

Design Partnership

Customisation

Precision Engineering

Comprehensive Range of Disc Springs... from INDIA



Astounded by the Indian intelligentsia, head-hunters around the world have made a bee-line to grab the best brains from our country. Be it in the field of IT or engineering designing, the new generation of Indian youth have created an indelible mark on the global platform. An inborn analytical and research oriented mind and the acumen for assimilating and absorbing the latest technological advancements, we Indians are quick to convert every learning into commercial applications.

China, on the other hand has witnessed a meteoric rise in the international economy by revolutionising the manufacturing technology. By investing in economies of scale and implementing the latest systems with discipline, China today is recognised as the global manufacturing hub.

Gala Precision Engineering, with its superlative engineering competency is working towards Business Excellence while catering to the needs in niche segments of some of the most advanced countries in the world.

Today, Gala combines the best of both India & China. This combination offers the perfect amalgamation of intelligence and discipline, quality and cost competency. And of course the perfect match of management and economies of scale.

Why should you choose GALA Disc Springs?

- Design Partnership & Application Engineering Support
- High Fatigue life
- ISO 9001:2000 / TS 16949 certified manufacturing facility in India & China
- '0' ppm rejection level
- Tested & Approved by leading OEs in Germany, Japan, USA, Denmark and France
- Exports to UK, Germany, Italy, France, USA, Denmark, Spain, Australia, Indonesia, Czech Republic, Netherlands, China, etc.



Gala has been manufacturing disc springs for over three decades, by virtue of its experience Gala has acquired mastery over the entire manufacturing cycle of disc springs. What with the design capability of stacks and application partnership with customers, Gala has made rapid forays in the international markets.

Standard Disc Springs

Gala has developed a complete range of standard products as per DIN 2093 & DIN 6796.

Apart from DIN standards, Gala offers Disc Springs as per

American Inch Standards. Gala is one of the very few companies in the world who can adhere to these demanding standards.

Gala has developed toolings for the entire range of Disc Spring varieties as per DIN 2093 like

Group 1 (Thickness < 1.25 mm),

Group 2 (Thickness = 1.25 mm to 6 mm) and

Group 3 (Thickness > 6 mm)

Within these groups, all standard sizes as per Series A, B & C are available.

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



Customised Disc Springs

Gala, with years of experience has developed the ability for :

- Application partnership and Designing of Disc Springs for specific applications
- In-house design & development of tooling for fast product development
- Capability of offering disc springs from a wide range of raw materials
- Manufacturing Disc Springs with a wide variety of customised coatings

Gala, with its wide experience and qualified manpower, now offers design partnership and application engineering support to its customers.

With this Application Engineering support from Gala, customers can design the disc spring and also select the dimensions of the disc springs.

Our Application Engineers study the static and dynamic load requirements, load deflection characteristics & have continuous interaction with OEMs engineering & design team & study the working conditions of the end application to design the most suitable Disc Spring.

**DESIGN PARTNERSHIP AND
APPLICATION ENGINEERING SUPPORT**

MANUFACTURING PROCESS AND FACILITIES

Raw Materials

Gala has successfully forged alliances with its suppliers of Steel, which is absolutely vital for maintaining consistency in quality & delivery. Its list of suppliers includes the best steels mills in India as well as leading steel mills from Europe, Brazil, Korea, etc.

Following materials are procured through the network of global steel suppliers:

- Spring Steel Ck55, Ck60, Ck67, Ck70, Ck75
- Chrome Vanadium Steel 50CrV4 / 51CrV4
- Precipitation Hardenable Steel 17/7Ph
- Work Hardened Stainless Steel AISI 301 & 304
- Inconel 718 & X750
- Nimonic 90

Blanking & Forming

Gala is equipped with power presses having capacity up to 250 tons (2500 KN). The presses are attached with automatic De-coiling, straightening and feeding arrangements. It has also installed 'Photo Sensor' for eliminating misblanking. The punching capacity is from thickness 0.1mm (0.0039") to 6 mm (0.23").

Machining

Depending on the customers' specific requirement, the Disc Springs are turned on CNC lathes (up to 350mm (13.7") O.D.) to ensure higher & consistent production.



Heat Treatment

Manufacturing Disc Springs with Spring Steel is not a mere science, but an art too. This is largely due to the inherent property of the material to spring back.

Therefore, Gala has separate and dedicated heat treatments facilities like Austempering to achieve homogeneous Bainite structure by ensuring controlled atmosphere and process parameters.

The resultant product is distortion free with uniform hardness.

Finishing

The proprietary finishing process developed by Gala ensures burr free edges (internal & external).

De-scaling is done to remove scales & finishing operation reduces the chances of stress concentration on the edges of disc springs and avoids subsequent failure of Disc Springs.

Scrapping & Load Testing

All heat treated Disc Springs are flattened on automatic hydraulic press at 1.5 times the load at 0.75h.

Each Disc Spring is tested with the load cell for load versus deflection characteristics as per DIN 2093 or customer specifications.

MANUFACTURING FACILITIES

Depending upon the application, the customised disc springs are also tested for its progressive and regressive load characteristic, thus ensuring the complete process validation as per specification. Gala is equipped with the state of the art Load Testing Machines having capacity from 0.10 KN to 400 KN (from 10Kgs to 40 Tons).

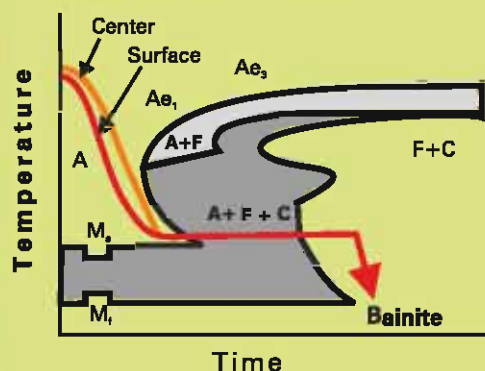
Surface Treatment & Coatings

Shot Peening is done on Disc Springs for tensile stress relieving and high endurance.

Gala offers Disc Springs with a variety of customized surface treatments & coatings such as :

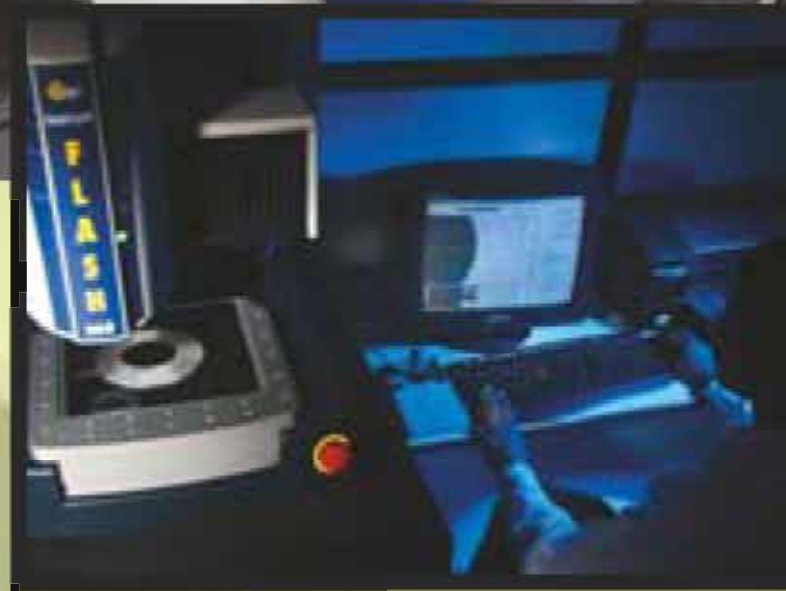
- Phosphating • Blackodising • Dacromating
- Geomat • Epoxy Coating
- Mechanical Zinc Plating (Chrome VI Free)
- Nickel Chrome Plating & Other coatings to suit customers' requirement

AUSTEMPERING PROCESS





Gala is committed to deliver products and services that consistently meet & exceed the requirements of its customers. Gala ensures quality checks at all stages of manufacturing right from Raw Material receipt to final dispatch. A well laid-out procedure as per ISO 9001:2000 and TS 16949 and Gala's adherence to it ensures a high quality product and service for its customers.

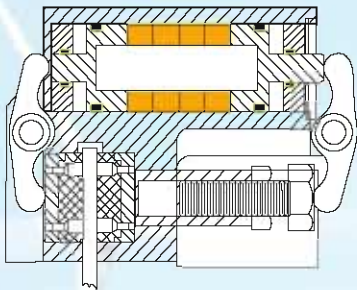


Apart from certifications, Gala practices modern and lean manufacturing techniques by incorporating Kaizen, Statistical Process Control (SPC), TPM & TQM methods for continuous improvement of productivity & cost reduction.

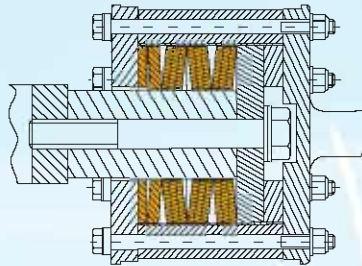
QUALITY ASSURANCE

GALA - THE LARGEST DISC SPRING MANUFACTURER

Fail-Safe Brake

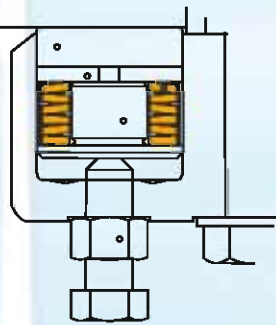


Gear Mounting

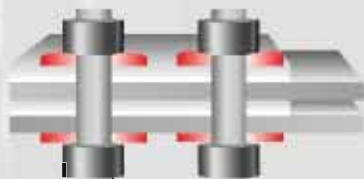


**WIND
TURBINES**

Yaw Bearing System



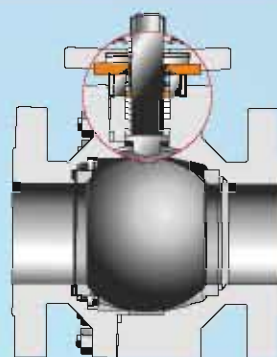
Electrical Bus Bars



SWITCHGEARS



RER IN ASIA - OFFERS DISC SPRINGS WITH 30% HIGHER



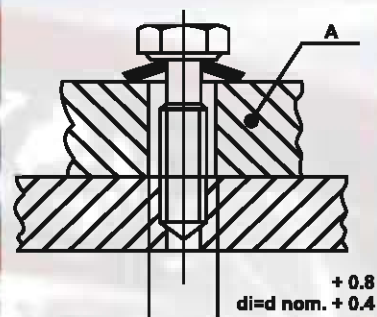
**BALL VALVES
& ACTUATORS**



**HYDRAULIC
BRAKES
& MOTORS**



FATIGUE LIFE FOR A VARIETY OF APPLICATIONS



AUTOMOBILES



**OFF-HIGHWAY
VEHICLES**

PREMIER TESTING LABORATORIES IN EUROPE AND INDIA CONFIRM GALA DISC SPRINGS OFFER HIGHER FATIGUE LIFE

UKAS TEST CERTIFICATE

CLIENT : Gala Springs Pvt Ltd A-59 Road No. 10, Wagale Estate Thane 400 604 INDIA	CERTIFICATE NUMBER : 008680 IST JOB NO : 87240 ORDER NO. : 25% payment
CONTACT : Page No 1 of 1	
SAMPLE IDENTITY : 10 off 25x12.2x1.5mm Series A Disc Springs	
TEST COMPLETION DATE : 28 th February 05	
TEST PROCEDURE : Fatigue test to documented in-house methods	

FATIGUE TESTING 10 DISC SPRINGS

was tested in series and cycled between lengths of 17.3mm and 15.33mm (i.e. 1.97mm at speed of 240 cycles per minute. Therefore each disc was deflected from free by 0.0696mm (2.67mm (1875N).

are as follows:-

Cycles	Broken	Unbroken
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X
3,000,000		X

End of Test Report



भारतीय प्रौद्योगिकी संस्थान मुंबई
पर्व, मुंबई-400 078, भारत
Indian Institute of Technology Bombay
Powai, Mumbai-400 078, India

दूरभाष/Phone : (+91-22) 2572 2545
फैक्स/Fax : (+91-22) 2572 3480
वेबसाइट/Website : www.iitb.ac.in

IIT Bombay

Date : 21/04/2006

To

Gala Springs Pvt. Ltd
Wagle Indl Estate
Thane - 400 604

Sub: Fatigue testing of disc spring size 100 X 51X 6mm Thick.

Ref: Job No : DRD/ME/SKM-2/05-06

Summary:

Stage	Deflection Range		Load range		No. of Cycles Applies (Lakhs)	Remarks
	Min(mm)	Max(mm)	Min(Kg)	Max(Kg)		
I	0.33	1.65	700	3780	5	No Visible Crack
II		1.65	760	4700	15	No Visible Crack

Conclusion:

The tests have been carried out as per the specification of the company (Vide Letter No: Gala/Fatigue test/DS/01, dated 8th Mar. 2006). The specimen survived two million cycles and showed no visible crack.

[Signature]
21/4/06

प्रोफेसर / Professor
मशीन इंजीनियरिंग विभाग
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Indian Institute of Technology Bombay
पर्व / Powai, मुंबई / Mumbai - 400 078

Approved by *[Signature]*
M.R. Seetharam / M.P. Hayes / M.S. Baylies
on behalf of the Institute of Spring Technology Ltd
Date *07/03/05*





IRMRA

INDIAN RUBBER MANUFACTURERS RESEARCH ASSOCIATION

Affiliated to Ministry of Commerce & Industry (Government of India)

E-mail: rubber@bcm7.vsnl.net.in Website: www.irmra.org

EVALUATION REPORT

Report No : RPT/064489/T-11363/2006 11.08.2006 Page 1 of 2

---CUSTOMER DETAILS---

Customer Name & Address:	
GALA PRECISION TECHNOLOGY LIMITED A-59 ROAD NO. 10 WAGLE INDUSTRIAL ESTATE THANE , 400604	
Customer Letter Ref No with Date :	Aug 9, 2006

---SAMPLE DETAILS---

Sample Code :	Disc Springs 150mm x 61mm x 4.5mm
Product Specification :	N.A
Date of Receipt :	9-Aug-2006 2:29:09 PM
Any other information like witness/ third party information etc	N.A

The customer has submitted above referred sample(s) for the evaluation purpose. The evaluation reports are enclosed

---REPORT DETAILS---

RPT/064489/T-11363/2006 / 4489-TML 11.08.2006
Sample : Disc Springs 150mm x 61mm x 4.5mm

Test(Unit) (Condition)	Test Method	Observation
Fatigue Testing In Servo Hydraulic Machine (2 million Cycles , Mean 2.97mm, Amplitude 0.425mm,freq 25Hz)	As per customers procedure	No visual cracks, deformation or failure observed after the test

Prepared and checked By

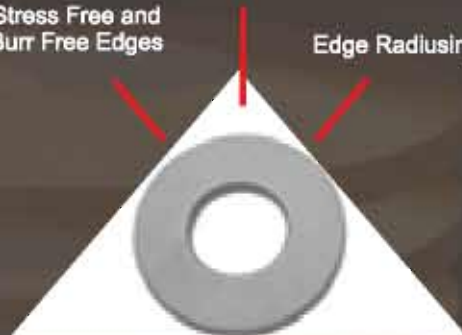
T. Mayilvaganan
(Sr. Scientific Officer)

Authorized Signatory

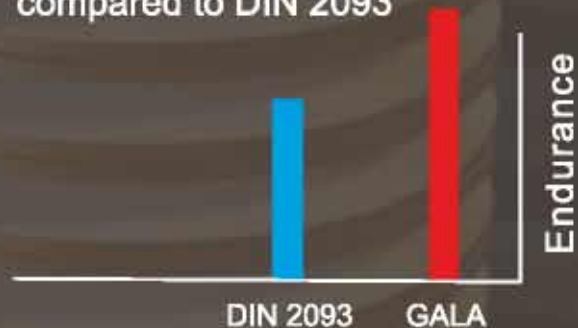
P.K. Des
(Assistant Director)

24/U-2, Wagle Industrial Estate, THANE - 400 604 INDIA. Ph : 2881 1348 / 2580 3753 / 2580 6108 Telefax : 2562 3910

Compressive Stress Induction
Stress Free and Burr Free Edges
Edge Radiusing



Higher Endurance compared to DIN 2093



Gala's Proprietary Finishing Process

Gala has developed a Proprietary Finishing Process, for relieving tensile stresses and induces compressive stresses with larger depth of penetration which results into higher Fatigue Life of the disc springs.

Life Testing of Gala Disc Springs

One of the major requirements of OEMs for disc springs is the Life Expectancy. To support our claim of offering disc springs with higher endurance life, Gala Disc Springs were tested for high Fatigue Life at "Institute of Spring Technology, UK" and other premier testing laboratories in India & Europe. The Fatigue test results show that Gala Disc Springs endured 40% more Load Cycles compared to the DIN Specification.



LIFE OF DISC SPRING

PACKING & LOGISTICS

From strong sea-worthy packing to environmental friendly corrugated packing, Gala can offer perfectly suitable packing options to its customers. Gala ensures the safe transport of disc springs and also protection during sea transportation.

Gala has wide experience in handling logistics to all major ports in the world. Gala has built up logistic lead times in its manufacturing planning itself to ensure on-time deliveries to its customers. Added to this, Tie-up with Global logistics partners ensure that Gala is in a position to meet customer specific delivery schedules globally.



● Office ● Manufacturing Facilities ● Export Countries

GLOBAL PRESENCE

GROUP 1

Sr. No.	Outside diameter of disc spring mm (De)	Inside dia of disc spring mm (Di)	Thickness of disc spring mm (t)	Free height of cone frustum of unload disc spring mm (ho)	Thickness of disc spring (mm) (reduced) (t')	Free height of cone frustum of unload disc spring with reduced Thickness mm (ho)	Overall Height (lo)	Load on each disc spring N (at s = 0.75 ho)
1	8.00	3.20	0.20	0.20	—	—	0.40	25.79
2	8.00	4.20	0.20	0.25	—	—	0.45	39.19
3	10.00	5.20	0.25	0.30	—	—	0.55	57.51
4	6.00	3.20	0.30	0.15	—	—	0.45	119.14
5	8.00	3.20	0.30	0.25	—	—	0.55	104.31
6	8.00	4.20	0.30	0.25	—	—	0.55	117.85
7	10.00	3.20	0.30	0.35	—	—	0.65	98.26
8	12.50	6.20	0.35	0.45	—	—	0.80	151.20
9	14.00	7.20	0.35	0.45	—	—	0.80	123.18
10	8.00	3.20	0.40	0.20	—	—	0.60	185.41
11	8.00	4.20	0.40	0.20	—	—	0.60	209.48
12	10.00	3.20	0.40	0.30	—	—	0.70	179.09
13	10.00	4.20	0.40	0.30	—	—	0.70	189.08
14	10.00	5.20	0.40	0.30	—	—	0.70	209.21
15	12.00	4.20	0.40	0.40	—	—	0.80	178.28
16	15.00	5.20	0.40	0.55	—	—	0.95	175.51
17	16.00	8.20	0.40	0.50	—	—	0.90	154.32
18	18.00	6.20	0.40	0.60	—	—	1.00	138.59
19	20.00	10.20	0.40	0.50	—	—	0.90	98.46
20	18.00	9.20	0.45	0.60	—	—	1.05	213.60
21	8.00	3.20	0.50	0.20	—	—	0.70	357.22
22	10.00	3.20	0.50	0.35	—	—	0.85	403.83
23	10.00	4.20	0.50	0.25	—	—	0.75	293.93
24	10.00	5.20	0.50	0.25	—	—	0.75	325.23
25	12.00	4.20	0.50	0.40	—	—	0.90	331.26
26	12.00	5.20	0.50	0.40	—	—	0.90	349.46
27	12.00	6.20	0.50	0.35	—	—	0.85	326.24
28	12.50	5.20	0.50	0.35	—	—	0.85	272.04
29	12.50	6.20	0.50	0.35	—	—	0.85	293.33
30	14.00	7.20	0.50	0.40	—	—	0.90	279.06
31	15.00	5.20	0.50	0.50	—	—	1.00	278.15
32	15.00	6.20	0.50	0.50	—	—	1.00	289.28
33	18.00	6.20	0.50	0.60	—	—	1.10	245.34
34	18.00	8.20	0.50	0.60	—	—	1.10	264.60
35	20.00	8.20	0.50	0.65	—	—	1.15	230.70
36	20.00	10.20	0.50	0.65	—	—	1.15	254.01
37	10.00	4.20	0.60	0.25	—	—	0.85	502.08
38	12.00	4.20	0.60	0.40	—	—	1.00	556.52
39	12.00	5.20	0.60	0.35	—	—	0.95	505.89
40	12.00	6.20	0.60	0.35	—	—	0.95	551.48
41	15.00	5.20	0.60	0.45	—	—	1.05	407.00
42	15.00	6.20	0.60	0.45	—	—	1.05	423.29
43	16.00	8.20	0.60	0.45	—	—	1.05	409.87
44	18.00	6.20	0.60	0.60	—	—	1.20	400.15
45	20.00	8.20	0.60	0.70	—	—	1.30	411.85
46	22.50	11.20	0.60	0.80	—	—	1.40	425.28
47	12.50	6.20	0.70	0.30	—	—	1.00	659.24
48	12.50	6.20	0.70	0.30	—	—	1.00	659.24
49	15.00	5.20	0.70	0.55	—	—	1.25	796.15
50	15.00	6.20	0.70	0.40	—	—	1.10	577.23
51	15.00	8.20	0.70	0.40	—	—	1.10	665.31
52	16.00	8.20	0.70	0.45	—	—	1.15	636.91
53	18.00	6.20	0.70	0.70	—	—	1.40	741.33
54	18.00	8.20	0.70	0.55	—	—	1.25	595.72
55	18.00	9.20	0.70	0.50	—	—	1.20	566.15
56	20.00	8.20	0.70	0.65	—	—	1.35	568.26
57	23.00	8.20	0.70	0.80	—	—	1.50	543.35
58	25.00	12.20	0.70	0.90	—	—	1.60	599.39
59	12.00	5.20	0.80	0.30	—	—	1.10	997.39
60	12.00	6.20	0.80	0.30	—	—	1.10	1087.29
61	14.00	7.20	0.80	0.30	—	—	1.10	796.46
62	15.00	8.20	0.80	0.40	—	—	1.20	981.82
63	16.00	8.20	0.80	0.40	—	—	1.20	824.84
64	18.00	6.20	0.80	0.70	—	—	1.50	1071.54
65	18.00	8.20	0.80	0.50	—	—	1.30	782.28

Sr. No.	Outside diameter of disc spring mm (De)	Inside dia of disc spring mm (Di)	Thickness of disc spring mm (t)	Free height of cone frustum of unload disc spring mm (ho)	Thickness of disc spring (mm) (reduced) (t')	Free height of cone frustum of unload disc spring with reduced Thickness mm (ho)	Overall Height (lo)	Load on each disc spring N (at $s = 0.75$ ho)
GROUP 1	66	20.00	8.20	0.80	0.60	—	1.40	750.68
	67	20.00	10.20	0.80	0.55	—	1.35	747.88
	68	22.50	11.20	0.80	0.65	—	1.45	707.13
	69	23.00	8.20	0.80	0.75	—	1.55	718.22
	70	28.00	10.20	0.80	0.95	—	1.75	661.20
	71	28.00	14.20	0.80	1.00	—	1.80	801.01
	72	31.50	16.30	0.80	1.05	—	1.85	686.54
	73	14.00	6.20	0.90	0.35	—	1.25	1229.18
	74	16.00	8.20	0.90	0.35	—	1.25	1012.36
	75	20.00	8.20	0.90	0.60	—	1.50	1050.71
	76	20.00	10.20	0.90	0.55	—	1.45	1049.48
	77	23.00	8.20	0.90	0.80	—	1.70	1077.48
	78	23.00	10.20	0.90	0.75	—	1.65	1057.41
	79	25.00	12.20	0.90	0.70	—	1.60	861.88
	80	35.50	18.30	0.90	1.15	—	2.05	831.56
	81	12.50	6.20	1.00	0.20	—	1.20	1253.36
	82	18.00	8.20	1.00	0.50	—	1.50	1496.26
	83	18.00	9.20	1.00	0.40	—	1.40	1253.54
	84	20.00	8.20	1.00	0.60	—	1.60	1423.52
	85	20.00	10.20	1.00	0.55	—	1.55	1424.53
	86	23.00	8.20	1.00	0.70	—	1.70	1239.29
	87	23.00	10.20	1.00	0.70	—	1.70	1314.78
	88	25.00	10.20	1.00	0.75	—	1.75	1171.24
	89	25.00	12.20	1.00	0.80	—	1.80	1357.93
	90	28.00	10.20	1.00	1.00	—	2.00	1287.99
	91	28.00	12.20	1.00	0.95	—	1.95	1267.55
	92	28.00	14.20	1.00	0.80	—	1.80	1106.58
	93	31.50	12.20	1.00	1.10	—	2.10	1166.40
	94	34.00	12.20	1.00	1.25	—	2.25	1171.66
	95	34.00	12.30	1.00	1.20	—	2.20	1109.12
	96	40.00	20.40	1.00	1.30	—	2.30	1016.02
GROUP 2	97	20.00	10.20	1.10	0.45	—	1.55	1520.03
	98	22.50	11.20	1.25	0.50	—	1.75	1927.99
	99	23.00	12.20	1.25	0.60	—	1.85	2330.00
	100	25.00	12.20	1.25	0.70	—	1.95	2213.09
	101	28.00	10.20	1.25	1.00	—	2.25	2393.23
	102	28.00	12.20	1.25	0.85	—	2.10	2081.58
	103	28.00	14.20	1.25	0.85	—	2.10	2238.44
	104	31.50	12.20	1.25	0.95	—	2.20	1803.97
	105	31.50	16.30	1.25	0.90	—	2.15	1911.98
	106	34.00	12.30	1.25	1.20	—	2.45	2023.00
	107	34.00	14.30	1.25	1.15	—	2.40	1992.34
	108	35.50	18.30	1.25	1.00	—	2.25	1697.88
	109	40.00	14.30	1.25	1.40	—	2.65	1778.97
	110	45.00	22.40	1.25	1.60	—	2.85	1889.99
	111	50.00	25.40	1.25	1.60	—	2.85	1549.40
	112	20.00	10.20	1.50	0.30	—	1.80	2519.72
	113	22.50	11.20	1.50	0.55	—	2.05	3650.44
	114	23.00	12.20	1.50	0.60	—	2.10	3983.49
	115	25.00	12.20	1.50	0.55	—	2.05	2924.56
	116	28.00	10.20	1.50	0.70	—	2.20	2721.23
	117	28.00	12.20	1.50	0.75	—	2.25	3075.57
	118	28.00	14.20	1.50	0.65	—	2.15	2839.53
	119	31.50	12.20	1.50	0.85	—	2.35	2686.59
	120	31.50	16.30	1.50	0.90	—	2.40	3228.26
	121	34.00	12.30	1.50	1.20	—	2.70	3361.30
	122	34.00	14.30	1.50	1.05	—	2.55	2988.80
	123	34.00	16.30	1.50	1.05	—	2.55	3153.58
	124	40.00	14.30	1.50	1.30	—	2.80	2666.79
	125	40.00	16.30	1.50	1.30	—	2.80	2748.00
	126	40.00	20.40	1.50	1.15	—	2.65	2620.13
	127	50.00	18.40	1.50	1.65	—	3.15	2317.65
	128	50.00	25.40	1.50	1.60	—	3.10	2510.61
	129	58.00	28.50	1.50	1.95	—	3.45	2620.89
	130	28.00	10.20	1.75	0.90	—	2.65	5595.06

GROUP 2

Sr. No.	Outside diameter of disc spring mm (De)	Inside dia of disc spring mm (Di)	Thickness of disc spring mm (t)	Free height of cone frustum of unload disc spring mm (ho)	Thickness of disc spring (mm) (reduced) (t')	Free height of cone frustum of unload disc spring with reduced Thickness mm (ho)	Overall Height (le)	Load on each disc spring N (at $s = 0.75 h_o$)
131	31.50	16.30	1.75	0.70	—	—	2.45	3869.21
132	34.00	16.30	1.75	0.90	—	—	2.65	4151.89
133	40.00	16.30	1.75	1.35	—	—	3.10	4432.69
134	45.00	22.40	1.75	1.30	—	—	3.05	3644.16
135	63.00	31.00	1.80	2.35	—	—	4.15	4236.24
136	31.50	16.30	2.00	0.75	—	—	2.75	6169.88
137	34.00	16.30	2.00	0.85	—	—	2.85	5779.60
138	35.50	18.30	2.00	0.80	—	—	2.80	5184.27
139	40.00	14.30	2.00	1.05	—	—	3.05	4766.17
140	40.00	16.30	2.00	1.10	—	—	3.10	5165.89
141	40.00	18.30	2.00	1.15	—	—	3.15	5653.00
142	40.00	20.40	2.00	1.10	—	—	3.10	5698.12
143	50.00	18.40	2.00	1.65	—	—	3.65	5111.53
144	50.00	20.40	2.00	1.50	—	—	3.50	4684.97
145	50.00	22.40	2.00	1.60	—	—	3.60	5218.96
146	50.00	25.40	2.00	1.40	—	—	3.40	4759.70
147	56.00	28.50	2.00	1.60	—	—	3.60	4435.83
148	60.00	20.50	2.00	2.20	—	—	4.20	5023.64
149	71.00	36.00	2.00	2.60	—	—	4.60	5141.37
150	45.00	22.40	2.20	1.15	—	—	3.35	6148.13
151	40.00	20.40	2.25	0.90	—	—	3.15	6496.89
152	50.00	25.40	2.25	1.50	—	—	3.75	7213.06
153	80.00	41.00	2.25	2.95	—	—	5.20	6609.20
154	40.00	20.40	2.50	0.95	—	—	3.45	9384.80
155	45.00	22.40	2.50	1.00	—	—	3.50	7711.94
156	50.00	18.30	2.50	1.35	—	—	3.85	7711.33
157	50.00	18.40	2.50	1.65	—	—	4.15	9637.98
158	50.00	20.40	2.50	1.35	—	—	3.85	7914.88
159	50.00	22.40	2.50	1.40	—	—	3.90	8505.60
160	50.00	25.40	2.50	1.40	—	—	3.90	9058.29
161	56.00	28.50	2.50	1.70	—	—	4.20	8973.00
162	60.00	20.50	2.50	2.20	—	—	4.70	9250.16
163	60.00	25.50	2.50	1.90	—	—	4.40	8170.54
164	60.00	30.50	2.50	2.00	—	—	4.50	9427.08
165	63.00	31.00	2.50	1.75	—	—	4.25	7185.34
166	70.00	30.50	2.50	2.40	—	—	4.90	8026.49
167	71.00	36.00	2.50	2.00	—	—	4.50	6721.86
168	80.00	31.00	2.50	2.80	—	—	5.30	7235.23
169	90.00	46.00	2.50	3.20	—	—	5.70	7680.21
170	100.00	51.00	2.70	3.50	—	—	6.20	8604.45
171	60.00	30.50	2.75	2.00	—	—	4.75	12349.47
172	50.00	18.30	3.00	1.00	—	—	4.00	9604.27
173	50.00	18.40	3.00	1.20	—	—	4.20	11623.96
174	50.00	25.40	3.00	1.10	—	—	4.10	11970.38
175	56.00	28.50	3.00	1.30	—	—	4.30	11382.53
176	60.00	20.50	3.00	2.20	—	—	5.20	15457.10
177	60.00	25.50	3.00	1.65	—	—	4.65	11777.57
178	60.00	30.50	3.00	1.70	—	—	4.70	13219.29
179	63.00	31.00	3.00	1.70	—	—	4.70	11765.87
180	70.00	30.50	3.00	2.10	—	—	5.10	11420.65
181	70.00	35.50	3.00	2.10	—	—	5.10	12281.24
182	80.00	31.00	3.00	2.50	—	—	5.50	10346.31
183	80.00	36.00	3.00	2.70	—	—	5.70	11912.75
184	80.00	41.00	3.00	2.30	—	—	5.30	10512.52
185	112.00	57.00	3.00	3.90	—	—	6.90	10483.58
186	60.00	30.50	3.50	1.50	—	—	5.00	18143.38
187	63.00	31.00	3.50	1.40	—	—	4.90	15017.79
188	70.00	35.50	3.50	1.80	—	—	5.30	16169.01
189	90.00	46.00	3.50	2.50	—	—	6.00	14153.65
190	100.00	51.00	3.50	2.80	—	—	6.30	13063.71
191	125.00	64.00	3.50	4.50	—	—	8.00	15408.05
192	140.00	72.00	3.80	4.90	—	—	8.70	17186.38
193	70.00	35.50	4.00	1.80	—	—	5.80	23911.17
194	71.00	36.00	4.00	1.60	—	—	5.60	20524.42
195	80.00	41.00	4.00	2.20	—	—	6.20	22862.07

GROUP 2

GROUP 3

Sr. No.	Outside diameter of disc spring mm (De)	Inside dia of disc spring mm (Di)	Thickness of disc spring mm (t)	Free height of cone frustum of unload disc spring mm (ho)	Thickness of disc spring (mm) (reduced) (t')	Free height of cone frustum of unload disc spring with reduced Thickness mm (ho)	Overall Height (lo)	Load on each disc spring N (at s = 0.75 ho)
196	100.00	41.00	4.00	3.20	—	—	7.20	20240.86
197	100.00	51.00	4.00	3.00	—	—	7.00	20663.23
198	112.00	57.00	4.00	3.20	—	—	7.20	17743.33
199	125.00	41.00	4.00	4.20	—	—	8.20	17336.88
200	125.00	51.00	4.00	4.50	—	—	8.50	19807.09
201	160.00	82.00	4.30	5.60	—	—	9.90	21831.46
202	180.00	92.00	4.80	6.20	—	—	11.00	26428.74
203	70.00	40.50	5.00	1.40	—	—	6.40	39390.43
204	80.00	41.00	5.00	1.70	—	—	6.70	33542.04
205	90.00	46.00	5.00	2.00	—	—	7.00	31338.44
206	100.00	41.00	5.00	2.75	—	—	7.75	32344.91
207	100.00	51.00	5.00	2.80	—	—	7.80	36320.79
208	125.00	51.00	5.00	3.90	—	—	8.90	30653.08
209	125.00	61.00	5.00	4.00	—	—	9.00	33948.26
210	125.00	64.00	5.00	3.50	—	—	8.50	29892.85
211	140.00	72.00	5.00	4.00	—	—	9.00	27906.00
212	150.00	61.00	5.00	5.30	—	—	10.30	31025.36
213	100.00	51.00	6.00	2.20	—	—	8.20	47997.31
214	112.00	57.00	6.00	2.50	—	—	8.50	43684.80
215	160.00	82.00	6.00	4.50	—	—	10.50	40987.14
216	180.00	92.00	6.00	5.00	—	—	11.00	36602.92
217	225.00	112.00	6.50	7.10	6.20	7.40	13.60	44557.36
218	100.00	51.00	7.00	2.20	6.55	2.65	9.20	75801.90
219	125.00	64.00	7.00	3.00	6.55	3.45	10.00	67182.11
220	150.00	61.00	7.00	4.80	6.55	5.25	11.80	70406.10
221	250.00	127.00	7.00	7.80	6.70	8.10	14.80	50440.30
222	125.00	61.00	8.00	2.90	7.50	3.40	10.90	93529.68
223	125.00	64.00	8.00	2.60	7.50	3.10	10.60	85882.04
224	125.00	71.00	8.00	2.90	7.45	3.45	10.90	103911.50
225	140.00	72.00	8.00	3.20	7.50	3.70	11.20	85207.66
226	150.00	71.00	8.00	4.05	7.50	4.55	12.05	91014.28
227	150.00	81.00	8.00	4.00	7.50	4.50	12.00	97269.94
228	200.00	82.00	8.00	6.20	7.50	6.70	14.20	77994.65
229	200.00	102.00	8.00	5.60	7.50	6.10	13.60	76339.44
230	225.00	112.00	8.00	6.50	7.50	7.00	14.50	70712.71
231	250.00	127.00	8.00	8.00	7.50	8.50	16.00	74781.55
232	125.00	71.00	10.00	1.80	9.30	2.50	11.80	124060.78
233	150.00	81.00	10.00	3.40	9.40	4.00	13.40	158219.63
234	160.00	82.00	10.00	3.50	9.40	4.10	13.50	138260.54
235	180.00	92.00	10.00	4.00	9.40	4.60	14.00	125353.76
236	200.00	82.00	10.00	5.50	9.40	6.10	15.50	129379.62
237	200.00	92.00	10.00	5.60	9.40	6.20	15.60	137617.82
238	200.00	102.00	10.00	5.60	9.40	6.20	15.60	145283.15
239	250.00	102.00	10.00	8.00	9.40	8.60	18.00	126323.23
240	250.00	127.00	10.00	7.00	9.40	7.60	17.00	118992.62
241	160.00	82.00	11.00	3.50	10.20	4.30	14.50	183424.94
242	200.00	82.00	12.00	4.60	11.25	5.35	16.60	182644.50
243	200.00	92.00	12.00	4.80	11.25	5.55	16.80	199168.21
244	200.00	102.00	12.00	4.20	11.25	4.95	16.20	182927.45
245	200.00	112.00	12.00	4.20	11.25	4.95	16.20	195730.50
246	225.00	112.00	12.00	5.00	11.25	5.75	17.00	170929.73
247	250.00	102.00	12.00	7.00	11.25	7.75	19.00	182869.03
248	250.00	127.00	12.00	7.30	11.30	8.00	19.30	210699.01
249	180.00	92.00	13.00	3.50	12.10	4.40	16.50	237762.14
250	200.00	92.00	14.00	4.10	13.05	5.05	18.10	267091.70
251	200.00	102.00	14.00	4.20	13.05	5.15	18.20	289034.62
252	200.00	112.00	14.00	3.50	13.05	4.45	17.50	256628.03
253	250.00	127.00	14.00	5.60	13.10	6.50	19.60	248701.69
254	200.00	112.00	16.00	3.80	14.80	5.00	19.80	415514.11
255	225.00	112.00	16.00	4.50	14.90	5.60	20.50	359407.48
256	250.00	127.00	16.00	5.80	14.90	6.90	21.80	382822.46
257	250.00	127.00	16.00	5.80	14.90	6.90	21.80	382822.46



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