As a global partner of the automobile industry, Mubea has divisions worldwide. We develop, manufacture, and sell high-quality suspension springs and stabilizer bars, valve springs, disc springs, hose clamps, belt tensioner systems, tubular shafts, camshafts, headrest supports, and Tailor Rolled Products.
Mubea disc springs are shot-peened as part of our standard manufacturing process. This is especially advantageous in dynamic applications requiring a long fatigue life. We maintain well-equipped laboratories capable of performing a wide variety of tests as required by our customers. Our team of highly qualified engineers is dedicated finding the optimal solution for every spring application through the use of new technologies, innovative approaches, and creativity. We look forward to working with you.

Mubea has specialized in the production of high-quality disc springs for over 40 years. Because of their versatility, disc springs are used extensively in a variety of applications, from safety valve systems 3000 m under the sea to satellites in space. We also specialize in the production of related components including complex precision fine blanked parts and high-quality roll pins.

Mubea stocks disc springs manufactured per the requirements of DIN 2093 as well as per our own internal standards. Mubea is capable of producing conventional disc springs with outer diameters up to 800 mm, internally and externally slotted disc springs, and wave springs. All of our products are manufactured in-house, starting with the production of the raw material in our own cold-rolling mill. Furthermore, all tooling is designed, manufactured, and maintained in-house. In addition to 50 CrV 4, Mubea stocks a variety of antimagnetic, corrosion resistant, and high/low temperature materials for special applications. This allows us to respond quickly to requests for disc springs of non-standard size and/or materials.

Reduced lead time by up to 70% offered by:

- Streamlined customer service
  - Creation of a customer service and order entry department
  - Increased staff in production and engineering
- All standard disc spring sizes in stock
- Large safety stock for special spring dimensions
- Continuous improvement of the production process by investing in the latest technologically advanced manufacturing equipment
  - Expansion of the tool shop
  - Fineblanking and deburring
  - Turning, hardening, and shot-peening
  - Pre-setting and testing per customer requirements
  - Surface treatment
  - Packaging per customer requirements
Because of their versatility, disc springs are used extensively in a variety of applications, from safety valve systems 3000 m under the sea to satellites up to 36,000 km in space. Disc springs must function in temperatures from −269°C up to 500°C. Mubea stocks the necessary materials to meet the required load and fatigue life requirements even under these severe conditions. In addition, disc springs can be coated with highly durable surface protections to withstand and guarantee a long life in a corrosive atmosphere.

Due to the versatility of disc springs, they are used in a variety of applications including the machine-tool industry, the oil industry, the automobile industry, as well as the aerospace industry.

In a parallel spring stack, the load is proportional to the number of individual springs (a).
In a series spring stack, the deflection of the stack is the sum of the deflection of the individual springs (b).
It is possible to combine these methods of stacking (c).
Conventional disc springs
- Disc springs to DIN 2093 (Group 1, Group 2, Group 3)
- Disc springs to Mubea Factory Standards or to customer requirements
- Size range: outer diameter 8.0 mm to 800 mm
- Materials to DIN 2093 (DIN 17 221, DIN 17 222) and special materials
- Disc springs with a thickness of 0.5 mm and greater are shot-peened to improve fatigue life

Disc spring stacks
Disc springs are mostly assembled in stacks. On request, Mubea can deliver disc springs pre-assembled in stacks or on a guiding device. Advantages include:
- Assembly is more efficient with pre-assembled stacks
- Ability to provide stack specific load-deflection diagrams (our load testing machines can measure loads up to 1000 kN)
- Small load tolerances possible
- 100% load testing can be used to verify proper stacking

Internally or externally slotted disc springs
- Size range: outer diameter 20 to 300 mm
- Slotted disc springs are typically developed in close collaboration with customers
- Special production processes are used to maintain extremely tight load tolerances and to achieve the maximum possible fatigue life.

Special springs
As necessary, Mubea will work with the customer to develop special springs to meet the requirements of specific applications.

Wave springs
Mubea produces wave springs with outer diameters ranging from 20 mm to 300 mm. Wave springs are often used to improve shift quality in automatic transmissions. Wave springs are designed per the specific requirements of each customer.
Disc Springs

Application examples

1. Pre-assembled spring stacks
   Plant construction, power station construction, and machine construction
   Spring stacks are used for boiler suspension systems. The spring assemblies compensate for localized deflections in the bearing surface and thus guarantee an even lowering of the boiler with load fluctuations due to thermal expansion.

2. Overload clutches
   Plant construction, machine construction, and motor vehicle construction
   In overload clutches, disc springs provide the load required to maintain sufficient friction to transmit the torque. The load level can be regulated with adjuster nuts. If overload occurs, the transmission of torque is interrupted.

3. Backlash compensation
   Plant and machine construction
   Disc springs are often used to compensate for geometric tolerances in component assemblies.

4. Valves
   Plant and machine construction, chemical industry
   In quick-action stop valves, the disc spring stack is hydraulically pre-loaded when in the open position. If a failure occurs, the hydraulic pressure drops and the disc spring stack is released, closing the valve and thus interrupting the flow. Often ball-centered disc spring stacks are used for this purpose.

5. Piston return springs
   Machine construction and motor vehicle construction
   The disc spring ensures that the hydraulically actuated piston returns to its original position after the load on the coupling is released.

6. Tool clamping components
   Machine construction, tool-making
   In tool clamping components, the function of the disc spring stack is to hold the tool securely in the tapered holder.

7. Energy storage for safety systems
   Circuit breakers, machine construction
   In hydraulic spring mechanisms, energy storage is often achieved by means of a disc spring stack.

8. Cableway grip
   Plant construction
   On cableways, a disc spring stack generates a friction lock between the cable grip and wire cable. Depending on the type of grip, the load can be static or dynamic.

9. Spring-actuated brakes
   Plant construction, machine construction, and motor vehicle construction
   The braking load is generated by the disc springs when the hydraulic pressure is reduced to a predetermined level.

10. Overload clutches
    Plant construction, machine construction, and motor vehicle construction
    In overload clutches, disc springs provide the load required to maintain sufficient friction to transmit the torque. The load level can be regulated with adjuster nuts. If overload occurs, the transmission of torque is interrupted.

11. Backlash compensation
    Plant and machine construction
    Disc springs are often used to compensate for geometric tolerances in component assemblies.

12. Valves
    Plant and machine construction, chemical industry
    In quick-action stop valves, the disc spring stack is hydraulically pre-loaded when in the open position. If a failure occurs, the hydraulic pressure drops and the disc spring stack is released, closing the valve and thus interrupting the flow. Often ball-centered disc spring stacks are used for this purpose.

Disc Springs
Disc Springs – Mubea, your competent partner

Classification according to DIN 2093
Disc spring design, sizing, and manufacture have been standardized according to DIN 2092 (Disc springs, Calculation) and DIN 2093 (Disc springs, Calculation, Dimensions, Quality requirements). Disc springs in accordance with DIN 2093 are classified into 3 groups:
- Group 1: Disc thickness, t, less than 1.25 mm
- Group 2: Disc thickness, t, from 1.25 mm to 6 mm
- Group 3: Disc thickness, t, over 6 mm up to 14 mm

Group 1 and 2 springs are manufactured without contact surfaces, Group 3 springs are manufactured with contact surfaces.

Mubea Engineering
As a first step, we can provide our design calculation program for disc springs. This program is based on the equations defined by DIN 2092 and can be downloaded from our website at www.mubea-discsprings.com. Additionally, we maintain a team of highly qualified engineers that is dedicated finding the optimal solution for every spring application, including the selection of the proper material and surface protection. Prototypes typically required during product development are manufactured in our sample shop, which is equipped with all necessary testing equipment.

Materials for Disc Springs
For standard applications, the spring material 51CrV4 (No. 1.8159) is used. Furthermore, special materials can be used for applications at very high and low temperatures or in a corrosive atmosphere. Depending upon the specific requirements, Mubea uses thermally stable materials (No. 1.4122, 1.2567, 1.4923), corrosion resistant materials (No. 1.4310, 1.4568, 1.4401), nickel based materials (2.4668, 2.4669, 2.4969) and beryllium copper alloys (2.1247, 2.4132).

Increased Fatigue Life
Nearly all Mubea disc springs are shot-peened in-house. Shot-peening creates residual compressive stresses that result in a considerably higher fatigue life than required by DIN 2093.

Corrosion protection for Disc Springs
The standard corrosion protection for disc springs is zinc-phosphating and oiling. If a higher level of corrosion protection is required due to the operating environment of the disc spring, the following alternatives are available:
- Zinc-phosphating and waxing
- Galvanizing
- Mechanical zinc plating and chromating
- Delta Tone/Delta Seal Coating
- Duracrom/Geomet Coating
- Chemical (Electroless) nickel plating

Effects of temperature on modulus of elasticity (recommended values for design purposes)
Complete In-House Production
It is Mubea’s philosophy to control all manufacturing processes in order to insure the quality of the disc spring and to maintain the most stringent tolerances. Commonly used materials are manufactured in our own cold-rolling mill, using the most modern rolling technology.

Fine Blanking (picture 1)
Disc Springs with material thickness between 1 mm and 6 mm are generally fine blanked. This method improves the fatigue life of the spring.

Heat Treatment (picture 2)
The heat treatment of disc springs is a fundamental production step for achieving the required spring characteristics. Depending upon the spring dimensions, modern continuous feed furnaces or chamber ovens are available. We have austempering and quenching and tempering processes available.

Shot-peening (picture 3)
A standard production process at Mubea is shot-peening. It results in a significantly higher fatigue life.

Pre-setting (picture 4)
Set loss can occur due to high stresses of the spring. In order to reduce the risk of set loss, Mubea pre-sets all disc springs at least to the flat position. This process greatly improves the quality of the spring and therefore is a requirement of the DIN 2093 standard.

Phosphating (picture 5)
The standard corrosion protection, zinc phosphating and oiling, is made with a fully automated continuous flow process. This guarantees a uniform coating thickness at a reasonable cost.

Delivery of disc spring stacks
Disc springs are often used in pre-assembled stacks. Mubea is able to deliver pre-assembled stacks and if desired, install these stacks in the final assembly device. Mubea can also manufacture these assembly devices per customer request. Test certificates (e.g. 100 % load testing) or certificates according to DIN EN 10204 (2.2/2.3/3.1B) can also be provided upon request.
List of disc springs in stock per DIN 2093 as well as per our own internal standards.

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Disc springs per DIN 2093

**Group 1**

**Group 2**

**Group 3**

Disc springs per Mubea internal standards

*Disc springs with flat bearings and reduced disc thickness.

We specialize in the design and manufacture of custom disc springs.