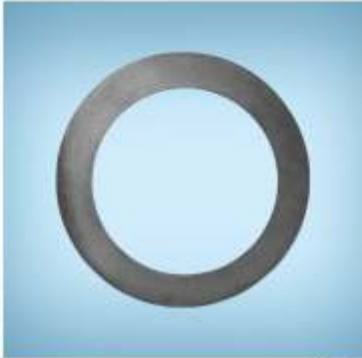
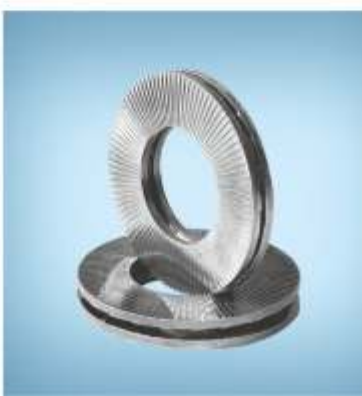




## Springs Technology



## About Gala

Gala is Asia's largest manufacturer of Disc springs.

Three decades of rich experience forms our backbone in keeping up-to-date with latest technology to design and manufacture high performance Disc springs & Strip springs. We serve global OEMs in Power Equipments, Oil & Gas Equipments, Wind Turbines, Automotive etc. from our TS16949 certified manufacturing facilities.

Exports to Germany, Switzerland, Finland, Italy, USA, Singapore, Taiwan, China etc. contributes 60%+ of our sales.

High quality, reliability and design collaboration are the key factors for us to become preferred partner of our global customers.

**No.1** Exporter of Springs from India

**300+** Global Customers

Over **100 Million** Disc Springs manufactured every year

**50+** Mechanical Engineers Team

Exports to **25** Countries

Cooperation with **7** Global Research Institutes

**30** years of experience

**18** types of Materials

**12** types of Surface Coatings

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## Disc Springs

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## Engineering Excellence

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# Global Clientele

American Ring & Tool  
Associated Spring Raymond  
Eaton  
GE

ABB  
Alexander Paal  
Antec  
Bosch  
Bossard  
Dana  
Emerson  
Fabory  
Gandini  
Vestas

Carlisle  
Harbin Turbine  
John Deere  
Shanghai Turbine

Vulkando

Alstom  
BHEL  
Case New Holland  
L & T  
Suzlon  
Tata  
Thermax B&W







Our engineers have developed high level of expertise over the entire manufacturing cycle of disc springs. With the design capability combined with application engineering excellence, Gala has become preferred partner for OEMs.

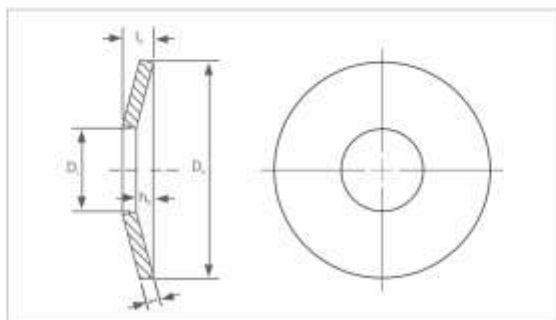
#### Standard Disc Springs

We offer Disc springs as per DIN 2093, American inch standard & specials as per customer specific requirements. Gala is one of the few companies in the world adhering to these demanding standards.

Within following groups of DIN 2093, standard sizes as per series A, B & C are available.

- Group 1 (Thickness  $t < 1.25$  mm)
- Group 2 (Thickness  $t = 1.25$  mm to 6 mm)
- Group 3 (Thickness  $t > 6$  mm)

Considering the worldwide trend of real time deliveries, Gala has set up a modern manufacturing system supported by high raw material stocks. Coupled with multi-cavity toolings & lean manufacturing systems, this results into faster deliveries.



#### Customised Disc Springs

We offer customized disc springs with choices of sizes, load-deflection characteristics, selection of materials and desired fatigue life.

Following are the key factors for faster product development:

- Application partnership and designing of disc springs
- In-house design & development of toolings
- Capability of offering disc springs from a wide range of materials with variety of coatings

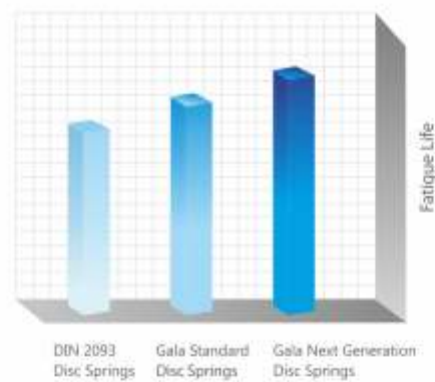
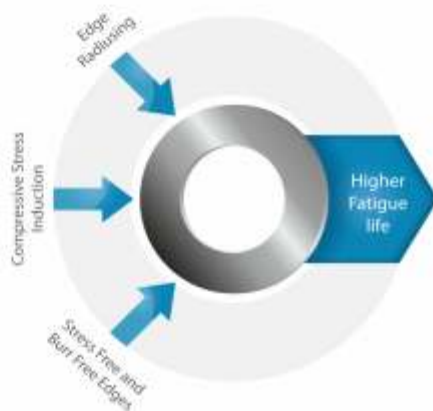
#### Next Generation Disc Springs

With years of in-house research and cooperation with German universities, Gala has developed Next Generation Disc springs. These are high performance disc springs offering high fatigue life at elevated stress levels.

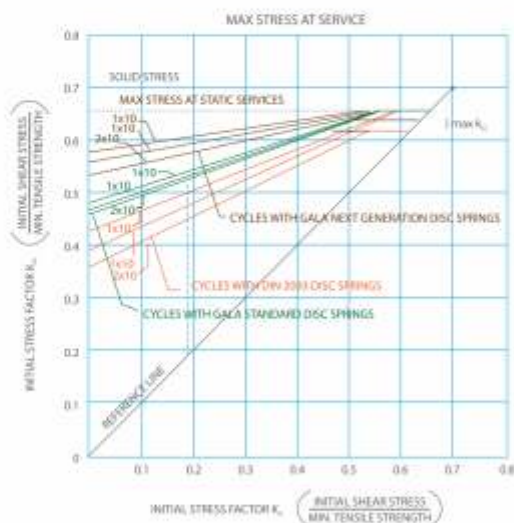
Alternatively, size of the disc springs can be reduced meeting the same load/deflection requirement resulting in substantial cost reduction by reduction of assembly dimensions upto 20% for same fatigue life.

### Advantages of Gala Disc Springs

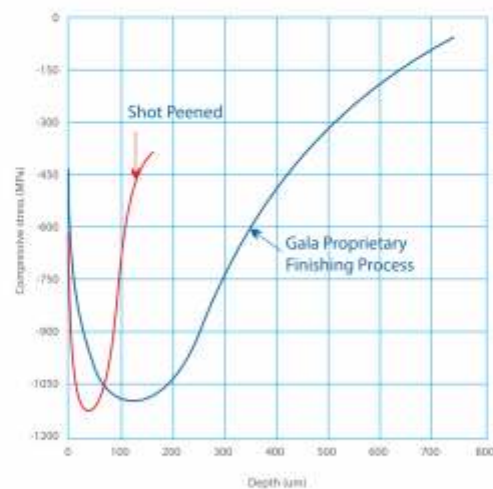
- Higher Fatigue Life
- Disc Spring Selection Software is available online
- ISO 9001 : 2009 / TS 16949 certified manufacturing facilities
- Tested & Approved by leading OEMs in Germany, Japan, USA, Denmark and France
- More than 100 standard sizes available ex-stock



Comparison of DIN 2093, Gala Standard Disc springs & Gala Next Generation Disc Springs



Comparison of residual compressive stress induction by shot peening & Gala's Proprietary Finishing Process

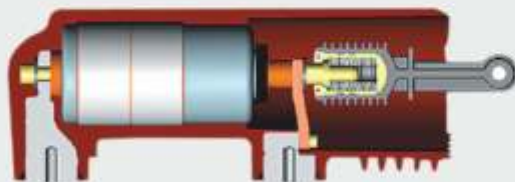


# Applications of Disc Springs

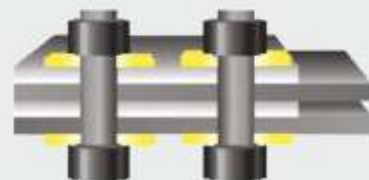
Gala offers standard & customised Disc springs  
Proven for variety of critical applications

## Power Equipments

Servomotor Actuator  
for Steam Turbine



Medium Voltage Switchgear



Electrical Busbar

## Off-highway Vehicles



Transmission Axle



Dual Clutch

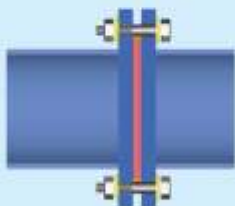


Hydraulic Brake & Motor

## Oil & Gas



Live Loading  
of Valve Stem  
Packing Glands

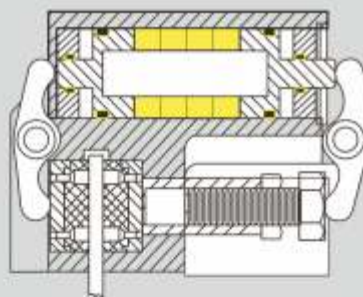


Flange Joint

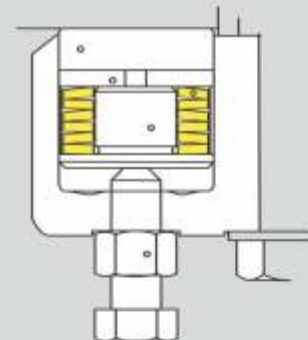


Drilling Jar

## Wind Turbines



Fail-Safe Brake



Yaw Bearing System

## CNC Machining Centers



Tool Clamping & CNC Spindle



## DIN 2093 Series Disc Springs

| Sr. No. | Outside diameter<br>mm (De) | Inside diameter<br>mm (Di) | Thickness<br>mm (t) | Free cone height<br>of spring mm (ho) | Reduced<br>thickness mm (t') | Free cone height of<br>spring with reduced<br>thickness mm (ho') | Overall height<br>mm (lo) | Load on each<br>disc spring N<br>(at $s=0.75\ h_o$ ) |
|---------|-----------------------------|----------------------------|---------------------|---------------------------------------|------------------------------|------------------------------------------------------------------|---------------------------|------------------------------------------------------|
| GROUP 1 | 1                           | 8.00                       | 4.20                | 0.20                                  | 0.25                         | -                                                                | 0.45                      | 39.19                                                |
|         | 2                           | 10.00                      | 5.20                | 0.25                                  | 0.30                         | -                                                                | 0.55                      | 57.51                                                |
|         | 3                           | 8.00                       | 4.20                | 0.30                                  | 0.25                         | -                                                                | 0.55                      | 117.85                                               |
|         | 4                           | 14.00                      | 7.20                | 0.35                                  | 0.45                         | -                                                                | 0.80                      | 123.18                                               |
|         | 5                           | 8.00                       | 3.20                | 0.40                                  | 0.20                         | -                                                                | 0.60                      | 185.41                                               |
|         | 6                           | 8.00                       | 4.20                | 0.40                                  | 0.20                         | -                                                                | 0.60                      | 209.48                                               |
|         | 7                           | 10.00                      | 3.20                | 0.40                                  | 0.30                         | -                                                                | 0.70                      | 179.09                                               |
|         | 8                           | 10.00                      | 4.20                | 0.40                                  | 0.30                         | -                                                                | 0.70                      | 189.08                                               |
|         | 9                           | 10.00                      | 5.20                | 0.40                                  | 0.30                         | -                                                                | 0.70                      | 209.21                                               |
|         | 10                          | 12.00                      | 4.20                | 0.40                                  | 0.40                         | -                                                                | 0.80                      | 178.28                                               |
|         | 11                          | 15.00                      | 5.20                | 0.40                                  | 0.55                         | -                                                                | 0.95                      | 175.51                                               |
|         | 12                          | 16.00                      | 8.20                | 0.40                                  | 0.50                         | -                                                                | 0.90                      | 154.32                                               |
|         | 13                          | 18.00                      | 6.20                | 0.40                                  | 0.60                         | -                                                                | 1.00                      | 138.59                                               |
|         | 14                          | 20.00                      | 10.20               | 0.40                                  | 0.50                         | -                                                                | 0.90                      | 98.46                                                |
|         | 15                          | 18.00                      | 9.20                | 0.45                                  | 0.60                         | -                                                                | 1.05                      | 213.6                                                |
|         | 16                          | 8.00                       | 3.20                | 0.50                                  | 0.20                         | -                                                                | 0.70                      | 357.22                                               |
|         | 17                          | 10.00                      | 3.20                | 0.507                                 | 0.35                         | -                                                                | 0.85                      | 403.83                                               |
|         | 18                          | 10.00                      | 4.20                | 0.50                                  | 0.25                         | -                                                                | 0.75                      | 293.93                                               |
|         | 19                          | 10.00                      | 5.20                | 0.50                                  | 0.25                         | -                                                                | 0.75                      | 325.23                                               |
|         | 20                          | 12.00                      | 4.20                | 0.50                                  | 0.40                         | -                                                                | 0.90                      | 331.26                                               |
|         | 21                          | 12.00                      | 5.20                | 0.50                                  | 0.40                         | -                                                                | 0.90                      | 349.46                                               |
|         | 22                          | 12.00                      | 6.20                | 0.50                                  | 0.35                         | -                                                                | 0.85                      | 326.24                                               |
|         | 23                          | 12.50                      | 5.20                | 0.50                                  | 0.35                         | -                                                                | 0.85                      | 272.04                                               |
|         | 24                          | 12.50                      | 6.20                | 0.50                                  | 0.35                         | -                                                                | 0.85                      | 293.33                                               |
|         | 25                          | 14.00                      | 7.20                | 0.50                                  | 0.40                         | -                                                                | 0.90                      | 279.06                                               |
|         | 26                          | 15.00                      | 5.20                | 0.50                                  | 0.50                         | -                                                                | 1.00                      | 278.15                                               |
|         | 27                          | 15.00                      | 6.20                | 0.50                                  | 0.50                         | -                                                                | 1.00                      | 289.28                                               |
|         | 28                          | 18.00                      | 6.20                | 0.50                                  | 0.60                         | -                                                                | 1.10                      | 245.34                                               |
|         | 29                          | 18.00                      | 8.20                | 0.50                                  | 0.60                         | -                                                                | 1.10                      | 264.6                                                |
|         | 30                          | 20.00                      | 8.20                | 0.50                                  | 0.65                         | -                                                                | 1.15                      | 230.7                                                |
|         | 31                          | 20.00                      | 10.20               | 0.50                                  | 0.65                         | -                                                                | 1.15                      | 254.01                                               |
|         | 32                          | 10.00                      | 4.20                | 0.60                                  | 0.25                         | -                                                                | 0.85                      | 502.08                                               |
|         | 33                          | 12.00                      | 4.20                | 0.60                                  | 0.40                         | -                                                                | 1.00                      | 556.52                                               |
|         | 34                          | 12.00                      | 5.20                | 0.60                                  | 0.35                         | -                                                                | 0.95                      | 505.89                                               |
|         | 35                          | 12.00                      | 6.20                | 0.60                                  | 0.35                         | -                                                                | 0.95                      | 551.48                                               |
|         | 36                          | 15.00                      | 5.20                | 0.60                                  | 0.45                         | -                                                                | 1.05                      | 407                                                  |
|         | 37                          | 15.00                      | 6.20                | 0.60                                  | 0.45                         | -                                                                | 1.05                      | 423.29                                               |
|         | 38                          | 16.00                      | 8.20                | 0.60                                  | 0.45                         | -                                                                | 1.05                      | 409.87                                               |
|         | 39                          | 18.00                      | 6.20                | 0.60                                  | 0.60                         | -                                                                | 1.20                      | 400.15                                               |
|         | 40                          | 20.00                      | 8.20                | 0.60                                  | 0.70                         | -                                                                | 1.30                      | 411.85                                               |
|         | 41                          | 22.50                      | 11.20               | 0.60                                  | 0.80                         | -                                                                | 1.40                      | 425.28                                               |
|         | 42                          | 12.50                      | 6.20                | 0.70                                  | 0.30                         | -                                                                | 1.00                      | 659.24                                               |
|         | 43                          | 12.50                      | 6.20                | 0.70                                  | 0.30                         | -                                                                | 1.00                      | 659.24                                               |
|         | 44                          | 15.00                      | 5.20                | 0.70                                  | 0.55                         | -                                                                | 1.25                      | 796.15                                               |
|         | 45                          | 15.00                      | 6.20                | 0.70                                  | 0.40                         | -                                                                | 1.10                      | 577.23                                               |
|         | 46                          | 15.00                      | 8.20                | 0.707                                 | 0.40                         | -                                                                | 1.10                      | 665.31                                               |
|         | 47                          | 16.00                      | 8.20                | 0.70                                  | 0.45                         | -                                                                | 1.15                      | 636.91                                               |
|         | 48                          | 18.00                      | 6.20                | 0.70                                  | 0.70                         | -                                                                | 1.40                      | 741.33                                               |
|         | 49                          | 18.00                      | 8.20                | 0.70                                  | 0.55                         | -                                                                | 1.25                      | 595.72                                               |
|         | 50                          | 18.00                      | 9.20                | 0.70                                  | 0.50                         | -                                                                | 1.20                      | 566.15                                               |
|         | 51                          | 20.00                      | 8.20                | 0.70                                  | 0.65                         | -                                                                | 1.35                      | 568.26                                               |
|         | 52                          | 23.00                      | 8.20                | 0.70                                  | 0.80                         | -                                                                | 1.50                      | 543.35                                               |
|         | 53                          | 25.00                      | 12.20               | 0.70                                  | 0.90                         | -                                                                | 1.60                      | 599.39                                               |
|         | 54                          | 12.00                      | 5.20                | 0.80                                  | 0.30                         | -                                                                | 1.10                      | 997.39                                               |
|         | 55                          | 12.00                      | 6.20                | 0.80                                  | 0.30                         | -                                                                | 1.10                      | 1087.29                                              |
|         | 56                          | 14.00                      | 7.20                | 0.80                                  | 0.30                         | -                                                                | 1.10                      | 796.46                                               |
|         | 57                          | 15.00                      | 8.20                | 0.80                                  | 0.40                         | -                                                                | 1.20                      | 981.82                                               |
|         | 58                          | 16.00                      | 8.20                | 0.80                                  | 0.40                         | -                                                                | 1.20                      | 824.84                                               |
|         | 59                          | 18.00                      | 6.20                | 0.80                                  | 0.70                         | -                                                                | 1.50                      | 1071.54                                              |
|         | 60                          | 18.00                      | 8.20                | 0.80                                  | 0.50                         | -                                                                | 1.30                      | 782.28                                               |
|         | 61                          | 20.00                      | 8.20                | 0.80                                  | 0.60                         | -                                                                | 1.40                      | 750.68                                               |
|         | 62                          | 20.00                      | 10.20               | 0.807                                 | 0.55                         | -                                                                | 1.35                      | 747.88                                               |
|         | 63                          | 23.00                      | 8.20                | 0.80                                  | 0.75                         | -                                                                | 1.55                      | 718.22                                               |
|         | 64                          | 28.00                      | 10.20               | 0.80                                  | 0.95                         | -                                                                | 1.75                      | 661.20                                               |
|         | 65                          | 28.00                      | 14.20               | 0.80                                  | 1.00                         | -                                                                | 1.80                      | 801.01                                               |
|         | 66                          | 31.50                      | 16.30               | 0.80                                  | 1.05                         | -                                                                | 1.85                      | 686.54                                               |
|         | 67                          | 14.00                      | 6.20                | 0.90                                  | 0.35                         | -                                                                | 1.25                      | 1229.18                                              |
|         | 68                          | 16.00                      | 8.20                | 0.90                                  | 0.35                         | -                                                                | 1.25                      | 1012.36                                              |
|         | 69                          | 20.00                      | 8.20                | 0.90                                  | 0.60                         | -                                                                | 1.50                      | 1050.71                                              |
|         | 70                          | 20.00                      | 10.20               | 0.90                                  | 0.55                         | -                                                                | 1.45                      | 1049.48                                              |
|         | 71                          | 23.00                      | 10.20               | 0.90                                  | 0.75                         | -                                                                | 1.65                      | 1057.41                                              |
|         | 72                          | 25.00                      | 12.20               | 0.90                                  | 0.70                         | -                                                                | 1.60                      | 861.88                                               |
|         | 73                          | 35.50                      | 18.30               | 0.90                                  | 1.15                         | -                                                                | 2.05                      | 831.56                                               |
|         | 74                          | 18.00                      | 8.20                | 1.007                                 | 0.50                         | -                                                                | 1.50                      | 1496.26                                              |
|         | 75                          | 18.00                      | 9.20                | 1.00                                  | 0.40                         | -                                                                | 1.40                      | 1253.54                                              |
|         | 76                          | 20.00                      | 8.20                | 1.00                                  | 0.60                         | -                                                                | 1.60                      | 1423.52                                              |
|         | 77                          | 20.00                      | 10.20               | 1.00                                  | 0.55                         | -                                                                | 1.55                      | 1424.53                                              |
|         | 78                          | 23.00                      | 10.20               | 1.00                                  | 0.70                         | -                                                                | 1.70                      | 1314.78                                              |
|         | 79                          | 25.00                      | 10.20               | 1.007                                 | 0.75                         | -                                                                | 1.75                      | 1171.24                                              |
|         | 80                          | 25.00                      | 12.20               | 1.00                                  | 0.80                         | -                                                                | 1.80                      | 1357.93                                              |
|         | 81                          | 28.00                      | 10.20               | 1.00                                  | 1.00                         | -                                                                | 2.00                      | 1287.99                                              |
|         | 82                          | 28.00                      | 12.20               | 1.00                                  | 0.95                         | -                                                                | 1.95                      | 1267.55                                              |
|         | 83                          | 28.00                      | 14.20               | 1.00                                  | 0.80                         | -                                                                | 1.80                      | 1106.58                                              |



## DIN 2093 Series Disc Springs

| Sr. No. | Outside diameter<br>mm (De) | Inside diameter<br>mm (Di) | Thickness<br>mm (t) | Free cone height<br>of spring mm (ho) | Reduced thickness<br>mm (t') | Free cone height of<br>spring with reduced<br>thickness mm (ho') | Overall height<br>mm (lo) | Load on each<br>disc spring N<br>(at s=0.75 ho) |
|---------|-----------------------------|----------------------------|---------------------|---------------------------------------|------------------------------|------------------------------------------------------------------|---------------------------|-------------------------------------------------|
| 84      | 31.50                       | 12.20                      | 1.00                | 1.10                                  | -                            | -                                                                | 2.10                      | 1166.40                                         |
| 85      | 34.00                       | 12.20                      | 1.00                | 1.25                                  | -                            | -                                                                | 2.25                      | 1171.66                                         |
| 86      | 40.00                       | 20.40                      | 1.00                | 1.30                                  | -                            | -                                                                | 2.30                      | 1016.02                                         |
| 87      | 20.00                       | 10.20                      | 1.10                | 0.45                                  | -                            | -                                                                | 1.55                      | 1520.03                                         |
| 88      | 25.00                       | 12.20                      | 1.25                | 0.70                                  | -                            | -                                                                | 1.95                      | 2213.09                                         |
| 89      | 28.00                       | 10.20                      | 1.25                | 1.00                                  | -                            | -                                                                | 2.25                      | 2393.23                                         |
| 90      | 28.00                       | 12.20                      | 1.25                | 0.85                                  | -                            | -                                                                | 2.10                      | 2081.58                                         |
| 91      | 28.00                       | 14.20                      | 1.25                | 0.85                                  | -                            | -                                                                | 2.10                      | 2238.44                                         |
| 92      | 31.50                       | 12.20                      | 1.25                | 0.95                                  | -                            | -                                                                | 2.20                      | 1803.97                                         |
| 93      | 31.50                       | 16.30                      | 1.25                | 0.90                                  | -                            | -                                                                | 2.15                      | 1911.98                                         |
| 94      | 34.00                       | 12.30                      | 1.25                | 1.20                                  | -                            | -                                                                | 2.45                      | 2023.00                                         |
| 95      | 34.00                       | 14.30                      | 1.25                | 1.15                                  | -                            | -                                                                | 2.40                      | 1992.34                                         |
| 96      | 35.50                       | 18.30                      | 1.25                | 1.00                                  | -                            | -                                                                | 2.25                      | 1697.88                                         |
| 97      | 40.00                       | 14.30                      | 1.25                | 1.40                                  | -                            | -                                                                | 2.65                      | 1778.97                                         |
| 98      | 45.00                       | 22.40                      | 1.25                | 1.60                                  | -                            | -                                                                | 2.85                      | 1889.99                                         |
| 99      | 50.00                       | 25.40                      | 1.25                | 1.60                                  | -                            | -                                                                | 2.85                      | 1549.40                                         |
| 100     | 20.00                       | 10.20                      | 1.50                | 0.30                                  | -                            | -                                                                | 1.80                      | 2519.72                                         |
| 101     | 22.50                       | 11.20                      | 1.50                | 0.55                                  | -                            | -                                                                | 2.05                      | 3650.44                                         |
| 102     | 23.00                       | 12.20                      | 1.50                | 0.60                                  | -                            | -                                                                | 2.10                      | 3983.49                                         |
| 103     | 25.00                       | 12.20                      | 1.50                | 0.55                                  | -                            | -                                                                | 2.05                      | 2924.56                                         |
| 104     | 28.00                       | 10.20                      | 1.50                | 0.70                                  | -                            | -                                                                | 2.20                      | 2721.23                                         |
| 105     | 28.00                       | 12.20                      | 1.50                | 0.75                                  | -                            | -                                                                | 2.25                      | 3075.57                                         |
| 106     | 28.00                       | 14.20                      | 1.50                | 0.65                                  | -                            | -                                                                | 2.15                      | 2839.53                                         |
| 107     | 28.00                       | 12.20                      | 1.50                | 0.85                                  | -                            | -                                                                | 2.35                      | 2686.59                                         |
| 108     | 31.50                       | 16.30                      | 1.50                | 0.90                                  | -                            | -                                                                | 2.40                      | 3228.26                                         |
| 109     | 31.50                       | 12.30                      | 1.50                | 1.20                                  | -                            | -                                                                | 2.70                      | 3361.30                                         |
| 110     | 34.00                       | 14.30                      | 1.50                | 1.05                                  | -                            | -                                                                | 2.55                      | 2988.80                                         |
| 111     | 34.00                       | 16.30                      | 1.50                | 1.05                                  | -                            | -                                                                | 2.55                      | 3153.58                                         |
| 112     | 34.00                       | 14.30                      | 1.50                | 1.30                                  | -                            | -                                                                | 2.80                      | 2666.79                                         |
| 113     | 40.00                       | 16.30                      | 1.50                | 1.30                                  | -                            | -                                                                | 2.80                      | 2748.00                                         |
| 114     | 40.00                       | 20.40                      | 1.50                | 1.15                                  | -                            | -                                                                | 2.65                      | 2620.13                                         |
| 115     | 50.00                       | 18.40                      | 1.50                | 1.65                                  | -                            | -                                                                | 3.15                      | 2317.65                                         |
| 116     | 50.00                       | 25.40                      | 1.50                | 1.60                                  | -                            | -                                                                | 3.10                      | 2510.61                                         |
| 117     | 56.00                       | 28.50                      | 1.50                | 1.95                                  | -                            | -                                                                | 3.45                      | 2620.89                                         |
| 118     | 28.00                       | 10.20                      | 1.75                | 0.90                                  | -                            | -                                                                | 2.65                      | 5595.06                                         |
| 119     | 31.50                       | 16.30                      | 1.75                | 0.70                                  | -                            | -                                                                | 2.45                      | 3869.21                                         |
| 120     | 34.00                       | 16.30                      | 1.75                | 0.90                                  | -                            | -                                                                | 2.65                      | 4151.89                                         |
| 121     | 40.00                       | 16.30                      | 1.75                | 1.35                                  | -                            | -                                                                | 3.10                      | 4432.69                                         |
| 122     | 45.00                       | 22.40                      | 1.75                | 1.30                                  | -                            | -                                                                | 3.05                      | 3644.16                                         |
| 123     | 63.00                       | 31.00                      | 1.80                | 2.35                                  | -                            | -                                                                | 4.15                      | 4236.24                                         |
| 124     | 31.50                       | 16.30                      | 2.00                | 0.75                                  | -                            | -                                                                | 2.75                      | 6169.88                                         |
| 125     | 34.00                       | 16.30                      | 2.00                | 0.85                                  | -                            | -                                                                | 2.85                      | 5779.60                                         |
| 126     | 35.50                       | 18.30                      | 2.00                | 0.80                                  | -                            | -                                                                | 2.80                      | 5184.27                                         |
| 127     | 40.00                       | 14.30                      | 2.00                | 1.05                                  | -                            | -                                                                | 3.05                      | 4766.17                                         |
| 128     | 40.00                       | 16.30                      | 2.00                | 1.10                                  | -                            | -                                                                | 3.10                      | 5165.89                                         |
| 129     | 40.00                       | 18.30                      | 2.00                | 1.15                                  | -                            | -                                                                | 3.15                      | 5653.00                                         |
| 130     | 40.00                       | 20.40                      | 2.00                | 1.10                                  | -                            | -                                                                | 3.10                      | 5698.12                                         |
| 131     | 50.00                       | 18.40                      | 2.00                | 1.65                                  | -                            | -                                                                | 3.65                      | 5111.53                                         |
| 132     | 50.00                       | 20.40                      | 2.00                | 1.50                                  | -                            | -                                                                | 3.50                      | 4684.97                                         |
| 133     | 50.00                       | 22.40                      | 2.00                | 1.60                                  | -                            | -                                                                | 3.60                      | 5218.96                                         |
| 134     | 50.00                       | 25.40                      | 2.00                | 1.40                                  | -                            | -                                                                | 3.40                      | 4759.70                                         |
| 135     | 56.00                       | 28.50                      | 2.00                | 1.60                                  | -                            | -                                                                | 3.60                      | 4435.83                                         |
| 136     | 60.00                       | 20.50                      | 2.00                | 2.20                                  | -                            | -                                                                | 4.20                      | 5023.64                                         |
| 137     | 71.00                       | 36.00                      | 2.00                | 2.60                                  | -                            | -                                                                | 4.60                      | 5141.37                                         |
| 138     | 45.00                       | 22.40                      | 2.20                | 1.15                                  | -                            | -                                                                | 3.35                      | 6148.13                                         |
| 139     | 40.00                       | 20.40                      | 2.25                | 0.90                                  | -                            | -                                                                | 3.15                      | 6496.89                                         |
| 140     | 50.00                       | 25.40                      | 2.25                | 1.50                                  | -                            | -                                                                | 3.75                      | 7213.06                                         |
| 141     | 80.00                       | 41.00                      | 2.25                | 2.95                                  | -                            | -                                                                | 5.20                      | 6609.20                                         |
| 142     | 40.00                       | 20.40                      | 2.50                | 0.95                                  | -                            | -                                                                | 3.45                      | 9384.80                                         |
| 143     | 45.00                       | 22.40                      | 2.50                | 1.00                                  | -                            | -                                                                | 3.50                      | 7711.94                                         |
| 144     | 50.00                       | 18.30                      | 2.50                | 1.35                                  | -                            | -                                                                | 3.85                      | 7711.33                                         |
| 145     | 50.00                       | 18.40                      | 2.50                | 1.65                                  | -                            | -                                                                | 4.15                      | 963798.00                                       |
| 146     | 50.00                       | 20.40                      | 2.50                | 1.35                                  | -                            | -                                                                | 3.85                      | 7914.88                                         |
| 147     | 50.00                       | 22.40                      | 2.50                | 1.40                                  | -                            | -                                                                | 3.90                      | 8505.60                                         |
| 148     | 50.00                       | 25.40                      | 2.50                | 1.40                                  | -                            | -                                                                | 3.90                      | 9058.29                                         |
| 149     | 56.00                       | 28.50                      | 2.50                | 1.70                                  | -                            | -                                                                | 4.20                      | 8973.00                                         |
| 150     | 60.00                       | 20.50                      | 2.50                | 2.20                                  | -                            | -                                                                | 4.70                      | 9250.16                                         |
| 151     | 60.00                       | 25.50                      | 2.50                | 1.90                                  | -                            | -                                                                | 4.40                      | 8170.54                                         |
| 152     | 60.00                       | 30.50                      | 2.50                | 2.00                                  | -                            | -                                                                | 4.50                      | 9427.08                                         |
| 153     | 63.00                       | 31.00                      | 2.50                | 1.75                                  | -                            | -                                                                | 4.25                      | 7185.35                                         |
| 154     | 70.00                       | 30.50                      | 2.50                | 2.40                                  | -                            | -                                                                | 4.90                      | 8026.49                                         |
| 155     | 71.00                       | 36.00                      | 2.50                | 2.00                                  | -                            | -                                                                | 4.50                      | 6721.86                                         |
| 156     | 80.00                       | 31.00                      | 2.50                | 2.80                                  | -                            | -                                                                | 5.30                      | 7235.23                                         |
| 157     | 90.00                       | 46.00                      | 2.50                | 3.20                                  | -                            | -                                                                | 5.70                      | 7680.21                                         |
| 158     | 100.00                      | 51.00                      | 2.70                | 3.50                                  | -                            | -                                                                | 6.20                      | 8604.45                                         |
| 159     | 60.00                       | 30.50                      | 2.75                | 2.00                                  | -                            | -                                                                | 4.75                      | 12349.47                                        |
| 160     | 50.00                       | 18.30                      | 3.00                | 1.00                                  | -                            | -                                                                | 4.00                      | 9604.24                                         |
| 161     | 50.00                       | 18.40                      | 3.00                | 1.20                                  | -                            | -                                                                | 4.20                      | 11623.96                                        |
| 162     | 50.00                       | 25.40                      | 3.00                | 1.10                                  | -                            | -                                                                | 4.10                      | 11970.38                                        |
| 163     | 56.00                       | 28.50                      | 3.00                | 1.30                                  | -                            | -                                                                | 4.30                      | 11382.53                                        |
| 164     | 60.00                       | 20.50                      | 3.00                | 2.20                                  | -                            | -                                                                | 5.20                      | 15457.10                                        |

GROUP 2

## DIN 2093 Series Disc Springs

|         | Sr. No. | Outside diameter<br>mm (De) | Inside diameter<br>mm (Di) | Thickness<br>mm (t) | Free cone height<br>of spring mm (ho) | Reduced<br>thickness<br>mm (t') | Free cone height of<br>spring with reduced<br>thickness mm (ho') | Overall height<br>mm (lo) | Load on each<br>disc spring N<br>(at s=0.75 ho) |
|---------|---------|-----------------------------|----------------------------|---------------------|---------------------------------------|---------------------------------|------------------------------------------------------------------|---------------------------|-------------------------------------------------|
| GROUP 2 | 165     | 60.00                       | 25.50                      | 3.00                | 1.65                                  | -                               | -                                                                | 4.65                      | 11777.57                                        |
|         | 166     | 60.00                       | 30.50                      | 3.00                | 1.70                                  | -                               | -                                                                | 4.70                      | 13219.29                                        |
|         | 167     | 63.00                       | 31.00                      | 3.00                | 1.70                                  | -                               | -                                                                | 4.70                      | 11765.87                                        |
|         | 168     | 70.00                       | 30.50                      | 3.00                | 2.10                                  | -                               | -                                                                | 5.10                      | 11420.65                                        |
|         | 169     | 70.00                       | 35.50                      | 3.00                | 2.10                                  | -                               | -                                                                | 5.10                      | 12281.24                                        |
|         | 170     | 80.00                       | 31.00                      | 3.00                | 2.50                                  | -                               | -                                                                | 5.50                      | 10346.31                                        |
|         | 171     | 80.00                       | 36.00                      | 3.00                | 2.70                                  | -                               | -                                                                | 5.70                      | 11912.75                                        |
|         | 172     | 80.00                       | 41.00                      | 3.00                | 2.30                                  | -                               | -                                                                | 5.30                      | 10512.52                                        |
|         | 173     | 112.00                      | 57.00                      | 3.00                | 3.90                                  | -                               | -                                                                | 6.90                      | 10483.58                                        |
|         | 174     | 60.00                       | 30.50                      | 3.50                | 1.50                                  | -                               | -                                                                | 5.00                      | 18143.35                                        |
|         | 175     | 63.00                       | 31.00                      | 3.50                | 1.40                                  | -                               | -                                                                | 4.90                      | 15017.79                                        |
|         | 176     | 70.00                       | 35.50                      | 3.50                | 1.80                                  | -                               | -                                                                | 5.30                      | 16169.01                                        |
|         | 177     | 90.00                       | 46.00                      | 3.50                | 2.50                                  | -                               | -                                                                | 6.00                      | 14153.65                                        |
|         | 178     | 100.00                      | 51.00                      | 3.50                | 2.80                                  | -                               | -                                                                | 6.30                      | 13063.71                                        |
|         | 179     | 125.00                      | 64.00                      | 3.50                | 4.50                                  | -                               | -                                                                | 8.00                      | 15408.05                                        |
|         | 180     | 140.00                      | 72.00                      | 3.80                | 4.90                                  | -                               | -                                                                | 8.70                      | 17186.38                                        |
|         | 181     | 70.00                       | 35.50                      | 4.00                | 1.80                                  | -                               | -                                                                | 5.80                      | 23911.17                                        |
|         | 182     | 71.00                       | 36.00                      | 4.00                | 1.60                                  | -                               | -                                                                | 5.60                      | 20524.42                                        |
|         | 183     | 80.00                       | 41.00                      | 4.00                | 2.20                                  | -                               | -                                                                | 6.20                      | 22862.07                                        |
|         | 184     | 100.00                      | 41.00                      | 4.00                | 3.20                                  | -                               | -                                                                | 7.20                      | 20240.86                                        |
|         | 185     | 100.00                      | 51.00                      | 4.00                | 3.00                                  | -                               | -                                                                | 7.00                      | 20663.23                                        |
|         | 186     | 112.00                      | 57.00                      | 4.00                | 3.20                                  | -                               | -                                                                | 7.20                      | 17743.33                                        |
|         | 187     | 125.00                      | 41.00                      | 4.00                | 4.20                                  | -                               | -                                                                | 8.20                      | 17336.88                                        |
|         | 188     | 125.00                      | 51.00                      | 4.00                | 4.50                                  | -                               | -                                                                | 8.50                      | 19807.09                                        |
|         | 189     | 160.00                      | 82.00                      | 4.30                | 5.60                                  | -                               | -                                                                | 9.90                      | 21831.46                                        |
|         | 190     | 180.00                      | 92.00                      | 4.80                | 6.20                                  | -                               | -                                                                | 11.00                     | 26428.74                                        |
|         | 191     | 70.00                       | 40.50                      | 5.00                | 1.40                                  | -                               | -                                                                | 6.40                      | 39390.43                                        |
|         | 192     | 80.00                       | 41.00                      | 5.00                | 1.70                                  | -                               | -                                                                | 6.70                      | 33542.04                                        |
|         | 193     | 90.00                       | 46.00                      | 5.00                | 2.00                                  | -                               | -                                                                | 7.00                      | 31338.44                                        |
|         | 194     | 100.00                      | 41.00                      | 5.00                | 2.75                                  | -                               | -                                                                | 7.75                      | 32344.91                                        |
|         | 195     | 100.00                      | 51.00                      | 5.00                | 2.80                                  | -                               | -                                                                | 7.80                      | 36320.79                                        |
|         | 196     | 125.00                      | 51.00                      | 5.00                | 3.90                                  | -                               | -                                                                | 8.90                      | 30653.08                                        |
|         | 197     | 125.00                      | 61.00                      | 5.00                | 4.00                                  | -                               | -                                                                | 9.00                      | 33948.26                                        |
|         | 198     | 125.00                      | 64.00                      | 5.00                | 3.50                                  | -                               | -                                                                | 8.50                      | 29892.82                                        |
|         | 199     | 140.00                      | 72.00                      | 5.00                | 4.00                                  | -                               | -                                                                | 9.00                      | 27906.00                                        |
|         | 200     | 150.00                      | 61.00                      | 5.00                | 5.30                                  | -                               | -                                                                | 10.30                     | 31025.36                                        |
|         | 201     | 100.00                      | 51.00                      | 6.00                | 2.20                                  | -                               | -                                                                | 8.20                      | 47997.31                                        |
|         | 202     | 112.00                      | 57.00                      | 6.00                | 2.50                                  | -                               | -                                                                | 8.50                      | 43684.80                                        |
|         | 203     | 160.00                      | 82.00                      | 6.00                | 4.50                                  | -                               | -                                                                | 10.50                     | 40987.14                                        |
|         | 204     | 180.00                      | 92.00                      | 6.00                | 5.00                                  | -                               | -                                                                | 11.00                     | 36602.92                                        |
| GROUP 3 | 205     | 225.00                      | 112.00                     | 6.50                | 7.10                                  | 6.20                            | 7.40                                                             | 13.60                     | 44557.36                                        |
|         | 206     | 100.00                      | 51.00                      | 7.00                | 2.20                                  | 6.55                            | 2.65                                                             | 9.20                      | 75801.90                                        |
|         | 207     | 125.00                      | 64.00                      | 7.00                | 3.00                                  | 6.55                            | 3.45                                                             | 10.00                     | 67182.11                                        |
|         | 208     | 150.00                      | 61.00                      | 7.00                | 4.80                                  | 6.55                            | 5.25                                                             | 11.80                     | 70406.10                                        |
|         | 209     | 250.00                      | 127.00                     | 7.00                | 7.80                                  | 6.70                            | 8.10                                                             | 14.80                     | 50440.30                                        |
|         | 210     | 125.00                      | 61.00                      | 8.00                | 2.90                                  | 7.50                            | 3.40                                                             | 10.90                     | 93529.68                                        |
|         | 211     | 125.00                      | 64.00                      | 8.00                | 2.60                                  | 7.50                            | 3.10                                                             | 10.60                     | 85882.04                                        |
|         | 212     | 125.00                      | 71.00                      | 8.00                | 2.90                                  | 7.45                            | 3.45                                                             | 10.90                     | 103911.50                                       |
|         | 213     | 140.00                      | 72.00                      | 8.00                | 3.20                                  | 7.50                            | 3.70                                                             | 11.20                     | 85207.66                                        |
|         | 214     | 150.00                      | 71.00                      | 8.00                | 4.05                                  | 7.50                            | 4.55                                                             | 12.05                     | 91014.28                                        |
|         | 215     | 150.00                      | 81.00                      | 8.00                | 4.00                                  | 7.50                            | 4.50                                                             | 12.00                     | 97269.94                                        |
|         | 216     | 200.00                      | 82.00                      | 8.00                | 6.20                                  | 7.50                            | 6.70                                                             | 14.20                     | 77994.65                                        |
|         | 217     | 200.00                      | 102.00                     | 8.00                | 5.80                                  | 7.50                            | 6.10                                                             | 13.60                     | 76339.44                                        |
|         | 218     | 225.00                      | 112.00                     | 8.00                | 6.50                                  | 7.50                            | 7.00                                                             | 14.50                     | 70712.71                                        |
|         | 219     | 250.00                      | 127.00                     | 8.00                | 8.00                                  | 7.50                            | 8.50                                                             | 16.00                     | 74781.55                                        |
|         | 220     | 125.00                      | 71.00                      | 10.00               | 1.80                                  | 9.30                            | 2.50                                                             | 11.80                     | 12060.78                                        |
|         | 221     | 150.00                      | 81.00                      | 10.00               | 3.40                                  | 9.40                            | 4.00                                                             | 13.40                     | 158219.63                                       |
|         | 222     | 160.00                      | 82.00                      | 10.00               | 3.50                                  | 9.40                            | 4.10                                                             | 13.50                     | 138260.54                                       |
|         | 223     | 180.00                      | 92.00                      | 10.00               | 4.00                                  | 9.40                            | 4.60                                                             | 14.00                     | 125353.76                                       |
|         | 224     | 200.00                      | 82.00                      | 10.00               | 5.50                                  | 9.40                            | 6.10                                                             | 15.50                     | 118992.62                                       |
|         | 225     | 200.00                      | 92.00                      | 10.00               | 5.60                                  | 9.40                            | 6.20                                                             | 15.60                     | 137617.82                                       |
|         | 226     | 200.00                      | 102.00                     | 10.00               | 5.60                                  | 9.40                            | 6.20                                                             | 15.60                     | 145283.15                                       |
|         | 227     | 250.00                      | 102.00                     | 10.00               | 8.00                                  | 9.40                            | 8.60                                                             | 18.00                     | 126323.23                                       |
|         | 228     | 250.00                      | 127.00                     | 10.00               | 7.00                                  | 9.40                            | 7.60                                                             | 17.00                     | 118992.62                                       |
|         | 229     | 160.00                      | 82.00                      | 11.00               | 3.50                                  | 10.20                           | 4.30                                                             | 14.50                     | 183424.94                                       |
|         | 230     | 200.00                      | 82.00                      | 12.00               | 4.60                                  | 11.25                           | 5.35                                                             | 16.60                     | 182644.50                                       |
|         | 231     | 200.00                      | 92.00                      | 12.00               | 4.80                                  | 11.25                           | 5.55                                                             | 16.80                     | 199168.21                                       |
|         | 232     | 200.00                      | 102.00                     | 12.00               | 4.20                                  | 11.25                           | 4.95                                                             | 16.20                     | 182927.45                                       |
|         | 233     | 200.00                      | 112.00                     | 12.00               | 4.20                                  | 11.25                           | 4.95                                                             | 16.20                     | 195730.50                                       |
|         | 234     | 225.00                      | 112.00                     | 12.00               | 5.00                                  | 11.25                           | 5.75                                                             | 17.00                     | 170929.73                                       |
|         | 235     | 250.00                      | 102.00                     | 12.00               | 7.00                                  | 11.25                           | 7.75                                                             | 19.00                     | 182869.03                                       |
|         | 236     | 250.00                      | 127.00                     | 12.00               | 7.30                                  | 11.30                           | 8.00                                                             | 19.30                     | 210699.01                                       |
|         | 237     | 180.00                      | 92.00                      | 13.00               | 3.50                                  | 12.10                           | 4.40                                                             | 16.50                     | 237762.14                                       |
|         | 238     | 200.00                      | 92.00                      | 14.00               | 4.10                                  | 13.05                           | 5.05                                                             | 18.10                     | 267091.70                                       |
|         | 239     | 200.00                      | 102.00                     | 14.00               | 4.20                                  | 13.05                           | 5.15                                                             | 18.20                     | 289034.62                                       |
|         | 240     | 200.00                      | 112.00                     | 14.00               | 3.50                                  | 13.05                           | 4.45                                                             | 17.50                     | 256628.03                                       |
|         | 241     | 250.00                      | 127.00                     | 14.00               | 5.60                                  | 13.10                           | 6.50                                                             | 19.60                     | 248701.69                                       |
|         | 242     | 200.00                      | 112.00                     | 16.00               | 3.80                                  | 14.80                           | 5.00                                                             | 19.80                     | 415514.11                                       |
|         | 243     | 225.00                      | 112.00                     | 16.00               | 4.50                                  | 14.90                           | 5.60                                                             | 20.50                     | 359407.48                                       |
|         | 244     | 250.00                      | 127.00                     | 16.00               | 5.80                                  | 14.90                           | 6.90                                                             | 21.80                     | 382822.46                                       |
|         | 245     | 250.00                      | 127.00                     | 16.00               | 5.80                                  | 14.90                           | 6.90                                                             | 21.80                     | 382822.46                                       |

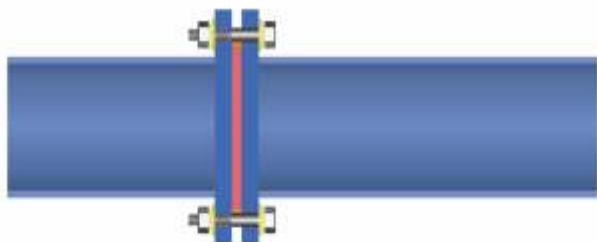


## Oil & Gas Applications

Disc springs are used in Oil refining areas such as pipelines, pipe supports, pumps, valves and actuators.

### Live Loading of Flange Joints

Disc springs are used in live loading of the flange joints which reduce flange leakage in pipelines, thereby lessening waste and downtime. They keep joints tight as large number of cycles occur and forces & deflections are critical for safer operation.



### Live Loading of Valve Stem Packing Glands

Disc springs are used to prevent leakage through the valve stem packing by maintaining a minimum seal pressure between the gland follower, fastening studs and nuts.



### Downhole Drilling

The heat and vibration involved in downhole drilling pose specific challenges for the equipment. Disc springs are used in Drilling Jar and Shock tools to counteract these stresses developed during drilling.



Disc Springs Based  
Latch Mechanism



Disc springs play a crucial role in shock tools because they are required to absorb axial vibrations which stress the tool. A stack of Disc Springs helps to compensate for the adverse conditions of downhole drilling.

Disc springs specifications for Oil & Gas applications are available on request.





## Bearing Series Disc Springs

Gala Bearing Series Disc Springs are specially designed as preloading springs for use with radial ball bearings. They help maintain positioning accuracy of the bearing with no end play. They also minimize vibration and shaft deflection. Proper preloading will increase bearing rigidity and eliminate excessive running noise. This ensures backlash compensation for ball bearings.

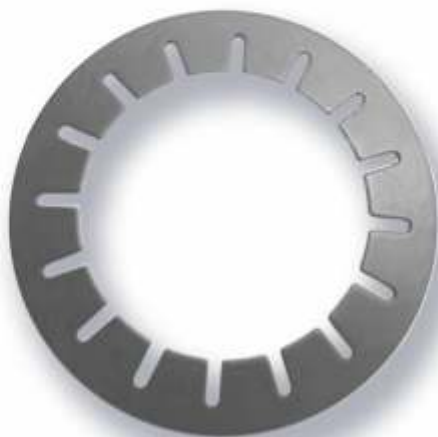
We offer Ball Bearing Disc Springs in two types

### Plain

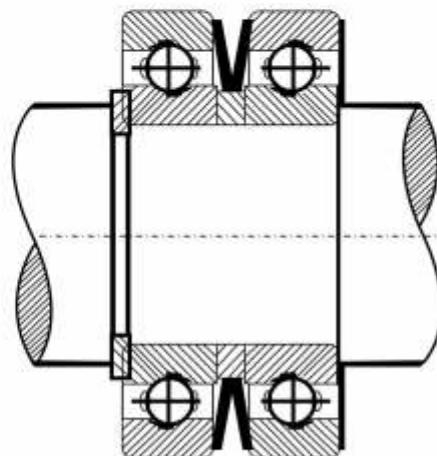
- Disc springs with high force, low deflection and pronounced regressive spring characteristics
- It provides for backlash compensation, silencing and protection of ball bearings
- The pre-load variation changes little within a wide range of deflection.
- Outside diameters OD ranging from 9.8-358 mm (0.386" - 14.1")

### Slotted

- Disc springs with low force and large deflection characteristics
- Used with small size ball bearings



**Slotted Disc Spring**

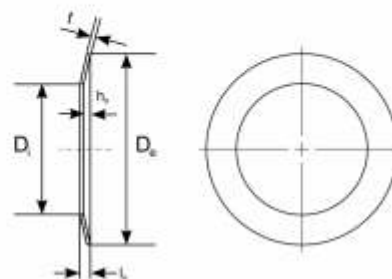


**Preloading Outer Race**

# Bearing Series GB

Spring sizes mentioned in this table are of our standard production. The loads and deflections given are at spring deflection of 75% of free cone height ( $h_0$ ), same is the recommended preload.

Slotted Disc Springs details are available on request.



| Dimensions |                     |                     |                     |                     |                     |                   | Deflection s and Spring Load F      |       | Ball-Bearing Type |           |
|------------|---------------------|---------------------|---------------------|---------------------|---------------------|-------------------|-------------------------------------|-------|-------------------|-----------|
| Sr. No.    | D <sub>0</sub> (mm) | D <sub>i</sub> (mm) | t <sub>0</sub> (mm) | t <sub>1</sub> (mm) | h <sub>0</sub> (mm) | h <sub>0</sub> /t | at s = 0.75h <sub>0</sub><br>s (mm) | F (N) |                   |           |
| 1          | 9.8                 | 6.2                 | 0.2                 | 0.4                 | 0.20                | 1.00              | 0.15                                | 23    | 623(EL3)          |           |
| 2          | 12.8                | 7.2                 | 0.25                | 0.5                 | 0.25                | 1.00              | 0.19                                | 29    | 624(EL4)          |           |
| 3          | 15.8                | 8.2                 | 0.25                | 0.55                | 0.30                | 1.20              | 0.23                                | 23    | 625(EL5)          | 634(R4)   |
| 4          | 18.8                | 9.2                 | 0.3                 | 0.65                | 0.35                | 1.17              | 0.26                                | 31    | 626(EL6)          | 635(R5)   |
| 5          | 18.8                | 10.2                | 0.35                | 0.7                 | 0.35                | 1.00              | 0.26                                | 51    | 607(EL7)          |           |
| 6          | 21.8                | 12.3                | 0.35                | 0.75                | 0.40                | 1.14              | 0.30                                | 46    | 608(EL8)          | 627(R7)   |
| 7          | 23.7                | 14.3                | 0.4                 | 0.9                 | 0.50                | 1.25              | 0.38                                | 81    | 609(EL9)          |           |
| 8          | 25.7                | 14.3                | 0.4                 | 0.9                 | 0.50                | 1.25              | 0.38                                | 63    | 6000              | 629(R9)   |
| 9          | 27.7                | 17.3                | 0.4                 | 1.0                 | 0.60                | 1.50              | 0.45                                | 80    | 6001              |           |
| 10         | 29.7                | 17.4                | 0.4                 | 1.1                 | 0.70                | 1.75              | 0.53                                | 83    |                   | 6200      |
| 11         | 31.7                | 20.4                | 0.4                 | 1.1                 | 0.70                | 1.75              | 0.53                                | 81    | 6002              | 6201      |
| 12         | 34.6                | 20.4                | 0.4                 | 1.1                 | 0.70                | 1.75              | 0.53                                | 61    |                   | 6300      |
| 13         | 34.6                | 22.4                | 0.5                 | 1.2                 | 0.70                | 1.40              | 0.53                                | 118   | 6003              | 6202      |
| 14         | 36.6                | 20.4                | 0.5                 | 1.3                 | 0.80                | 1.60              | 0.60                                | 110   |                   | 6301      |
| 15         | 39.6                | 25.5                | 0.5                 | 1.3                 | 0.80                | 1.60              | 0.60                                | 110   |                   | 6203      |
| 16         | 41.6                | 25.5                | 0.5                 | 1.4                 | 0.90                | 1.80              | 0.68                                | 113   | 6004              | 6302      |
| 17         | 46.5                | 30.5                | 0.6                 | 1.5                 | 0.90                | 1.50              | 0.68                                | 153   | 6005              | 6204 6303 |
| 18         | 51.5                | 35.5                | 0.6                 | 1.5                 | 0.90                | 1.50              | 0.68                                | 135   |                   | 6205 6304 |
| 19         | 54.5                | 40.5                | 0.6                 | 1.5                 | 0.90                | 1.50              | 0.68                                | 141   | 6006              |           |
| 20         | 61.5                | 40.5                | 0.7                 | 1.8                 | 1.10                | 1.57              | 0.83                                | 176   | 6007              | 6206 6305 |
| 21         | 67.5                | 50.5                | 0.7                 | 1.7                 | 1.00                | 1.43              | 0.75                                | 161   | 6008              |           |
| 22         | 71.5                | 45.5                | 0.7                 | 2.1                 | 1.40                | 2.00              | 1.05                                | 185   |                   | 6306      |
| 23         | 71.5                | 50.5                | 0.7                 | 2.1                 | 1.40                | 2.00              | 1.05                                | 218   |                   | 6207      |
| 24         | 74.5                | 55.5                | 0.8                 | 1.9                 | 1.10                | 1.38              | 0.83                                | 211   | 6009              |           |
| 25         | 79.5                | 50.5                | 0.8                 | 2.3                 | 1.50                | 1.88              | 1.13                                | 228   |                   | 6307      |
| 26         | 79.5                | 55.5                | 0.8                 | 2.3                 | 1.50                | 1.88              | 1.13                                | 263   | 6010              | 6208      |
| 27         | 84.5                | 60.5                | 0.9                 | 2.5                 | 1.60                | 1.78              | 1.20                                | 359   |                   | 6209      |
| 28         | 89.5                | 60.5                | 0.9                 | 2.5                 | 1.60                | 1.78              | 1.20                                | 288   |                   | 6308      |
| 29         | 89.5                | 65.5                | 0.9                 | 2.5                 | 1.60                | 1.78              | 1.20                                | 335   | 6011              | 6210      |
| 30         | 94.5                | 75.5                | 1                   | 2.2                 | 1.20                | 1.20              | 0.90                                | 325   | 6012              |           |
| 31         | 99                  | 65.5                | 1                   | 2.6                 | 1.60                | 1.60              | 1.20                                | 292   |                   | 6309      |
| 32         | 99                  | 70.5                | 1                   | 2.6                 | 1.60                | 1.60              | 1.20                                | 332   | 6013              | 6211      |
| 33         | 109                 | 70.5                | 1.25                | 2.7                 | 1.45                | 1.16              | 1.09                                | 357   |                   | 6310      |
| 34         | 109                 | 75.5                | 1.25                | 2.7                 | 1.45                | 1.16              | 1.09                                | 398   | 6014              | 6212      |
| 35         | 114                 | 90.5                | 1.25                | 2.45                | 1.20                | 0.96              | 0.90                                | 398   | 6015              |           |
| 36         | 119                 | 75.5                | 1.25                | 2.8                 | 1.55                | 1.24              | 1.16                                | 320   |                   | 6311      |
| 37         | 119                 | 85.5                | 1.25                | 2.8                 | 1.55                | 1.24              | 1.16                                | 393   |                   | 6213      |
| 38         | 124                 | 90.5                | 1.25                | 3                   | 1.75                | 1.40              | 1.31                                | 445   | 6016              | 6214      |
| 39         | 129                 | 85.5                | 1.25                | 3.2                 | 1.9                 | 1.56              | 1.46                                | 405   |                   | 6312      |
| 40         | 129                 | 95.5                | 1.25                | 3.2                 | 1.95                | 1.56              | 1.46                                | 500   | 6017              | 6215      |
| 41         | 139                 | 90.5                | 1.25                | 3.25                | 2.00                | 1.60              | 1.50                                | 354   |                   | 6313      |
| 42         | 139                 | 101                 | 1.25                | 3.25                | 2.00                | 1.60              | 1.50                                | 429   | 6018              | 6216      |
| 43         | 149                 | 95.5                | 1.5                 | 3.2                 | 1.705               | 1.13              | 1.28                                | 379   |                   | 6314      |
| 44         | 149                 | 106                 | 1.5                 | 3.2                 | 1.70                | 1.13              | 1.28                                | 450   | 6020              | 6217      |
| 45         | 159                 | 101                 | 1.5                 | 3.5                 | 2.00                | 1.33              | 1.50                                | 412   |                   |           |
| 46         | 159                 | 111                 | 1.5                 | 3.5                 | 2.00                | 1.33              | 1.50                                | 477   | 6021              | 6218 6315 |
| 47         | 169                 | 111                 | 1.5                 | 3.8                 | 2.30                | 1.53              | 1.73                                | 470   |                   | 6316      |
| 48         | 169                 | 121                 | 1.5                 | 3.8                 | 2.30                | 1.53              | 1.73                                | 546   | 6022              | 6219      |
| 49         | 179                 | 121                 | 2                   | 4.2                 | 2.20                | 1.10              | 1.65                                | 864   |                   | 6317      |
| 50         | 179                 | 126                 | 2                   | 4.2                 | 2.20                | 1.10              | 1.65                                | 928   | 6024              | 6220      |
| 51         | 189                 | 121                 | 2                   | 4.3                 | 2.30                | 1.15              | 1.73                                | 759   |                   | 6318      |
| 52         | 189                 | 131                 | 2                   | 4.3                 | 2.30                | 1.15              | 1.73                                | 858   |                   | 6221      |
| 53         | 198                 | 131                 | 2                   | 4.5                 | 2.50                | 1.25              | 1.88                                | 812   |                   | 6319      |
| 54         | 198                 | 141                 | 2                   | 4.5                 | 2.50                | 1.25              | 1.88                                | 923   | 6026              | 6222      |
| 55         | 213                 | 151                 | 2.25                | 4.5                 | 2.25                | 1.00              | 1.69                                | 941   |                   | 6224 6321 |
| 56         | 223                 | 161                 | 2.25                | 4.6                 | 2.35                | 1.04              | 1.76                                | 942   | 6030              |           |
| 57         | 228                 | 161                 | 2.25                | 4.95                | 2.70                | 1.20              | 2.03                                | 1036  |                   | 6226      |
| 58         | 238                 | 161                 | 2.25                | 5.25                | 3.00                | 1.33              | 2.25                                | 1021  | 6032              | 6322      |
| 59         | 248                 | 171                 | 2.5                 | 5                   | 2.50                | 1.00              | 1.88                                | 1005  |                   | 6228      |
| 60         | 258                 | 171                 | 2.5                 | 5.5                 | 3.00                | 1.20              | 2.25                                | 1106  | 6034              | 6324      |
| 61         | 268                 | 181                 | 2.5                 | 5.7                 | 3.20                | 1.28              | 2.40                                | 1155  |                   | 6230      |
| 62         | 278                 | 181                 | 2.5                 | 6                   | 3.50                | 1.40              | 2.63                                | 1155  | 6036              | 6326      |
| 63         | 288                 | 191                 | 2.75                | 5.75                | 3.00                | 1.09              | 2.25                                | 1145  | 6038              | 6232      |
| 64         | 298                 | 191                 | 2.75                | 6.35                | 3.60                | 1.31              | 2.70                                | 1307  |                   | 6328      |
| 65         | 308                 | 202                 | 3                   | 6.1                 | 3.10                | 1.03              | 2.33                                | 1300  | 6040              | 6234      |
| 66         | 318                 | 212                 | 3                   | 6.2                 | 3.20                | 1.07              | 2.40                                | 1302  |                   | 6236 6330 |
| 67         | 338                 | 232                 | 3                   | 6.6                 | 3.60                | 1.20              | 2.70                                | 1415  | 6044              | 6238 6332 |
| 68         | 358                 | 242                 | 3                   | 7                   | 4.00                | 1.33              | 3.00                                | 1424  | 6048              | 6240 6334 |



## Safety Disc Washers

### **Gala Safety Disc Washer Series GS**

Safety Washer GS is suitable for normal requirements and available for bolt sizes from M 1.6 to M 36.

### **Gala High Safety Disc Washer Series GVS**

Safety Washer GVS can be used with high- tensile bolts. These are stronger safety disc washers having higher thickness for higher pre-tensioning loads. The outside and inside diameters as well as the serrations are same as GS series.

#### **Available Material Grades**

Spring Steel according to DIN EN 10132-4, Corrosion-resistant Stainless Steel 1.4310, Inconel etc.

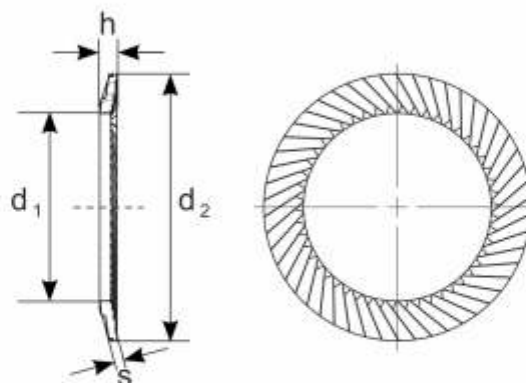
#### **Surface Treatments**

Phosphated, Mechanical Zinc plated (Cr 6-free), Zinc Flake Coatings, Electrolytic Plating.

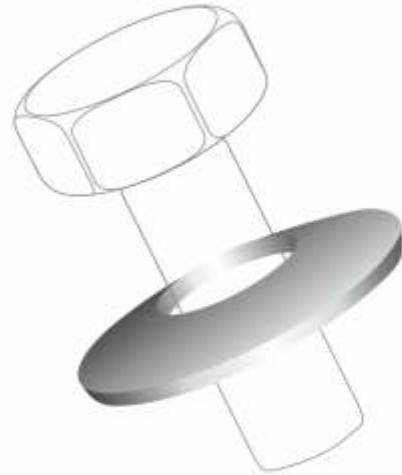
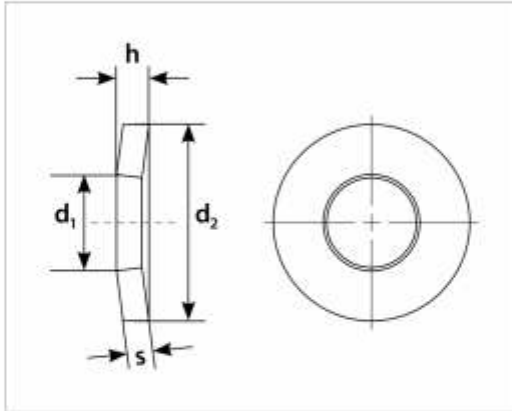


| Safety Washer Series GS |                   |        |            |            |          |                       |                       |  |
|-------------------------|-------------------|--------|------------|------------|----------|-----------------------|-----------------------|--|
| Size                    |                   |        | Dimensions |            |          |                       |                       |  |
| Sr. No.                 | Nominal Size (mm) | (Inch) | $d_1$ (mm) | $d_2$ (mm) | $s$ (mm) | $h_{\text{ext}}$ (mm) | $h_{\text{int}}$ (mm) |  |
| 1                       | GS 1.6            | -      | 1.70       | 3.20       | 0.35     | 0.38                  | 0.60                  |  |
| 2                       | GS 2.0            | -      | 2.20       | 4.00       | 0.35     | 0.39                  | 0.60                  |  |
| 3                       | GS 2.5            | -      | 2.70       | 4.80       | 0.45     | 0.49                  | 0.90                  |  |
| 4                       | GS 3.0            | 1/8"   | 3.20       | 5.50       | 0.45     | 0.51                  | 0.90                  |  |
| 5                       | GS 3.5            |        | 3.70       | 6.00       | 0.45     | 0.52                  | 0.90                  |  |
| 6                       | GS 4              | 5/32"  | 4.30       | 7.00       | 0.50     | 0.59                  | 1.00                  |  |
| 7                       | GS 5              | 3/16"  | 5.30       | 9.00       | 0.60     | 0.73                  | 1.10                  |  |
| 8                       | GS 6              |        | 6.40       | 10.00      | 0.70     | 0.82                  | 1.20                  |  |
| 9                       | GS 6.35           | 1/4"   | 6.70       | 9.50       | 0.70     | 0.79                  | 1.20                  |  |
| 10                      | GS 7              |        | 7.40       | 12.00      | 0.70     | 0.89                  | 1.30                  |  |
| 11                      | GS 8              | 5/16"  | 8.40       | 13.00      | 0.80     | 0.98                  | 1.40                  |  |
| 12                      | GS 10             | 3/8"   | 10.50      | 16.00      | 1.00     | 1.21                  | 1.60                  |  |
| 13                      | GS 11.1           | 7/16"  | 11.60      | 15.90      | 1.00     | 1.18                  | 1.60                  |  |
| 14                      | GS 12             |        | 13.00      | 18.00      | 1.10     | 1.31                  | 1.70                  |  |
| 15                      | GS 12.7           | 1/2"   | 13.70      | 19.00      | 1.10     | 1.33                  | 1.80                  |  |
| 16                      | GS 14             |        | 15.00      | 22.00      | 1.20     | 1.52                  | 2.00                  |  |
| 17                      | GS 16             | 5/8"   | 17.00      | 24.00      | 1.30     | 1.63                  | 2.10                  |  |
| 18                      | GS 18             |        | 19.00      | 27.00      | 1.50     | 1.85                  | 2.30                  |  |
| 19                      | GS 19             | 3/4"   | 20.00      | 30.00      | 1.50     | 1.98                  | 2.50                  |  |
| 20                      | GS 20             |        | 21.00      | 30.00      | 1.50     | 1.94                  | 2.50                  |  |
| 21                      | GS 22             | 7/8"   | 23.00      | 33.00      | 1.50     | 2.08                  | 2.70                  |  |
| 22                      | GS 24             |        | 25.60      | 36.00      | 1.80     | 2.32                  | 2.90                  |  |
| 23                      | GS 25.4           | 1"     | 27.00      | 38.00      | 2.00     | 2.52                  | 3.10                  |  |
| 24                      | GS 27             |        | 28.60      | 39.00      | 2.00     | 2.52                  | 3.10                  |  |
| 25                      | GS 30             | 1 1/8" | 31.60      | 45.00      | 2.00     | 2.78                  | 3.60                  |  |
| 26                      | GS 36             | 1 3/8" | 38.00      | 54.00      | 2.50     | 3.38                  | 4.20                  |  |

| High Safety Washer Series GVS |                   |        |            |            |          |                       |                       |  |
|-------------------------------|-------------------|--------|------------|------------|----------|-----------------------|-----------------------|--|
| Size                          |                   |        | Dimensions |            |          |                       |                       |  |
| Sr. No.                       | Nominal Size (mm) | (Inch) | $d_1$ (mm) | $d_2$ (mm) | $s$ (mm) | $h_{\text{ext}}$ (mm) | $h_{\text{int}}$ (mm) |  |
| 1                             | GSV 5             | 3/16"  | 5.30       | 9.00       | 1.00     | 1.07                  | 1.30                  |  |
| 2                             | GSV 6             | -      | 6.40       | 10.00      | 1.00     | 1.08                  | 1.40                  |  |
| 3                             | GSV 8             | 5/16"  | 8.40       | 13.00      | 1.20     | 1.32                  | 1.70                  |  |
| 4                             | GSV 10            | 3/8"   | 10.50      | 16.00      | 1.50     | 1.64                  | 2.00                  |  |
| 5                             | GSV 12            | -      | 13.00      | 18.00      | 1.50     | 1.65                  | 2.10                  |  |
| 6                             | GSV 14            | -      | 15.00      | 22.00      | 1.50     | 1.76                  | 2.20                  |  |
| 7                             | GSV 16            | 5/8"   | 17.00      | 24.00      | 2.00     | 2.21                  | 2.60                  |  |
| 8                             | GSV 18            | -      | 19.00      | 27.00      | 2.00     | 2.27                  | 2.70                  |  |
| 9                             | GSV 20            | -      | 21.00      | 30.00      | 2.00     | 2.34                  | 2.80                  |  |
| 10                            | GSV 22            | 7/8"   | 23.00      | 33.00      | 2.00     | 2.42                  | 3.00                  |  |
| 11                            | GSV 24            | -      | 25.60      | 36.00      | 2.50     | 2.87                  | 3.40                  |  |
| 12                            | GSV 25.4          | 1"     | 27.00      | 38.00      | 2.50     | 2.95                  | 3.40                  |  |
| 13                            | GSV 27            | -      | 28.60      | 39.00      | 2.50     | 2.91                  | 3.50                  |  |
| 14                            | GSV 30            | 1 1/8" | 31.60      | 45.00      | 2.50     | 3.12                  | 3.80                  |  |
| 15                            | GSV 36            | 1 3/8" | 38.00      | 54.00      | 3.00     | 3.72                  | 4.50                  |  |



## DIN 6796 Washers



Conical Spring Washers are used to counteract the loss of preload of a bolted connection for bolts. They are most effective on axially loaded short bolts where they increase the axial compliance.

These are highly stressed components and are recommended for static or infrequent varying load applications.

Nominal Bolt Size ranging from M2 - M30 and are available in a variety of materials and finishes.

Available material grades : Spring Steel, Stainless Steel etc.

Surface treatments : Phosphated, Mechanical Zinc plated (Cr 6-free), Zinc Flake Coating etc.

| Sr. No | Size | Outer Diameter<br>$d_2$ (mm) | Inner Diameter<br>$d_1$ (mm) | Thickness<br>$s$ (mm) | Max Height<br>(mm) | Min Height<br>(mm) | Permanent Set Test : Compression Load KN (as per DIN 267-26) | Minimum Free Height after Permanent Set Test (mm) | Residual Spring Force Test : Minimum Residual Spring Force (kN) |
|--------|------|------------------------------|------------------------------|-----------------------|--------------------|--------------------|--------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------------------------|
| 1      | M2   | 5.00                         | 2.20                         | 0.40                  | 0.60               | 0.50               | 0.92                                                         | 0.50                                              | -                                                               |
| 2      | M2.5 | 6.00                         | 2.70                         | 0.50                  | 0.72               | 0.60               | 1.52                                                         | 0.60                                              | -                                                               |
| 3      | M3   | 7.00                         | 3.20                         | 0.60                  | 0.85               | 0.70               | 2.35                                                         | 0.70                                              | -                                                               |
| 4      | M3.5 | 8.00                         | 3.70                         | 0.80                  | 1.06               | 0.90               | 3.16                                                         | 0.90                                              | -                                                               |
| 5      | M4   | 9.00                         | 4.30                         | 1.00                  | 1.30               | 1.10               | 4.40                                                         | 1.10                                              | 1.40                                                            |
| 6      | M5   | 11.00                        | 5.30                         | 1.20                  | 1.55               | 1.30               | 7.20                                                         | 1.30                                              | 2.30                                                            |
| 7      | M6   | 14.00                        | 6.40                         | 1.50                  | 2.00               | 1.70               | 10.20                                                        | 1.70                                              | 4.20                                                            |
| 8      | M7   | 17.00                        | 7.40                         | 1.75                  | 2.30               | 2.00               | 14.80                                                        | 2.00                                              | 6.20                                                            |
| 9      | M8   | 18.00                        | 8.40                         | 2.00                  | 2.60               | 2.20               | 18.60                                                        | 2.20                                              | 7.70                                                            |
| 10     | M10  | 23.00                        | 10.50                        | 2.50                  | 3.20               | 2.80               | 29.60                                                        | 2.80                                              | 12.40                                                           |
| 11     | M12  | 29.00                        | 13.00                        | 3.00                  | 3.95               | 3.40               | 43.00                                                        | 3.40                                              | 18.00                                                           |
| 12     | M14  | 35.00                        | 15.00                        | 3.50                  | 4.65               | 4.00               | 59.10                                                        | 4.00                                              | 25.00                                                           |
| 13     | M16  | 39.00                        | 17.00                        | 4.00                  | 5.25               | 4.60               | 80.90                                                        | 4.60                                              | 34.00                                                           |
| 14     | M18  | 42.00                        | 19.00                        | 4.50                  | 5.80               | 5.10               | 102.00                                                       | 5.10                                              | 57.00                                                           |
| 15     | M20  | 45.00                        | 21.00                        | 5.00                  | 6.40               | 5.60               | 130.00                                                       | 5.60                                              | 73.00                                                           |
| 16     | M22  | 49.00                        | 23.00                        | 5.50                  | 7.05               | 6.10               | 162.00                                                       | 6.10                                              | 91.00                                                           |
| 17     | M24  | 56.00                        | 25.00                        | 6.00                  | 7.75               | 6.80               | 188.00                                                       | 6.80                                              | 122.00                                                          |
| 18     | M27  | 60.00                        | 28.00                        | 6.50                  | 8.35               | 7.30               | 246.00                                                       | 7.30                                              | 161.00                                                          |
| 19     | M30  | 70.00                        | 31.00                        | 7.00                  | 9.20               | 8.00               | 300.00                                                       | 8.00                                              | 196.00                                                          |



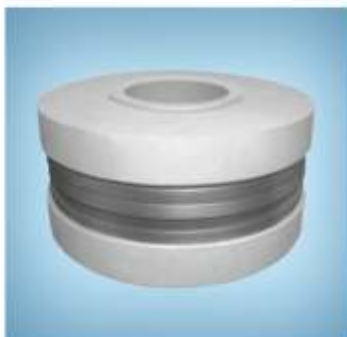
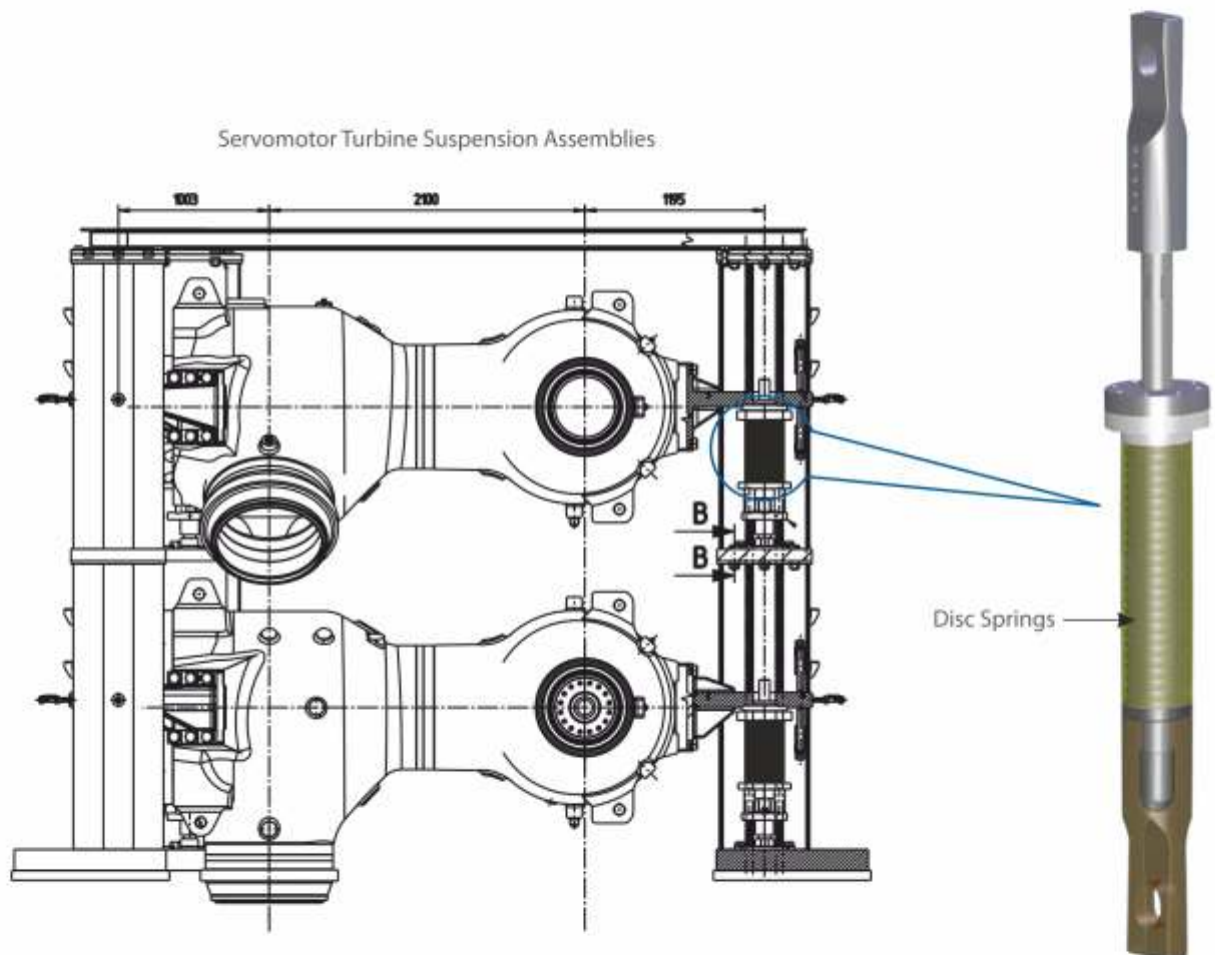
# Springs Innovation in our DNA



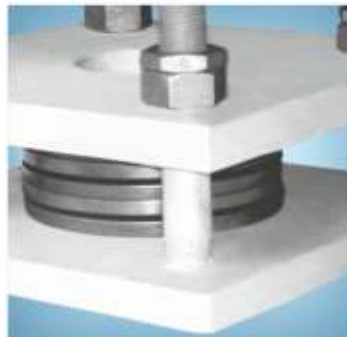


## Spring Assemblies

| Disc Spring Assemblies for                                                                                                                                                          | Advantages                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• Servomotor Suspension</li> <li>• Boiler Support &amp; Hanger</li> <li>• Servomotor Valve Actuator</li> <li>• Wind Turbine Brake</li> </ul> | <ul style="list-style-type: none"> <li>• 100% Load tested assemblies</li> <li>• Support in Design &amp; Application Engineering</li> <li>• Variety of raw materials &amp; coatings</li> <li>• Customized packaging</li> </ul> |



Boiler Support



Boiler Hanger



Spring Pack for  
Wind Turbine Brake



## Special Springs

The experience and knowledge established in the disc spring manufacturing is applied also to the production of special springs for various Applications.

A wide variety of styles, sizes and functions are possible and each application has its unique sets of requirements.





## Engineering & Manufacturing Facilities

### Disc Spring Design & Tooling

- In-house tool design and development with latest CAD and 3D Modeling software.
- State-of-the-art CNC Wire Cut Machines for achieving surface finish upto 5 microns on cutting elements.
- Competency of manufacturing tools from variety of materials like HSS, Carbide, Powder Metal etc.
- Variety of Coatings & Treatments on tool cutting elements to increase performance & achieve better edge quality.



We have developed tooling technology for shaving of edges for reducing the shear zone upto 20% of material thickness. This results in edge quality close to fine blanking.

### Blanking & Forming

Gala is equipped with power presses of capacity up to 500 tons (5000 KN). Presses are attached with automatic De-coiling, straightening and feeding arrangements. Photo Sensors are installed for eliminating misblanking. The blanking capacity is from thickness 0.10 mm to 10 mm.

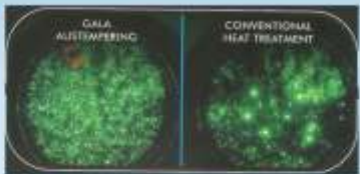
### Machining

Depending on the requirement, the Disc Springs up to 500 mm Outer Diameter are turned on CNC centers to achieve required edge quality & stringent tolerances.









**Heat Treatment**

Over the years of experience Gala has developed capability to offer variety of heat treatment processes based on raw material and application of Disc Springs.

We offer options of Austempering, Carbo-Austempering, Martempering, Stress relieving, Vacuum heat treatment etc in technically advanced Austempering, Sealed Quench & Vacuum furnaces. Heat treatment cycle is followed in a controlled atmosphere. This results in homogeneous & fine micro-structure leading to higher fatigue life & uniform hardness.

**AUSTEMPERING PROCESS**



### Shot Peening & Finishing



Shot Peening is done on Disc Springs for tensile stress relieving & inducing high level of compressive stresses resulting in higher fatigue life. The proprietary finishing process developed by Gala ensures burr free internal & external edges and imparts additional compressive stresses to further enhance fatigue life under adverse working conditions. This also reduces the chances of stress concentration on the edges of disc springs.

### Scragging & Load Testing

Disc Springs are flattened for removal of permanent set. Disc Springs are tested with the load versus deflection characteristics as per DIN 2093 or customer specifications.

Depending upon the application, the customised disc springs are also tested for its progressive & regressive load characteristics ensuring process validation as per specifications.



Scragging



Load Testing

### Quality Assurance

Gala is committed to deliver products that consistently meet & exceed the requirements of our customers. A well laid-out procedure as per ISO 9001:2009 & TS 16949 ensures high quality products consistently.

### Packing & Logistics

We offer customised packing of products based on volume & customer requirement. Quantum of delivery can be matched with the production schedule, be it every week or month with customer preferred options like at their warehouse, sea port, etc.



## Raw Materials & Coatings

### Raw Materials

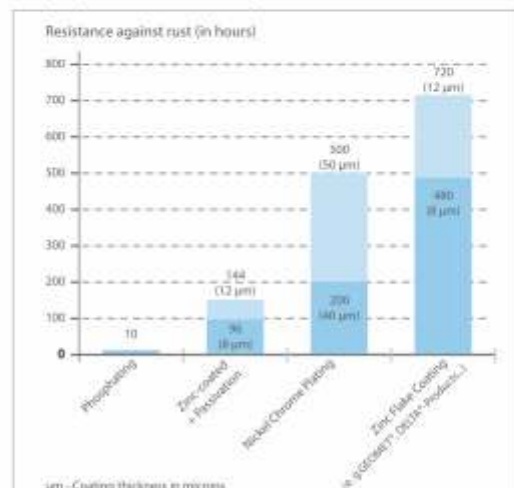
| Spring Material Properties |              |              |                       |                                    |                                                                                                                                                                            |
|----------------------------|--------------|--------------|-----------------------|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Material Name              | Material No. | Standard     | Working Temp Range °C | Tensile Strength N/mm <sup>2</sup> | Suitable Applicable Areas                                                                                                                                                  |
| C 60                       | 1.1211       | EN 10132-4   | -20 +100              | 1150-1750                          | These materials offer the best spring characteristics, most suited to: high fatigue and low and moderate stressed applications.                                            |
| C 75                       | 1.1248       | EN 10132-4   | -20 +100              | 1200-1800                          |                                                                                                                                                                            |
| 51CrV4<br>50 CrV4          | 1.8159       | EN 10132-4   | -50 +200              | 1200-1800                          |                                                                                                                                                                            |
| SS 301                     | 1.4310       | DIN EN 10151 | -200 +200             | 1150-1500                          | Suitable for high corrosion resistance, indoor & outdoor services, high temperature, wear, abrasion, chemical & organic materials.                                         |
| SS 304                     | 1.4301       | DIN EN 10151 | -200 +200             | 1000-1500                          |                                                                                                                                                                            |
| 17/7 Ph                    | 1.4568       | DIN EN 10151 | -200 +300             | 1150-1700                          | Offers combined advantage of high strength & corrosion resistance, used for cryogenic applications & intricate parts due to its low distortion in heat treatment.          |
| INCONEL X750               | 2.4668       | -            | -200 +700             | ≥1170                              | Involving good strength under high temperatures, corrosive environment, high fatigue strength, excellent resistance to oxidation at elevated temperatures.                 |
| INCONEL 718                | 2.4669       | -            | -200 +600             | ≥1240                              |                                                                                                                                                                            |
| H11                        | 1.2343       | -            | 0- +600               | 1650-1990                          | Suitable for highly stressed structural parts, resistance to softening & retention of good toughness with high strength at temperatures upto 600°C.                        |
| H13                        | 1.2344       | -            | 0- +600               | 1650-1990                          | Offers high hardenability, excellent wear resistance, hot toughness, good thermal resistance, greater homogeneity & fine structure with high temperature tensile strength. |

All above values are for reference only. For further details contact Gala Precision Engineering Pvt. Ltd.

### Coatings

|                                   |                        |
|-----------------------------------|------------------------|
| Phosphating                       | Dacromate              |
| Blackodising                      | Deltatone              |
| Mechanical Zn Plating (Cr 6 free) | Zinc Silicate          |
| Geomet                            | Powder & Epoxy coating |

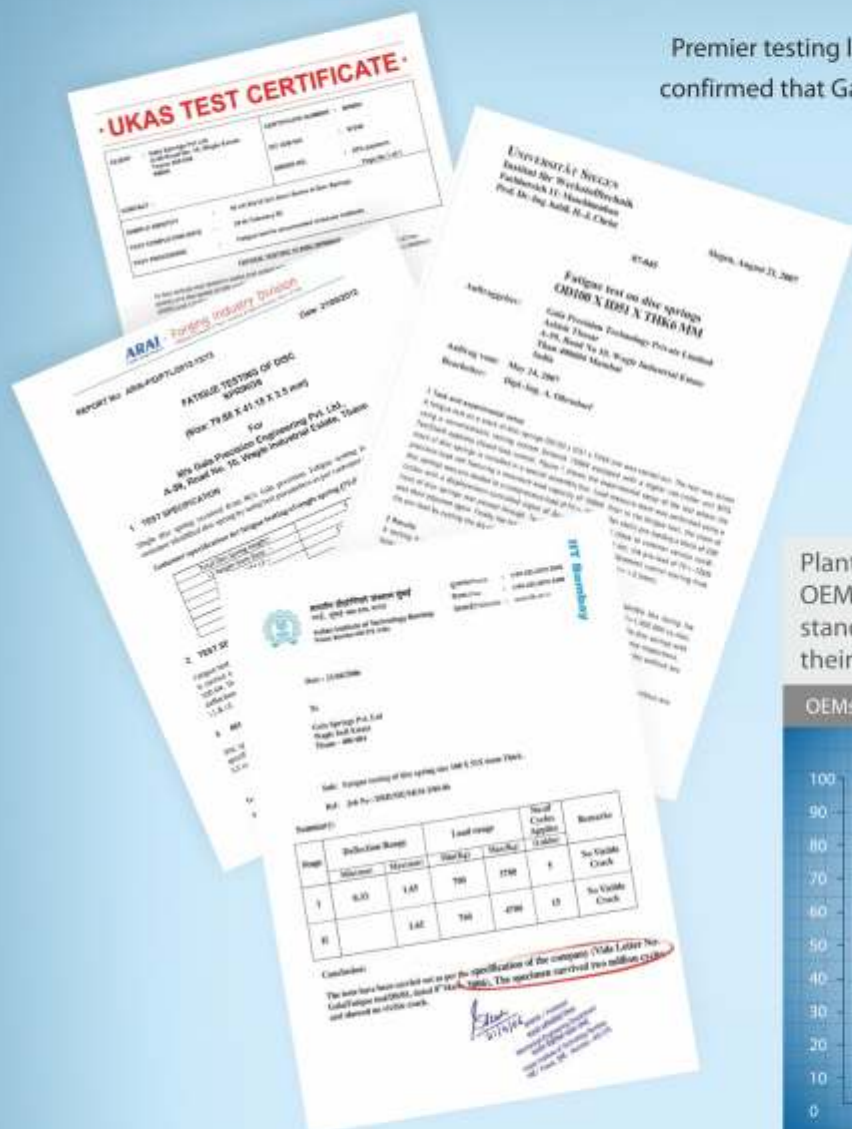
Salt Spray Life for various coatings





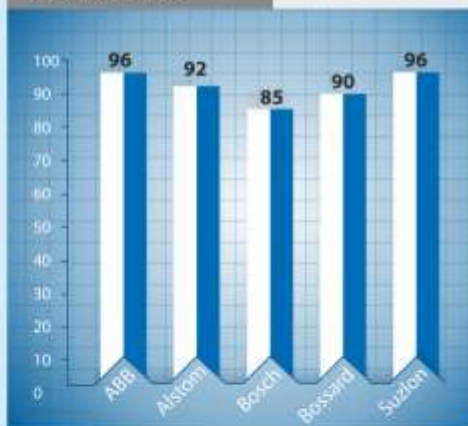
## Our Credentials

Premier testing laboratories in Europe and India have confirmed that Gala Disc Springs offer high fatigue life to meet customer requirements.



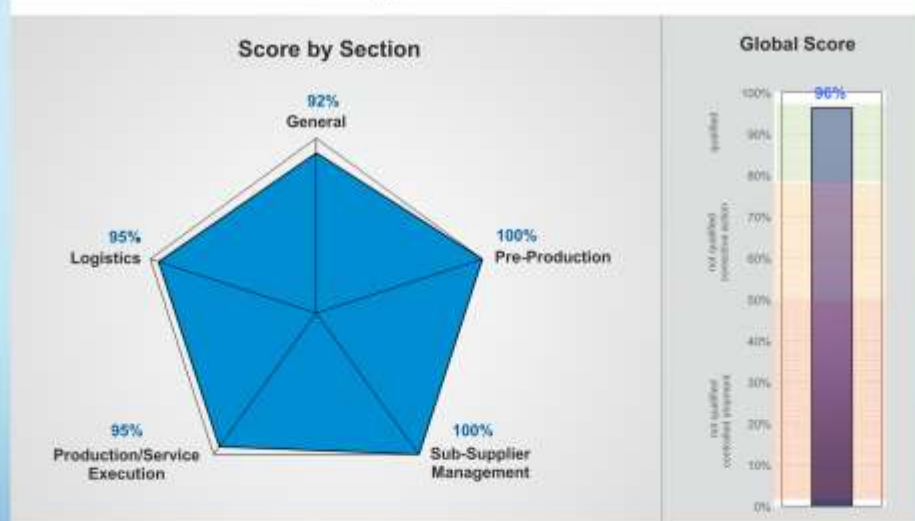
Plant audited & approved by global OEMs & distributors for supplying standard as well customised springs to their worldwide locations

OEMs Audit Score



Supplier Process Audit Summary by a global OEM

Supplier- Gala 16.11.13







ISO/TS 16949 Certified by Bureau Veritas

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