M48	1740	356	
33	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	M56	1880	356	M56	1880	356	
34	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
35	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
36	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
37	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
38	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
39	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
40	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*





DIMENSIONAL DETAILS FOR BASE MOUNTING TYPE CONSTANT SUPPORT

SUPPORT SIZE	TOTAL TRAVEL RANGE																				
	50		60		70		80		90		100		120		150		180		250		
	BE	ØC	BE	ØC	BE	ØC	BE	ØC	BE	ØC	BE	ØC	BE	ØC	BE	ØC	BE	ØC	BE	ØC	
01	540	101	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02	540	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03	540	114	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04	540	114	540	101	570	140	580	140	570	140	580	140	570	140	580	140	570	140	580	140	
05	540	114	540	101	570	140	580	140	570	140	580	140	570	140	580	140	570	140	580	140	
06	540	140	540	140	570	140	580	140	570	140	580	140	570	140	580	140	570	140	580	140	
07	540	140	540	140	570	140	580	140	570	140	580	140	570	140	580	140	570	140	580	140	
08	570	140	540	140	570	140	580	140	570	140	580	140	570	140	580	140	570	140	580	140	
09	570	168	580	140	570	140	580	152	710	140	580	152	710	140	580	152	710	140	580	152	
10	570	168	580	168	570	168	610	152	710	140	580	152	710	140	580	152	710	140	580	152	
11	570	168	580	168	570	168	610	168	730	140	580	168	730	140	580	168	730	140	580	168	
12	600	195	580	168	570	195	610	168	730	140	580	168	730	140	580	168	730	140	580	168	
13	600	195	580	195	600	195	610	195	730	168	750	195	730	168	750	195	730	168	750	195	
14	640	195	620	195	600	195	650	195	730	195	750	195	730	195	750	195	730	195	750	195	
15	640	195	620	195	650	195	650	195	760	195	750	195	760	195	750	195	760	195	750	195	
16	880	219	640	195	650	195	650	195	800	168	800	168	800	168	800	168	800	168	800	168	
17	880	219	920	219	650	195	760	273	760	219	800	168	760	219	800	168	760	219	800	168	
18	905	273	920	219	920	219	760	273	800	219	800	219	800	219	800	219	800	219	800	219	
19	925	273	975	273	920	219	760	273	800	273	800	219	800	219	800	219	800	219	800	219	
20	1080	273	975	273	945	273	855	273	800	273	800	219	800	219	800	219	800	219	800	219	
21	1080	273	1010	273	1005	273	885	273	865	273	865	273	865	273	865	273	865	273	865	273	
22	1180	273	1080	273	1035	324	1005	273	885	273	865	273	865	273	865	273	865	273	865	273	
23	1235	324	1105	324	1035	324	1055	273	905	324	985	273	905	324	985	273	905	324	985	273	
24	1305	324	1135	324	1155	324	1175	273	905	324	985	273	905	324	985	273	905	324	985	273	
25	1310	356	1240	356	1235	324	1175	273	905	324	985	273	905	324	985	273	905	324	985	273	
26	*	*	1340	356	1240	356	1200	324	1115	356	1195	273	1115	356	1195	273	1115	356	1195	273	
27	*	*	1440	406	1340	356	1320	324	836	356	1220	324	836	356	1220	324	836	356	1220	324	
28	*	*	*	*	*	*	*	*	1280	356	1220	324	1280	356	1220	324	1280	356	1220	324	
29	*	*	*	*	*	*	*	*	1460	356	1500	356	1460	356	1500	356	1460	356	1500	356	
30	*	*	*	*	*	*	*	*	1680	356	1500	356	1680	356	1500	356	1680	356	1500	356	
31	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
32	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
33	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
34	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
35	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
36	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
37	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
38	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
39	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
40	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*



- **LOAD ADJUSTMENT**

Constant Spring Hanger Supports are preset to the load specified by the customer in the factory. Sometimes it is necessary to adjust this preset loads to accommodate minor variations in the site. So the constant spring hanger supports are equipped with load adjustment capability. This load adjustment capability consists of a load adjustment scale and indicator, which are used to increase or decrease the load by 20% of the mean load.

- **PRESETTING**

All Constant Spring Hanger Supports are fitted with preset pins, in the factory, which are painted red. According to the installations guidelines, the preset pins must be removed before commissioning the system.

- **SPECIAL RANGE**

Special types of constant supports are designed to suit's according customer requirements, i.e. other than those indicated in the standard range.

- **SELECTION**

In order to select a Constant type support, first calculate the load & travel, which the support is to accommodate.

It is good to add over travel to the calculated travel.

Recommended Over travel: Add 25 mm for travels up to 125mm. For travels in excess of 125mm add 20% of the calculated travel.

The obtained data should then be rounded up to the next whole 10mm increment giving the total travel thus enabling a standard support to be selected.

In order to determine the correct constant supports refer to the selection table & select a support to accommodate the calculated load & the total travel.

N.B: The travel given in the table is the total travel, this being the maximum vertical travel the unit will accommodate.

- **FINISH**

All constant type supports are painted; other corrosion resistant finishes are available if required at extra cost.

- **MAINTENANCE**

No maintenance or lubrication is required.

- **LONG TRAVEL CONSTANTS SPRING SUPPORTS.**

Sometimes it may be necessary to use a constant type support with a total travel, which exceeds the standard travel range. To determine the size of a constant support with a total travel larger than the standard range, the following should be carried out:

**REVISED LOADS:**                      **OPERATING LOAD X TOTAL TRAVEL**



## **INSTALLATION**

### **Constant Effort Support**

1. The hanger is fixed firmly at point where load coupling is directly over the desired point of attachment to the pipe in the operating position.
2. There should be 4 clear access for moving parts of hanger.
3. Before taking up the load, enough thread engagement should be in between lower hanger rod, turn buckle and pipe attachment.
4. a) If the constant effort support is not provided with travel stop, rotate the turn buckle until the travel indicator rotate to the desired cold setting (Blue dot) marked 'C' on the travel scale.  
b) In case the travel stop is fixed by the manufacturer at the cold position (Blue dot) marked 'C' on the scale, this is the scale, and this is not to be distributed till complete erection is over. The travel stop locks the hanger against upward or downward movement for temporary conditions of under load or over-load, such as may during erection, hydrostatic test or chemicals clean out.  
This travel stop must be removed before the piping system is put into operation but not before the hanger is installed and fully loaded. The travel stop is released by removing the cap screws.
5. After the line is in operation, check hanger for indicated hot setting. If necessary, make adjustment by turning the turn buckle to bring the indicator to the hot position (Red dot) marked H.
6. Since load – scale is marked with operating load & cold load is indicated in purchase order, keeping the load block in position, under normal conditions the setting of load block shall not be distributed.  
If necessary, the load adjustment block can be reset for different operating load through a screw provided. This may facilitate the usage of hanger when (i) The hanger either in a different position than earlier intended (ii) or the operating load calculated earlier is different from. That on the line due to change in last minute piping layout or similar such reasons.

### **Variable hangers or variable spring supports**

A hanger with pre-set condition i.e. locked with pre-set pin or Nut-Bolts system at the cold load or installed load position fastened in the structure at the point where from support the pipe line. Then it is connected with pipe lines through hanger rod, turn buckle, pipe clamps etc. or placed the pipe line directly over the load disc fitted with shoe or any other devices in case of pedestal or base or F – type support.

Present condition of hanger to be kept all along the operation for hydro test of pipe line, or acid cleaning etc. prior to final operation starts, present condition to be removed by releasing the present pin or dismantling the lock nuts. It is very easy to release the present pin or locknut at installed or cold load subjected on it properly. If any reason, the actual installed load/installed load condition. Then the preset condition and external load of pipe line, care should be taken to bring the indicator to the cold position and preset pin be re-installed o lock nuts keep in position.

## **INSPECTION & ACCEPTANCE TEST**

We offer full to our customers to conduct any stage inspection if they wish to do so. Otherwise 10% of the hangers are offered for load travel check, cold load and hot checking unless of the instructions are mentioned in the Purchase Order.

The necessary testing data from our records is submitted to the customers' inspection Engineer.

The springs and hangers are tested as per B S – 1726 PT.2 and are to be inspected and accepted as per the same standard unless otherwise stated.

## **DRAWING OF SUPPORT & OTHER ACCESSORIES**

We would supply the drags for supports or any other accessories with dimensions and technical parameters with in seven days after receiving firm Purchase order from client.

## **GUARANTEE**

All hanger, Assembles and springs are guaranteed for a period of 18 months from the date of commissioning whichever earlier. The guarantee is subjected on design, materials and workmanship only.

## **STORE**

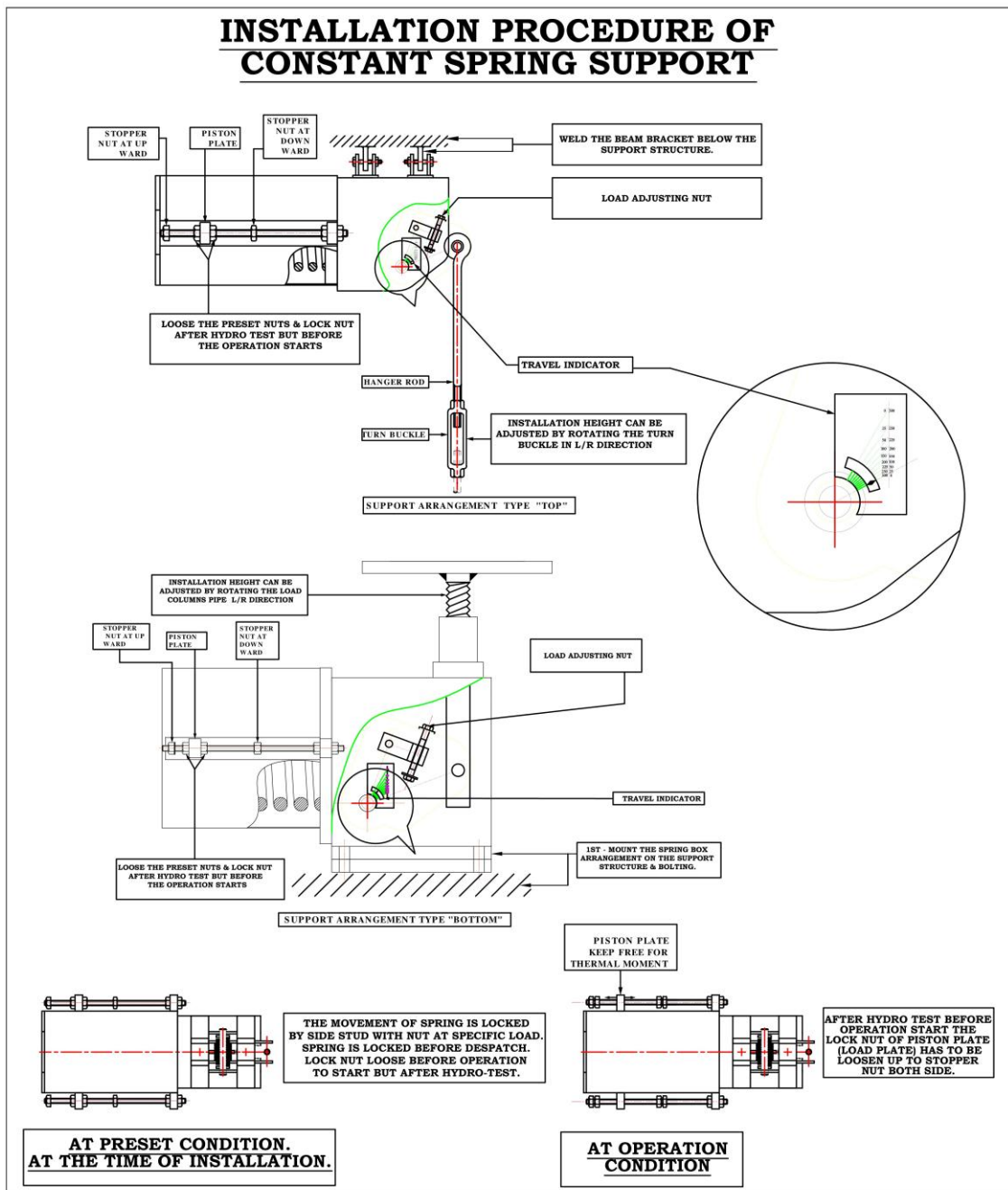
All supplied supports to be stored in proper way so as the supports would get no damage with its name plate, load indicator and threaded portions of bolts/rods prior to installation of the supports.



## Instruction for installation:

### Constant spring Support :

- 1) At the preset condition movement of spring is locked by universal locking arrangement (side stud with nut) at the specific load. Spring is locked before despatch.
- 2) At operation condition after hydro test before operation start, locknut of piston plate has to be loosening up to stopper nut both side.





**PIPE ATTACHMENTS & RIGID HANGERS**

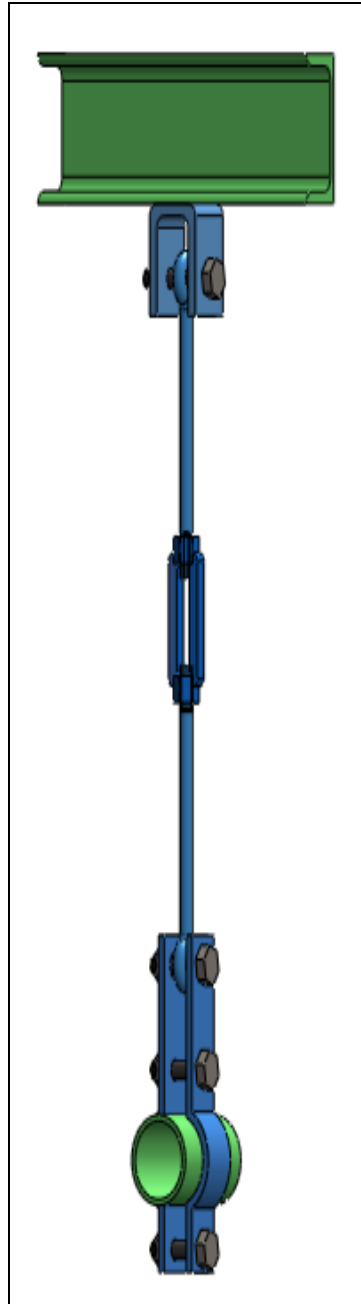


FIGURE – 10C



## **APPLICATION:**

**RIGID HANGERS & PIPE ATTACHMENTS** are generally used at points where the objects to be supported very slightly deflect vertically. These supporting components also are served for many special purposes such as supports of high temperature piping and equipment. The application fields may be classified into the following categories:

### **\* NORMAL TEMPERATURE (20°C) PIPING :**

The piping may be supported by rigid hangers & pipe attachments because the fluid in the piping is at normal temperature, so that there is little or no pipe displacement due to thermal expansion whether or not the plant is in operation.

### **\* LONG HORIZONTAL PIPING AT HIGH TEMPERATURE:**

The combination of these supporting components is suitable for such process steam piping as having long horizontal sections. The piping deflects vertically only very slightly or negligibly, even with a large thermal expansion along the line.

Expansion joints and U bends should be used in the design of this type of piping to compensate for the longitudinal displacement. Also roller supports should be provided to allow the piping to extend freely.

### **\* RESTRAINTS FOR EXTRA HIGH – TEMPERATURE PIPING:-**

High temperature piping may have a point which does not deflect vertically, if it has long risers. This is because the pipe expands upward & downward, leaving the middle section movements less. Rigid hangers & pipe attachments should be provided at such immovable points. This design will serve to support very heavy piping economically.

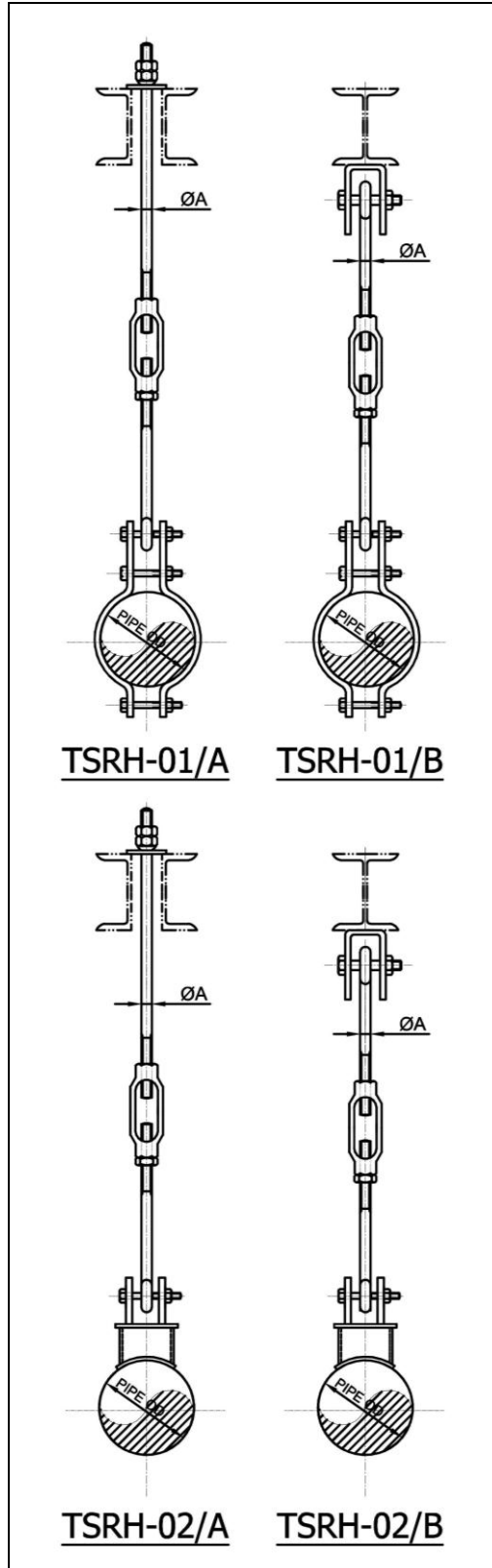
In this usage, a great reaction force may be exerted on the support because of thermal expansion. In determining the size of rigid hanger, therefore, this reaction force must be considered the addition to the gravity load of piping.

### **\* RESTRAINTS AGAINST MOVEMENT OF HIGH TEMPERATURE PIPING:**

Rigid hangers are used to restrain the movement of high temperature piping. In this usage, the devices do not carry the gravity load of piping.

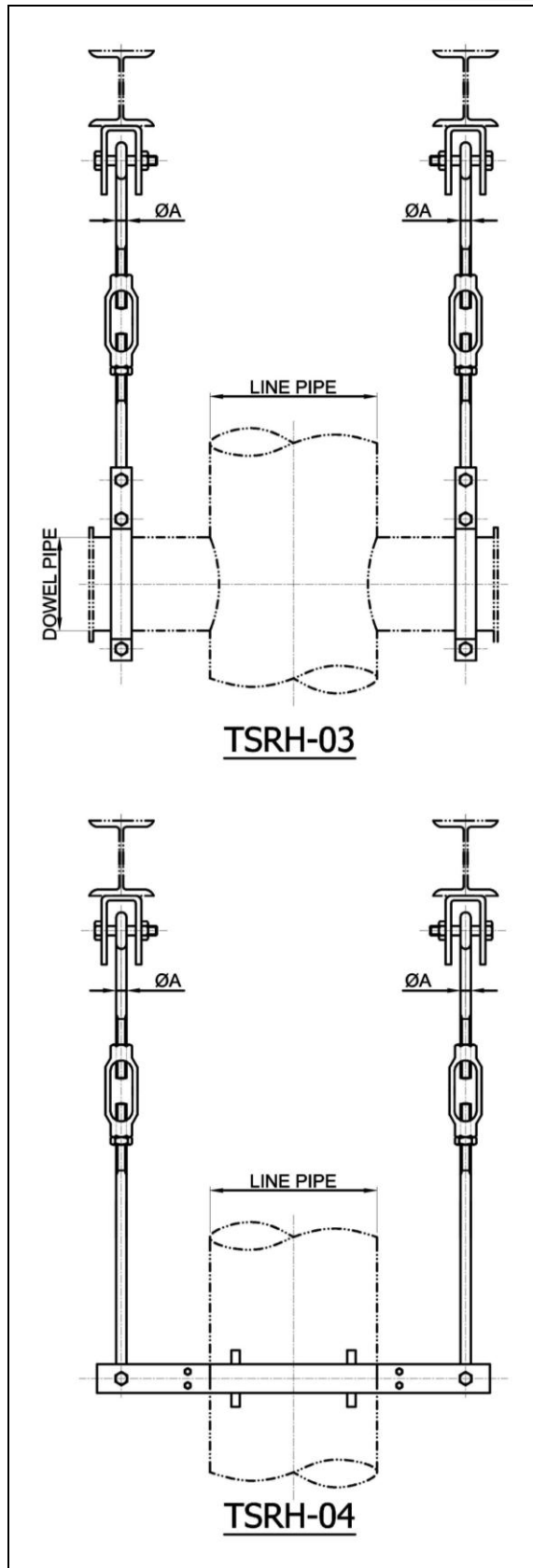
### **\* CONSTRUCTION & ARRANGEMENT OF RIGID HANGER & PIPE ATTACHMENT:**

Generally indoor piping is hung by rigid hangers and pipe attachments whereas out door piping is supported on the racks through rigid support device. The rigid support devices consist of various components according to applications



## TYPICAL ARRANGMENT OF SINGLE RIGID HANGER





## TYPICAL ARRANGMENT OF DOUBLE RIGID HANGER



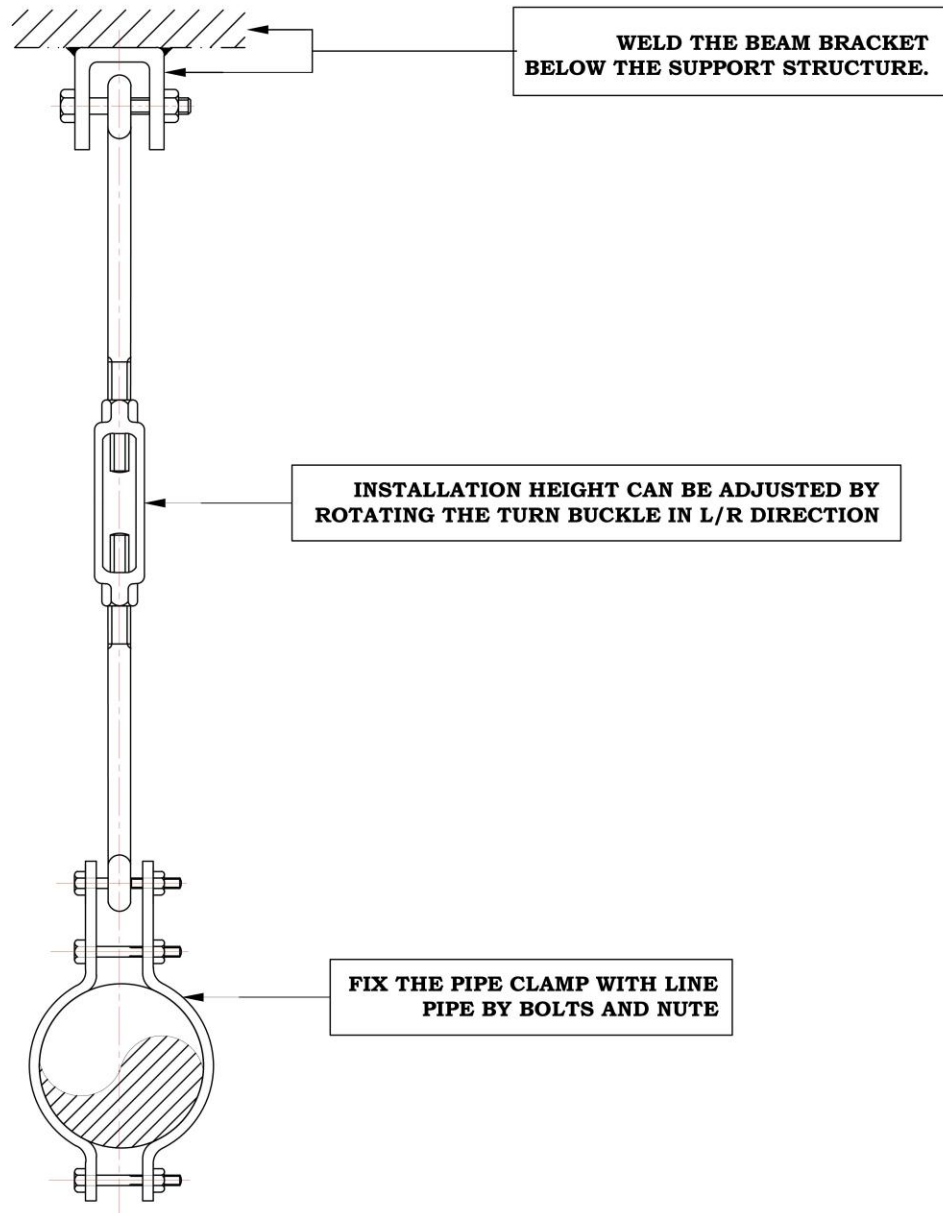


DIMENSIONAL DATA FOR RIGID HANGER		
LOAD GROUP	ALLOWABLE LOAD (KG)	ØA
1	373	M10
2	545	M12
3	1040	M16
4	1631	M20
5	2355	M24
6	3792	M30
7	5556	M36
8	7666	M42
9	10112	M48
10	15189	M56
11	20387	M64
12	26300	M72
13	32926	M80

In above selection table we provide in briefly as per customer requirement we can provide verbosely.



## INSTALLATION PROCEDURE OF RIGID HANGER



**RIGID HANGER**



## **SWAY BRACES**

Sway brace are used for controlling vibration, absorbing shock loadings and guiding or restraining the pipe movement. The unit comprises a pre-loaded spring which can be extended or compressed in order to give increasing resistance in both directions. This increase in resistance overcomes the dynamic forces generated by the equipment thereby damping vibrations, opposing sway and absorbing shock forces.



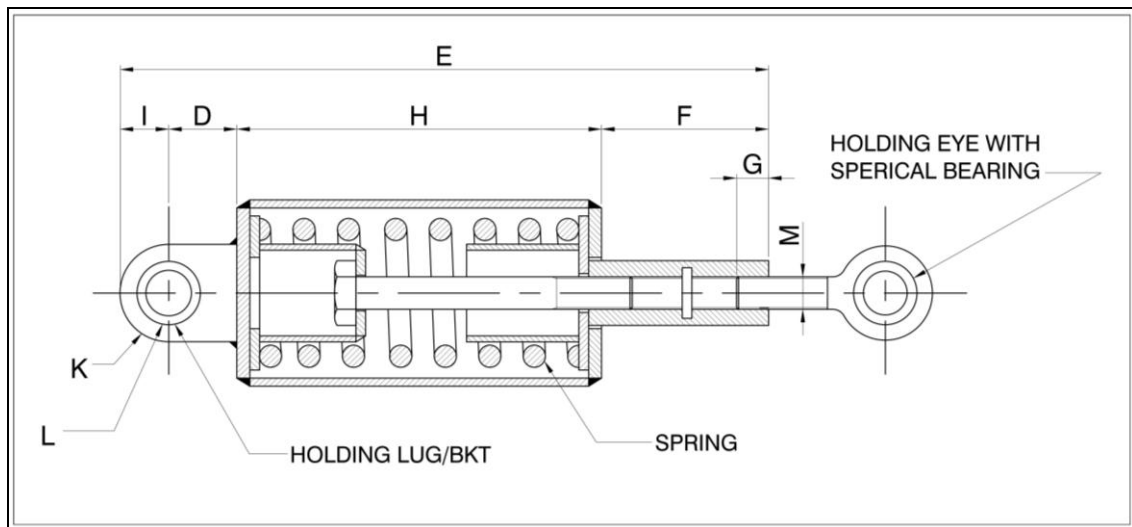


FIGURE – 10D

### **SELECTION TABLE OF SPRING SWAY BRACES**

SIZE	PIPE SIZE	LOAD PRE KG	SPRING RATE KG/mm	MAX FORCE KG	M	HOLE 'L'	PLATE THICK 'K'	D	E	F	G	H	I
1	50-90	23	0.89	90	20	28	12	42	400	100	25	225	30
2	100-200	68	2.68	270	24	28	12	42	415	120	25	225	30
3	225-600	204	8.04	815	24	28	12	42	505	150	25	280	30
4	225-600	400	16.07	1630	30	40	12	58	515	140	40	270	45
5	225-600	614	24.48	2450	36	40	20	58	575	150	50	312	54
6	225-600	820	32.66	3270	36	40	20	58	625	150	50	362	54



## RIGID STRUT SUPPORT

It is a dynamic component i.e. is designed to withstand both tensile and compression load. Strut can be provide in vertical as well as horizontal direction. It consists of stiff clamp, rigid strut, welding clevis. Selection depends on pipe size, load, temperature, insulation, assembly length. As it comes with hinge and clamp, no substantial frictional force comes into play.

Our Rigid Struts come complete with maintenance-free bearings and are available in loads up to 54431Kg. Special design Rigid Struts are available for extreme loads.



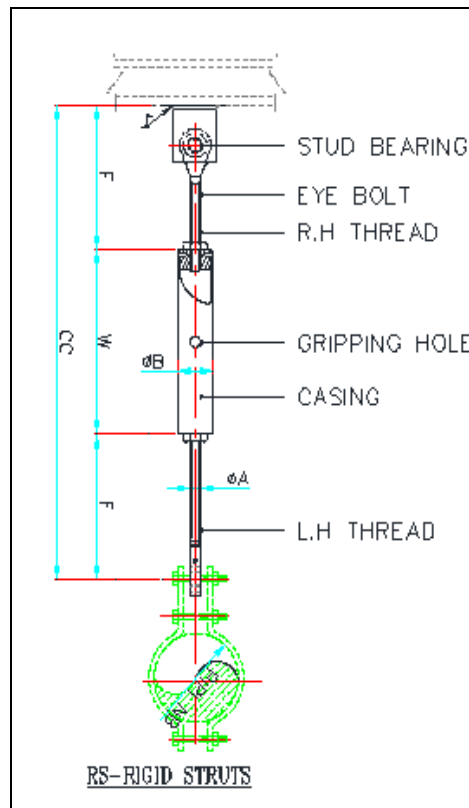


FIGURE – 10E

### SELECTION TABLE OF HIGH STIFFNESS STRUTS

SL.No	TECHNO DESIGNATION	LOAD (Kg)	CC (MM)		W (MM)		ALL DIMENSIONES ARE IN MM				
			MIN	MAX	MIN	MAX	F	R	T	ØA	ØB
1	RS-01	680	490	2700	245	2460	120	35	10	12	26
2	RS-02	2041	490	3000	245	2760	120	35	20	24	48
3	RS-03	3629	530	3000	275	2745	100	38	25	27	60
4	RS-04	5275	530	3000	275	2675	100	38	25	36	73
5	RS-05	7121	600	3000	275	2660	110	50	30	45	88
6	RS-06	9389	660	3000	320	2610	110	50	30	50	101
7	RS-07	12338	710	3000	320	2560	140	70	38	56	114
8	RS-08	15195	750	3000	320	2500	140	75	38	60	127
9	RS-09	30935	870	3000	370	2360	200	88	50	72	141
10	RS-10	54431	1060	3000	425	2360	200	120	60	85	219



## DISC SPRING SUPPORT

These disc springs conform to the DIN 2093 specification and are used when the application requires a large number of deflection cycles or when the required forces or deflections are critical.

A disc spring is a spring washer with a conical shape. This shape gives the spring washer its flexible effect. Disc springs are also called Belleville spring washers and conical spring washers.

The properties of the disc spring make it unique in applications where space is limited - but where high force is wanted. By using disc springs you can achieve high force and very little travel (deflection). Disc springs can also be used as vibration dampers or to provide a damping effect. Potential applications and effects can be adjusted by stacking disc springs.





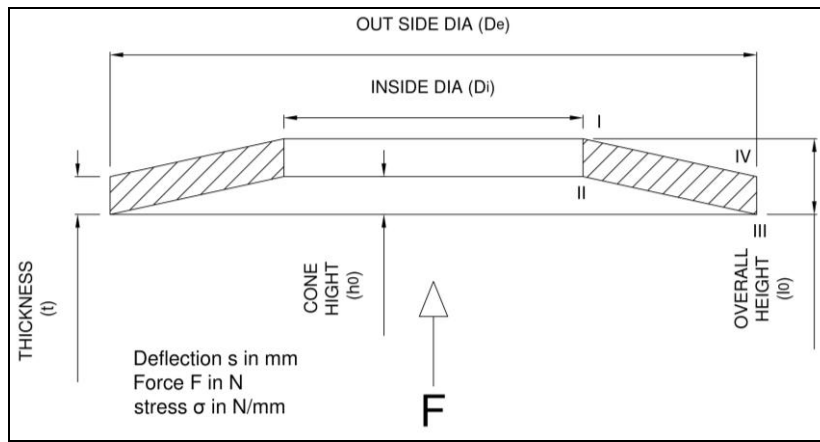


FIGURE – 10F

TECHNO PART NO	Dimensions						Design Force, Deflection and Stresses Based on E = 206 kN/mm²:																						
							Preload, s = 0.15 h					s = 0.25 h					s = 0.5 h					s = 0.75 h					s = h		
	De	Di	t	l <sub>e</sub>	h	h/t	s	l	F	σ <sub>II</sub>	σ <sub>III</sub>	s	l	F	σ <sub>II</sub>	σ <sub>III</sub>	s	l	F	σ <sub>II</sub>	σ <sub>III</sub>	s	l	F	σ <sub>II</sub>	σ <sub>III</sub>	s	F	σ <sub>III</sub>
TI-DSC-01	8	3.2	0.3	0.55	0.25	0.83	0.04	0.51	31	122	263	0.06	0.49	44	197	386	0.13	0.42	81	540	775	0.19	0.36	105	930	1057	0.25	126	-1332
TI-DSC-02	8	3.2	0.4	0.60	0.20	0.50	0.03	0.57	43	212	214	0.05	0.55	69	365	350	0.10	0.50	130	792	666	0.15	0.45	186	1281	949	0.20	238	-1421
TI-DSC-03	8	3.2	0.5	0.70	0.20	0.40	0.03	0.67	79	299	249	0.05	0.65	128	511	408	0.10	0.60	246	1083	782	0.15	0.55	357	1717	1123	0.20	465	-1776
TI-DSC-04	8	4.2	0.2	0.45	0.25	1.25	0.04	0.41	15	-6	269	0.06	0.39	21	6	394	0.13	0.32	34	127	778	0.19	0.26	39	329	1044	0.25	42	-1003
TI-DSC-05	8	4.2	0.3	0.55	0.25	0.83	0.04	0.51	35	107	328	0.06	0.49	50	175	482	0.13	0.42	92	493	971	0.19	0.36	119	865	1325	0.25	142	-1505
TI-DSC-06	8	4.2	0.4	0.60	0.20	0.50	0.03	0.57	48	198	268	0.05	0.55	78	343	439	0.10	0.50	147	749	837	0.15	0.45	210	1218	1194	0.20	269	-1605
TI-DSC-07	10	3.2	0.3	0.65	0.35	1.17	0.05	0.60	32	36	223	0.09	0.56	52	95	388	0.18	0.47	83	324	714	0.26	0.39	98	640	951	0.35	108	-1147
TI-DSC-08	10	3.2	0.5	0.85	0.35	0.70	0.05	0.80	99	240	289	0.09	0.76	169	461	506	0.18	0.67	303	1057	948	0.26	0.59	401	1700	1290	0.35	500	-1911
TI-DSC-09	10	4.2	0.4	0.70	0.30	0.75	0.05	0.65	55	151	275	0.08	0.62	84	260	430	0.15	0.55	140	570	760	0.23	0.47	192	1019	1084	0.30	232	-1384
TI-DSC-10	10	4.2	0.5	0.75	0.25	0.50	0.04	0.71	72	222	235	0.06	0.69	106	343	348	0.13	0.62	214	815	713	0.19	0.56	297	1280	992	0.25	377	-1441
TI-DSC-11	10	4.2	0.6	0.85	0.25	0.42	0.04	0.81	118	296	266	0.06	0.79	175	453	394	0.13	0.72	360	1053	813	0.19	0.66	508	1629	1138	0.25	652	-1730
TI-DSC-12	10	5.2	0.25	0.55	0.30	1.20	0.05	0.50	22	4	260	0.08	0.47	32	26	403	0.15	0.40	48	133	702	0.23	0.32	58	352	980	0.30	63	-957
TI-DSC-13	10	5.2	0.4	0.70	0.30	0.75	0.05	0.65	61	139	330	0.08	0.62	93	242	516	0.15	0.55	155	539	912	0.23	0.47	213	974	1303	0.30	257	-1531
TI-DSC-14	10	5.2	0.5	0.75	0.25	0.50	0.04	0.71	80	212	283	0.06	0.69	117	328	418	0.13	0.62	236	784	858	0.19	0.56	329	1238	1195	0.25	418	-1595
TI-DSC-15	12	4.2	0.4	0.80	0.40	1.00	0.06	0.74	55	76	238	0.10	0.70	85	149	385	0.20	0.60	141	411	714	0.30	0.50	178	786	988	0.40	206	-1228
TI-DSC-16	12	4.2	0.5	0.90	0.40	0.80	0.06	0.84	91	158	266	0.10	0.80	143	285	432	0.20	0.70	249	683	809	0.30	0.60	331	1193	1130	0.40	402	-1535
TI-DSC-17	12	5.2	0.5	0.90	0.40	0.80	0.06	0.84	96	137	303	0.10	0.80	150	251	493	0.20	0.70	263	611	923	0.30	0.60	350	1080	1291	0.40	424	-1619
TI-DSC-18	12	5.2	0.6	0.95	0.35	0.58	0.05	0.90	116	202	266	0.09	0.86	201	384	467	0.18	0.77	370	856	884	0.26	0.69	502	1350	1213	0.35	641	-1700
TI-DSC-19	12	6.2	0.5	0.85	0.35	0.70	0.05	0.80	80	132	278	0.09	0.76	137	257	487	0.18	0.67	245	604	917	0.26	0.59	324	988	1249	0.35	404	-1544
TI-DSC-20	12	6.2	0.6	0.95	0.35	0.58	0.05	0.90	127	194	310	0.09	0.86	219	369	545	0.18	0.77	403	829	1033	0.26	0.69	547	1313	1417	0.35	699	-1853
TI-DSC-21	12.5	6.2	0.35	0.80	0.45	1.29	0.07	0.73	57	-14	325	0.11	0.69	82	1	496	0.23	0.57	131	142	949	0.34	0.46	152	401	1284	0.45	160	-1250
TI-DSC-22	12.5	6.2	0.5	0.85	0.35	0.70	0.05	0.80	72	122	246	0.09	0.76	123	238	431	0.18	0.67	220	559	811	0.26	0.59	291	913	1105	0.35	363	-1388
TI-DSC-23	12.5	6.2	0.7	1.00	0.30	0.43	0.05	0.95	162	263	287	0.08	0.92	255	432	452	0.15	0.85	457	864	814	0.23	0.77	673	1419	1189	0.30	855	-1666
TI-DSC-24	14	7.2	0.35	0.80	0.45	1.29	0.07	0.73	46	-12	268	0.11	0.69	67	-2	409	0.23	0.57	107	109	784	0.34	0.46	123	315	1061	0.45	131	-1018
TI-DSC-25	14	7.2	0.5	0.90	0.40	0.80	0.06	0.84	76	94	258	0.10	0.80	120	173	419	0.20	0.70	210	428	787	0.30	0.60	279	764	1101	0.40	338	-1293
TI-DSC-26	14	7.2	0.8	1.10	0.30	0.38	0.05	1.05	192	255	261	0.08	1.02	302	418	411	0.15	0.95	547	826	743	0.23	0.87	813	1341	1092	0.30	1040	-1551
TI-DSC-27	15	5.2	0.4	0.95	0.55	1.38	0.08	0.87	66	-15	242	0.14	0.81	103	4	408	0.28	0.67	156	149	746	0.41	0.54	175	411	998	0.55	181	-1079
TI-DSC-28	15	5.2	0.7	1.25	0.55	0.79	0.08	1.17	210	194	314	0.14	1.11	346	370	535	0.28	0.97	605	882	1000	0.41	0.84	793	1483	1370	0.55	969	-1888
TI-DSC-29	15	6.2	0.5	1.00	0.50	1.00	0.08	0.92	95	70	278	0.13	0.87	143	137	439	0.25	0.75	229	368	787	0.38	0.62	291	732	1100	0.50	334	-1275
TI-DSC-30	15	6.2	0.6	1.05	0.45	0.75	0.07	0.98	116	141	255	0.11	0.94	174	236	392	0.23	0.82	320	591	786	0.34	0.71	426	1005	1060	0.45	519	-1377
TI-DSC-31	15	6.2	0.7	1.10	0.40	0.57	0.06	1.04	138	189	228	0.10	1.00	222	328	373	0.20	0.90	411	727	707	0.30	0.80	578	1195	1002	0.40	733	-1428
TI-DSC-32	15	8.2	0.7	1.10	0.40	0.57	0.06	1.04	159	178	293	0.10	1.00	256	311	479	0.20	0.90	474	694	909	0.30	0.80	666	1150	1291	0.40	844	-1646
TI-DSC-33	15	8.2	0.8	1.20	0.40	0.50	0.06	1.14	226	226	320	0.10	1.10	367	391	523	0.20	1.00	689	856	997	0.30	0.90	982	1392	1423	0.40	1261	-1881
TI-DSC-34	16	8.2	0.4	0.90	0.50	1.25	0.08	0.82	58	-5	262	0.13	0.77	86	12	413	0.25	0.65	131	117	735	0.38	0.52	155	332	1018	0.50	165	-988
TI-DSC-35	16	8.2	0.6	1.05	0.45	0.75	0.07	0.98	112	114	267	0.11	0.94	169	192	411	0.23	0.82	309	488	805	0.34	0.71	412	838	1115	0.45	503	-1333
TI-DSC-36	16	8.2	0.9	1.25	0.35	0.39	0.05	1.20	211	215	227	0.09	1.16	372	398	401	0.18	1.07	716	846	771	0.26	0.99	1004	1287	1071	0.35	1319	-1555
TI-DSC-37	18	6.2	0.4	1.00	0.60	1.50	0.09	0.91	57	-32	198	0.15	0.85	85	-30	319	0.30	0.70	126	52	583	0.45	0.55	139	247	791	0.60	137	-816
TI-DSC-38	18	6.2	0.5	1.10	0.60	1.20	0.09	1.01	85	23	217	0.15	0.95	130	61	350	0.30	0.80	206	234	646	0.45	0.65	245	520	885	0.60	267	-1021
TI-DSC-39	18	6.2	0.6	1.20	0.60	1.00	0.09	1.11	124	78	236	0.15	1.05	191	152	382	0.30	0.90	317	416	708	0.45	0.75	400	794	980	0.60	462	-1225
TI-DSC-40	18	6.2	0.7	1.40	0.70	1.00	0.11	1.29	239	112	335	0.18	1.22	362	215	533	0.35	1.05	588	567	964	0.53	0.87	745	1097	1343	0.70	855	-1667
TI-DSC-41	18	6.2	0.8	1.50	0.70	0.88	0.11	1.39	320	179	358	0.18	1.32	491	324	571	0.35	1.15	822	779	1037	0.53	0.97	1078	1419	1454	0.70	1277	-1905
TI-DSC-42	18	8.2	0.7	1.25	0.55	0.79	0.08	1.17	157	114	259	0.14	1.11	259	220	442	0.28	0.97	452	536	827	0.41	0.84	594	914	1135	0.55	725	-1412
TI-DSC-43	18	8.2	0.8	1.30	0.63	0.68	0.08	1.22	205	178	268	0.13	1.17	320	306	427	0.25	1.05	564	660	777	0.38	0.92	791	1124	1110	0.50	984	-1468
TI-DSC-44	18	8.2	1	1.50	0.50	0.50	0.08	1.42	367	268	309	0.13	1.37	580	451	493	0.25	1.25	1051	939	904	0.38	1.12	1514	1547	1303	0.50	1921	-1834
TI-DSC-45																													



TECHNO PART NO	Dimensions							Design Force, Deflection and Stresses Based on E = 206 kN/mm <sup>2</sup>																					
								Preload, s = 0.15 h					s = 0.25 h					s = 0.5 h					s = 0.75 h					s = h	
	D <sub>e</sub>	D <sub>i</sub>	t	$\frac{l}{s}$	h	h/t	s	$\frac{l}{i}$	F	$\sigma_{II}$	$\sigma_{III}$	s	$\frac{l}{i}$	F	$\sigma_{II}$	$\sigma_{III}$	s	$\frac{l}{i}$	F	$\sigma_{II}$	$\sigma_{III}$	s	$\frac{l}{i}$	F	$\sigma_{II}$	$\sigma_{III}$	s	F	$\sigma_{III}$
TI-DSC-51	20	8.2	0.9	1.50	0.60	0.67	0.09	1.41	265	177	262	0.15	1.35	423	313	427	0.30	1.20	765	715	804	0.45	1.05	1051	1205	1133	0.60	1311	-1545
TI-DSC-52	20	10.2	0.5	1.15	0.65	1.30	0.10	1.05	96	-15	268	0.16	0.99	140	-5	416	0.33	0.82	221	102	786	0.49	0.66	254	309	1067	0.65	268	-1024
TI-DSC-53	20	10.2	0.8	1.35	0.55	0.69	0.08	1.27	186	125	251	0.14	1.21	309	235	428	0.28	1.07	555	548	806	0.41	0.94	745	909	1112	0.55	929	-1386
TI-DSC-54	20	10.2	0.9	1.45	0.55	0.61	0.08	1.37	249	161	289	0.14	1.31	419	298	460	0.28	1.17	765	674	870	0.41	1.04	1045	1094	1206	0.55	1323	-1560
TI-DSC-55	20	10.2	1	1.55	0.55	0.55	0.08	1.47	327	197	287	0.14	1.41	553	361	492	0.28	1.27	1026	800	934	0.41	1.14	1418	1278	1300	0.55	1815	-1733
TI-DSC-56	20	10.2	1.1	1.55	0.45	0.41	0.07	1.48	347	230	251	0.11	1.44	537	370	388	0.23	1.32	1072	830	776	0.34	1.21	1531	1301	1100	0.45	1976	-1560
TI-DSC-57	22.5	11.2	0.6	1.40	0.80	1.33	0.12	1.28	160	-23	302	0.20	1.20	240	-14	488	0.40	1.00	370	98	897	0.60	0.80	425	336	1227	0.80	444	-1178
TI-DSC-58	22.5	11.2	0.8	1.45	0.65	0.81	0.10	1.35	199	96	260	0.16	1.29	302	168	406	0.33	1.12	539	434	782	0.49	0.96	710	768	1083	0.65	855	-1276
TI-DSC-59	22.5	11.2	1.25	1.75	0.50	0.40	0.08	1.67	451	239	249	0.13	1.62	720	399	398	0.25	1.50	1330	815	737	0.38	1.37	1952	1316	1071	0.50	2509	-1534
TI-DSC-60	23	8.2	0.7	1.50	0.80	1.14	0.12	1.38	183	37	245	0.20	1.30	279	87	397	0.40	1.10	448	295	733	0.60	0.90	544	626	1007	0.80	602	-1173
TI-DSC-61	23	8.2	0.8	1.55	0.75	0.94	0.11	1.44	209	90	232	0.19	1.36	336	178	389	0.38	1.17	565	466	722	0.56	0.99	717	840	988	0.75	842	-1257
TI-DSC-62	23	8.2	0.9	1.70	0.80	0.89	0.12	1.58	311	125	277	0.20	1.50	486	233	449	0.40	1.30	829	589	837	0.60	1.10	1078	1066	1164	0.80	1279	-1508
TI-DSC-63	23	10.2	0.9	1.65	0.75	0.83	0.11	1.54	289	113	282	0.19	1.46	468	217	475	0.38	1.27	810	541	887	0.56	1.09	1055	947	1221	0.75	1273	-1500
TI-DSC-64	23	10.2	1	1.70	0.70	0.70	0.11	1.59	353	167	290	0.18	1.52	552	291	463	0.35	1.35	964	655	849	0.53	1.17	1325	1133	1204	0.70	1629	-1556
TI-DSC-65	23	12.2	1.25	1.85	0.60	0.48	0.09	1.76	532	231	304	0.15	1.70	863	399	497	0.30	1.55	1630	868	949	0.45	1.40	2331	1404	1356	0.60	3000	-1834
TI-DSC-66	23	12.2	1.5	2.10	0.60	0.40	0.09	2.01	875	308	344	0.15	1.95	1432	527	565	0.30	1.80	2748	1124	1085	0.45	1.65	3986	1788	1560	0.60	5184	-2200
TI-DSC-67	25	12.2	0.7	1.60	0.90	1.29	0.14	1.46	226	-13	320	0.23	1.37	337	5	509	0.45	1.15	515	136	919	0.68	0.92	601	403	1265	0.90	635	-1238
TI-DSC-68	25	12.2	0.9	1.60	0.70	0.78	0.11	1.49	243	105	250	0.18	1.42	376	187	400	0.35	1.25	644	440	730	0.53	1.07	868	787	1031	0.70	1050	-1238
TI-DSC-69	25	12.2	1.5	2.05	0.55	0.37	0.08	1.97	615	242	232	0.14	1.91	1058	433	400	0.28	1.77	2041	916	769	0.41	1.64	2910	1410	1085	0.55	3821	-1622
TI-DSC-70	28	10.2	0.8	1.75	0.95	1.19	0.14	1.61	225	23	228	0.24	1.51	351	63	379	0.48	1.27	556	244	698	0.71	1.04	661	520	947	0.95	723	-1078
TI-DSC-71	28	10.2	1	2.00	1.00	1.00	0.15	1.85	398	84	278	0.25	1.75	615	165	451	0.50	1.50	1022	459	837	0.75	1.25	1289	880	1158	1.00	1486	-1419
TI-DSC-72	28	10.2	1.25	2.25	1.00	0.80	0.15	2.10	654	176	312	0.25	2.00	1030	319	507	0.50	1.75	1799	765	949	0.75	1.50	2394	1340	1326	1.00	2902	-1774
TI-DSC-73	28	10.2	1.5	2.20	0.70	0.47	0.11	2.09	645	259	221	0.18	2.02	1030	437	366	0.35	1.85	1899	911	660	0.53	1.67	2745	1478	950	0.70	3511	-1490
TI-DSC-74	28	12.2	1	1.95	0.95	0.95	0.14	1.81	374	78	283	0.24	1.71	595	158	472	0.48	1.47	999	432	878	0.71	1.24	1266	802	1204	0.95	1482	-1415
TI-DSC-75	28	12.2	1.25	2.10	0.85	0.68	0.13	1.97	539	173	282	0.21	1.89	835	296	446	0.43	1.67	1534	701	858	0.64	1.46	2089	1178	1200	0.85	2590	-1583
TI-DSC-76	28	12.2	1.5	2.25	0.75	0.50	0.11	2.14	694	230	255	0.19	2.06	1163	412	432	0.38	1.87	2185	897	822	0.56	1.69	3065	1423	1153	0.75	3949	-1676
TI-DSC-77	28	14.2	0.8	1.80	1.00	1.25	0.15	1.65	287	-7	319	0.25	1.55	435	13	515	0.50	1.30	681	154	950	0.75	1.05	801	422	1304	1.00	859	-1282
TI-DSC-78	28	14.2	1	1.80	0.80	0.80	0.12	1.68	303	94	254	0.20	1.60	476	174	414	0.40	1.40	832	429	776	0.60	1.20	1107	765	1086	0.80	1342	-1282
TI-DSC-79	28	14.2	1.25	2.10	0.85	0.68	0.13	1.97	580	165	321	0.21	1.89	898	283	508	0.43	1.67	1649	677	978	0.64	1.46	2246	1144	1369	0.85	2785	-1702
TI-DSC-80	28	14.2	1.5	2.15	0.65	0.43	0.10	2.05	649	222	252	0.16	1.99	1018	365	397	0.33	1.82	1997	809	783	0.49	1.66	2854	1281	1111	0.65	3680	-1562
TI-DSC-81	31.5	16.3	0.8	1.85	1.05	1.31	0.16	1.69	258	-19	282	0.26	1.59	382	-9	444	0.53	1.32	597	97	831	0.79	1.06	687	310	1132	1.05	722	-1077
TI-DSC-82	31.5	16.3	1.25	2.15	0.90	0.72	0.14	2.01	515	130	285	0.23	1.92	806	230	458	0.45	1.70	1409	530	844	0.68	1.47	1923	927	1194	0.90	2359	-1442
TI-DSC-83	31.5	16.3	1.5	2.40	0.60	0.40	0.14	2.26	812	193	318	0.23	2.17	1286	334	512	0.45	1.95	2314	734	950	0.68	1.72	3249	1235	1354	0.90	4077	-1730
TI-DSC-84	31.5	16.3	1.75	2.45	0.70	0.40	0.11	2.34	890	235	255	0.18	2.27	1429	394	410	0.35	2.10	2669	814	766	0.53	1.92	3905	1310	1111	0.70	5036	-1570
TI-DSC-85	31.5	16.3	2	2.75	0.75	0.38	0.11	2.64	1313	276	286	0.19	2.56	2227	488	486	0.38	2.37	4292	1035	935	0.56	2.19	6148	1607	1326	0.75	8054	-1923
TI-DSC-86	34	12.3	1	2.20	1.20	1.20	0.18	2.02	386	22	249	0.30	1.90	587	63	403	0.60	1.60	930	250	742	0.90	1.30	1110	563	1018	1.20	1208	-1153
TI-DSC-87	34	12.3	1.25	2.45	1.20	0.96	0.18	2.27	610	98	276	0.30	2.15	946	188	448	0.60	1.85	1587	500	833	0.90	1.55	2024	938	1154	1.20	2359	-1442
TI-DSC-88	34	12.3	1.5	2.70	1.20	0.80	0.18	2.52	919	173	304	0.30	2.40	1447	313	493	0.60	2.10	2527	750	923	0.90	1.80	3363	1313	1290	1.20	4076	-1730
TI-DSC-89	34	14.3	1.25	2.40	1.15	0.92	0.17	2.23	579	91	280	0.29	2.11	919	179	464	0.58	1.82	1555	472	865	0.86	1.54	1990	864	1190	1.15	2347	-1435
TI-DSC-90	34	14.3	1.5	2.55	1.05	0.70	0.16	2.39	781	170	279	0.26	2.29	1213	294	443	0.53	2.02	2209	696	848	0.79	1.76	2997	1177	1186	1.05	3704	-1572
TI-DSC-91	34	16.3	1.5	2.55	1.05	0.70	0.16	2.39	824	161	309	0.26	2.29	1280	280	491	0.53	2.02	2330	668	941	0.79	1.76	3163	1136	1316	1.05	3908	-1658
TI-DSC-92	34	16.3	2	2.85	0.85	0.43	0.13	2.72	1309	265	279	0.21	2.64	2073	439	444	0.43	2.42	4046	964	870	0.64	2.21	5803	1527	1238	0.85	7498	-1790
TI-DSC-93	35.5	18.3	0.9	2.05	1.15	1.28	0.17	1.88	299	-12	261	0.29	1.76	461	2	430	0.58	1.47	716	111	792	0.86	1.19	831	318	1076	1.15	884	-1042
TI-DSC-94	35.5	18.3	1.25	2.25	1.00	0.80	0.15	2.10	464	91	251	0.25	2.00	731	168	409	0.50	1.75	1277	416	766	0.75	1.50	1699	743	1073	1.00	2059	-1258
TI-DSC-95	35.5	18.3	2	2.80	0.80	0.40	0.12	2.68	1139	230	249</																		





TECHNO PART NO	Dimensions						Design Force, Deflection and Stresses Based on E = 206 kN/mm <sup>2</sup>																						
							Preload, s = 0.15 h					s = 0.25 h					s = 0.5 h					s = 0.75 h					s = h		
	D <sub>e</sub>	D <sub>i</sub>	t	l <sub>s</sub>	h	h/t	s	l <sub>s</sub>	F	σ <sub>II</sub>	σ <sub>III</sub>	s	l <sub>s</sub>	F	σ <sub>II</sub>	σ <sub>III</sub>	s	l <sub>s</sub>	F	σ <sub>II</sub>	σ <sub>III</sub>	s	l <sub>s</sub>	F	σ <sub>II</sub>	σ <sub>III</sub>	s	F	σ <sub>III</sub>
TI-DSC-101	40	18.3	2	3.15	1.15	0.58	0.17	2.98	1337	206	281	0.29	2.86	2199	368	469	0.58	2.57	4060	819	890	0.86	2.29	5642	1333	1249	1.15	7171	-1712
TI-DSC-102	40	20.4	1	2.30	1.30	1.30	0.20	2.10	383	-15	288	0.33	1.97	572	-3	428	0.65	1.65	876	98	776	0.98	1.32	1018	309	1067	1.30	1072	-1024
TI-DSC-103	40	20.4	1.5	2.65	1.15	0.77	0.17	2.48	693	106	261	0.29	2.36	1117	198	435	0.58	2.07	1966	480	816	0.86	1.79	2616	831	1134	1.15	3201	-1359
TI-DSC-104	40	20.4	2	3.10	1.10	0.55	0.17	2.93	1386	210	305	0.28	2.82	2211	361	492	0.55	2.55	4041	783	920	0.83	2.27	5730	1298	1314	1.10	7258	-1733
TI-DSC-105	40	20.4	2.25	3.15	0.90	0.40	0.14	3.01	1479	238	255	0.23	2.92	2385	401	412	0.45	2.70	4481	835	774	0.68	2.47	6544	1339	1120	0.90	8456	-1595
TI-DSC-106	40	20.4	2.5	3.45	0.95	0.38	0.14	3.31	2010	270	279	0.24	3.21	3385	475	471	0.48	2.97	6516	1008	905	0.71	2.74	9359	1573	1286	0.95	12243	-1871
TI-DSC-107	45	22.4	1.25	2.85	1.60	1.28	0.24	2.61	689	-13	307	0.40	2.45	1041	4	497	0.80	2.05	1620	134	914	1.20	1.65	1891	389	1253	1.60	2007	-1227
TI-DSC-108	45	22.4	1.75	3.05	1.30	0.74	0.20	2.85	985	122	273	0.33	2.72	1544	218	440	0.65	2.40	2701	512	814	0.98	2.07	3659	898	1148	1.30	4475	-1396
TI-DSC-109	45	22.4	2.5	3.50	1.00	0.40	0.15	3.35	1695	224	234	0.25	3.25	2773	383	384	0.50	3.00	5320	815	737	0.75	2.75	7716	1296	1059	1.00	10037	-1534
TI-DSC-110	50	18.4	1.5	3.15	1.65	1.10	0.25	2.90	768	43	231	0.41	2.74	1161	92	368	0.83	2.32	1897	297	687	1.24	1.91	2321	607	943	1.65	2600	-1104
TI-DSC-111	50	18.4	2	3.65	1.65	0.83	0.25	3.40	1432	139	266	0.41	3.24	2218	249	426	0.83	2.82	3885	615	804	1.24	2.41	5121	1082	1118	1.65	6163	-1471
TI-DSC-112	50	18.4	2.5	4.15	1.65	0.66	0.25	3.90	2447	235	301	0.41	3.74	3849	406	483	0.83	3.32	7037	933	921	1.24	2.91	9658	1557	1293	1.65	12038	-1839
TI-DSC-113	50	20.4	2	3.50	1.50	0.75	0.23	3.27	1268	139	249	0.38	3.12	1989	248	402	0.75	2.75	3478	578	745	1.13	2.37	4702	1006	1048	1.50	5745	-1371
TI-DSC-114	50	20.4	2.5	3.85	1.35	0.54	0.20	3.65	1840	212	238	0.34	3.51	3028	376	396	0.68	3.17	5637	825	751	1.01	2.84	7902	1330	1058	1.35	10098	-1543
TI-DSC-115	50	22.4	2	3.60	1.60	0.80	0.24	3.36	1427	125	286	0.40	3.20	2247	228	466	0.80	2.80	3924	556	872	1.20	2.40	5222	985	1220	1.60	6329	-1511
TI-DSC-116	50	22.4	2.5	3.90	1.40	0.56	0.21	3.69	2023	209	270	0.35	3.55	3261	364	442	0.70	3.20	6044	806	838	1.05	2.85	8510	1324	1190	1.40	10817	-1653
TI-DSC-117	50	25.4	1.25	2.85	1.60	1.28	0.24	2.61	565	-11	254	0.40	2.45	854	2	410	0.80	2.05	1328	106	755	1.20	1.65	1550	312	1035	1.60	1646	-1006
TI-DSC-118	50	25.4	1.5	3.10	1.60	1.07	0.24	2.86	808	32	276	0.40	2.70	1242	74	447	0.80	2.30	2028	250	828	1.20	1.90	2512	528	1145	1.60	2844	-1207
TI-DSC-119	50	25.4	2	3.40	1.40	0.70	0.21	3.19	1226	128	264	0.35	3.05	1949	230	430	0.70	2.70	3491	537	810	1.05	2.35	4762	923	1140	1.40	5888	-1408
TI-DSC-120	50	25.4	2.25	3.75	1.50	0.67	0.23	3.52	1859	169	318	0.38	3.37	2840	297	515	0.75	3.00	5249	675	959	1.13	2.62	7241	1154	1358	1.50	8997	-1697
TI-DSC-121	50	25.4	2.5	3.90	1.40	0.56	0.21	3.69	2154	204	302	0.35	3.55	3473	355	494	0.70	3.20	6437	789	938	1.05	2.85	9063	1301	1332	1.40	11519	-1760
TI-DSC-122	50	25.4	3	4.10	1.10	0.37	0.17	3.93	2671	257	256	0.28	3.82	4329	432	416	0.55	3.55	8214	897	787	0.83	3.27	12044	1428	1141	1.10	15640	-1659
TI-DSC-123	56	28.5	1.5	3.45	1.95	1.30	0.29	3.16	959	-17	297	0.49	2.96	1464	-4	485	0.98	2.47	2265	114	893	1.46	1.99	2621	348	1217	1.95	2766	-1174
TI-DSC-124	56	28.5	2	3.60	1.60	0.80	0.24	3.36	1213	94	255	0.40	3.20	1910	173	415	0.80	2.80	3335	428	778	1.20	2.40	4438	765	1090	1.60	5379	-1284
TI-DSC-125	56	28.5	3	4.30	1.30	0.43	0.20	4.10	2602	222	253	0.33	3.97	4203	377	410	0.65	3.65	7895	795	775	0.98	3.32	11441	1281	1115	1.30	14752	-1565
TI-DSC-126	60	20.5	2	4.20	2.20	1.10	0.33	3.87	1650	58	272	0.55	3.65	2528	125	440	1.10	3.10	4097	386	812	1.65	2.55	5026	784	1119	2.20	5636	-1346
TI-DSC-127	60	20.5	2.5	4.70	2.20	0.88	0.33	4.37	2657	149	303	0.55	4.15	4151	276	491	1.10	3.60	7102	688	916	1.65	3.05	9255	1237	1273	2.20	11008	-1682
TI-DSC-128	60	25.5	2.5	4.40	1.90	0.76	0.29	4.11	2216	146	282	0.48	3.92	3478	262	456	0.95	3.45	6081	616	847	1.43	2.97	8195	1078	1190	1.90	9997	-1527
TI-DSC-129	60	25.5	3	4.65	1.65	0.55	0.25	4.40	2812	125	256	0.41	4.24	4470	367	412	0.83	3.82	8396	818	791	1.24	3.41	11803	1334	1119	1.65	15002	-1592
TI-DSC-130	60	30.5	2.5	4.50	2.00	0.80	0.30	4.20	2578	128	347	0.50	4.00	4059	236	564	1.00	3.50	7088	583	1058	1.50	3.00	9432	1041	1481	2.00	11433	-1747
TI-DSC-131	60	30.5	3	4.70	1.70	0.57	0.26	4.44	3213	208	313	0.43	4.27	5137	361	508	0.85	3.85	9407	793	953	1.28	3.42	13269	1316	1358	1.70	16792	-1782
TI-DSC-132	60	30.5	3.5	5.00	1.50	0.43	0.23	4.77	4126	261	294	0.38	4.62	6874	443	478	0.75	4.25	12574	937	905	1.13	3.87	18225	1507	1302	1.50	23528	-1834
TI-DSC-133	63	31	1.8	4.15	2.35	1.31	0.35	3.80	1557	-19	330	0.59	3.56	2371	-4	538	1.18	2.97	3665	132	990	1.76	2.39	4237	400	1349	2.35	4463	-1315
TI-DSC-134	63	31	2.5	4.25	1.75	0.70	0.26	3.99	1834	126	250	0.44	3.81	2957	229	412	0.88	3.37	5294	535	777	1.31	2.94	7179	909	1086	1.75	8904	-1360
TI-DSC-135	63	31	3	4.70	1.70	0.57	0.26	4.44	2860	190	275	0.43	4.27	4573	329	446	0.85	3.85	8373	721	838	1.28	3.42	11810	1196	1193	1.70	14946	-1586
TI-DSC-136	63	31	3.5	4.90	1.40	0.40	0.21	4.69	3301	224	231	0.35	4.55	5399	383	380	0.70	4.20	10359	815	729	1.05	3.85	15025	1296	1047	1.40	19545	-1524
TI-DSC-137	70	30.5	2.5	4.90	2.40	0.96	0.36	4.54	2421	78	293	0.60	4.30	3755	153	475	1.20	3.70	6297	422	883	1.80	3.10	8031	806	1225	2.40	9360	-1430
TI-DSC-138	70	30.5	3	5.10	2.10	0.70	0.32	4.78	2984	158	270	0.53	4.57	4715	279	436	1.05	4.05	8376	640	814	1.58	3.52	11453	1097	1148	2.10	14152	-1502
TI-DSC-139	70	35.5	3	5.10	2.10	0.70	0.32	4.78	3209	150	307	0.53	4.57	5070	267	497	1.05	4.05	9007	617	928	1.58	3.52	12316	1085	1310	2.10	15218	-1615
TI-DSC-140	70	35.5	4	5.80	1.80	0.45	0.27	5.53	5376	250	294	0.45	5.35	8757	430	482	0.90	4.90	16634	925	921	1.35	4.45	23923	1486	1319	1.80	30919	-1845
TI-DSC-141	71	36	2	4.60	2.60	1.30	0.39	4.21	1895	-19	330	0.65	3.95	2861	-5	532	1.30	3.30	4432	125	980	1.95	2.65	5144	388	1342	2.60	5426	-1295
TI-DSC-142	71	36	2.5	4.50	2.00	0.80	0.30	4.20	1838	92	247	0.50	4.00	2894	169	402	1.00	3.50	5054	417	754	1.50	3.00	6725	744	1055	2.00	8152	-1246
TI-DSC-143	71	36	4	5.60	1.60	0.40	0.24	5.36	4511	230	245	0.40	5.20	7379	393	402	0.80	4.80	14157	837	772	1.20	4.40	20635	1332	1109	1.60	26712	-1594
TI-DSC-144	80	41	2.25	5.20	2.95	1.31	0.44	4.76	2440	-22	335	0.74	4.46	3707	-9	545	1.48	3.72	5724	118	1003	2.21	2.99	6611	378	1369	2.95	6950	



TECHNO PART NO	Dimensions						Design Force, Deflection and Stresses Based on E = 206 kN/mm <sup>2</sup>																						
							Preload, s = 0.15 h					s = 0.25 h					s = 0.5 h					s = 0.75 h					s = h		
	D <sub>e</sub>	D <sub>i</sub>	t	$\frac{l}{s}$	h	h/t	s	$\frac{l}{s}$	F	σ <sub>II</sub>	σ <sub>III</sub>	s	$\frac{l}{s}$	F	σ <sub>II</sub>	σ <sub>III</sub>	s	$\frac{l}{s}$	F	σ <sub>II</sub>	σ <sub>III</sub>	s	$\frac{l}{s}$	F	σ <sub>II</sub>	σ <sub>III</sub>	s	F	σ <sub>DM</sub>
TI-DSC-151	100	41	4	7.20	3.20	0.80	0.48	6.72	5535	131	269	0.80	6.40	8714	238	437	1.60	5.60	15219	577	818	2.40	4.80	20251	1017	1144	3.20	24547	-1465
TI-DSC-152	100	41	5	7.75	2.75	0.55	0.41	7.34	7606	214	246	0.69	7.06	12386	376	405	1.38	6.37	23009	827	769	2.06	5.69	32328	1344	1088	2.75	41201	-1574
TI-DSC-153	100	51	2.7	6.20	3.50	1.30	0.53	5.67	3191	-17	306	0.88	5.32	4800	-3	492	1.75	4.45	7410	116	902	2.63	3.57	8613	359	1237	3.50	9091	-1191
TI-DSC-154	100	51	3.5	6.30	2.80	0.80	0.42	5.88	3572	91	246	0.70	5.60	5624	167	399	1.40	4.90	9823	411	749	2.10	4.20	13070	734	1049	2.80	15843	-1235
TI-DSC-155	100	51	4	7.00	3.00	0.75	0.45	6.55	5482	124	292	0.75	6.25	8673	225	476	1.50	5.50	15341	540	894	2.25	4.75	20674	944	1255	3.00	25338	-1512
TI-DSC-156	100	51	5	7.80	2.80	0.56	0.42	7.38	8637	204	303	0.70	7.10	13924	355	496	1.40	6.40	25810	789	942	2.10	5.70	36339	1301	1337	2.80	46189	-1764
TI-DSC-157	100	51	6	8.20	2.20	0.37	0.33	7.87	10401	249	250	0.55	7.65	17061	424	411	1.10	7.10	32937	897	790	1.65	6.55	48022	1418	1139	2.20	62711	-1663
TI-DSC-158	112	57	3	6.90	3.90	1.30	0.59	6.31	3893	-17	302	0.98	5.92	5856	-4	485	1.95	4.95	9038	112	889	2.93	3.97	10493	352	1220	3.90	11064	-1174
TI-DSC-159	112	57	4	7.20	3.20	0.80	0.48	6.72	4852	94	255	0.80	6.40	7639	173	415	1.60	5.60	13341	428	778	2.40	4.80	17752	765	1090	3.20	21518	-1284
TI-DSC-160	112	57	6	8.50	2.50	0.42	0.38	8.12	9797	215	237	0.63	7.87	15920	367	387	1.25	7.25	30215	777	737	1.88	6.62	43812	1243	1061	2.50	56737	-1505
TI-DSC-161	125	64	3.5	8.00	4.50	1.29	0.68	7.32	5671	-16	325	1.13	6.87	8542	0	524	2.25	5.75	13231	129	961	3.38	4.62	15422	390	1319	4.50	16335	-1273
TI-DSC-162	125	64	5	8.50	3.50	0.70	0.53	7.97	7765	130	268	0.88	7.62	12300	231	436	1.75	6.75	21924	537	816	2.63	5.87	29950	925	1151	3.50	37041	-1415
TI-DSC-163	140	72	3.8	8.70	4.90	1.29	0.74	7.96	6335	-16	308	1.23	7.47	9543	-2	497	2.45	6.25	14773	119	911	3.68	5.02	17201	364	1250	4.90	18199	-1203
TI-DSC-164	140	72	5	9.00	4.00	0.80	0.60	8.40	7631	94	258	1.00	8.00	12014	173	419	2.00	7.00	20982	428	787	3.00	6.00	27920	764	1101	4.00	33843	-1293
TI-DSC-165	160	82	4.3	9.90	5.60	1.30	0.84	9.06	8058	-18	304	1.40	8.50	12162	-6	491	2.80	7.10	18832	111	904	4.20	5.70	21843	350	1238	5.60	23022	-1189
TI-DSC-166	160	82	6	10.50	4.50	0.75	0.68	9.82	10947	110	260	1.13	9.37	17270	199	422	2.25	8.25	30431	474	790	3.38	7.12	41051	831	1110	4.50	50260	-1333
TI-DSC-167	180	92	4.8	11.00	6.20	1.29	0.93	10.07	9698	-15	295	1.55	9.45	14646	-2	476	3.10	7.90	22731	115	877	4.65	6.35	26442	350	1201	6.20	27966	-1159
TI-DSC-168	180	92	6	11.10	5.10	0.85	0.77	10.33	10631	77	246	1.28	9.82	18613	145	398	2.55	8.55	28552	368	742	3.83	7.27	37533	674	1036	5.10	44930	-1192
TI-DSC-169	200	102	5.5	12.50	7.00	1.27	1.05	11.45	13104	-12	306	1.75	10.75	19817	5	494	3.50	9.00	30882	131	910	5.25	7.25	36111	381	1247	7.00	38423	-1213

ALL THE DATA MENTIONED ABOVE ARE ACCORDING WITH DIN-2093 SPECIFICATION



## PTFE Slide Bearings

PTFE slide bearings are used to solve the problems of movement caused by temperature change and differential material thermal expansion, settlement and natural forces encountered by high winds and even seismic activity.

### Advantages of PTFE Friction Bearings

#### Very Low Friction Constant

The friction constant is lower than for any other solid material. Since the static and dynamic sliding coefficient are very close, no so-called stick-slip effect occurs.

Differentiation is made between dry running bearings and lubricated bearings.

For lubricated bearings, pan-shaped recesses are pressed in the PTFE sliding plate and provided with depot lubrication (silicone grease 300 medium, bridge bearing quality).

The friction constant of PTFE deteriorates in case of low temperatures, while it remains largely constant for high temperatures. The values stated by us therefore refer to the most unfavorable values of  $-35^{\circ}\text{C}$ , which occur in the approval procedures.

For the sake of simplicity, the following friction constants may be assumed under optimum installation conditions:

PTFE friction bearing, unlubricated about  $f = 0.1$

PTFE friction bearing, lubricated about  $f = 0.04$

#### Corrosion Resistance

The PTFE glide plates are absolutely corrosion resistant, resistant against chemicals and aging. The steel parts of the bearings are by standard sandblasted and provided with a zincphosphate coating. Upon request, all usual corrosion protection processes are offered, including hot galvanizing. Versions made of special steel alloys or stainless steel are also possible.

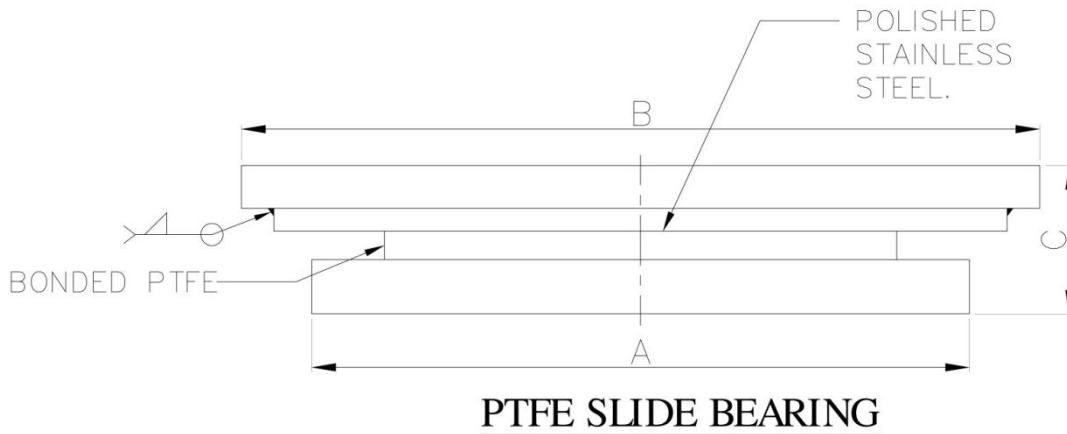
#### Temperature Resistance

The range of application of our bearings is limited to those temperature ranges which are secured by official friction tests under load.

- Use at temperatures of  $-60^{\circ}\text{C}$  is ensured by tests.
- Use at temperatures of over  $180^{\circ}\text{C}$  requires custom constructions / high temperature bearings.

#### Maintenance-Free

PTFE friction bearings are totally maintenance-free, this also applies to lubricated PTFE bearings; no subsequent lubrication is required.



## DIMENSIONAL DATA FOR PTFE STAINLESS STEEL SLIDE BEARING

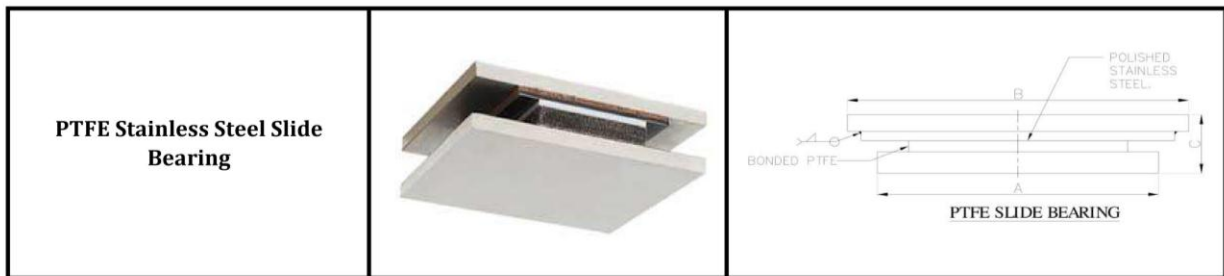


FIGURE - 10G

SL.No	TECHNO . SIZE	PART NO	RECOMMENDED LOADING AT 25°C (Kg)	A sqr (MM)	C (MM)	B (MM)		
						MAXIM ALLOWABLE MOVEMENT		
						+/-12.5	+/-25	+/-37.5
						RANGE-1	RANGE-2	RANGE-3
1	250	TI39-250	100 TO 250	40	15	65	90	115
2	500	TI39-500	200 TO 500	55	21	75	100	125
3	1000	TI39-1000	400 TO 1000	70	25	85	110	135
4	2000	TI39-2000	800 TO 2000	100	29	105	130	155
5	4000	TI39-4000	1600 TO 4000	125	35	125	150	175
6	8000	TI39-8000	3200 TO 8000	180	45	165	190	215
7	16000	TI39-16000	6400 TO 16000	230	55	205	230	255
8	32000	TI39-32000	12800 TO 32000	300	55	275	300	325
9	64000	TI39-64000	25600 TO 64000	400	55	375	400	425



ANCILLARY EQUIPMENTS  
FOR CRITICAL PIPING





## ANCILARY ITEMS:



SLIDING SUPPORT



SLIDING GUIDE



SLIDING BASE SUPPORT



DISC SPRING SUPPORT



SPRING SWAY BRACE



FORGE CLEVIS



CLEVIS HANGER



U-BOLT



PIPE CLAMP



ANCHOR CHAIR



ROLLER SUPPORT



BEAM WELDING ATTACHMENT



RIGID STRUTS



PIPE CLAMP



RISER CLAMP



OFFSET PIPE CLAMP



YOKE PIPE CLAMP



SADDLE GUIDE ANCHOR



CONNECTING PLATE



STEEL ROD COUPLING



TURNBUCKLE



SLING ROD MACHINED EYE



SLING ROD WELDLESS EYE



SLING ROD FORMED EYE



NUT & BOLT



WASHER



SPRING WASHER



TAPER WASHER



ADJUSTABLE PIPE SUPPORT



PIPE ROLL



U-STRAP



PIPE CLAMP



EXTENDED  
PIPE CLAMP



WELDLESS  
EYE NUT



DEE SHACKLE



CAST IORN  
PIPE ROLL



EXTENSION  
HANGER RING



PIPE GUIDE



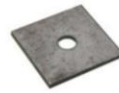
ONE PIECE STRAP



STEEL CLEVIS



YOKE RESTRAINT  
CLAMP



STEEL SQUARE  
PLATE



CUSHION SPRING  
ASSEMBLY



ADJUSTABLE STEEL  
CHAIR AND ROLL



STEEL CHAIR  
AND ROLL



HEMISPHERICAL  
WASHER AND CUP



ROLL  
HANGER



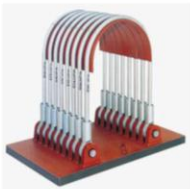
STEEL BRACKET



'C' CLAMP WITH  
LOCKING NUT



PIPE COVERING  
PROTECTION SADDLE



WHIP  
RESTRAINT



ADJUSTABLE  
BEAM CLAMP



SIDE AND TOP  
BEAM CLAMP



BEAM CLAMP



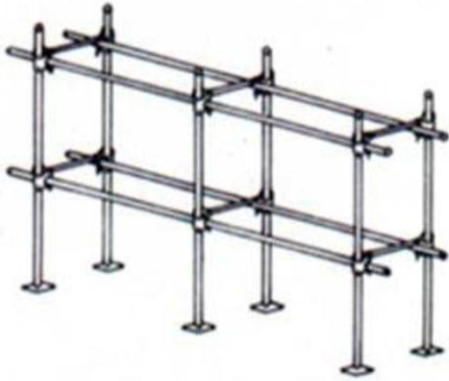
LINKED EYE ROD



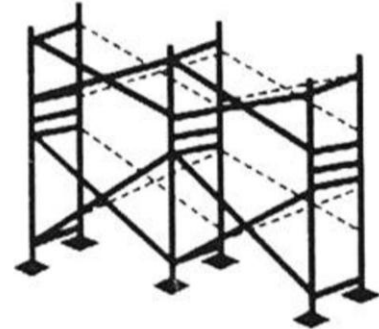
MACHINE EYE ROD



## Scaffoldings & Accessories:



'H' Frame Scaffolding



A.P.U Scaffolding



Double Coupler



Swivel Coupler



Expanding Joint Pin



Sleeve Coupler



Putlog Coupler



Adjustable Fork head



Stirrup head


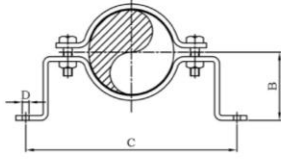



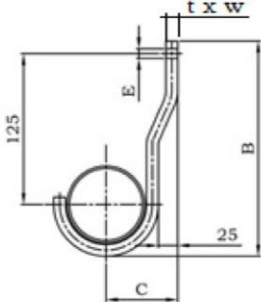
Fixed base plate  
With Spigots / Pins



Castor Wheel


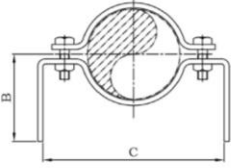


<b>OFFSET PIPE CLAMP</b>									
FIGURE - 11		Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize							
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	B	C	D	WEIGHT (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	OPC-20	TI11-20	20	70	222	11	0.59	86	1
2	OPC-25	TI11-25	25	73	235	11	0.64	86	1
3	OPC-35	TI11-32	32	78	248	11	0.68	86	1
4	OPC-40	TI11-40	40	81	254	11	0.73	86	1
5	OPC-50	TI11-50	50	89	286	14	1.27	190	1
6	OPC-65	TI11-65	65	95	298	14	1.32	190	1
7	OPC-80	TI11-80	80	103	327	14	1.45	190	1
8	OPC-100	TI11-100	100	116	352	14	1.91	277	1
9	OPC-125	TI11-125	125	129	397	17	2.95	277	1
10	OPC-150	TI22-150	150	143	425	17	3.27	394	2
11	OPC-200	TI22-200	200	168	476	17	3.76	394	2
12	OPC-250	TI22-250	250	187	546	21	5.62	476	2
13	OPC-300	TI22-300	300	213	632	21	9.53	544	2

<b>OFFSET HOOK</b>										
FIGURE - 12		Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize								
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	B	C	E	t x w	WEIGHT (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	OH-15	TI12-15	15	163	41	14	4x32	0.24	91	1
2	OH-20	TI12-20	20	164	43	14	4x32	0.25	91	1
3	OH-25	TI12-25	25	168	48	14	4x32	0.37	91	1
4	OH-32	TI12-32	32	173	52	14	4x32	0.38	91	1
5	OH-40	TI12-40	40	177	56	14	5x40	0.4	91	1
6	OH-50	TI12-50	50	183	67	14	5x40	0.44	91	1
7	OH-65	TI12-65	65	190	68	14	5x40	0.57	159	1
8	OH-80	TI12-80	80	198	76	14	5x40	0.63	159	1
9	OH-90	TI12-90	90	203	83	14	5x50	0.67	159	1
10	OH-100	TI12-100	100	211	92	14	6x50	1.08	204	1
11	OH-125	TI12-125	125	224	106	14	6x65	1.77	204	1
12	OH-150	TI12-150	150	238	119	14	6x65	1.93	204	1





<b>EXTENDED OFFSET PIPE CLAMP</b>						
FIGURE - 13				Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize		
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	B	C	WEIGHT (Kg)
1	EXT-OPC-10	TI13-10	10	305	95	0.84
2	EXT-OPC-15	TI13-15	15	305	95	0.84
3	EXT-OPC-20	TI13-20	20	305	121	0.84
4	EXT-OPC-25	TI13-25	25	305	140	1.06
5	EXT-OPC-32	TI13-32	32	305	149	1.09
6	EXT-OPC-40	TI13-40	40	305	156	1.11
7	EXT-OPC-50	TI13-50	50	305	178	1.42
8	EXT-OPC-65	TI13-65	65	305	191	1.91
9	EXT-OPC-80	TI13-80	80	305	200	2.03
10	EXT-OPC-100	TI13-100	100	305	267	2.22
11	EXT-OPC-125	TI13-125	125	305	311	2.22
12	EXT-OPC-150	TI13-150	150	305	330	2.41
13	EXT-OPC-200	TI13-200	200	305	387	5.06
14	EXT-OPC-250	TI13-250	250	305	464	6.12
15	EXT-OPC-300	TI13-300	300	305	527	110
16	EXT-OPC-350	TI13-350	350	305	533	15.9


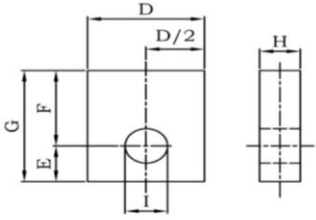
<b>WELDING LUG ATTACHMENT</b>													
FIGURE - 14				Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize									
SL. NO.	TECHNO DESIGNATION	PART NO	ROAD SIZE	BOLT OR PIN SIZE	D	E	F	G	H	I	WEIGHT EACH (Kg)	MAXIMUM LOAD (Kg)	LOAD GROUP
1	WL-12	TI14-12	12	M16	64	32	76	108	6	18	0.34	1040	3
2	WL-16	TI14-16	16	M20	64	32	76	108	6	22	0.31	1631	4
3	WL-20A	TI14-20	20	M20	64	32	76	108	10	22	0.45	1631	4
4	WL-20B	TI14-20	20	M24	64	32	76	108	10	26	0.44	2355	5
5	WL-24	TI14-24	24	M30	76	38	76	114	13	32	0.73	3792	6
6	WL-30	TI14-30	30	M36	102	51	102	152	16	40	1.68	5556	7
7	WL-36	TI14-36	36	M42	127	64	114	178	19	45	2.9	7666	8
8	WL-42	TI14-42	42	M48	127	64	114	178	19	52	2.68	10112	9
9	WL-48	TI14-48	48	M56	152	76	114	191	19	60	3.27	15189	10
10	WL-56	TI14-56	56	M64	152	76	114	191	19	68	3.45	20387	11
11	WL-64	TI14-64	64	M72	203	102	114	216	25	75	7.03	26300	12
12	WL-72	TI14-72	72	M80	203	102	114	216	25	85	6.85	32926	13
13	WL-80A	TI14-80	80	M80	203	102	127	229	25	85	7.26	32926	13



FIGURE - 15

Material : Carbon steel (IS-2062,Gr.A/B)  
Finish : Plain,Painted,Galvanize

SL. NO.	TECHNO DESIGNATION	PART NO	ROAD SIZE	F	IM	IQ	LM	LX	M	S	UQ	UM	XQ	XM	WEIGHT (Kg)	MAXIMUM LOAD (Kg)	LOAD GROUP
1	LBB-10	TI15-10	M10	44	12	13	102	-	152	32	6	6	102	64	5.3	373	1
2	LBB-12	TI15-12	M12	48	14	16	127	-	178	32	10	6	102	64	5.3	545	2
3	LBB-16	TI15-16	M16	51	18	19	152	-	203	32	13	6	102	64	5.3	1040	3
4	LBB-20	TI15-20	M20	76	22	22	165	165	216	38	19	10	229	76	10	1631	4
5	LBB-24	TI15-24	M24	76	26	22	203	203	267	38	19	13	229	76	14.5	2355	5
6	LBB-30	TI15-30	M30	102	32	25	203	203	305	51	25	16	305	102	19.9	3792	6
7	LBB-36	TI15-36	M36	108	40	29	203	203	305	64	25	19	305	127	20.7	5556	7
8	LBB-42	TI15-42	M42	114	45	35	203	203	305	64	32	19	305	127	25.3	7666	8
9	LBB-48	TI15-48	M48	133	52	35	203	203	305	76	32	19	305	152	26.4	10112	9

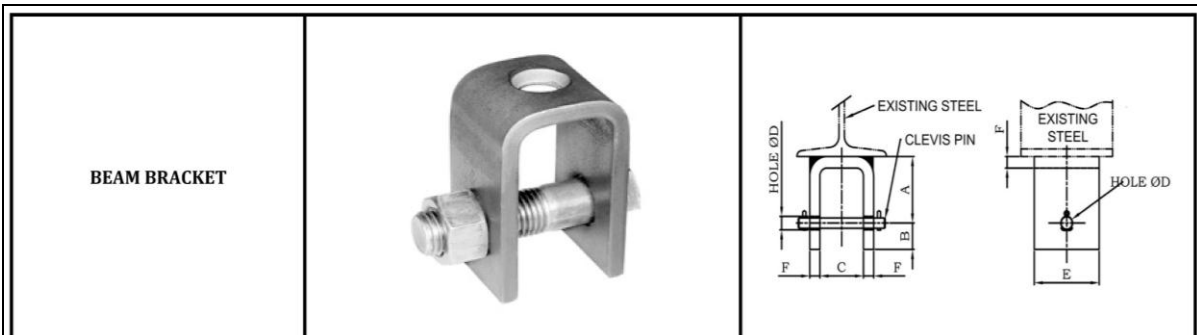

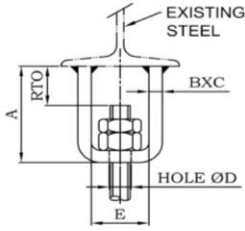


FIGURE - 16

Material : Carbon steel (IS-2062,Gr.A/B)  
Finish : Plain,Painted,Galvanize

SL. NO	TECHNO DESIGNATION	PART NO	PIN SIZE	A	B	C	HOLE DIA (D)	E	F	WEIGHT (Kg)	LOAD CAPACITY (Kg)	LOAD GROUP
1	BB-10	TI16-10	10	36	20	30	12	50	6	0.39	373	1
2	BB-12	TI16-12	12	36	20	30	14	50	6	0.4	545	2
3	BB-16	TI16-16	16	42	30	30	18	50	6	0.51	1040	3
4	BB-20	TI16-20	20	60	35	35	22	60	10	1.1	1631	4
5	BB-24	TI16-24	24	70	45	40	26	80	10	2	2355	5
6	BB-30	TI16-30	30	82	55	40	32	100	12	3.5	3792	6
7	BB-36	TI16-36	36	95	65	55	39	110	15	5.8	5556	7
8	BB-42	TI16-42	42	105	75	65	45	130	15	7.9	7666	8
9	BB-48	TI16-48	48	125	85	70	51	150	20	13.6	10112	9
10	BB-56	TI16-56	56	140	100	80	60	180	20	18.7	15189	10
11	BB-64	TI16-64	64	160	115	90	68	200	20	24.2	20387	11
12	BB-72	TI16-72	72	180	130	100	76	220	25	35.5	26300	12
13	BB-80	TI16-80	80	200	150	100	84	240	25	43	32926	13



<b>INVERTED BEAM BRACKET</b>												
FIGURE - 17				Material : Carbon steel (IS-2062,Gr.A/B)				Finish : Plain,Painted,Galvanize				
SL. NO	TECHNO DESIGNATION	PART NO	ROD SIZE	A	B	C	HOLE DIA (D)	E	RTO	WEIGHT (Kg)	LOAD CAPACITY (Kg)	LOAD GROUP
1	IBB-10	TI17-10	10	75	50	6	12	40	36	0.44	373	1
2	IBB-12	TI17-12	12	75	50	6	14	40	33	0.44	545	2
3	IBB-16	TI17-16	16	85	75	10	18	60	39	1.3	1040	3
4	IBB-20	TI17-20	20	85	75	12	22	70	25	1.7	1631	4
5	IBB-24	TI17-24	24	115	100	12	27	75	51	2.8	2355	5
6	IBB-30	TI17-30	30	125	125	15	33	100	54	5.3	3792	6
7	IBB-36	TI17-36	36	165	150	20	39	125	72	11	5556	7
8	IBB-42	TI17-42	42	195	150	20	46	135	95	12.6	7666	8
9	IBB-48	TI17-48	48	210	150	20	52	150	79	14.5	10112	9
10	IBB-56	TI17-56	56	240	200	20	60	180	78	22.4	15189	10
11	IBB-64	TI17-64	64	250	200	20	68	215	80	25.9	20387	11
12	IBB-72	TI17-72	72	275	200	25	76	230	90	36.2	26300	12
13	IBB-80	TI17-80	80	300	220	25	85	250	100	43.1	32926	13


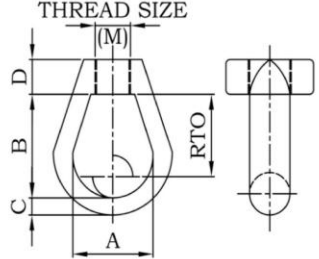
<b>EYE NUT</b>											
FIGURE - 18				Material : FORGED (IS-1875,CL-II/SA-105)				Finish : Plain,Painted,Galvanize			
SL. NO	TECHNO DESIGNATION	PART NO	THREAD SIZE(M)	A	B	C	D	RTO	WEIGHT (Kg)	LOAD CAPACITY (Kg)	LOAD GROUP
1	EN-10	TI18-10	10	25	38	10	16	33	0.1	373	1
2	EN-12	TI18-12	12	38	51	13	17	45	0.27	545	2
3	EN-16	TI18-16	16	38	51	13	17	43	0.25	1040	3
4	EN-20	TI18-20	20	50	79	17	28	69	0.84	1631	4
5	EN-24	TI18-24	24	50	79	17	28	67	0.81	2355	5
6	EN-30	TI18-30	30	47	95	20	47	80	2.1	3792	6
7	EN-36	TI18-36	36	47	95	20	47	77	2	5556	7
8	EN-42	TI18-42	42	101	159	38	57	138	7.5	7666	8
9	EN-48	TI18-48	48	101	159	38	57	135	7.3	10112	9
10	EN-56	TI18-56	56	101	159	38	57	131	7.1	15189	10
11	EN-64	TI18-64	64	101	159	38	57	127	6.8	20387	11
12	EN-72	TI18-72	72	101	222	49	89	186	18	26300	12
13	EN-80	TI18-80	80	101	222	49	89	182	17.4	32926	13





FIGURE - 19

Material : (IS-1875,CL-II/SA-105)

Finish : Plain,Painted,Galvanize

SL. NO.	TECHNO DESIGNATION	PART NO	ROD SIZE 'A'	C	WEIGHT EACH (Kg)	MAXIMUM LOAD 343°C (Kg)	LOAD GROUP
1	TB-10	TI19-10	M10	181	0.14	373	1
2	TB-12	TI19-12	M12	191	0.27	545	2
3	TB-16	TI20-16	M16	200	0.45	1040	3
4	TB-20	TI21-20	M20	210	0.54	1631	4
5	TB-24	TI22-24	M24	229	1.13	2355	5
6	TB-30	TI23-30	M30	232	1.72	3792	6
7	TB-36	TI24-36	M36	248	2.59	5555	7
8	TB-42	TI26-42	M42	264	3.72	7666	8
9	TB-48	TI27-48	M48	279	6.44	10112	9
10	TB-56	TI32-56	M56	327	12.25	15188	10
11	TB-64	TI34-64	M64	343	14.97	20387	11



FIGURE - 20


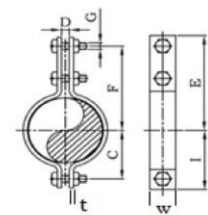
Material : Carbon steel (IS-2062,Gr.A/B)


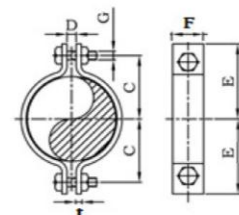
Finish : Plain,Painted,Galvanize

Specified loads are for up to 399°C

SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB. (mm)	A	C	D	E x F	K	J	M	WEIGHT (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	2-LPC-15	TI20-15	15	58	40	12	32x6	M12	40	15	0.76	750	3
2	2-LPC-20	TI20-20	20	58	40	12	32x6	M12	40	15	0.76	750	3
3	2-LPC-25	TI30-25	25	63	45	12	32x6	M12	40	15	0.85	750	3
4	2-LPC-32	TI40-32	32	63	50	12	32x6	M12	40	15	0.95	750	3
5	2-LPC-40	TI50-40	40	79	55	25	40x6	M16	60	19	1.2	1180	4
6	2-LPC-50	TI60-50	50	84	60	25	40x6	M16	60	19	1.3	2000	5
7	2-LPC-65	TI70-65	65	94	75	25	40x6	M16	60	19	1.5	2000	5
8	2-LPC-80	TI80-80	80	105	80	25	40x6	M16	60	19	1.65	2000	5
9	2-LPC-100	TI90-100	100	120	95	25	50x10	M16	70	19	3.8	2000	5
10	2-LPC-125	TI100-125	125	130	110	25	50x10	M16	70	19	4	2000	5
11	2-LPC-150	TI110-150	150	170	135	35	65x10	M24	80	28	7	2600	5
12	2-LPC-200	TI120-200	200	195	160	35	65x10	M24	80	28	8.4	2600	6
13	2-LPC-250	TI130-250	250	220	186	35	65x10	M24	80	28	9.3	2600	6
14	2-LPC-300	TI140-300	300	250	215	35	65x10	M24	80	28	10.3	2600	6
15	2-LPC-350	TI150-350	350	290	245	50	75x16	M30	115	35	20.4	4000	7
16	2-LPC-400	TI160-400	400	310	265	50	75x16	M30	115	35	22.8	4000	7
17	2-LPC-450	TI170-450	450	350	300	50	75x16	M30	115	35	26	4000	7
18	2-LPC-500	TI180-500	500	375	325	50	75x16	M30	115	35	28	4000	7
19	2-LPC-600	TI190-600	600	425	375	50	75x16	M30	115	35	32	4000	7



LIGHT DUTY 3-BOLT PIPE CLAMP														
 														
FIGURE - 21										Material : Carbon steel (IS-2062,Gr.A/B)				
Specified loads are for up to 399 °C										Finish : Plain,Painted,Galvanize				
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	C	D	E	F	G	W x t	I	WEIGHT (Kg)	Maximum load (Kg)		LOAD GROUP
												343 °C	399 °C	
1	3-LPC-15	TI21-15	15	25	16	73	57	M10	32x4	41	0.25	431	383	2
2	3-LPC-20	TI21-20	20	29	16	83	64	M10	32x4	44	0.3	431	383	2
3	3-LPC-25	TI21-25	25	38	16	95	64	M10	32x4	54	0.34	431	383	2
4	3-LPC-32	TI21-32	32	38	19	92	73	M10	32x4	57	0.35	431	383	2
5	3-LPC-40	TI21-40	40	44	25	124	105	M16	40x5	60	0.66	497	626	2
6	3-LPC-50	TI31-50	50	54	29	149	130	M16	40x5	70	0.8	701	626	3
7	3-LPC-65	TI31-65	65	57	29	156	137	M16	40x6	76	1	701	626	3
8	3-LPC-80	TI31-80	80	70	29	168	152	M16	40x6	89	1.16	701	626	3
9	3-LPC-100	TI41-100	100	86	25	194	165	M20	60x8	114	2.81	1134	1011	4
10	3-LPC-125	TI41-125	125	102	29	206	178	M20	60x8	130	3.13	1134	1011	4
11	3-LPC-150	TI41-150	150	121	32	244	210	M20	65x10	156	5.08	1299	1159	4
12	3-LPC-200	TI41-200	200	146	32	270	235	M20	65x10	181	5.88	1299	1159	4
13	3-LPC-250	TI41-250	250	175	32	305	263	M24	65x12	210	8.21	1469	1310	4
14	3-LPC-300	TI41-300	300	213	38	330	292	M24	65x12	251	9.38	1469	1310	4
15	3-LPC-350	TI51-350	350	232	51	365	324	M30	75x16	273	15.84	1950	1739	5
16	3-LPC-400	TI51-400	400	254	51	397	356	M30	75x16	298	17.45	1950	1739	5
17	3-LPC-450	TI51-450	450	295	51	425	384	M30	75x16	337	19.26	1950	1739	5
18	3-LPC-500	TI51-500	500	314	51	445	403	M36	75x20	356	25.68	2041	1821	5
19	3-LPC-600	TI61-600	600	375	51	505	454	M36	75x25	416	37.35	2490	2222	6
20	3-LPC-750	TI61-750	750	470	38	670	594	M36	100x25	533	64.27	3401	3034	6
21	3-LPC-900	TI71-900	900	572	76	816	730	M42	100x30	660	94	4761	4244	7

HEAVY DUTY 2-BOLT PIPE CLAMP													
 													
FIGURE - 22										Material : Carbon steel (IS-2062,Gr.A/B)			
Specified loads are for up to 399 °C										Finish : Plain,Painted,Galvanize			
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB (mm)	C	D	E	Fxt	G	WEIGHT (Kg)	Maximum load (Kg)		LOAD GROUP	
										343 °C	399 °C		
1	2-HPC-50	TI22-50	50	51	19	76	50x8	M16	1.2	1542	1360	4	
2	2-HPC-80	TI22-80	80	79	25	102	65x8	M20	2.1	1610	1428	4	
3	2-HPC-100	TI22-100	100	95	25	124	65x10	M20	3.2	1610	1428	4	
4	2-HPC-125	TI22-125	125	111	25	140	65x10	M20	3.7	1610	1428	4	
5	2-HPC-150	TI22-150	150	137	29	171	75x12	M24	6.2	2222	1973	5	
6	2-HPC-200	TI22-200	200	171	29	206	75x12	M24	7.6	2222	1973	5	
7	2-HPC-250	TI22-250	250	194	32	232	100x12	M30	11.7	2721	2449	6	
8	2-HPC-300	TI22-300	300	235	41	289	110x16	M36	21.1	3945	3514	7	
9	2-HPC-350	TI22-350	350	248	41	302	110x20	M36	27.9	4149	3696	7	
10	2-HPC-400	TI22-400	400	279	41	327	110x20	M36	30.6	4149	3696	7	
11	2-HPC-450	TI22-450	450	368	76	438	150x20	M48	53.5	6258	5568	7	
12	2-HPC-500	TI22-500	500	406	76	476	150x25	M48	73.1	6938	6176	7	
13	2-HPC-600	TI22-600	600	470	83	546	175x25	M56	98.9	7391	6575	8	
14	2-HPC-750	TI22-750	750	572	89	660	200x30	M64	165.3	9296	8276	9	
15	2-HPC-900	TI22-900	900	673	89	768	200x40	M72	258.7	14837	11291	10	

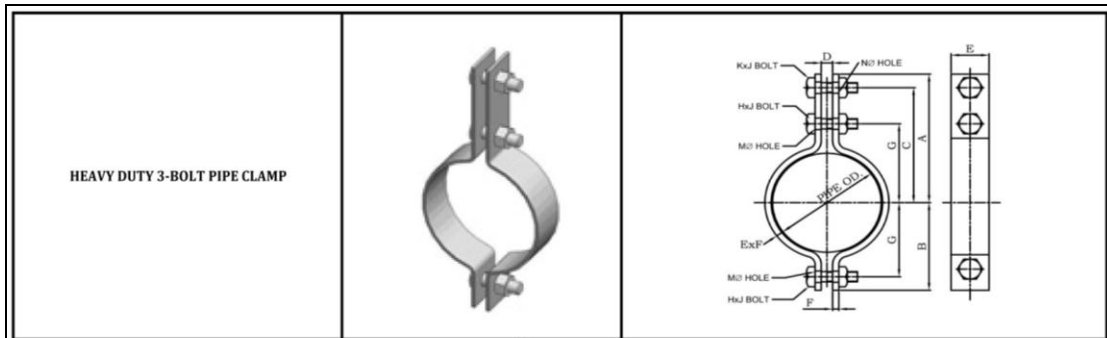


FIGURE - 23 Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize

SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB. (mm)	Specified loads are for up to 399°C											WEIGHT (Kg)	MAX LOAD (Kg)	LOAD GROUP
				A	B	C	D	ExF	G	H	J	K	M	N			
1	3-HDC-15	TI23-15	15	95	45	76	12	32x6	35	M10	40	M12	12	15	0.86	750	3
2	3-HDC-20	TI23-20	20	100	45	86	12	32x6	35	M10	40	M12	12	15	0.92	750	3
3	3-HDC-25	TI23-25	25	105	50	92	12	32x6	40	M10	40	M12	12	15	0.98	750	3
4	3-HDC-32	TI23-32	32	115	60	98	12	32x6	45	M10	40	M12	12	15	1.1	750	3
5	3-HDC-40	TI24-40	40	125	70	105	25	40x6	50	M12	60	M16	14	19	1.5	1180	4
6	3-HDC-50	TI25-50	50	150	75	130	25	40x6	60	M12	60	M16	15	19	1.65	2000	5
7	3-HDC-65	TI25-65	65	156	80	140	25	40x6	65	M12	60	M16	15	19	1.8	2000	5
8	3-HDC-80	TI25-80	80	170	90	150	25	40x6	75	M12	60	M16	15	19	1.9	2000	5
9	3-HDC-100	TI25-100	100	195	115	165	25	50x10	95	M16	70	M16	15	19	4.6	2000	5
10	3-HDC-125	TI25-125	125	225	135	195	25	50x10	110	M16	70	M16	19	19	5.25	2000	5
11	3-HDC-150	TI26-150	150	255	150	220	35	65x10	125	M20	80	M24	19	28	8	2600	6
12	3-HDC-200	TI26-200	200	280	175	245	35	65x10	155	M20	80	M24	24	28	9	2600	6
13	3-HDC-250	TI26-250	250	305	215	270	35	65x10	185	M20	80	M24	24	28	10.7	2600	6
14	3-HDC-300	TI26-300	300	330	250	295	35	65x10	210	M20	80	M24	24	28	11.8	2600	6
15	3-HDC-350	TI27-350	350	365	270	325	50	75X16	235	M24	115	M30	24	35	23	4000	7
16	3-HDC-400	TI27-400	400	390	295	350	50	75X16	260	M24	115	M30	28	35	25.2	4000	7
17	3-HDC-450	TI27-450	450	420	330	375	50	75X16	295	M24	115	M30	28	35	28.4	4000	7
18	3-HDC-500	TI27-500	500	445	360	405	50	75X16	320	M24	115	M30	28	35	29.4	4000	7
19	3-HDC-600	TI27-600	600	495	425	455	50	75X16	380	M24	115	M30	28	35	34	4000	7



FIGURE - 24 Material : SAE-1018 Finish : Plain,Painted,Galvanize

SL. No	TECHNO DESIGNATION	PART NO	Pipe NB. MM	A	B	C	D	M	Max Temperature °C	Weight (Kg)	Load Capacity (Kg)			LOAD GROUP
											Vertical	Lateral	Axial	
1	UB-10-I	TI24-10	10	19	27	36	25	8	350	2.40	460	210	100	2
2	UB-15-I	TI24-15	15	23	31	38	27	8	350	2.32	460	170	80	2
3	UB-20-I	TI24-20	20	29	37	45	27	8	350	2.87	460	140	70	2
4	UB-25-I	TI24-24	25	37	45	46	27	8	350	2.55	460	100	50	2
5	UB-32-I	TI24-32	32	47	55	52	27	8	350	2.82	460	80	40	2
6	UB-40-I	TI24-40	40	50	60	63	37	10	350	6.52	720	140	70	3
7	UB-50-I	TI24-50	50	65	75	67	37	10	350	7.43	720	110	60	3
8	UB-65-I	TI24-65	65	78	90	88	47	12	350	15.62	1060	160	80	4
9	UB-80-I	TI24-80	80	92	108	100	52	16	350	45.26	2020	330	170	5
10	UB-100-I	TI24-100	100	119	135	112	52	16	350	44.72	2020	250	120	5
11	UB-125-I	TI24-125	125	144	160	125	52	16	350	49.30	2020	210	100	5
12	UB-150-I	TI24-150	150	170	190	143	57	20	350	113.85	3160	340	170	6
13	UB-200-I	TI24-200	200	225	245	178	67	20	350	139.74	3160	260	130	6
14	UB-250-I	TI24-250	250	280	300	205	67	20	350	151.59	3160	210	100	6
15	UB-300-I	TI24-300	300	330	350	230	67	24	350	178.58	3160	170	90	6
16	UB-350-I	TI24-350	350	361	385	253	77	24	350	336.13	4560	280	140	7
17	UB-400-I	TI24-400	400	411	435	287	82	24	350	369.28	4560	240	120	7
18	UB-450-I	TI24-450	450	461	485	302	72	24	350	397.14	4560	220	110	7
19	UB-500-I	TI24-500	500	516	540	336	77	24	350	447.23	4560	190	100	7
20	UB-600-I	TI24-600	600	616	640	385	77	24	350	485.88	4560	160	80	7

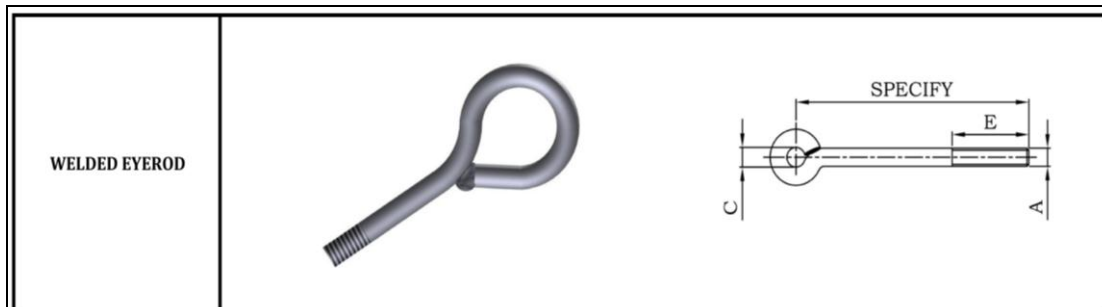




**U-Bolt  
Type II  
(Non Grip type)**

FIGURE - 25 Material : SAE-1018  
Finish : Plain,Painted,Galvanize

SL. No	TECHNO DESIGNATION	PART NO	Pipe NB MM	A	B	C	D	M	Max Temperature °C	Weight in (Kg)	Load Capacity (Kg)			LOAD GROUP
											Vertical	Lateral	Axial	
1	UB-10-II	TI25-10	10	28	36	25	25	8	350	1.55	170	130	70	1
2	UB-15-II	TI25-15	15	32	40	27	27	8	350	1.60	150	120	60	1
3	UB-20-II	TI25-20	20	37	45	35	32	8	350	1.94	140	100	50	1
4	UB-25-II	TI25-24	25	42	50	37	32	8	350	1.82	130	90	40	1
5	UB-32-II	TI25-32	32	52	60	42	32	8	350	2.48	110	70	40	1
6	UB-40-II	TI25-40	40	55	65	55	42	10	350	6.17	190	130	70	1
7	UB-50-II	TI25-50	50	70	80	62	42	10	350	6.11	160	100	50	1
8	UB-65-II	TI25-65	65	83	95	75	52	12	350	14.05	230	150	80	1
9	UB-80-II	TI25-80	80	94	110	87	57	16	350	37.74	470	310	160	2
10	UB-100-II	TI25-100	100	124	140	97	57	16	350	40.17	380	240	120	2
11	UB-125-II	TI25-125	125	149	165	110	57	16	350	44.74	330	200	100	1
12	UB-150-II	TI25-150	150	175	195	130	67	20	350	99.98	540	330	160	2
13	UB-200-II	TI25-200	200	230	250	152	67	20	350	121.77	430	250	130	2
14	UB-250-II	TI25-250	250	285	305	185	77	20	350	139.08	350	200	100	1
15	UB-300-II	TI25-300	300	335	355	210	77	20	350	165.38	310	170	90	1
16	UB-350-II	TI25-350	350	366	390	232	82	24	350	312.23	480	270	140	2
17	UB-400-II	TI25-400	400	416	440	257	82	24	350	334.48	430	240	120	2
18	UB-450-II	TI25-450	450	471	495	280	82	24	350	375.80	380	210	110	2
19	UB-500-II	TI25-500	500	521	545	305	82	24	350	409.73	350	190	100	1
20	UB-600-II	TI25-600	600	621	645	355	82	24	350	451.52	300	160	80	1





**WELDED EYEROD**

FIGURE - 26 Material : Carbon steel (IS-2062,Gr.A/B)  
Finish : Plain,Painted,Galvanize

SL. NO.	1	2	3	4	5	6	7	8	9	10	11	12
TECHNO DESIGNATION	WER-10	WER-12	WER-16	WER-20	WER-20	WER-24	WER-30	WER-36	WER-42	WER-48	WER-56	WER-64
PART NO	TI26-10	TI26-12	TI26-16	TI26-20	TI26-20	TI26-24	TI26-30	TI26-36	TI26-42	TI26-48	TI26-56	TI26-64
A	M10	M12	M16	M20	M20	M24	M30	M36	M42	M48	M56	M64
C	19	22	25	29	32	35	41	48	64	70	76	83
THREAD LENGTH (E)	75	75	75	75	100	100	100	150	150	150	150	150
LOAD AT 343°C (Kg)	373	545	1040	1631	1631	2355	3792	5555	7666	10112	15188	20387
LOAD GROUP	1	2	3	4	4	5	6	7	8	9	10	11



<b>FULL THREADED HANGER ROD</b>						
FIGURE - 27		Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize				
SL. NO.	TECHNO DESIGNATION	PART NO	DIAMETER 'A'	WEIGHT PER METER (Kg)	LOAD AT 343°C (Kg)	LOAD GROUP
1	F-HR-10	TI27-10	M10	0.6	373	1
2	F-HR-12	TI27-12	M12	0.8	545	2
3	F-HR-16	TI27-16	M16	1.5	1040	3
4	F-HR-20	TI27-20	M20	2.3	1631	4
5	F-HR-24	TI27-24	M24	3.4	2355	5
6	F-HR-30	TI27-30	M30	5.3	3792	6
7	F-HR-36	TI27-36	M36	7.6	5555	7
8	F-HR-42	TI27-42	M42	10.3	7666	8
9	F-HR-48	TI27-48	M48	13.5	10112	9
10	F-HR-56	TI27-56	M56	18.4	15188	10
11	F-HR-64	TI27-64	M64	24.0	20387	11
12	F-HR-72	TI27-72	M72	30.3	26300	12
13	F-HR-80	TI27-80	M80	37.5	32926	13


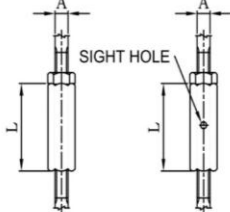
<b>ROD COUPLING</b>							
FIGURE - 28		Material : (IS-1875 CL-II/SA-105) Finish : Plain,Galvanize					
SL. NO.	TECHNO DESIGNATION	PART NO	ROD SIZE - A	L	WEIGHT EACH (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	RC-10	TI28-10	M10	44	0.04	373	1
2	RC-12	TI28-12	M12	44	0.05	545	2
3	RC-16	TI28-16	M16	54	0.08	1040	3
4	RC-20	TI28-20	M20	57	0.13	1631	4
5	RC-24	TI28-24	M24	70	0.33	2355	5
6	RC-30	TI28-30	M30	83	0.64	3792	6
7	RC-36	TI28-36	M36	102	0.89	5556	7



FIGURE - 29

Material : Carbon steel (IS-2062,Gr.A/B)

Finish : Plain,Painted,Galvanize

SL. NO.	TECHNO DESIGNATION	PART NO	ROAD SIZE	A	B	C	D	T	S	ØE	WEIGHT (Kg)	LOAD CAPACITY (Kg)	LOAD GROUP
1	CLV-12	TI29-12	M12	78	26	24	25	8	35	14	0.6	545	2
2	CLV-16	TI29-16	M16	100	30	30	32	10	45	18	1.3	1040	3
3	CLV-20	TI29-20	M20	100	35	30	32	10	45	22	1.3	1631	4
4	CLV-24	TI29-24	M24	100	38	34	32	12	65	26	2.2	2355	5
5	CLV-30	TI29-30	M30	150	40	34	32	12	65	32	2.9	3792	6
6	CLV-36	TI29-36	M36	196	45	60	44	12	70	40	4.6	5556	7
7	CLV-48	TI29-48	M48	236	64	70	58	16	100	52	10.7	10112	9
8	CLV-56	TI29-56	M56	274	75	80	66	20	120	60	18.1	15189	10
9	CLV-72	TI29-72	M72	352	96	105	85	25	155	75	38.1	26300	12


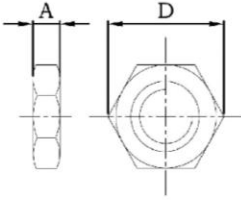



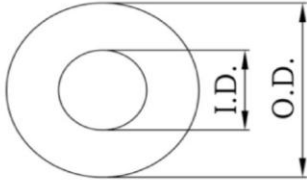
FIGURE - 30

Material :(IS-1367,CL-4)

SL. NO.	TECHNO DESIGNATION	PART NO	TAP SIZE	G	U	X	WEIGHT EACH (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	HN-10	TI30-10	M10	17	10	21	0.01	373	1
2	HN-12	TI30-12	M12	22	13	25	0.03	545	2
3	HN-16	TI30-16	M16	27	16	32	0.05	1040	3
4	HN-20	TI30-20	M20	32	19	37	0.09	1631	4
6	HN-24	TI30-24	M24	41	25	48	0.19	2355	5
7	HN-30	TI30-30	M30	51	32	59	0.36	3792	6
8	HN-36	TI30-36	M36	60	38	70	0.59	5555	7
9	HN-42	TI30-42	M42	70	44	81	0.93	7666	8
10	HN-48	TI30-48	M48	79	51	92	1.36	10112	9
11	HN-56	TI30-56	M56	89	56	103	1.90	15188	10
12	HN-64	TI30-64	M64	98	62	114	2.56	20387	11
13	HN-72	TI30-72	M72	108	68	125	3.35	26300	12
14	HN-80	TI30-80	M80	117	75	135	4.31	32926	13


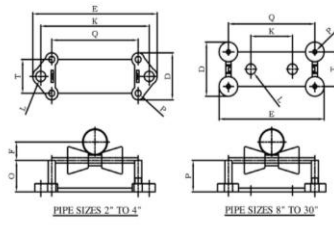



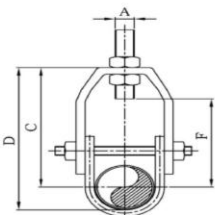
<b>LOCK NUT</b>								
FIGURE - 31 <span style="float: right;">Material : (IS-1367,CL-4)</span>								
SL. NO.	TECHNO DESIGNATION	PART NO	THREAD SIZE	A	D	WEIGHT (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	LN-10	TI31-10	M10	6	20	0.009	373	1
2	LN-12	TI31-12	M12	7	22	0.011	545	2
3	LN-16	TI31-16	M16	8	28	0.019	1040	3
4	LN-20	TI31-20	M20	9	35	0.034	1631	4
6	LN-24	TI31-24	M24	10	42	0.054	2355	5
7	LN-30	TI31-30	M30	12	53	0.105	3792	6
8	LN-36	TI31-36	M36	14	64	0.181	5555	7
9	LN-42	TI31-42	M42	16	75	0.285	7666	8
10	LN-48	TI31-48	M48	18	87	0.44	10112	9
11	LN-56	TI31-56	M56	22	99	0.675	15188	10
12	LN-64	TI31-64	M64	24	110	0.876	20387	11
13	LN-72	TI31-72	M72	28	120	1.023	26300	12
14	LN-80	TI31-80	M80	32	131	1.324	32926	13

<b>ROUND WASHER</b>									
FIGURE - 32 <span style="float: right;">Material : Carbon steel (IS-2062,Gr. A/B) Finish : Painted,Galvanize</span>									
SL. NO.	1	2	3	4	5	6	7	8	9
TECHNO DESIGNATION	RW-6	RW-8	RW-10	RW-12	RW-16	RW-20	RW-24	RW-30	RW-36
PART NO	TI32-6	TI32-8	TI32-10	TI32-12	TI32-16	TI32-20	TI32-27	TI32-30	TI32-36
BOLT SIZE	M6	M8	M10	M12	M16	M20	M24	M30	M36
I.D	8	10	11	14	17	24	27	35	41
O.D	19	25	25	35	44	57	64	76	89
WGT. EACH (Kg)	0.04	0.09	0.09	0.18	0.36	0.67	0.85	1.16	1.69





<b>PIPE ROLLER ASSEMBLY (TYPE-I)</b>																	
FIGURE - 33				Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize													
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	D	E	F	K	L	O	P	Q	T	Weight (Kg)	Maximum load (Kg)	LOAD GROUP		
1	I-PR-50	TI33-50	50	146	216	38	165	26	51	11	89	105	3.2	177	1		
2	I-PR-65	TI33-65	65			44											
3	I-PR-80	TI33-80	80			64											
4	I-PR-90	TI33-90	90			70											
5	I-PR-100	TI33-100	100	146	257	70	203	26	60	14	121	108	4.8	431	2		
6	I-PR-125	TI33-125	125			86											
7	I-PR-150	TI33-150	150			98											
8	I-PR-200	TI33-200	200	175	225	130	102	22	95	16	178	127	7.5	952	3		
9	I-PR-250	TI33-250	250			159											
10	I-PR-300	TI33-300	300	200	279	187	146	22	121	14	235	152	12.2	1394	4		
11	I-PR-350	TI33-350	350			203											
12	I-PR-400	TI33-400	400			225											
13	I-PR-450	TI33-450	450	222	318	254	171	26	117	19	260	165	18.4	2258	5		
14	I-PR-500	TI33-500	500			279											
15	I-PR-600	TI33-600	600	225	349	330	191	26	121	21	292	171	23.1	2766	6		
16	I-PR-750	TI33-750	750	273	438	413	254	26	143	25	365	203	40.7	3401	6		
17	I-PR-900	TI33-900	900	305	476	508	305	26	146	33	432	229	68.9	5441	7		
18	I-PR-1050	TI33-1050	1050			587											

<b>CLEVIS HANGER</b>											
FIGURE - 34				Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize							
Specified loads are for up to 399°C											
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB. (mm)	ROD SIZE A	C	D	F	WEIGHT (Kg)	MAXIMUM LOAD (Kg)	LOAD GROUP	
1	CH-15	TI34-15	15	M10	70	79	48	0.12	277	1	
2	CH-20	TI34-20	20	M10	54	70	38	0.13	277	1	
3	CH-25	TI34-25	25	M10	76	95	57	0.15	277	1	
4	CH-32	TI34-32	32	M10	79	102	57	0.16	277	1	
5	CH-40	TI34-40	40	M10	83	108	60	0.19	277	1	
6	CH-50	TI34-50	50	M10	86	117	79	0.24	277	1	
7	CH-65	TI34-65	65	M12	105	143	79	0.28	512	2	
8	CH-80	TI34-80	80	M12	127	175	105	0.41	512	2	
9	CH-90	TI34-90	90	M12	114	168	92	0.45	512	2	
10	CH-100	TI34-100	100	M16	137	197	111	0.64	648	3	
11	CH-125	TI34-125	125	M16	152	225	127	0.95	648	3	
12	CH-150	TI34-150	150	M20	178	267	149	1.36	880	3	
13	CH-200	TI34-200	200	M20	216	324	171	2.04	907	3	
14	CH-250	TI34-250	250	M20	254	391	210	4.13	1632	5	
15	CH-300	TI34-300	300	M20	283	445	235	5.33	1723	5	
16	CH-350	TI34-350	350	M24	318	495	270	6.46	1904	5	
17	CH-400	TI34-400	400	M24	381	584	333	9.41	2177	5	
18	CH-450	TI34-450	450	M24	400	629	349	10.43	2177	5	
19	CH-500	TI34-500	500	M30	441	695	387	18.82	2177	5	
20	CH-600	TI34-600	600	M30	498	803	445	22.68	2177	5	
21	CH-750	TI34-750	750	M30	629	1035	552	30.88	2721	5	
22	CH-900	TI34-900	900	M36	835	1292	762	31.15	4308	7	



Pipe Clamp Base Support (TYPE-I)															
FIGURE - 35A				Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize											
Specified loads are for up to 350°C															
SL. No	TECHNO DESIGNATION	PART NO	Pipe Size NB	M	N	Y	Z	Q	Max Temperature °C	Load Capacity (Kg)	Weight in (Kg)				LOAD GROUP
											PB1	PB2	PB3	PB4	
1	PCBS-15	TI35A-15	15	50	150	90	106	185	350	360	1.8	3	4.2	5.4	1
2	PCBS-20	TI35A-20	20	50	150	90	110	185	350	360	1.8	3	4.2	5.4	1
3	PCBS-25	TI35A-25	25	50	150	90	120	185	350	360	1.9	3.1	4.3	5.4	1
4	PCBS-32	TI35A-32	32	60	150	100	130	185	350	360	2.3	3.7	5.2	6.7	1
5	PCBS-40	TI35A-40	40	60	150	100	138	185	350	360	2.3	3.8	5.2	6.7	1
6	PCBS-50	TI35A-50	50	70	150	110	150	203	350	530	2.7	4.4	6.2	7.9	2
7	PCBS-65	TI35A-65	65	70	200	110	166	253	350	530	3.1	5.2	7.2	9.3	2
8	PCBS-80	TI35A-80	80	100	200	160	182	253	350	530	4.6	7.9	11	15	2
9	PCBS-90	TI35A-90	90	100	200	160	196	253	350	530	4.7	8	11	15	2
10	PCBS-100	TI35A-100	100	100	200	170	208	253	350	1010	4.8	8.2	12	15	3
11	PCBS-125	TI35A-125	125	110	200	180	236	253	350	1010	5.4	9.2	13	17	3
12	PCBS-150	TI35A-150	150	120	200	200	278	264	350	1580	9.3	15	21	27	4
13	PCBS-175	TI35A-175	175	140	250	240	302	314	350	2280	12	20	29	37	5
14	PCBS-200	TI35A-200	200	150	250	250	320	308	350	1010	9.8	16	23	29	3
15	PCBS-225	TI35A-225	225	160	250	260	346	308	350	1010	11	18	25	32	4
16	PCBS-250	TI35A-250	250	170	250	280	384	314	350	1580	16	26	36	41	5
17	PCBS-300	TI35A-300	300	190	300	320	446	369	350	1580	22	65	49	62	5
18	PCBS-350	TI35A-350	350	210	300	340	506	396	350	3650	39	62	86	109	6
19	PCBS-400	TI35A-400	400	240	300	360	570	391	350	3650	47	74	101	128	6

Pipe Clamp Base Support (TYPE-II)															
FIGURE - 35B				Material : Carbon steel (SA-515, Gr 70) Finish : Plain,Painted,Galvanize											
Specified loads are for up to 530°C															
SL. No	TECHNO DESIGNATION	PART NO	Pipe Size NB	M	N	Y	Z	Q	Max Temperature °C	Load Capacity (Kg)	Weight in (Kg)				LOAD GROUP
											PB1	PB2	PB3	PB4	
1	PCBS-15	TI35B-15	15	70	150	110	96	190	530	360	2.6	4.4	6.2	8	1
2	PCBS-20	TI35B-20	20	70	150	110	106	190	530	360	2.6	4.5	6.3	8.1	1
3	PCBS-25	TI35B-25	25	70	150	120	116	190	530	360	2.8	4.7	6.5	8.4	1
4	PCBS-32	TI35B-32	32	70	150	120	126	190	530	360	2.9	4.7	6.6	8.4	1
5	PCBS-40	TI35B-40	40	80	150	130	136	190	530	360	3.3	5.5	7.7	9.9	1
6	PCBS-50	TI35B-50	50	80	150	130	146	208	530	530	3.4	5.6	7.7	9.9	2
7	PCBS-65	TI35B-65	65	80	200	140	166	258	530	530	4	6.6	9.2	12	2
8	PCBS-80	TI35B-80	80	100	200	170	176	258	530	530	5	8.5	12	15	2
9	PCBS-90	TI35B-90	90	110	200	180	196	258	530	530	5.7	6.6	13	17	2
10	PCBS-100	TI35B-100	100	110	200	190	206	264	530	1010	7.3	13	18	24	3
11	PCBS-125	TI35B-125	125	120	200	200	236	264	530	1010	8.2	14	20	26	3
12	PCBS-150	TI35B-150	150	130	200	210	276	274	530	1580	12	18	25	31	4
13	PCBS-175	TI35B-175	175	150	250	250	306	324	530	2280	15	24	33	42	5
14	PCBS-200	TI35B-200	200	160	250	270	336	356	530	3650	27	42	57	73	6
15	PCBS-225	TI35B-225	225	170	250	280	366	356	530	3650	29	45	62	78	6
16	PCBS-250	TI35B-250	250	180	250	300	396	365	530	5340	36	59	82	105	7
17	PCBS-300	TI35B-300	300	200	300	340	478	425	530	7400	52	81	110	139	8
18	PCBS-350	TI35B-350	350	220	300	360	518	440	530	9650	70	115	159	204	9
19	PCBS-400	TI35B-400	400	240	300	390	610	475	530	13350	114	178	242	307	10


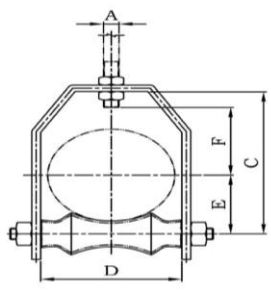



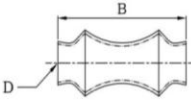


Pipe Clamp Base Support (TYPE-III)															
FIGURE - 35C										Material : Carbon steel (SA-387, Gr 11/22) Finish : Plain,Painted,Galvanize					
Specified loads are for up to 600°C															
SL. No	TECHNO DESIGNATION	PART NO	Pipe Size NB	M	N	Y	Z	Q	Max Temperature °C	Load Capacity (Kg)	Weight in (Kg)				LOAD GROUP
											PB1	PB2	PB3	PB4	
1	PCBS-15	TI35C-15	15	80	150	140	96	190	600	360	3	5.4	7.7	10	1
2	PCBS-20	TI35C-20	20	80	150	140	106	190	600	360	3.1	5.4	7.7	10	1
3	PCBS-25	TI35C-25	25	80	150	140	116	190	600	360	3.2	5.5	7.8	10	1
4	PCBS-32	TI35C-32	32	90	150	150	126	190	600	360	3.7	6.3	8.9	12	1
5	PCBS-40	TI35C-40	40	90	150	150	136	190	600	360	3.7	6.4	9	12	1
6	PCBS-50	TI35C-50	50	100	150	160	146	208	600	530	4.2	7.2	10	13	2
7	PCBS-65	TI35C-65	65	100	200	160	176	268	600	530	6.5	9.9	13	17	2
8	PCBS-80	TI35C-80	80	110	200	180	196	268	600	530	7.5	11	15	19	2
9	PCBS-90	TI35C-90	90	110	200	190	206	268	600	530	7.8	12	16	20	2
10	PCBS-100	TI35C-100	100	120	200	200	226	274	600	1010	10	16	22	28	3
11	PCBS-125	TI35C-125	125	130	200	210	246	274	600	1010	11	18	24	31	3
12	PCBS-150	TI35C-150	150	140	200	230	276	274	600	1580	13	20	27	35	4
13	PCBS-175	TI35C-175	175	160	250	270	306	340	600	2280	20	33	46	58	5
14	PCBS-200	TI35C-200	200	170	250	280	356	375	600	3650	38	59	80	102	6
15	PCBS-225	TI35C-225	225	180	250	300	398	375	600	3650	42	65	88	111	6
16	PCBS-250	TI35C-250	250	190	250	310	428	395	600	5340	50	75	99	123	7
17	PCBS-300	TI35C-300	300	230	300	380	498	460	600	7400	88	137	185	234	8
18	PCBS-350	TI35C-350	350	230	300	390	538	460	600	9650	92	141	189	238	9
19	PCBS-400	TI35C-400	400	250	300	420	630	465	600	13350	126	196	266	335	10

RISER CLAMP																
FIGURE - 36										Material : Carbon steel (IS-2062,Gr.A/B) Finish : Plain,Painted,Galvanize						
Specified loads are for up to 399°C																
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB (mm)	A	C	D	E x F	G	H	J	K	M	N	WEIGHT (Kg)	MAX LOAD (Kg)	LOAD GROUP
1	RC-15	TI36-15	15	95	76	12	32x6	35	M10	40	M12	12	15	0.95	750	3
2	RC-20	TI36-20	20	100	86	12	32x6	35	M10	40	M12	12	15	1.05	750	3
3	RC-25	TI36-25	25	105	92	12	32x6	40	M10	40	M12	12	15	1.1	750	3
4	RC-32	TI36-32	32	115	98	12	32x6	45	M10	40	M12	12	15	1.2	750	3
5	RC-40	TI36-40	40	125	105	25	40x6	50	M12	60	M16	14	19	1.6	1180	4
6	RC-50	TI36-50	50	150	130	25	40x6	60	M12	60	M16	15	19	1.8	2000	5
7	RC-65	TI36-65	65	156	140	25	40x6	65	M12	60	M16	15	19	1.9	2000	5
8	RC-80	TI36-80	80	170	150	25	40x6	75	M12	60	M16	15	19	2	2000	5
9	RC-100	TI36-100	100	195	165	25	50x10	95	M16	70	M16	15	19	4.9	2000	5
10	RC-125	TI36-125	125	225	195	25	50x10	110	M16	70	M16	19	19	5.5	2000	5
11	RC-150	TI36-150	150	255	220	35	65x10	125	M20	80	M24	19	28	8.4	2600	6
12	RC-200	TI36-200	200	280	245	35	65x10	155	M20	80	M24	24	28	9.4	2600	6
13	RC-250	TI36-250	250	305	270	35	65x10	185	M20	80	M24	24	28	11	2600	6
14	RC-300	TI36-300	300	330	295	35	65x10	210	M20	80	M24	24	28	12.2	2600	6
15	RC-350	TI36-350	350	365	325	50	75X16	235	M24	115	M30	24	35	23.6	4000	7
16	RC-400	TI36-400	400	390	350	50	75X16	260	M24	115	M30	28	35	25.8	4000	7
17	RC-450	TI36-450	450	420	375	50	75X16	295	M24	115	M30	28	35	29	4000	7
18	RC-500	TI36-500	500	445	405	50	75X16	320	M24	115	M30	28	35	30	4000	7
19	RC-600	TI36-600	600	495	455	50	75X16	380	M24	115	M30	28	35	34.5	4000	7



<b>HARVARD ROLL HANGER</b>												
FIGURE - 37				Material : Carbon steel (IS-2062,Gr. A/B) Finish : Painted,Galvanize								
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	ROD SIZE A	C	D	E	F	G	WEIGHT (KG)	MAXIMUM LOAD (Kg)	WEIGHT (KG)
1	HRH-50	TI37-50	50	M12	108	70	41	67	5X32	0.73	68	1
2	HRH-65	TI37-65	65	M12	124	83	51	73	5X32	0.91	102	1
3	HRH-80	TI37-80	80	M12	159	98	57	79	5X32	1.04	141	1
4	HRH-90	TI37-90	90	M12	175	114	67	89	6X32	1.13	177	1
5	HRH-100	TI37-100	100	M16	191	124	73	92	6X38	1.81	215	1
6	HRH-125	TI37-125	125	M16	213	162	89	114	6X51	2.4	311	1
7	HRH-150	TI37-150	150	M20	251	194	102	127	6X51	9.4	354	1
8	HRH-175	TI37-175	175	M20	283	216	121	133	6X51	4.26	354	1
9	HRH-200	TI37-200	200	M20	321	241	130	156	10X51	5.58	354	1
10	HRH-250	TI37-250	250	M20	381	286	159	184	10X64	8.75	438	2
11	HRH-300	TI37-300	300	M20	435	343	191	213	13X51	10.5	438	2
12	HRH-350	TI37-350	350	M24	467	371	213	222	13X64	16.1	544	2
13	HRH-400	TI37-400	400	M24	521	438	241	248	13X64	21.1	635	3
14	HRH-450	TI37-450	450	M24	587	483	267	292	13X76	25.9	635	3
15	HRH-500	TI37-500	500	M30	622	533	295	311	16X76	34.4	725	3
16	HRH-600	TI37-600	600	M36	759	629	356	400	16X76	54.1	816	3

<b>PIPE ROLL</b>							
FIGURE - 38				Material : Carbon steel (IS-2062,Gr. A/B) Finish : Painted,Galvanize			
SL. NO.	TECHNO DESIGNATION	PART NO	PIPE SIZE NB	B	ROLL ROD DIAMETER (D)	WEIGHT ( Kg)	
1	PR-25	TI38-25	25	38	10	0.05	
2	PR-32	TI38-32	32	48	10	0.08	
3	PR-40	TI38-40	40	54	10	0.11	
4	PR-50	TI38-50	50	73	10	0.15	
5	PR-65	TI38-65	65	79	13	0.17	
6	PR-80	TI38-80	80	95	13	0.19	
7	PR-90	TI38-90	90	111	13	0.31	
8	PR-100	TI38-100	100	121	13	0.41	
9	PR-125	TI38-125	125	149	16	0.59	
10	PR-150	TI38-150	150	171	16	0.82	
11	PR-200	TI38-200	200	225	19	1.5	
12	PR-250	TI38-250	250	279	22	2.18	
13	PR-300	TI38-300	300	330	22	4.5	
14	PR-350	TI38-350	350	365	25	5.4	
15	PR-400	TI38-400	400	429	32	8.6	
16	PR-450	TI38-450	450	467	32	10.2	
17	PR-500	TI38-500	500	518	32	10.3	
18	PR-600	TI38-600	600	616	38	19.8	
19	PR-750	TI38-750	750	768	44	44.5	

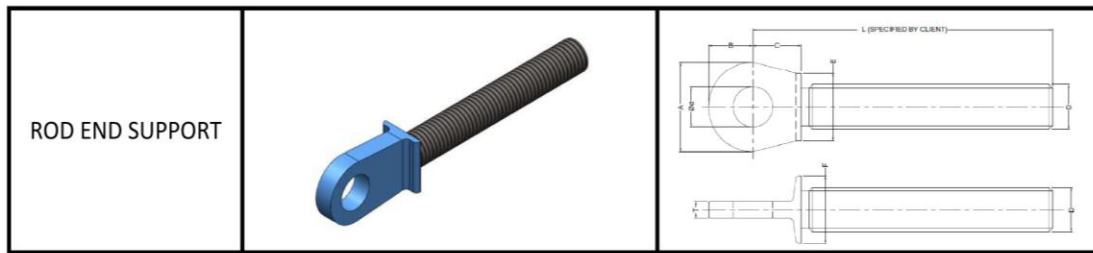


FIGURE - 39

Material :FORGED (SA-105)

Finish : Plain,Painted

Sl. No.	TECHNO DESIGNATION	PART NO.	D	Ød	A	B	C	T	E	f
1	RES-12	TI10G-12	12	14	25	14	21	7	21	18
2	RES-16	TI10G-16	16	18	32	18	27	9	27	23
3	RES-20	TI10G-20	20	22	39	22	33	11	33	28
4	RES-24	TI10G-24	24	26	46	26	39	13	39	33
5	RES-30	TI10G-30	30	33	58	33	50	17	50	41
6	RES-36	TI10G-36	36	38	67	38	57	19	57	48
7	RES-42	TI10G-42	42	45	79	45	68	23	68	56
8	RES-48	TI10G-48	48	52	91	52	78	26	78	65
9	RES-56	TI10G-56	56	60	105	60	90	30	90	75
10	RES-64	TI10G-64	64	68	119	68	102	34	102	85
11	RES-72	TI10G-72	72	75	131	75	113	38	113	94

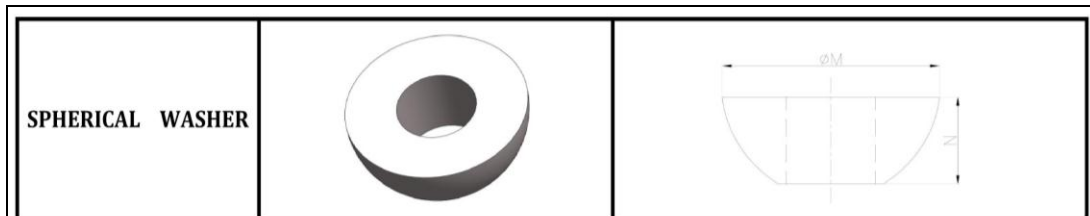


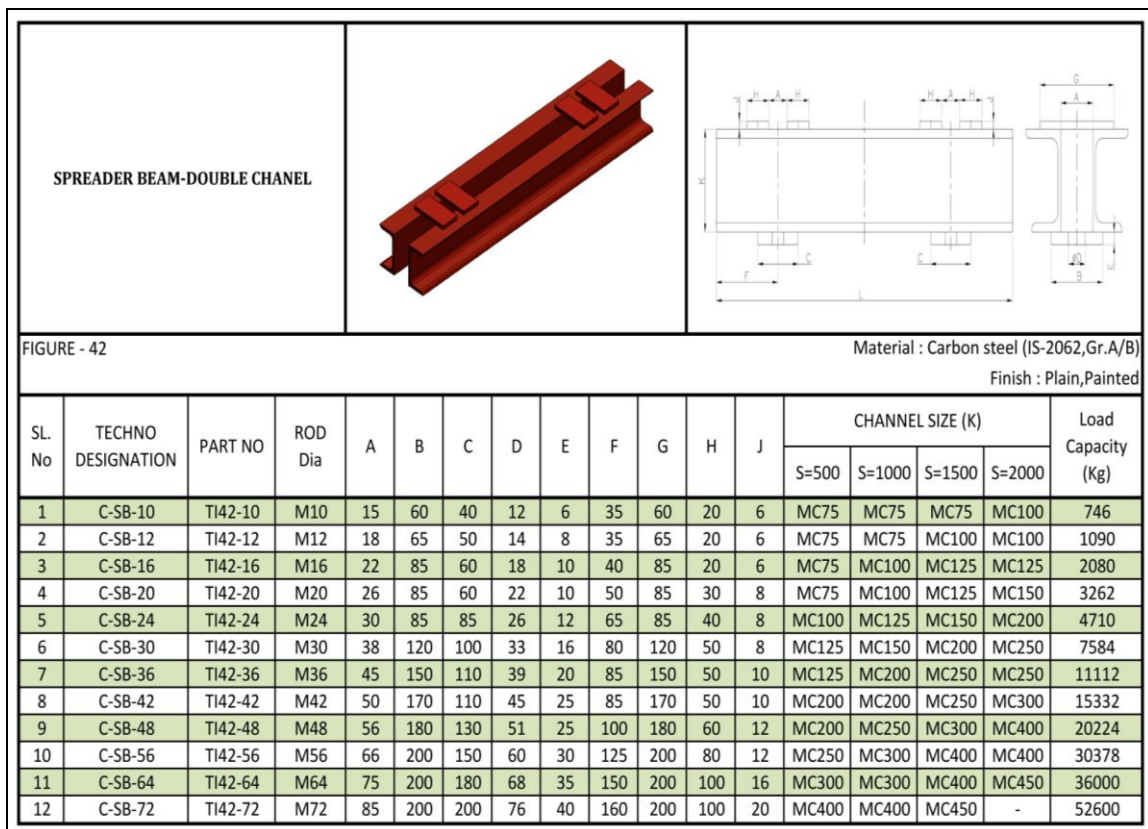
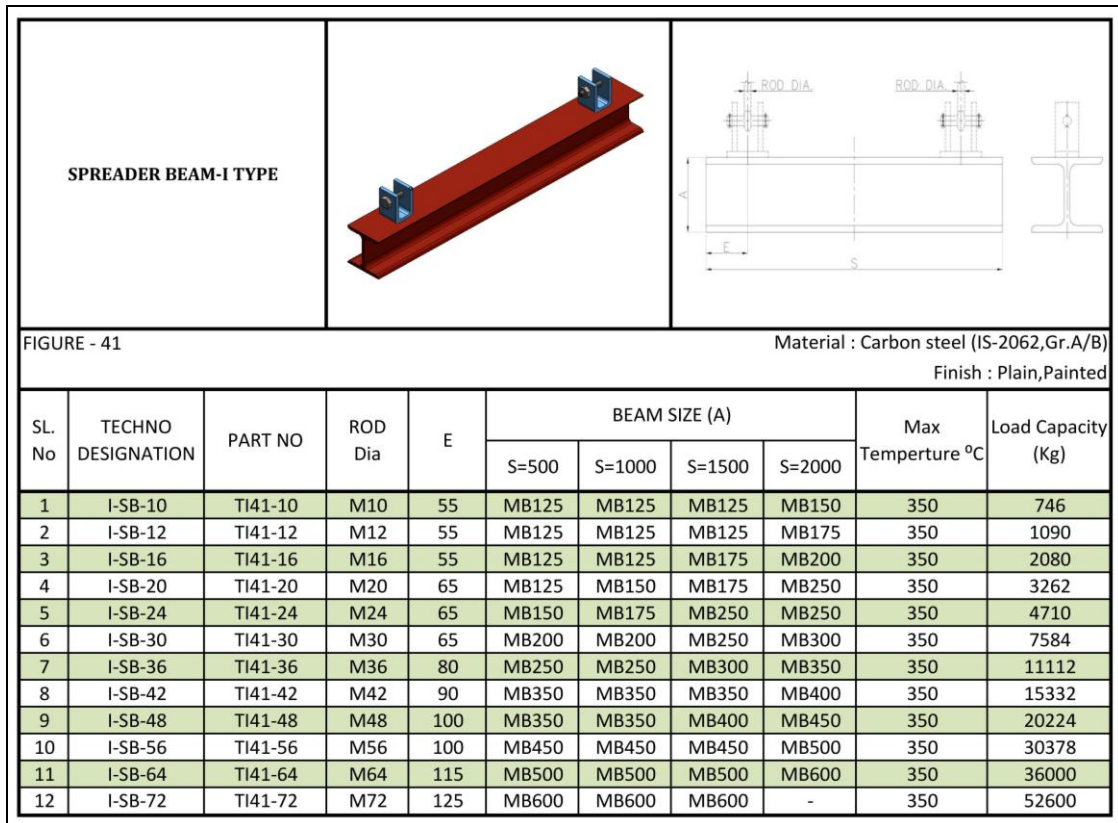
FIGURE - 40

Material : Carbon steel (IS-2062,Gr. A/B)


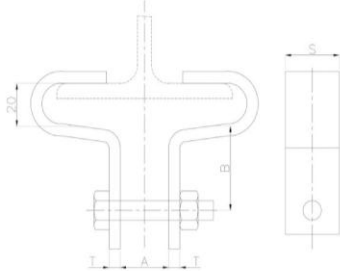
Finish : Plain,Galvanize


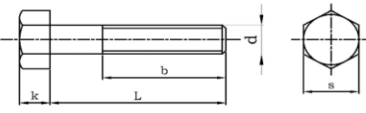
SL. NO.	TECHNO DESIGNATION	PART NO	ROD DIA	M	N	WEIGHT ( Kg)	MAXIMUM LOAD (Kg)	LOAD GROUP
1	SPH-10	TI40-10	10	30	10	0.05	373	1
2	SPH-12	TI40-12	12	35	12	0.08	545	2
3	SPH-16	TI40-16	16	40	16	0.13	1040	3
4	SPH-20	TI40-20	20	50	20	0.26	1631	4
5	SPH-24	TI40-25	24	65	25	0.56	2355	5
6	SPH-30	TI40-30	30	75	30	0.87	3792	6
7	SPH-36	TI40-35	36	85	35	1.28	5556	7
8	SPH-42	TI40-42	42	100	42	2.13	7666	8
9	SPH-48	TI40-50	48	115	50	3.36	10112	9
10	SPH-56	TI40-60	56	135	60	5.58	15189	10
11	SPH-64	TI40-65	64	160	65	8.61	20387	11
12	SPH-72	TI40-75	72	175	75	11.76	26300	12
13	SPH-80	TI40-85	80	200	85	17.60	32926	13







BEAM CLAMP										
FIGURE - 43		Material : Carbon steel (IS-2062,Gr.A/B)		Finish : Plain,Painted						
SL. No	TECHNO DESIGNATION	PART NO	BOLT SIZE	A	B	S	T	Weight in (Kg)	Load Capacity (Kg)	LOAD GROUP
1	BC-10	TI43-10	M10	12	45	35	8	0.4	373	1
2	BC-12	TI43-12	M12	15	45	40	10	0.50	545	2
3	BC-16	TI43-16	M16	18	50	45	10	0.60	820	3
4	BC-20A	TI43-20A	M20	22	60	55	12	1.10	1130	4
5	BC-20B	TI43-20B	M20	22	70	70	12	1.50	1355	4
6	BC-20C	TI43-20C	M20	22	70	70	16	1.90	1631	4

HEXAGON BOLT															
				Material : (IS-1367,CL-4.6)											
SL. NO.	TECHNO DESIGNATION	PART NO	BOLT SIZE	P	b			ds		k		s		MAX LOAD Kg	LOAD GROUP
					d	L<125	125<L<200	200<L	max	min	max	min	max		
1	HB-10	TI45-10	M10	1.5	26	32	45	10.58	9.42	6.85	5.95	16	15.57	373	1
2	HB-12	TI45-12	M12	1.75	30	36	49	12.7	11.3	7.95	7.05	18	17.57	545	2
3	HB-16	TI45-16	M16	2	38	44	57	16.7	15.3	10.75	9.25	24	23.16	1040	3
4	HB-20	TI45-20	M20	2.5	46	52	65	20.84	19.16	13.4	11.6	30	29.16	1631	4
6	HB-24	TI45-24	M24	3	54	60	73	24.84	23.16	15.9	14.1	36	35	2355	5
7	HB-30	TI45-30	M30	3.5	66	72	85	30.84	29.16	19.75	17.65	46	45	3792	6
8	HB-36	TI45-36	M36	4	-	84	97	37	35	23.55	21.45	55	53.8	5555	7
9	HB-42	TI45-42	M42	4.5	-	96	109	43	41	27.05	24.95	65	63.1	7666	8
10	HB-48	TI45-48	M48	5	-	108	121	49	47	31.05	28.95	75	73.1	10112	9
11	HB-56	TI45-56	M56	5.5	-	-	137	57.2	54.8	36.25	33.75	85	82.8	15188	10
12	HB-64	TI45-64	M64	6	-	-	153	65.2	62.8	41.25	38.75	95	92.8	20387	11

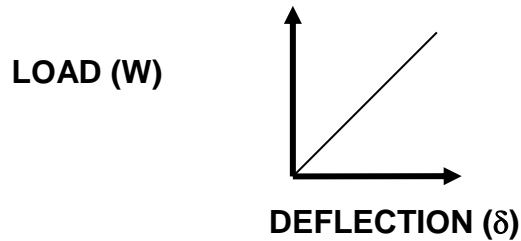




## SPRINGS

A mechanical spring may be defined as an elastic body whose primary function is to deflect under load (or to absorb energy) and which recovers its original shape when released after being distorted. A mechanical spring should primarily deflect more and it attains there by greater elastic energy.

Provided the material is not stressed beyond the elastic limit, the usual type of spring will have a straight-line load deflection diagram as shown:



Among the primary functions of the springs the followings are perhaps the important:

To cushion, absorb energy due to shock or vibrations.

To store energy.

To measure forces.

### ➤ CLASSIFICATION:

The different types of springs manufactured by TECHNO INDUSTRY are as follows:

(A) TORSION SPRINGS:

(B) LAMINATED OR LEAF SPRINGS.

(C) DISC OR BELLEVILLE SPRINGS.

(D) HELICAL COMPRESSION SPRINGS.

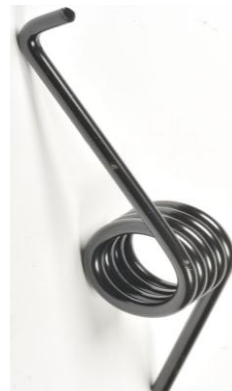
(E) VOLUTE & HELICAL EXTENSION SPRINGS

(F) DIFFERENT TYPES OF SPRING WASHERS.

### ➤ BASIC SPRING TYPES:

Springs are of several types, the most plentiful of which are shown as follows,

#### COMPRESION, TENSION, TORSION





Circular cross section springs are shown. If space is limited, such as with automotive valve springs, square cross section springs can be considered. If space is extremely limited and the load is high, Belleville washer springs can be considered. These springs are illustrated below,

## BELLEVILLE WASHER



Leaf springs, which are illustrated above in a typical wheeled-vehicle application, can be designed to have progressive spring rates. This "non-linear spring constant" is useful for vehicles, which must operate with widely varying loads, such as trucks.

## LAMINATED LEAF SPRING



- HOOKE'S LAW:

Springs are fundamental mechanical components, which form the basis of many mechanical systems. A spring can be defined to be an elastic member, which exerts a resisting force when its shape is changed. Most springs are assumed linear and obey the Hooke's Law,

$$F = k \Delta$$

Where  $F$  is the resisting force,  $\Delta$  is the displacement, and the  $k$  is the spring constant.

For a non-linear spring, the resisting force is not linearly proportional to its displacement. Non-linear springs are not covered in depth here.

- GEOMETRICAL FACTORS:

The spring index,  $C$ , can be used to express the deflection,

$$C = \frac{D}{d}$$

$$\Delta = \frac{8FC^3na}{Gd} = \frac{F}{k}$$

The useful range for  $C$  is about 4 to 12, with an optimum value of approximately 9. The wire diameter,  $d$ , should conform to a standard size if at all possible.

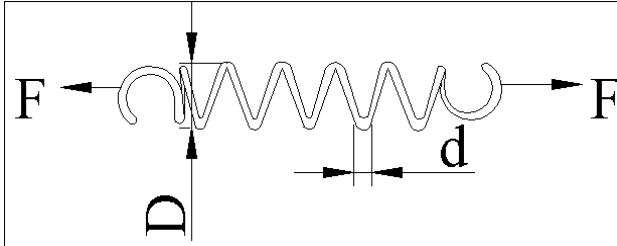


The active wire length  $L_a$  can also be used to form an expression for the deflection,

$$L_a = \pi D n \alpha$$

$$\Delta = \frac{8FD^2 L_a}{\pi G d^4}$$

Extension springs typically appear as follows,



Extension springs are typically manufactured with an initial tension  $F_i$  that presses the coils together in the Free State. This fabrication method allows consistent free lengths to be produced, but since the initial tension is not zero, the spring rate is not truly linear when measured from the resting state. However once the initial tension is overcome, the spring does behave linearly.

- **SHEAR STRESS:**

Since extension springs have an initial tension in their resting state, they also have a shear stress in their coils while at rest. The maximum shear stress (at rest)  $\tau_i$  occurs on the inner face of the coils, and is given by the equation,

$$\tau_i = \frac{8WDF_i}{\pi d^3}$$

Where  $D$  is the nominal diameter of the spring,  $d$  is the wire diameter, and  $W$  is the Wahl correction Factor.

After the initial tension is overcome, the extension spring can be analyzed as a compression spring with a negative force. The maximum shear stress ( $\tau_{\max}$ ) in the spring increases with the load and is given by,

$$\tau_{\max} = \tau_i + \frac{8WDF}{\pi d^3}$$

The spring extension  $\Delta$  is given by,

$$\Delta = \frac{8n\tau (F - F_i)}{Gd^4}$$



Where  $G$  is the shear modulus and  $n_t$  is the total number of coils.

The maximum shear stress  $\tau_{\max}$  in a helical spring occurs on the inner face of the spring coils and is equal to,

$$\tau_{\max} = \frac{8CFW}{\pi d^2} = \frac{8FDW}{\pi d^3}$$

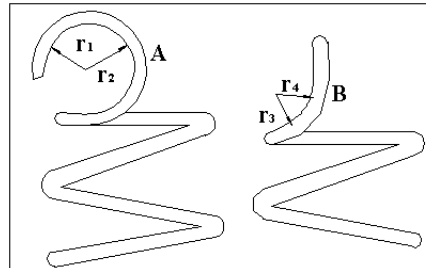
Where  $W$  is the **Wahl Correction Factor**, which accounts for shear stress resulting from spring curvature,

$$W = \frac{4C - 1}{4C - 4} + \frac{0.615}{C}$$

- **END STRESS CONCENTRATION:**

Consider a regular hook we typically see on an extension spring. The geometry of the hook often causes stress concentration, which leads to failure. The following illustration shows this geometry and defines the radial parameters  $r_1$  to  $r_4$ ,

### EXTENSION SPRING STRESS CONCENTRATION



The maximum bending stress at point A and the maximum shear stress at point B can be expressed as follows,

$$\sigma_A = \frac{16FD}{\pi d^3} \left( \frac{r_1}{r_2} \right)$$

$$\tau_B = \frac{8FD}{\pi d^3} \left( \frac{r_3}{r_4} \right)$$

- **EXTENSION SPRING FACTOR OF SAFETY:**

If a compression spring fails, catastrophic failure of the supported assembly is often prevented by the fact that the parts containing the ends of the compression spring will at worst compress the remains of the spring.

With an extension spring, there is no such safety geometry since the spring is in tension. For this and other reasons, extension spring maximum working stresses are typically limited to **three-fourths** (3/4) of those for compression springs of similar geometry and material.



## • FIRST NATURAL FREQUENCY FORMULA.

When springs are used in a moving mechanism, their dynamic behaviors have to be analyzed. For example, valve springs in an engine have their own natural frequencies. The designers must ensure that springs are operated well under their first natural frequency at maximum engine speed, or they risk damage to the pistons because the springs may not return the valves in time.

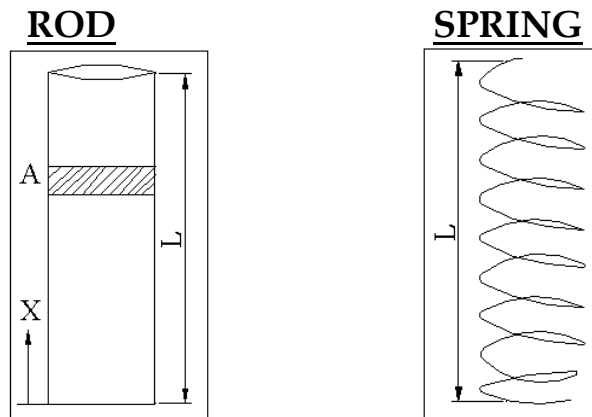
The first natural frequency of a helical spring is found to be,

$$f_{res} = \frac{d}{9D^2 n_t} \sqrt{\frac{G}{\rho}}$$

Where  $d$  is the wire diameter,  $D$  is the nominal coil diameter,  $n_t$  is the total number of coils,  $G$  and  $\rho$  are the shear modulus and density of the spring material, respectively.

## • DEVIATION BY ANOLOGY.

An easy way to derive the above equation is to draw an analogy between a rod and a spring. The analogy works because both objects are continuously distributed elements, in that their stiffness and mass are spread uniformly throughout their interiors.



Both the spring and the rod obey Hooke's Law when used in static applications,

$$\mathbf{F = k \Delta L}$$

Where  $\Delta L$  is the change in length of the spring or rod. The stiffness  $k$  for the rod is given by,

$$k_{rod} = \frac{EA}{L}$$

Where  $E$  is the Young's modulus of the material, and  $A$  and  $L$  are defined in the picture above. The change in length of the rod for dynamic applications is given by,

$$\Delta L_{rod} = \frac{F}{k_{rod}} \left( 2 \frac{1 - \cos nL}{nL \sin nL} \right)$$



Where the wave number  $n$  is given by,

$$n = 2\pi f \sqrt{\frac{\rho}{E}}$$

And  $f$  is the driving frequency (in Hz). To check that we have the right equation, we note 2 things: The dynamic equation for  $DL$  satisfies the governing partial differential equation for the rod, and  $DL$  becomes Hooke's Law in the static limit ( $f$  goes to zero),

$$EA \frac{\partial^2 u}{\partial x^2} = \rho A \frac{\partial^2 u}{\partial t^2} \Delta L_{rod} (f \rightarrow 0) = \frac{F}{k_{rod}}$$

To find the natural frequencies for the rod, we look at where the change in length of the rod blows up. This occurs when  $nL$  in the denominator equals one of the following:  $\{p, 2p, 3p, \dots\}$ . The first natural frequency occurs when,

$$\pi = nL = \left( 2\pi f_{res} \sqrt{\frac{\rho}{E}} \right) L$$

We solve for  $f_{res}$  and substitute in  $k_{rod}$  and the volume of the rod ( $A*L$ ),

$$f_{res} = \frac{1}{2} \sqrt{\frac{E}{\rho L^2}} = \frac{1}{2} \sqrt{\frac{EA}{\rho AL^2}} = \frac{1}{2} \sqrt{\frac{k_{rod}}{\rho \cdot Volume}}$$

We recognize that the density times the volume equals the mass of the rod. We can therefore simplify the resonant frequency formula to,

$$f_{res} = \frac{1}{2} \sqrt{\frac{k_{rod}}{M_{rod}}}$$

By analogy, the spring's first natural frequency will have the same equation,

$$f_{res} = \frac{1}{2} \sqrt{\frac{k}{M}}$$

Where  $k$  is now the spring stiffness and  $M$  is the spring mass (which can be found by weighing the spring).

Note that this equation is similar to that for a lumped spring-mass oscillator. However, the frequency here is a factor of  $p$  higher due to the distributed mass in the spring (and rod).

- **EXPRESSED IN TERMS OF SPRING GEOMETRY:**

We can express the natural frequency for the spring in terms of its geometry and shear modulus (instead of its overall stiffness  $k$  and its mass).

To do so, we find the volume of the spring,

$$volume = \left( \frac{\pi}{4} d^2 \right) \pi D n_t$$





And note the stiffness of the spring in terms of its geometry and shear modulus  $G$  and number of active coils  $n_a$ ,

$$k = \frac{Gd^4}{8D^3n_a}$$

Substituting these two equations into the formula for  $f_{res}$  gives,

$$f_{res} = \frac{1}{2} \sqrt{\frac{\frac{Gd^4}{8D^3n_a}}{\rho \left(\frac{\pi}{4}d^2\right) \pi D n_t}} = \frac{d}{2\pi D^2} \sqrt{\frac{G}{2\rho n_a n_t}}$$

If the spring has several coils, we can assume that the number of active coils equals the number of total coils. We can also allow the following numerical approximation,

$$2\pi\sqrt{2} \approx 9$$

These two approximations give us our final equation for the spring resonant frequency,

$$f_{res} = \frac{d}{9D^2n_t} \sqrt{\frac{G}{\rho}}$$

To use this formula we need to know the material's  $G$  and all of the spring geometry. It's much easier to use the formula from the last section, which only needs the spring stiffness and mass, especially when working with springs where the material is uncertain.

## • RISK FACTORS

Compression spring buckling refers to when the spring deforms in a non-axial direction, as shown here,

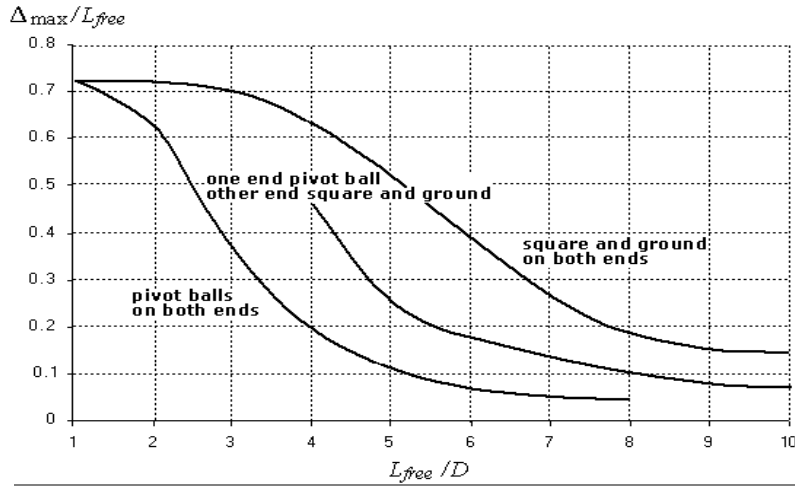


Buckling is a very dangerous condition, as the spring can no longer provide the intended force. Once buckling starts, the off-axis deformation typically continues rapidly until the spring fails. As a result, it is important to design compression springs such that their likeliness to buckle is minimized. Buckling of compression springs is similar to buckling for vertical structural columns. When the free height of the spring ( $L_{free}$ ) is more than **4~5 times** the nominal coil diameter  $D$ , the spring can buckle under a sufficiently heavy load. The maximum allowable spring deflection  $D_{max}$  that avoids buckling depends on the free length, the coil diameter, and the spring ends (pivot ball, ground & squared, etc.).

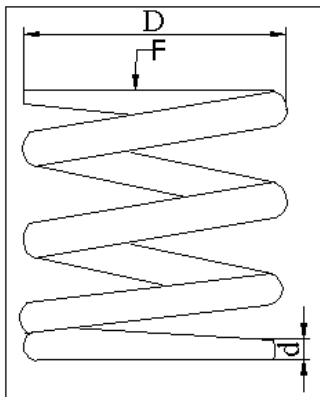


## • BUCKLING THRESHOLD

One quick method for checking for buckling is to compute the deflection to free height ratio ( $D/L_{free}$ ) and use the following chart to check if the ratio exceeds the maximum allowable value:



## • SPRING CONSTANT DEPENDENCIES:



For the springs in this discussion, Hooke's Law is typically assumed to hold,

$$F = k \Delta$$

We can expand the spring constant  $k$  as a function of the material properties of the spring. Doing so and solving for the spring displacement gives,

$$\Delta = \frac{F}{k} = \frac{8FD^3 n_a}{Gd^4}$$

where  $G$  is the material shear modulus,  $n_a$  is the number of active coils, and  $D$  and  $d$  are defined in the drawing. The number of active coils is equal to the total number of coils  $n_t$ , minus the number of end coils  $n^*$  that do not help carry the load,

$$n_a = n_t - n^*$$



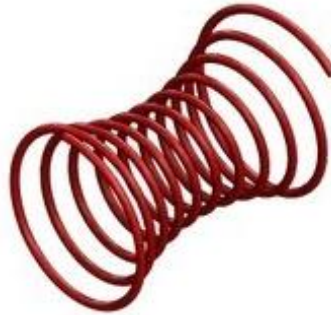
## • MATERIALS FOR SPRINGS:

The majority of coil springs are made of oil-tempered carbon steel wire containing 0.60 to 0.70 percent carbons and 0.60 to 1.0 percent manganese. Annealed wire containing 0.85 to 0.95 percent carbons and 0.30 to 0.40 percent manganese is used in the larger sizes that are coiled hot and hardened and drawn after coiling. Nickel steel, chromium steel (stainless steel), brass, phosphor bronze, model metal, and other metals that can be hard drawn are used in special cases to increase fatigue resistance, and temperature resistance.

Name of the spring 1) Constant Pitch, 2) Hourglass, 3) Barrel 4) Helical Extension, 5) Conical, 6) Volute, 7) Torsion spring, 8) Leaf spring



01



02



03



04



05



06



07



08





## OUR FEW PRODUCT

















**OUR WORKSHOPE OVERVIEW**















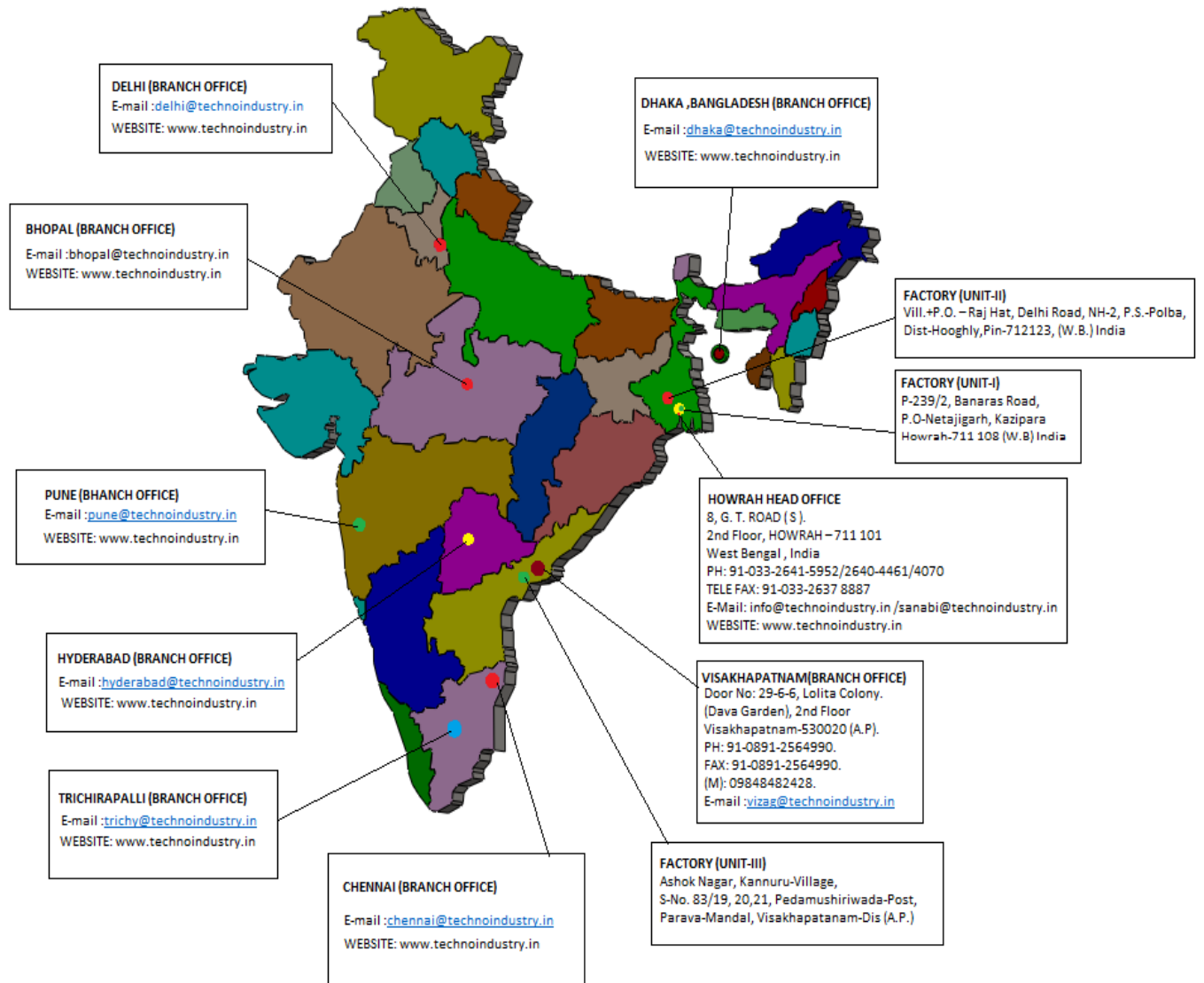
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# TECHNO INDUSTRY

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### BRANCH OFFICE

AT: BHOPAL,BANGLADESH,CHENNAI, DELHI,HYDERABAD,PUNE, TRICHIRAPALLI,VIZAG.

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P.O-Netajigarh, Kazipara  
Howrah-711 108 (W.B) India

#### **PLANT (UNIT-II)**

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#### **VISAKHAPATNAM PLANT (UNIT-III)**

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S-No. 83/19, 20,21, Pedamushiriwada-Post,  
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