

SOLON® BELLEVILLE SPRINGS

Washer Catalog

MAINTAIN BOLT PRELOAD

Solon Belleville Springs | Solon Disc Springs (SDS) – DIN 2093

Solon Flange Washers | Solon Flat Washers

Engineered Solutions for Industries Worldwide | Est. 1949

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ABOUT SOLON MANUFACTURING

OUR HISTORY

Solon Manufacturing Co. was founded in 1949 by four Case Western Reserve University engineering graduates: Arnold Siedle, Red Ralston, Joel Carpenter, and Bob Ramsdell. Together, they shared a vision to bring innovation to Northeast Ohio in a post-war industrialism era. Today, Solon Manufacturing Co. continues to thrive on the ideals of its founders—our passion for our company and its stakeholders has led to successful growth initiatives through new products and services.



Solon Manufacturing Co.
– est. 1949, Solon, OH

OUR VALUES

Our core values influence every facet of our business. Integrity, pride and teamwork connect employees, departments and customers. These principles drive the decisions that contribute to our growth and our customers' success.



Solon Manufacturing Co.
– Chardon, OH (present day)

OUR FUTURE

With the skills and expertise of our team members, we are always exploring new ways to improve the customer experience. Our agile manufacturing approach means that we can respond to our customers' needs effectively—giving us a key competitive advantage. Continuous and lean improvement efforts generate forward-thinking, results-oriented solutions.

INDUSTRIES SERVED

We design and manufacture Belleville springs and industrial pressure switches for customers in energy and utility transmission and distribution, petro-chemical, transportation and environmental compliance worldwide. Among others, Solon Manufacturing Co. supports applications in:

- Industrial automation
- Packaging
- Pump & valve manufacturing
- Food & beverage
- Live loading of packing
- Live loading ball seats

While largely domestic, Solon Manufacturing Co. has grown to serve industries in over forty countries. We continue to expand into new markets as new product ideas are developed, lending to market potential.

BELLEVILLE SPRINGS

Belleville spring, disc spring, and conical compression washer are all names for the same type of spring (Figure 1). A Belleville spring is a conical shaped disc that will deflect (flatten) at a given rate. This spring rate is usually very high, allowing the spring to produce very large loads in a very small space.

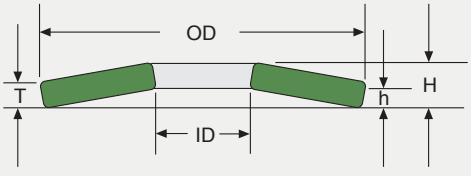


Figure 1

Belleville springs can be stacked in a variety of ways (Figure 2).

A. Single, one spring
B. Parallel, all springs stacked the same way
C. Series, all springs stacked opposing each other
D. Parallel-Series, a combination of parallel and series

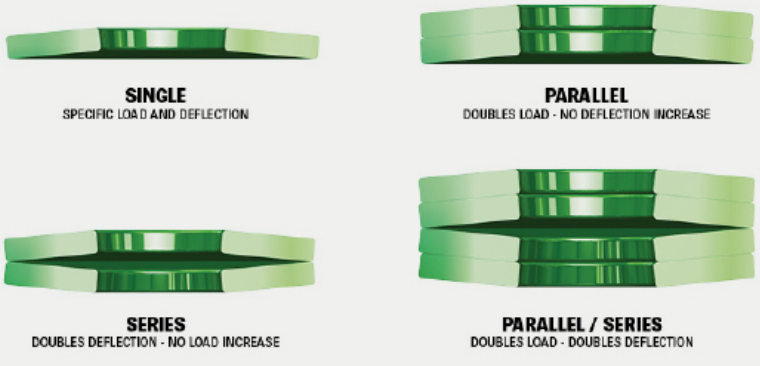


Figure 2

A single Belleville spring has a specific load and deflection. Belleville springs in stacked arrangements provide increased load and/or deflection. Two springs stacked in parallel doubles the load of a single spring with no increase in deflection. Two springs stacked in series doubles the deflection of a spring with no increase in load. The parallel-series combination as shown results in the load of two springs and the deflection of two springs (Figure 3).

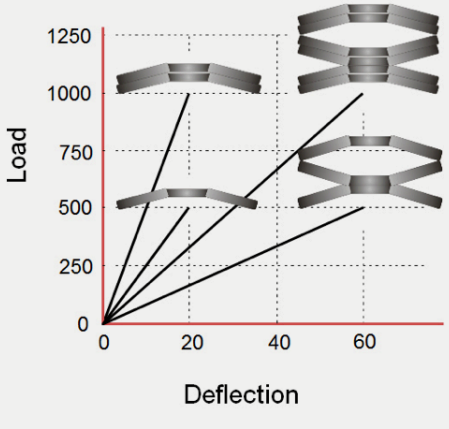


Figure 3

INSTALLATION

Belleville springs must be utilized correctly in order to maximize their benefit. There are several important points when using Belleville springs in a bolting application.

A. Be sure that the bolts are long enough to account for the thickness of the Belleville.
B. The OD of the spring should contact the surface of the joint.
   The ID should contact the bolt head or nut.
C. If a tensioner is used to preload the bolts, the Bellevilles must be on the
   opposite side of the joint.

PRE-STRESSING

Many Solon Belleville Springs are pre-stressed (scragging) by deflecting them to flat as part of the manufacturing process. This flattening procedure results in residual stresses as the spring recovers height from the flat position. Most Belleville springs that are pre-stressed are optimized with the maximum possible load and deflection for any given spring geometry and material. The spring will no longer yield during subsequent loadings. The resultant residual stresses will also increase fatigue life and and improve overall spring performance. Pre-stressing is also an excellent inspection method for maintaining the quality of springs. Because pre-stressing produces consistent spring free height, springs that do not meet free height tolerances are rejected.

Some standard springs are not pre-stressed for design considerations. If overall height (H) minus Thickness (T) is greater than the Deflection (h) value, the part is most likely NOT preset. Consult Solon Manufacturing. for preset part information. Consult Solon Manufacturing for preset part information.

Note: Not all Belleville spring applications require the spring to be pre-stressed.
For special applications, consult a Solon application engineer.

SOLON BELLEVILLE SPRINGS
SPECIFICATIONS

BELLEVILLE SPRING CATALOG TOLERANCES

USE THESE TOLERANCES AS A GENERAL GUIDE. SOLON MANUFACTURERS A WIDE VARIETY OF SPRINGS AND WASHER SIZES THAT MEET DIFFERENT TOLERANCE REQUIREMENTS. FOR ACTUAL TOLERANCES FOR A SPECIFIC PART, CONTACT SOLON MANUFACTURING CO.

ID = +1.5% of the Catalog ID Min
OD = -1.5% of the Catalog OD Max
Thickness = +/-5% of the Catalog Thickness
Overall Height (OAH) = +/-10% of the Catalog Overall Height
Deflection (h) = +/-10% of the Catalog Deflection
Flat Load = +/-10% of the Catalog Flat Load
Torque = +/-10% of the Catalog Torque

Note: Tolerances for custom designed Belleville springs may vary.
Consult a Solon application engineer for special applications.
Solon Disc Springs (SDS) follow DIN 2093 requirements..

BELLEVILLE SPRING UNITS OF MEASURE IN CATALOG TABLES

IMPERIAL:
Dimensions = inches
Load = pounds force
Torque = foot-pounds
Temperature = ° F

METRIC:
Dimensions = millimeters
Load = Newton
Torque = Newton-meters
Temperature = ° C

TORQUE CALCULATION:
Imperial: (ft. – lbs.) = .2 X Bolt Diameter (in.) X Load (lbs.) / 12
Metric: (N-m) = .2 X Bolt Diameter (mm) X Load (N) / 1000

MATERIALS

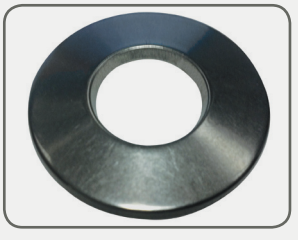
Solon Belleville Springs, disc springs (DIN 2093), and flange washers are used in a variety of applications across many different environments. From low-carbon steel to exotic metals, Solon Manufacturing Co. offers a variety of materials to satisfy your applications' needs.

SELECTING MATERIAL

Considerations:

- Bolt Material
- Temperature
- Environment
- Application
- Cost
- Availability

17-7PH STAINLESS STEEL
ASTM A693



- Operating temperature range
  - o -400°F / -240°C to 550°F / 288°C
- For indoor/outdoor service and corrosive environments
  - o Not recommended for extreme chlorine or fluoride applications without plating or reduced stresses
- Suitable for cryogenic applications
- Highly magnetic
- Standard material condition – Solon Proprietary Condition results in improved spring properties and corrosion resistance: Rockwell Hardness RC 38-43
- Alternate available material conditions
  - o TH1050: Rockwell Hardness RC 38-44
  - o TH1075: Rockwell Hardness RC 37-42
  - o RH950: Rockwell Hardness RC 46-49
  - o CH900: Rockwell Hardness RC 49
- Standard finish: Scale-free plain finish
  - o Also available: Sulfamate Nickel plated (AMS 2424D)

301 STAINLESS STEEL
ASTM A666



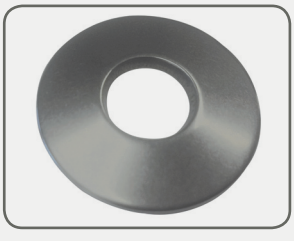
- Operating temperature range
  - o -400°F / -240°C to 500°F / 288°C
- For indoor/outdoor service and corrosive atmospheres
- Slightly magnetic
- Material Hardness RC 38-45
- Standard finish: Scale-free plain finish

510 PHOSPHOR BRONZE
ASTM B139



- Operating temperature range
  - o -400°F / -240°C to 300°F / 150°C
- For use with copper bus and silicon bronze bolts and nuts
- For non-magnetic requirements and good electrical conductivity
- Extremely durable
- Non-magnetic
- Standard finish: Scale-free plain finish

AISI 6150 ALLOY / 1074 CARBON STEEL
ASTM A506 / ASTM A684



- Operating temperature range
  - o -40°F / -40°C to 350°F / 177°C
- For indoor/outdoor service, electrical and corrosive atmospheres
- Abrasion-resistant
- Suitable for many general engineering applications requiring high-tensile strength and toughness
- Fully magnetic
- Standard finish: Mechanically Zinc Plated with Trivalent Chromate (ASTM B6595, Class 12, RoHS compliant)
  - o Also available with scale-free, oil finish, or a Zinc Phosphate and oil finish

INCONEL 718
ASTM B637



- Operating temperature range
  - o -400°F / -240°C to 1100°F / 594°C
- For indoor/outdoor service and high-temperature applications or corrosive atmospheres
- Non-magnetic
- Available in NACE MR0175 Condition
- Standard finish: Scale-free plain finish

H-13 TOOL STEEL
ASTM A681



- Operating temperature range
  - o Ambient to 1100°F / 593°C
- For indoor/outdoor service and high-temperature atmospheres
- Fully magnetic
- Finish: Black Oxide AMS 2485K (BOOC)

Additional materials available include 17-4, X750, A286 Custom 450, Waspaloy and other exotic materials available upon request.

MATERIAL – PHYSICAL PROPERTIES

MATERIAL	MODULUS (PSI)	YIELD STRENGTH (PSI)	TEMPERATURE RANGE	FINISH	AVAILABLE FINISH	MAGNETIC	CORROSION RESISTANCE	RELATIVE COST
1074	30,000,000	210,000	-40°F / 350°F	ZINC PLATED , ZINC PHOSPHATE	LIGHT OIL, ZINC PHOSPHATE	YES	LOW	$
6150	30,000,000	220,000	-40°F / 350°F	ZINC PLATED , ZINC PHOSPHATE	LIGHT OIL	YES	LOW	$
H-13	30,000,000	220,000	-250°F / 1100°F	BLACK OXIDE	-	YES	LOW	$$
301	25,000,000	140,000	-400°F / 550°F	PLAIN	-	SLIGHTLY	MODERATE	$
17-7PH	29,000,000	180,000	-400°F / 500°F	PLAIN	NICKEL PLATED	YES	MODERATE	$$
718	29,000,000	180,000	-400°F / 1100°F	PLAIN	-	NO	HIGH	$$$$
510 PB	16,000,000	100,000	-400°F / 300°F	PLAIN	-	NO	LOW	$$$

MATERIAL – CHEMICAL PROPERTIES

MATERIAL	ASTM	C	Mn	P	S	CR	Si	Mo	Ni	V	Cu	Al	Ti	Co	B	Fe	Columbium + Tantalum
1074	A684	.70-.80	.50-.80	.04 max	.05 max												
6150	A506	.48-.53	.70-.90	.04 max	.04 max	.80-1.10	.15-.30			.15 min							
4140	A829	.38-.43	.75-1.00	.035 max	.035 max	.80-1.10	.15-.30	.15-.25									
H-13	A681	.032-.45	.20-.60	.03 max	.03 max	4.75-5.50	.80-1.20	1.10-1.75		.80-1.20							
301	A666	.15 max	2.0 max	.045 max	.03 max	16.0-18.0	1.0 max		6.0-8.0								
17-7PH	A693	.09 max	1.0 max	.04 max	.03 max	16.0-18.0	1.0 max		6.5-7.5			.75-1.50				Balance	
718	B637	.08 max	.35 max	.015 max	.015 max	17.0-21.0	.35 max	2.8-3.3	50.0-55.0		.30 max	.20-.80	.65-1.15	1.0 max	.006 max	Balance	4.75-5.50
X750	5542L	.08 max	1.0 max		.01 max	14.0-17.0	.50 max		70.0 min		.50 max	.40-1.0	2.25-2.75	1.0 max		5.0-9.0	.05 max
MATERIAL	**ASTM**	**P**	**Pb**	**Sn**	**Zn**	**Cu**	**Fe**										
510PB	B103	.030-.035	0.05	4.2-5.8	0.3	Balance	0.1										

FINISHING

In addition to zinc plating, Solon offers other methods to protect parts such as nickel plating, yellow chromate, black oxide, and oil coatings. Natural finish, as well as custom finish are also available options.

BOOC	Finish: Black Oxide per AMS 2485K
G321A	Finish: Geomet 321 A
ZN	Mechanically Zinc Plated with Clear Trivalent Chromate (ASTM B695, Class 12), RoHS compliant
NF	Finish: Plain finish, dry
NFOC	Finish: Plain with oil, RoHS compliant
N	Finish: Sulfamate Nickel Plated for added corrosion protection per AMS 2424E
PSVT	Finish: Passivated to ASTM A967
Shot	Shot peened to AMS-S-13165
YC Non-ROH	Finish: Mechanically Zinc Plated with Yellow Hexavalent Chromate (ASTM B695, Class 12, Type II)
YC	Finish: Mechanically Zinc Plated with Yellow Trivalent Chromate (ASTM B695, Class 12, Type I, Yellow Chromate), RoHS compliant
ZP	Finish: Zinc Phosphate and Oil, RoHS compliant

MECHANICAL PLATING

Mechanical plating's greatest advantage is its ability to overcome hydrogen embrittlement problems. This is especially important for work pieces that have a hardness greater than HRC 40, while still offering equivalent corrosion protection of electroplating.
Mechanical plating is normally applied to carbon steel springs.

DEBURRING

Substantially, all of Solon® Belleville Springs and washers are deburred to the Solon Manufacturing Co. standard radius specification. Belleville springs and washers with a thickness greater than .312 will typically have a machined radius.
H-13 Flange Washers will have machined contact points at load bearing corners.

WASHERS

Solon Belleville Springs are highly configurable products that are used in conjunction with complementary hardware (bolts/studs and nuts) as well as other industrial components, such as gaskets and packing material to achieve an optimally tight connection where high spring loads are desired. They are particularly useful where vibration, differential thermal expansion, relaxation and bolt creep and bolt yield are problematic.

Long-service life, self-damping, and efficient use of space are among the common characteristics of all Solon washer products. Application-specific product groups include:

- Belleville spring washers
- DIN/disc springs
- Flange washers
- Flat washers

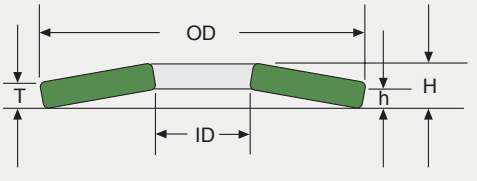
CHOOSING A SOLON BELLEVILLE SPRING

Belleville Springs and washers are used in a variety of applications across virtually every industry that maintains bolted connections. The washer is not an insignificant engineering contribution—by combining washers in stacks or series or including them in other bolt assemblies, longer service life, lower maintenance and high levels of equipment dependability and safety are realized. Solon offers thousands of catalog washer options—sizes ranging from #4 screw to 4 inch available in both Imperial and metric sizes. With industry-standard and exotic material options, Solon Manufacturing provides a washer solution for every requirement. Our vertically-integrated approach to manufacturing makes Solon custom-friendly. Submit your drawing or contact an application engineer to discuss your needs.

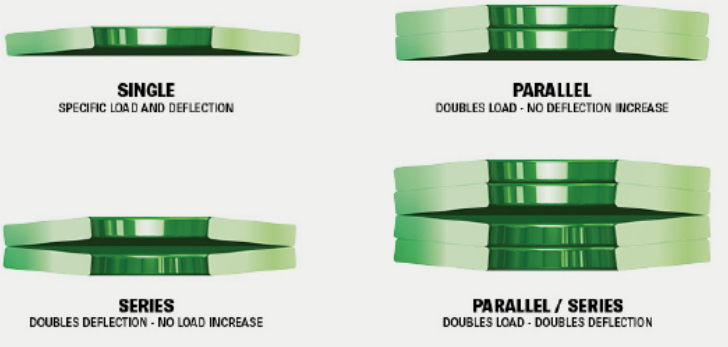
Considerations:

- ID
- OD
- Stacking Constraints
- Load
- Bolt Size
- Bolt Material
- Temperature
- Environment
- Application
- Size Constraints
- Aim Preload

TYPICAL WASHER DIAGRAM



STACKING ARRANGEMENTS



**It is ultimately user's responsibility to determine product suitability. Solon Mfg. is not responsible for product that is ordered incorrectly, misused, or misapplied. Contact a Solon engineer for recommended guidelines to product use.*

TECHNICAL GLOSSARY

TYPES OF SOLON WASHERS:

BELLEVILLE SPRING
A conical-shaped washer that is statically or dynamically loaded along its axis. It is often used to maintain bolt preload. It may be applied singly or used in a variety of stack/series configuration to achieve different levels of deflection to sustain heavy loads in small spaces. Also called Belleville washers, disc springs, or compression washers.

DISC SPRING
A conical-shaped washer used to cushion heavy loads with short motion. Disc springs are typically "stacked" in various arrangements to alter flat load of deflection. Also called Belleville washers, disc springs, or conical springs. Solon® Disc Springs (SDS) conform to the DIN 2093 specification and are RoHS compliant. The springs are used when the application requires a large number of deflection cycles or when the required forces or deflections are critical.

FLANGE WASHER
Solon® Flange Washers help create a more reliable flange assembly by maintaining residual gasket/bolt load and evening load distribution. Typical flange washer materials are H-13 Tool Steel, 17-7 PH Stainless Steel, Inconel 718, 17-4, Waspalloy, Custom 450, etc.

FLAT WASHER
Designed for a more general purpose, flat washers provide a stable bearing surface for a nut, or a screw head or an adjoining Belleville washer. Distributing fastener loads over a greater surface reduces contact stress that can lead to relaxation and loosened joints.

BELLEVILLE SPRING & WASHER GLOSSARY

BOLT CREEP/YIELD
Stress relaxation between the bolt and the washer is sometimes referred to as "bolt creep" or "bolt yield". This condition is the loss in bolt load due to elevated temperatures. The amount of loss depends on the bolt material, operating temperature, and the length of time at that temperature.

BOLT PRELOAD
The tension created in a spring/washer with torqueing develops an equal compressive load in the parts fastened. When an external force is applied, the compressive strain is amortized among all assembly parts and connections, which reduces the fatigue loading of the bolt.

DEFLECTION
It can also be defined as the degree to which a washer is displaced under load. Solon Belleville Springs are designed to produce predictable load versus deflection characteristics. Springs/washers can be configured in parallel stacks to increase load, or stacked in series to increase deflection. The load and deflection can also be adjusted by adding or removing additional washers and/or by changing the sequence in which they are arranged.

DIFFERENTIAL THERMAL EXPANSION (DTE)
DTE is experienced when connecting materials expand or contract at different rates during a temperature change and impact the performance of the joint integrity.

INSIDE DIAMETER (ID)
The inner diameter measurement of a typical Belleville spring, washer, or disc spring.

ELASTIC INTERACTION
Occurs when multiple bolts in a joint are not tightened simultaneously. Once a first bolt is tightened, the fastener stretches and the joint is partially compressed. When an adjacent bolt is tightened, the joint in the vicinity of the first bolt is further compressed, allowing the first bolt to relax.

EMBEDMENT RELAXATION
Yielding that occurs when bolts are tightened. When a bolt is tightened, the threads contact each other on microscopic high points. These highpoints are overloaded and will yield causing the bolt to relax. In some cases, 5% to 10% of the initial bolt load can be lost due to embedment relaxation.

FLAT LOAD
How much load (force) will be required to elastically deflect the Belleville spring completely. Load is measured by force in lbs for Imperial and in Newtons for metric sizes. Flat torque is bolt torque required to produce the flat load assuming a k factor of 0.2.

OUTSIDE DIAMETER (OD)
The outer diameter measurement of a typical Belleville spring, washer, or disc spring.

OVERALL HEIGHT (H)
The free (unloaded) height measurement of a typical Belleville spring, washer, or disc spring.

PRESET
Presetting, also referred to as prestressing, is an optional condition of Belleville springs where they are coaxed flat before yielding to their design height. After presetting, the material does not return to its original state. The effects of this process increase cycle life and performance of the part.

RELAXATION
The loosening of the connection between a bolt and a washer/nut.

VALVE LIVE LOADING
The addition of Belleville springs to the gland follower studs maintains the packing load of the valve.

VIBRATION
Vibration loosens a bolt load very slowly over time. It is common for bolts that are subjected to vibration to remain tight over a long period of time and then loosen quickly.

FAQs

Q: How many times can a Belleville spring be used?
A: A Belleville spring can be used indefinitely as long as it is not damaged. It is perfectly acceptable to reuse the springs many times in bolted applications. However, it is important to note that as highly stressed parts, Belleville springs can be prone to failures if they have been compromised in some way. Parts can be damaged by excessive cycling, corrosion, exposure to temperatures beyond the material ratings, and mechanical damage such as galling.

Q: What do you consider a cyclical application?
A: Load on a Belleville spring changes (or cycles) to some extent in all applications. We consider an application to be cyclical when these changes in load will eventually result in the failure of the part. If this is the case, we must then determine if the number of calculated cycles provides adequate life of the product. Cycle life is calculated by considering the maximum load (and resultant stress) for each cycle and the change in load. Generally, the calculated cycle life in a bolting application will be nearly infinite.

Q: Should one or two Solon Belleville Springs be used on a bolt?
A: Depending on the application about 90% of the time, the most common bolting arrangement is to have one Solon Belleville Spring on each side of the joint. On the other hand, there are many applications where a single spring adds enough elasticity to the system. Conversely, there are other situations where three or more springs may be needed for a sound design. Your Solon application engineer can suggest how many Belleville springs should be used for a specific application.

Q: Should a Belleville spring be bolted down until it is flat?
A: In general, Solon Belleville Springs are designed to be loaded to flat without damaging them. However, this does not mean they should be bolted to flat in every case. There are some applications where a spring should be employed at a load considerably lower than the flat load. For instance, when elevated temperatures may damage the springs, it may be necessary to use a heavier spring in order to keep the stresses below a certain threshold. In addition, in some elevated temperature applications it may be desirable to allow the spring to partially “absorb” the differential expansion to prevent excessive loading.

Q: How do I know when a Belleville spring is flat?

A: In general, Solon Manufacturing Co. suggests that the following torque calculation be used to determine the bolt load.

Imperial: (ft. – lbs.) - .2 X Bolt Diameter (in.) X Load (lbs.) / 12
Metric: (N-m) = .2 X Bolt Diameter (mm) X Load (N) / 1000
If lubricant is used on the joint, then the torque should be reduced.

If the nuts and bolts are stainless, then torque may need to be increased. Your Solon application engineer can help determine the appropriate torque value for your requirement.

Q: What load should be used on a Belleville spring?

A: The application will determine proper load. The following factors are important for live loading a bolted joint:

- Decide what load or torque should be used for a sound joint design. If the joint is a flange, the gasket manufacturer should provide this value. If the joint is a bus (electrical) connection, the designer of the system should provide this value.
- Decide which material the Belleville spring should be. We generally suggest a material that is similar to the bolt material.
- If the Belleville spring may be used at its flat load, use a spring whose flat load is close to the design preload. It may be necessary to use multiple Belleville springs in parallel in order to achieve the requisite flat load. Ideally, the design preload will be 70%-100% of the flat load.
- Confirm the spring arrangement fits into the space constraints of the application.

Q: Shouldn't the deflection plus the thickness of a Belleville equal the overall height (H)?

A: Actually, thickness plus deflection is not equal to H. This is because thickness is measured on an angle with respect to the deflection. However, since this angle is typically very small, the thickness plus deflection is approximately equal to H. In addition, if a spring is not prestressed, the H will usually be greater than the thickness plus deflection.

SOLON BELLEVILLE SPRINGS
IMPERIAL



BELLEVILLE SPRING

A conical-shaped washer used to maintain bolt preload. May be applied singly or used in a variety of stack/series configurations to achieve different levels of deflection to sustain heavy loads in small spaces. Also called Belleville washers, disc springs, or compression washers.

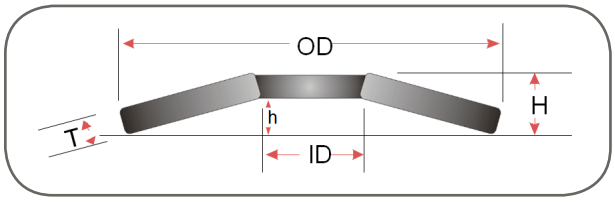
For over 65 years, Belleville spring washers have been an integral part of the Solon Manufacturing product family. While other companies provide washers, springs, and lock nuts, Solon's standard for excellence continues to distinguish us from our competitors. Attention to engineering detail along with investments in technology and resources have given us the opportunity to rise to the occasion of meeting our customers' needs—big and small—consistently.

SIZES

IMPERIAL
Belleville springs are available as standard Imperial sizes from 7/64" to 2-1/2" ID.

METRIC
Belleville springs are available as standard metric sizes from 4mm-80mm.
For metric sizes see page 29.

We welcome the opportunity to quote your custom part.
Submit your drawing to our engineering team, techsupport@solonmfg.com.



**It is ultimately user's responsibility to determine product suitability. Solon Manufacturing Co. is not responsible for product that is ordered incorrectly, misused, or misapplied. Contact a Solon engineer for recommended guidelines to product use.*

SOLON BELLEVILLE SPRINGS
IMPERIAL

17-7PH STAINLESS STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
06L15177	#6	0.140	0.281	0.015	0.024	0.007	61
06L21177	#6	0.142	0.281	0.020	0.032	0.005	150
06M26177	#6	0.142	0.344	0.025	0.042	0.007	240
06H31177	#6	0.142	0.406	0.031	0.052	0.009	350
08L26177	#8	0.168	0.344	0.025	0.040	0.007	240
08M31177	#8	0.168	0.406	0.031	0.050	0.008	370
08H35177	#8	0.168	0.469	0.035	0.059	0.010	450
010L31177	#10	0.196	0.406	0.031	0.048	0.007	375
010M35177	#10	0.196	0.469	0.035	0.057	0.009	470
010M50177	#10	0.196	0.469	0.050	0.067	0.007	1000
010M25177	#10	0.196	0.472	0.025	0.041	0.012	200
010H20177	#10	0.196	0.563	0.020	0.055	0.020	115
010H42177	#10	0.196	0.563	0.042	0.071	0.012	650
4L42177	1/4	0.258	0.563	0.042	0.067	0.010	680
4M52177	1/4	0.258	0.688	0.050	0.086	0.014	1000
4H61177	1/4	0.258	0.813	0.062	0.080	0.018	1300
4EH70177	1/4	0.258	0.938	0.072	0.095	0.022	1900
51032177	5/16	0.317	0.630	0.032	0.046	0.014	300
51045177	5/16	0.317	0.635	0.042	0.069	0.011	675
5L52177	5/16	0.322	0.688	0.050	0.082	0.012	1000
5M61177	5/16	0.322	0.813	0.062	0.078	0.016	1450
5H70177	5/16	0.322	0.938	0.072	0.092	0.020	1900
5EH80177	5/16	0.322	1.063	0.083	0.106	0.024	2350
61235177	3/8	0.380	0.755	0.035	0.056	0.021	282
61240177	3/8	0.380	0.755	0.042	0.054	0.016	640
61261177	3/8	0.380	0.755	0.062	0.074	0.012	1500
61149177	3/8	0.385	0.689	0.049	0.060	0.011	935
6L61177	3/8	0.386	0.813	0.062	0.076	0.014	1500
6M70177	3/8	0.386	0.938	0.072	0.090	0.018	2000
6H80177	3/8	0.386	1.063	0.083	0.105	0.022	2600
6EH89177	3/8	0.386	1.188	0.095	0.122	0.027	3300
620125177	3/8	0.386	1.250	0.125	0.147	0.022	5150
61350177	3/8	0.397	0.792	0.050	0.070	0.015	950
71445177	7/16	0.442	0.880	0.042	0.063	0.019	540
7L70177	7/16	0.450	0.938	0.072	0.088	0.016	2000
7L80177	7/16	0.450	0.938	0.083	0.097	0.014	2760
7M80177	7/16	0.450	1.063	0.083	0.103	0.020	2600
7H89177	7/16	0.450	1.188	0.095	0.118	0.023	3400
81650177	1/2	0.505	1.005	0.050	0.070	0.023	700
8L80177	1/2	0.515	1.063	0.083	0.101	0.018	2700

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
8L112177	1/2	0.515	1.063	0.117	0.130	0.013	5600
8M89177	1/2	0.515	1.188	0.095	0.116	0.021	3500
819125177	1/2	0.515	1.188	0.125	0.142	0.017	6300
82062177	1/2	0.515	1.250	0.062	0.100	0.033	1100
820125177	1/2	0.515	1.250	0.125	0.144	0.019	6300
8H98177	1/2	0.515	1.313	0.095	0.122	0.027	3400
8EH112177	1/2	0.515	1.500	0.117	0.148	0.031	5000
81662177	1/2	0.531	1.000	0.059	0.085	0.021	1090
9L89177	9/16	0.579	1.188	0.095	0.114	0.019	3500
9M98177	9/16	0.579	1.313	0.095	0.120	0.025	3500
9H112177	9/16	0.579	1.500	0.117	0.146	0.029	5200
101860177	5/8	0.625	1.130	0.060	0.090	0.022	1000
102062177	5/8	0.625	1.250	0.059	0.089	0.030	909
1020125177	5/8	0.644	1.250	0.125	0.141	0.016	6350
10L98177	5/8	0.644	1.313	0.095	0.118	0.023	3500
1022131177	5/8	0.644	1.385	0.136	0.156	0.020	7500
10M100177	5/8	0.644	1.500	0.095	0.127	0.032	3300
10M112177	5/8	0.644	1.500	0.117	0.145	0.028	5300
10H90177	5/8	0.644	1.750	0.095	0.141	0.049	2700
10H131177	5/8	0.644	1.750	0.136	0.173	0.037	7000
10EH150177	5/8	0.644	2.000	0.155	0.198	0.043	8600
12L112177	3/4	0.773	1.500	0.117	0.141	0.024	5400
12M150177	3/4	0.773	1.630	0.155	0.179	0.024	9400
12M131177	3/4	0.773	1.750	0.136	0.168	0.032	7200
12H150177	3/4	0.773	2.000	0.155	0.195	0.040	9100
12EH168177	3/4	0.773	2.250	0.193	0.236	0.044	13800
14L95177	7/8	0.901	1.750	0.095	0.132	0.037	3300
14L131177	7/8	0.901	1.750	0.136	0.164	0.031	7200
14M150177	7/8	0.901	2.000	0.155	0.191	0.036	9400
14H168177	7/8	0.901	2.250	0.193	0.232	0.040	14400
16L150177	1	1.030	2.000	0.155	0.187	0.032	9400
16M168177	1	1.030	2.250	0.193	0.229	0.037	14600
16H187177	1	1.030	2.500	0.193	0.240	0.048	14200
18L168177	1 1/8	1.155	2.250	0.193	0.225	0.033	14700
18M187177	1 1/8	1.155	2.500	0.193	0.234	0.042	14400
18H206177	1 1/8	1.155	2.750	0.193	0.249	0.056	14000
20L187177	1 1/4	1.280	2.500	0.193	0.230	0.040	14400
20M206177	1 1/4	1.280	2.750	0.193	0.244	0.052	14100
20H225177	1 1/4	1.280	3.000	0.255	0.307	0.052	25600
20L125177	1 1/4	1.281	2.500	0.125	0.250	0.056	4136
22L206177	1 3/8	1.405	2.750	0.193	0.240	0.048	14200
22M225177	1 3/8	1.405	3.000	0.255	0.303	0.048	25800
22H244177	1 3/8	1.405	3.250	0.255	0.314	0.059	25300
24L125177	1 1/2	1.500	3.000	0.125	0.188	0.063	3300

SOLON BELLEVILLE SPRINGS
IMPERIAL

1074 CARBON STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
6S33	3/8	0.380	0.730	0.035	0.046	0.018	500
61240	3/8	0.380	0.755	0.040	0.058	0.018	516
81673	1/2	0.505	1.000	0.073	0.091	0.018	1335
81650	1/2	0.505	1.005	0.050	0.076	0.020	550
81628	1/2	0.505	1.010	0.028	0.060	0.034	250
81635	1/2	0.505	1.010	0.035	0.070	0.032	450
820131	1/2	0.512	1.259	0.134	0.175	0.020	7500
818125	1/2	0.515	1.125	0.125	0.142	0.017	7700
101860	5/8	0.625	1.125	0.061	0.090	0.025	1200
102040	5/8	0.630	1.250	0.040	0.082	0.042	403
102050	5/8	0.630	1.250	0.050	0.086	0.036	575
102089	5/8	0.642	1.250	0.089	0.115	0.026	3460
12-24-72	3/4	0.755	1.500	0.072	0.109	0.037	1256
12L72	3/4	0.773	1.500	0.072	0.111	0.039	1600

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
24L225177	1 1/2	1.530	3.000	0.255	0.299	0.044	25900
24M244177	1 1/2	1.530	3.250	0.255	0.310	0.055	25500
24H262177	1 1/2	1.530	3.500	0.262	0.322	0.067	25000
26L244177	1 1/2	1.650	3.250	0.255	0.308	0.052	25000
26M262177	1 1/2	1.650	3.500	0.262	0.324	0.062	26700
26H281177	1 1/2	1.650	3.750	0.280	0.350	0.070	30300
28L262177	1 3/4	1.780	3.500	0.262	0.320	0.058	26800
28M281177	1 3/4	1.780	3.750	0.280	0.346	0.066	30500
28H300177	1 3/4	1.780	4.000	0.300	0.374	0.074	34800
32L300177	2	2.063	4.000	0.300	0.365	0.065	35200
32M318177	2	2.063	4.250	0.318	0.391	0.073	39400

SOLON BELLEVILLE SPRINGS
IMPERIAL

301 STAINLESS STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
08L20301	#8	0.164	0.343	0.019	0.028	0.006	93
010S15301	#10	0.190	0.375	0.015	0.024	0.009	59
010S20301	#10	0.195	0.375	0.020	0.030	0.006	112
4-8-18-301	1/4	0.255	0.500	0.018	0.034	0.012	70
4-8-38-301	1/4	0.255	0.500	0.038	0.047	0.006	400
41261301	1/4	0.255	0.750	0.061	0.084	0.013	900
4-7-40-301	1/4	0.258	0.449	0.042	0.055	0.005	576
4L42301	1/4	0.258	0.563	0.042	0.072	0.012	600
4M52301	1/4	0.258	0.688	0.050	0.090	0.013	650
4H61301	1/4	0.258	0.813	0.062	0.114	0.021	1350
4EH70301	1/4	0.258	0.938	0.073	0.130	0.023	1450
4S35301	1/4	0.266	0.469	0.042	0.053	0.006	550
5-10-22-301	5/16	0.317	0.625	0.022	0.042	0.015	89
51032301	5/16	0.317	0.625	0.032	0.048	0.016	203
51047301	5/16	0.317	0.625	0.047	0.059	0.012	800
5H45301	5/16	0.317	0.938	0.045	0.072	0.026	480
5L52301	5/16	0.322	0.688	0.050	0.082	0.013	1000
5M61301	5/16	0.322	0.813	0.062	0.100	0.015	1100
5M98301	5/16	0.322	0.813	0.095	0.115	0.010	2900
5H70301	5/16	0.322	0.938	0.073	0.115	0.022	1500
5EH80301	5/16	0.322	1.063	0.083	0.140	0.023	1700
61261301	3/8	0.380	0.750	0.062	0.084	0.010	1200
61240301	3/8	0.380	0.755	0.040	0.058	0.016	500
61850301	3/8	0.380	1.125	0.050	0.082	0.032	500
6L61301	3/8	0.386	0.813	0.062	0.100	0.015	1300
6M70301	3/8	0.386	0.938	0.073	0.112	0.020	1500
6M80301	3/8	0.386	0.938	0.083	0.113	0.014	2100
616109301	3/8	0.386	1.000	0.109	0.132	0.013	3730
6H80301	3/8	0.386	1.063	0.083	0.143	0.024	2000
6EH89301	3/8	0.386	1.188	0.095	0.158	0.025	2600
71361301	7/16	0.450	0.813	0.062	0.078	0.009	1200
7L70301	7/16	0.450	0.938	0.073	0.117	0.018	1500
7M80301	7/16	0.450	1.063	0.083	0.124	0.020	2000
7H89301	7/16	0.450	1.188	0.095	0.143	0.021	2700
81635301	1/2	0.505	1.000	0.035	0.052	0.012	300
81650301	1/2	0.505	1.000	0.050	0.075	0.016	500
81670301	1/2	0.505	1.000	0.072	0.091	0.018	1335
82470301	1/2	0.505	1.500	0.072	0.114	0.042	1320

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
8L109301	1/2	0.515	1.063	0.109	0.135	0.013	3800
8L40301	1/2	0.515	1.063	0.042	0.090	0.028	450
8L80301	1/2	0.515	1.063	0.083	0.130	0.019	2300
8L90301	1/2	0.515	1.063	0.095	0.142	0.018	3300
818125301	1/2	0.515	1.125	0.125	0.170	0.018	6000
81862301	1/2	0.515	1.125	0.062	0.104	0.018	800
8M89301	1/2	0.515	1.188	0.095	0.152	0.022	2800
82062301	1/2	0.515	1.250	0.062	0.115	0.053	860
820125301	1/2	0.515	1.250	0.125	0.180	0.022	5500
8H98301	1/2	0.515	1.313	0.098	0.157	0.024	2870
8EH131301	1/2	0.515	1.500	0.135	0.183	0.023	5200
91769301	9/16	0.563	1.059	0.072	0.089	0.017	1400
8-30-89-301	9/16	0.563	1.875	0.095	0.245	0.048	2320
9L89301	9/16	0.579	1.188	0.095	0.127	0.015	2800
1020125301	5/8	0.644	1.250	0.125	0.159	0.014	5500
10M131301	5/8	0.644	1.500	0.135	0.177	0.020	5700
10M72301	5/8	0.644	1.500	0.073	0.109	0.036	1450
10H131301	5/8	0.644	1.750	0.135	0.200	0.029	5486
12L60301	3/4	0.755	1.505	0.062	0.098	0.036	990
12L131301	3/4	0.773	1.500	0.135	0.153	0.017	5500
12L72301	3/4	0.773	1.500	0.072	0.108	0.030	1400
12M131301	3/4	0.773	1.750	0.135	0.195	0.026	5000

SOLON BELLEVILLE SPRINGS
IMPERIAL

AISI 4140 CARBON STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
28M281	1 3/4	1.780	3.750	0.281	0.358	0.077	37000
28H300	1 3/4	1.780	4.000	0.300	0.386	0.086	41900
30H318	1 3/4	1.910	4.250	0.318	0.409	0.091	47100
32L300	2	2.063	4.000	0.300	0.376	0.076	42300
32H356	2	2.063	4.750	0.356	0.460	0.104	58800

SOLON BELLEVILLE SPRINGS
IMPERIAL

AISI 6150 ALLOY STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
010H42	#10	0.196	0.563	0.043	0.072	0.014	800
41236	1/4	0.255	0.755	0.035	0.052	0.016	300
4L42	1/4	0.258	0.563	0.043	0.068	0.012	870
4M52	1/4	0.258	0.688	0.053	0.089	0.016	1200
4H61	1/4	0.258	0.813	0.063	0.083	0.021	1600
4EH70	1/4	0.258	0.938	0.072	0.097	0.025	2000
5L52	5/16	0.322	0.688	0.053	0.085	0.014	1300
5M61	5/16	0.322	0.813	0.063	0.081	0.019	1800
5H70	5/16	0.322	0.938	0.072	0.095	0.023	2300
5EH80	5/16	0.322	1.063	0.082	0.110	0.028	2800
61042	3/8	0.380	0.640	0.043	0.067	0.011	850
614112	3/8	0.380	0.875	0.115	0.136	0.012	6500
61232	3/8	0.382	0.750	0.032	0.055	0.023	246
6L61	3/8	0.386	0.813	0.063	0.078	0.016	1800
6M70	3/8	0.386	0.938	0.072	0.093	0.021	2400
6H80	3/8	0.386	1.063	0.082	0.107	0.025	3000
6EH89	3/8	0.386	1.188	0.091	0.121	0.030	3500
62062	3/8	0.386	1.250	0.065	0.170	0.042	1880
71445	7/16	0.442	0.880	0.045	0.067	0.022	800
7L70	7/16	0.450	0.938	0.072	0.091	0.019	2400
7M80	7/16	0.450	1.063	0.082	0.105	0.023	3100
7H89	7/16	0.450	1.188	0.091	0.119	0.028	3700
81680	1/2	0.505	1.000	0.082	0.100	0.018	3200
8L42	1/2	0.515	1.063	0.043	0.086	0.033	500
8L80	1/2	0.515	1.063	0.082	0.103	0.021	3200
8M89	1/2	0.515	1.188	0.091	0.117	0.026	3800
82062	1/2	0.515	1.250	0.065	0.144	0.036	1880
8H98	1/2	0.515	1.313	0.101	0.131	0.030	4600
8H112	1/2	0.515	1.313	0.115	0.142	0.027	6200
8EH112	1/2	0.515	1.500	0.115	0.152	0.037	6000
828131	1/2	0.515	1.750	0.134	0.180	0.046	7400
822109	1/2	0.538	1.385	0.109	0.148	0.027	4600
9L89	9/16	0.579	1.188	0.091	0.114	0.023	4000
9M98	9/16	0.579	1.313	0.101	0.129	0.028	4700
9H112	9/16	0.579	1.500	0.115	0.150	0.035	6000
10L98	5/8	0.644	1.313	0.101	0.127	0.026	4800
10M112	5/8	0.644	1.500	0.115	0.147	0.032	6100

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
10H131	5/8	0.644	1.750	0.134	0.176	0.042	8100
10EH150	5/8	0.644	2.000	0.154	0.205	0.051	10200
12L60	3/4	0.773	1.500	0.063	0.105	0.043	1100
12L112	3/4	0.773	1.500	0.115	0.143	0.028	6200
12M131	3/4	0.773	1.750	0.134	0.171	0.037	8300
12H150	3/4	0.773	2.000	0.154	0.200	0.046	10800
12EH168	3/4	0.773	2.250	0.172	0.228	0.056	13000
1324112	3/4	0.845	1.500	0.115	0.140	0.025	6000
14L131	7/8	0.901	1.750	0.134	0.167	0.033	8500
14M150	7/8	0.901	2.000	0.154	0.196	0.042	11100
14H168	7/8	0.901	2.250	0.172	0.223	0.051	13600
163284	1	1.005	2.005	0.082	0.136	0.054	2600
1632131	1	1.020	2.000	0.134	0.175	0.041	8200
16L150	1	1.030	2.000	0.154	0.195	0.041	11200
16M168	1	1.030	2.250	0.172	0.219	0.047	13800
16H187	1	1.030	2.500	0.192	0.248	0.056	17000
18L168	1 1/8	1.155	2.250	0.172	0.214	0.042	14000
18M187	1 1/8	1.155	2.500	0.192	0.243	0.051	17300
18H206	1 1/8	1.155	2.750	0.211	0.271	0.060	20600
204098	1 1/8	1.245	2.505	0.101	0.174	0.076	3600
20L187	1 1/4	1.280	2.500	0.192	0.239	0.047	17400
20M206	1 1/4	1.280	2.750	0.211	0.267	0.056	20900
20H225	1 1/4	1.280	3.000	0.231	0.296	0.065	24800
22M225	1 3/8	1.405	3.000	0.231	0.292	0.061	25000
22H244	1 3/8	1.405	3.250	0.250	0.320	0.070	29000
24L225	1 1/2	1.530	3.000	0.231	0.287	0.056	25200
24M244	1 1/2	1.530	3.250	0.250	0.315	0.065	29400
24H262	1 1/2	1.530	3.500	0.262	0.338	0.076	32000
26L244	1 1/2	1.650	3.250	0.250	0.311	0.061	29500
26M262	1 5/8	1.650	3.500	0.262	0.334	0.072	32100
28L262	1 3/4	1.780	3.500	0.262	0.329	0.067	32200

SOLON BELLEVILLE SPRINGS
IMPERIAL

INCONEL 718

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Load (lbs)
06L21718	#6	0.142	0.281	0.020	0.032	0.005	150
06M26718	#6	0.142	0.344	0.025	0.040	0.007	230
08L26718	#8	0.168	0.344	0.025	0.045	0.006	250
08M31718	#8	0.168	0.406	0.030	0.045	0.008	370
08M35718	#8	0.168	0.406	0.035	0.042	0.007	400
010L31718	#10	0.196	0.406	0.030	0.048	0.007	325
010M42718	#10	0.196	0.469	0.040	0.056	0.008	630
4-8-40-718	1/4	0.255	0.500	0.040	0.049	0.009	473
41240718	1/4	0.255	0.750	0.040	0.061	0.022	500
4L61718	1/4	0.258	0.563	0.061	0.079	0.007	1478
4M52718	1/4	0.258	0.688	0.050	0.085	0.015	930
4H61718	1/4	0.258	0.813	0.061	0.100	0.018	1300
51032718	5/16	0.317	0.630	0.032	0.058	0.014	365
51040718	5/16	0.317	0.630	0.040	0.053	0.012	600
5L52718	5/16	0.322	0.688	0.050	0.063	0.013	1000
5M61718	5/16	0.322	0.813	0.061	0.077	0.016	1400
51680718	5/16	0.322	1.000	0.077	0.101	0.021	2100
5EH80718	5/16	0.322	1.063	0.077	0.100	0.023	2050
61240718	3/8	0.380	0.755	0.040	0.056	0.016	570
61261718	3/8	0.380	0.755	0.061	0.073	0.012	1400
6-16-40-718	3/8	0.380	1.000	0.040	0.075	0.035	365
6-18-40-718	3/8	0.380	1.125	0.040	0.085	0.045	365
6L61718	3/8	0.386	0.813	0.061	0.075	0.014	1200
6M70718	3/8	0.386	0.938	0.068	0.087	0.019	1900
6H80718	3/8	0.386	1.063	0.077	0.101	0.024	2400
6EH89718	3/8	0.386	1.188	0.089	0.119	0.026	2900
71261718	7/16	0.442	0.755	0.061	0.085	0.010	1470
71445718	7/16	0.442	0.880	0.045	0.064	0.019	1000
7H100718	7/16	0.450	1.188	0.100	0.122	0.022	3800
81650718	1/2	0.505	1.005	0.050	0.073	0.023	800
8L80718	1/2	0.515	1.063	0.077	0.093	0.016	2300
8M89718	1/2	0.515	1.188	0.090	0.112	0.022	3100
820125718	1/2	0.515	1.250	0.125	0.144	0.019	6000
8H98718	1/2	0.515	1.313	0.100	0.129	0.029	3200
8H125718	1/2	0.515	1.313	0.125	0.145	0.020	6700
8EH125718	1/2	0.515	1.500	0.125	0.155	0.030	5600

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Load (lbs)
91840718	9/16	0.562	1.130	0.040	0.063	0.023	280
101860718	5/8	0.625	1.130	0.061	0.083	0.023	1300
102040718	5/8	0.625	1.255	0.040	0.074	0.034	300
102050718	5/8	0.625	1.255	0.050	0.080	0.030	600
102061718	5/8	0.637	1.250	0.061	0.090	0.029	1200
10L76718	5/8	0.644	1.313	0.077	0.102	0.027	2100
10L98718	5/8	0.644	1.313	0.100	0.122	0.022	3900
10M125718	5/8	0.644	1.500	0.125	0.151	0.026	6000
10H131718	5/8	0.644	1.750	0.125	0.163	0.038	5800
10EH150718	5/8	0.644	2.000	0.155	0.199	0.043	8700
12L98718	3/4	0.760	1.500	0.100	0.134	0.028	2435
12L72718	3/4	0.773	1.500	0.068	0.105	0.035	1700
12L112718	3/4	0.773	1.500	0.125	0.147	0.022	6200
12M131718	3/4	0.773	1.750	0.125	0.159	0.034	6000
12H150718	3/4	0.773	2.000	0.155	0.198	0.042	9700
122461718	3/4	0.806	1.565	0.062	0.112	0.040	1200
14L131718	7/8	0.901	1.750	0.125	0.155	0.030	6000
14M150718	7/8	0.901	2.000	0.155	0.191	0.035	9500
14H187718	7/8	0.901	2.250	0.187	0.228	0.041	13600
163284718	7/8	0.995	2.005	0.084	0.136	0.047	2300
16L150718	1	1.030	2.000	0.155	0.183	0.033	8800
16H187718	1	1.030	2.500	0.187	0.236	0.049	13400
18H206718	1 1/8	1.155	2.750	0.192	0.248	0.056	17600
204098718	1 1/8	1.245	2.505	0.100	0.156	0.056	3250
20L187718	1 1/4	1.280	2.500	0.187	0.228	0.041	13600
24-44-118-718	1 1/2	1.503	2.760	0.118	0.205	0.068	2980
24-48-125-718	1 1/2	1.515	3.000	0.125	0.205	0.080	3380
28L187718	1 3/4	1.780	3.500	0.193	0.266	0.073	13500
32-68-262-718	2	2.000	4.250	0.262	0.359	0.097	17000
42-88-150-718	2 1/2	2.625	5.500	0.156	0.329	0.173	4700

SOLON BELLEVILLE SPRINGS
IMPERIAL

510 PHOSPHOR BRONZE

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
04H26PB	#4	0.116	0.344	0.032	0.043	0.005	150
06M26PB	#6	0.142	0.344	0.032	0.042	0.005	160
08L26PB	#8	0.168	0.344	0.032	0.040	0.004	160
010M35PB	#10	0.196	0.469	0.040	0.060	0.008	301
4L42PB	1/4	0.258	0.563	0.040	0.063	0.009	295
4M52PB	1/4	0.258	0.688	0.050	0.082	0.014	440
5L52PB	5/16	0.322	0.688	0.050	0.082	0.012	500
6L61PB	3/8	0.386	0.813	0.063	0.098	0.012	700
6H80PB	3/8	0.386	1.063	0.080	0.150	0.019	1146
6EH89PB	3/8	0.386	1.188	0.093	0.165	0.017	1500
8L80PB	1/2	0.515	1.063	0.080	0.125	0.016	1200
818125PB	1/2	0.515	1.125	0.125	0.150	0.012	3400
8M89PB	1/2	0.515	1.188	0.093	0.150	0.017	1600
8H98PB	1/2	0.515	1.313	0.125	0.170	0.017	3400
8EH112PB	1/2	0.515	1.500	0.125	0.195	0.024	3100
10M112PB	5/8	0.644	1.500	0.125	0.180	0.022	3100
10H131PB	5/8	0.644	1.750	0.125	0.195	0.033	2900
12L112PB	3/4	0.773	1.500	0.125	0.180	0.018	3300
12H93PB	3/4	0.773	2.000	0.093	0.180	0.044	1060
12H150PB	3/4	0.773	2.000	0.125	0.210	0.037	2400

SOLON BELLEVILLE SPRINGS
METRIC



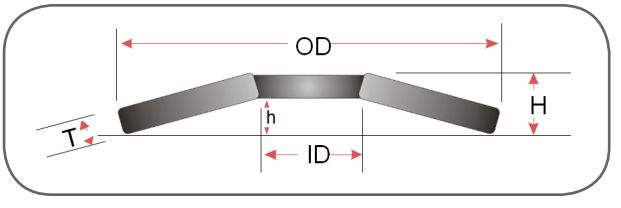
For over 60 years, Belleville spring washers have been an integral part of the Solon Manufacturing product family. While other companies provide washers, springs, and lock nuts, Solon's standard for excellence continues to distinguish us from our competitors. Attention to engineering detail along with investments in technology and resources have given us the opportunity to rise to the occasion of meeting our customers' needs—big and small—consistently.

SIZES

METRIC
Belleville springs are available as standard metric sizes from 4mm-80mm.
For imperial sizes see page 16.

IMPERIAL
Belleville springs are available as tandard Imperial sizes from 7/64" to 2-1/2" ID.

We welcome the opportunity to quote your custom part.
Submit your drawing to our engineering team, techsupport@solonmfg.com.



**It is ultimately user's responsibility to determine product suitability. Solon Manufacturing Co. is not responsible for product that is ordered incorrectly, misused, or misapplied. Contact a Solon engineer for recommended guidelines to product use.*

SOLON BELLEVILLE SPRINGS
METRIC

1074 CARBON STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M4.3-9-1	M4	4.293	8.992	0.991	1.295	0.127	3496
M5-11-1.0	M5	5.309	10.998	1.016	1.397	0.203	2593
M6.4-14-1.25	M6	6.401	13.995	1.270	1.702	0.254	4203
M10-25-2	M10	10.211	24.994	2.007	2.388	0.559	5934
M10-22.2-2.75ZC	M10	10.312	22.225	2.769	3.150	0.381	20532
M10-23-2	M10	10.490	23.012	1.981	2.692	0.432	8562

SOLON BELLEVILLE SPRINGS
METRIC

17-7PH STAINLESS STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M4-8-.45-177	M3.5	3.962	8.001	0.457	0.635	0.178	342
M4-8-.40-177	M4	4.191	8.001	0.381	0.787	0.178	356
M4-L-.60-177	M4	4.191	8.738	0.635	1.143	0.178	1068
M4-L-.80-177	M4	4.191	8.738	0.787	1.041	0.127	1383
M4-M-.80-177	M4	4.191	10.312	0.787	1.346	0.203	1646
M4-H-.90-177	M4	4.191	11.913	0.889	1.549	0.254	2002
M4-EH-1.10-177	M4	4.191	14.300	1.067	1.829	0.305	2669
M5-L-.80-177	M5	5.207	10.312	0.787	1.118	0.152	1668
M5-M-.90-177	M5	5.207	11.913	0.889	1.448	0.229	2091
M5-EH-1.30-177	M5	5.207	17.475	1.270	2.210	0.432	3781
M6-F-1.10-177	M6	6.198	10.922	1.067	1.194	0.127	3247
M6-14-1.1-177	M6	6.198	13.995	1.067	1.651	0.229	3025
M6-14-1.6-177	M6	6.198	13.995	1.499	1.956	0.178	6005
M6-L-1.10-177	M6	6.198	14.300	1.067	1.702	0.254	3025
M8-F-1.3-177	M8	8.179	14.732	1.270	1.676	0.203	4226
M8-16-.90-177	M8	8.179	16.002	0.813	1.168	0.356	1334
M8-18-2.1-177	M8	8.179	18.009	2.108	2.337	0.229	12899
M8-35-2.1-177	M8	8.179	35.001	2.108	3.150	1.041	9118
M8-32-2.1-177	M8	8.484	32.004	2.108	3.048	0.940	9198
M10-L-1.5-177	M10	10.211	20.650	1.575	1.880	0.330	6672
M10-M-1.8-177	M10	10.211	24.003	1.829	2.261	0.432	8451
M10-16-0.6-177	M10	10.287	16.129	0.610	0.991	0.381	600
M10-23-2.4-177	M10	10.312	23.012	2.413	2.743	0.330	16458
M10-F-2-177	M10	10.414	18.237	2.108	2.286	0.178	12454
M12-F-2.3-177	M12	12.395	21.692	2.413	2.667	0.254	16458
M12-L-1.8-177	M12	12.395	24.003	1.829	2.235	0.381	9341
M12-M-2.1-177	M12	12.395	27.000	2.108	2.616	0.483	12010
M12-29-3.0-177	M12	12.395	28.981	2.972	3.404	0.432	24464
M14-F-2.3-177	M14	14.402	25.273	2.413	2.718	0.305	16235
M14-M-2.4-177	M14	14.402	33.350	2.413	3.073	0.660	15346
M15-25-0.9-177	M14	15.113	25.019	0.889	1.473	0.584	1245
M16-F-3-177	M16	16.358	29.159	2.972	3.302	0.330	28912
M16-L-2.4-177	M16	16.358	33.350	2.413	2.997	0.584	15568
M16-39-3.9-177	M16	16.358	38.989	3.937	4.521	0.584	43146
M16-H-3.4-177	M16	16.358	44.450	3.454	4.394	0.940	28467
M17-39-3.5-177	M16	16.993	38.989	3.454	4.115	0.660	32248
M17-40-2.5-177	M16	17.501	40.005	2.489	3.378	0.889	12677
M18-F-3.5-177	M18	18.390	32.639	3.454	3.810	0.381	33582

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M18-L-3.0-177	M18	18.390	38.100	2.972	3.607	0.635	24019
M18-51-3.2-177	M18	18.390	50.800	3.175	4.420	1.245	24909
M20-40-4.9-177	M20	20.599	40.005	4.902	5.334	0.432	68944
M20-40-1.5-177	M20	20.599	40.005	1.575	2.692	1.118	4003
M20-40-2.0-177	M20	20.599	40.005	2.108	2.972	0.864	11031
M20-40-3.5-177	M20	20.599	40.005	3.454	4.039	0.584	32915
M20-40-2.25-177	M20	20.599	40.005	2.337	3.200	0.787	14994
M20-L-3.4-177	M20	20.599	44.450	3.454	4.216	0.762	32470
M20-57-4-177	M20	20.625	57.150	3.988	5.207	1.270	39587
M20-41.5-.77-177	M20	20.701	41.580	0.762	1.880	1.067	543
M20-F-4-177	M20	20.828	36.449	3.937	4.318	0.381	43590
M22-L-3.4-177	M22	22.606	44.450	3.454	4.166	0.711	32470
M22-F-4-177	M22	22.885	40.386	3.937	4.420	0.483	43368
M24-L-4.0-177	M24	24.613	51.003	3.937	4.801	0.864	41811
M24-H-4.9-177	M24	24.613	63.500	4.902	6.147	1.245	63162
M24-F-4-177	M24	24.816	43.409	3.937	4.470	0.533	42923
M25.4-50-2-177	M25.4	25.400	50.013	2.007	3.404	1.448	6828
M27-60-6.4-177	M27	27.788	59.995	6.477	7.264	0.787	118762
M27-F-4-177	M27	27.813	48.692	3.937	4.623	0.686	42256
M30-60-3.0-177	M30	30.505	59.944	2.972	4.318	1.346	21444
M30-F-5-177	M30	30.810	53.924	4.902	5.563	0.660	66720
M32-F-5-177	M30	32.791	57.379	4.902	5.639	0.737	66053
M33-F-5-177	M33	33.528	59.182	4.902	5.690	0.787	88960
M33-L-5-177	M33	33.528	63.500	4.902	5.893	0.991	64941
M36-F-5-177	M36	36.805	65.532	4.902	5.867	0.965	64941
M36-F-7-177	M36	36.805	65.532	6.477	7.366	0.889	117427
M39-F-7-177	M39	39.624	69.850	6.477	7.341	0.864	117672
M40-80-5.0-177	M39	40.996	80.010	4.902	6.325	1.575	57824
M42-F-7-177	M42	42.850	74.930	6.655	7.595	0.965	122320
M45-F-7-177	M45	45.720	80.518	7.137	8.128	1.016	137888
M48-F-8-177	M48	49.200	86.081	8.077	9.119	1.041	181256
M50-100-5.0-177	M48	51.003	100.000	4.902	7.493	2.438	43657
M50-100-6.5-177	M48	51.003	100.000	6.502	8.560	2.057	110755
M59-73-2.54-177	M56	59.055	72.923	2.540	4.318	1.702	11120

SOLON BELLEVILLE SPRINGS
METRIC

301 STAINLESS STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M3-8-0.8-301	M3	3.200	8.001	0.813	1.016	0.076	1001
M6-L-1.10-301	M6	6.198	14.300	1.067	1.651	0.254	2313
M8-M-1.5-301	M8	8.179	20.650	1.575	2.540	0.381	5115
M8-H-1.8-301	M8	8.179	24.003	1.854	2.921	0.559	6672
M8-16.5-1.1-301	M8	8.382	16.561	1.067	1.600	0.279	1753
M10-L-1.5-301	M10	10.211	20.650	1.575	2.388	0.305	6672
M10-M-1.8-301	M10	10.211	24.003	1.854	2.921	0.406	7117
M10-H-2.1-301	M10	10.211	27.000	2.108	3.378	0.483	8896
M10-EH-2.4-301	M10	10.211	30.175	2.413	4.140	0.610	11565
M12-L-1.8-301	M12	12.395	24.003	1.854	2.769	0.356	7117
M12-M-2.1-301	M12	12.395	27.000	2.108	3.226	0.432	9341
M16-32-3.2-301	M16	16.358	31.750	3.175	4.039	0.356	24464
M16-L-2.4-301	M16	16.358	33.350	2.413	3.785	0.533	12454
M20-40-1.0-301	M20	20.396	40.005	0.991	2.134	1.143	1468

SOLON BELLEVILLE SPRINGS
METRIC

AISI 6150 ALLOY STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M5-14-1.1	M5	5.207	14.300	1.092	1.778	0.356	3701
M6-14-1.6	M6	6.198	13.995	1.499	1.981	0.229	7651
M6-14-1.1	M6	6.198	14.300	1.092	1.727	0.305	3870
M8-20-2.5	M8	8.204	19.990	2.565	2.845	0.279	22680
M8-18-2.1	M8	8.407	18.009	2.007	2.362	0.279	12454
M10-25-3.9	M10	10.287	24.892	3.912	4.242	0.330	38827
M10-21-1.6	M10	10.312	20.650	1.600	2.007	0.406	8340
M10-23-2.5	M10	10.312	23.012	2.565	2.946	0.381	21795
M10-27-2.1	M10	10.312	27.000	2.083	2.819	0.737	15568
M10-30-2.5	M10	10.312	30.175	2.565	3.251	0.686	20016
M15-35-3.5	M14	15.011	35.001	3.429	4.343	0.660	32915
M20-45-3.8	M18	19.990	44.983	3.912	4.851	0.838	51152
M20-40-3.4	M20	20.599	40.005	3.404	4.089	0.686	37808
M20-L-3.4	M20	20.599	44.450	3.404	4.318	0.914	37808
M20-45-4.9	M20	20.599	44.983	4.877	5.563	0.686	70278
M30-70-6.4	M30	30.810	76.073	6.579	8.255	1.321	136554

SOLON BELLEVILLE SPRINGS
METRIC

INCONEL 718

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M4-L-.60-718	M4	4.191	8.738	0.635	0.864	0.152	1112
M5-L-.80-718	M5	5.207	10.312	0.762	1.067	0.152	1668
M5-H-1.0-718	M5	5.207	14.300	1.016	1.473	0.305	2687
M5-EH-1.3-718	M5	5.207	17.475	1.270	2.007	0.432	3781
M6-M-1.3-718	M6	6.198	17.475	1.270	1.981	0.381	4092
M8-F-2.0-718	M8	8.179	14.732	1.956	2.134	0.127	10898
M10-20-1.0-718	M10	10.211	19.990	1.016	1.448	0.432	1890
M10-20-1.0-718	M10	10.211	19.990	1.016	1.448	0.432	1890
M10-F-2.3-718	M10	10.414	18.009	2.311	2.464	0.152	14901
M10-F-2.5-718	M10	10.414	18.237	2.540	2.692	0.152	18521
M12-M-2.0-718	M12	12.395	27.000	1.956	2.438	0.483	12010
M12-F-2.5-718	M12	12.395	21.692	2.540	2.743	0.203	18308
M14-28-1.5-718	M14	14.199	27.991	1.549	2.134	0.584	4448
M14-F-2.5-718	M14	14.402	25.273	2.540	2.819	0.279	18063
M24-F-4.0-718	M24	24.816	43.409	3.962	4.496	0.533	43484

SOLON BELLEVILLE SPRINGS
METRIC

H-13 TOOL STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M10-F-2.6-H13	M10	10.414	18.237	2.642	2.819	0.178	16222
M10-F-3.0-H13	M10	10.414	18.237	3.023	3.200	0.178	21631
M12-F-3.7-H13	M12	12.395	21.692	3.658	3.861	0.203	31541
M16-F-3.6-H13	M16	16.358	29.159	3.607	3.988	0.381	30157
M16-F-4.4-H13	M16	16.358	29.159	4.394	4.699	0.305	45236
M16-F-5.1-H13	M16	16.358	29.159	5.105	5.385	0.279	60315
M20-F-4.5-H13	M20	20.599	36.957	4.470	4.877	0.406	46571
M20-F-5.4-H13	M20	20.599	36.957	5.436	5.791	0.356	69856
M20-F-6.1-H13	M20	20.599	36.957	6.147	6.452	0.305	93141
M22-F-7.4-H13	M22	22.885	40.386	7.417	7.798	0.381	123299
M24-F-5.4-H13	M24	24.816	43.409	5.385	5.918	0.533	67120
M24-F-6.5-H13	M24	24.816	43.409	6.528	6.960	0.432	100680
M24-F-7.5-H13	M24	24.816	43.409	7.518	7.899	0.381	134241
M27-F-8.3-H13	M27	27.813	45.974	8.280	8.763	0.406	177253
M27-F-5.9-H13	M27	27.813	48.692	5.969	6.604	0.635	88070
M27-F-7.3-H13	M27	27.813	48.692	7.264	7.798	0.533	132106
M27-F-8.4-H13	M27	27.813	48.692	8.382	8.814	0.432	176675
M30-F-6.8-H13	M30	30.810	53.924	6.782	7.417	0.635	107286
M30-F-8.3-H13	M30	30.810	53.924	8.255	8.788	0.533	160929
M30-F-10.1-H13	M30	30.810	53.924	9.500	9.982	0.483	214572
M32-F-8.4-H13	M30	32.537	58.674	7.645	8.382	0.737	133440
M32-F-10.2-H13	M30	32.537	58.674	9.550	10.16	0.610	200160
M33-F-7.6-H13	M33	33.528	59.182	7.569	8.255	0.686	133840
M33-F-9.2-H13	M33	33.528	59.182	9.220	9.804	0.584	200760
M33-F-10.6-H13	M33	33.528	59.182	10.617	11.125	0.508	267681
M36-F-8.2-H13	M36	36.805	65.532	8.179	8.992	0.813	157046
M36-F-10.0-H13	M36	36.805	65.532	9.957	10.643	0.686	235571
M36-F-11.5-H13	M36	36.805	65.532	11.455	12.040	0.584	314091
M39-F-9.2-H13	M39	39.624	68.072	9.246	9.982	0.737	199270
M39-F-11.2-H13	M39	39.624	68.072	11.252	11.862	0.610	298536
M39-F-13-H13	M39	39.624	68.072	12.954	13.538	0.584	398185
M42-F-10.2-H13	M42	42.850	74.93	10.414	11.278	0.864	237523
M42-F-14.6-H13	M42	42.850	74.93	14.580	15.215	0.635	475936
M48-F-14.6-H13	M48	48.235	86.081	14.376	15.215	0.838	482386
M58-F-17.8-H13	M56	59.004	102.616	17.882	18.847	0.965	752157
M72-F-22.1-H13	M72	73.508	128.651	22.149	23.292	1.143	1145493

SOLON BELLEVILLE SPRINGS
METRIC

510 PHOSPHOR BRONZE

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
M4-L-.70-PB	M4	4.191	8.738	0.813	1.016	0.102	712
M8-F-1.3-PB	M8	8.179	14.732	1.270	1.575	0.152	2188
M8-L-1.3-PB	M8	8.179	17.475	1.270	2.007	0.305	2224
M8-EH-2.1-PB	M8	8.179	27.000	2.032	3.277	0.508	4750
M10-F-2.1-PB	M10	10.211	18.237	2.032	2.337	0.152	5538
M10-L-1.5-PB	M10	10.211	20.650	1.600	2.362	0.305	3114
M14-F-2.3-PB	M14	14.402	25.273	2.362	2.819	0.229	7606
M14-H-3.2-PB	M14	14.402	38.100	3.175	4.648	0.584	13566
M16-F-3.2-PB	M16	16.358	29.159	3.175	3.632	0.229	13922
M16-H-3.2-PB	M16	16.358	44.450	3.175	4.953	0.838	12899
M18-F-3.2-PB	M18	18.390	32.639	3.175	3.734	0.279	13789

SOLON DISC SPRINGS (SDS)



Disc Spring– A conical-shaped washer used to cushion heavy loads with short motion. Disc springs are typically “stacked” in various arrangements to alter load or deflection characteristics. Also called Belleville washers, disc springs, or conical springs. Solon® Disc Springs conform to the DIN 2092 and 2093 specifications and are RoHS compliant. The springs are used when the application requires a large number of deflection cycles or when the required forces or deflections are critical.

Solon Manufacturing Co. offers a line of DIN spec parts for applications when exacting tolerances are crucial. Solon Disc Springs (SDS) conform to the DIN 2093 specifications and are RoHS compliant. These springs are effective when a large number of deflection cycles or forces are critical.

DIN/SDS are available as standard metric sizes from 2.5mm-125mm.

Available in Carbon Steel, 17-7 PH Stainless Steel, 301 Stainless Steel and Inconel. Carbon steel disc springs are finished with the standard corrosion protection of phosphate & oil.

Solon offers a full range of disc springs for use in dynamic applications which require a large number of deflection cycles or critical deflections.

- Punch and die sets
- Clutch break mechanisms
- Bearing assemblies
- Valve live loading
- Heavy equipment

DIN 2093 STANDARD

The DIN 2093 specification classifies disc springs into three groups:
Group 1: Under 1.25mm thick; cold formed, radiused edges, without contact flats
Group 2: 1.25mm-6mm thick; cold formed (or fine blanked), radiused edges, without contact flats
Group 3: Over 6mm thick; fully machined from forged blanks, with contact flats, thickness reduced

SOLON DISC SPRINGS
DIN 2093

17-7PH STAINLESS STEEL

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 8x3.2x0.2-177	3.200	8.001	0.203	0.406	0.330	58
SDS 8x3.2x0.5-177	3.200	8.001	0.508	0.711	0.203	547
SDS 10x3.2x0.4-177	3.200	10.008	0.406	0.711	0.381	325
SDS 10x3.2x0.5-177	3.200	10.008	0.508	0.762	0.330	556
SDS 8x4.2x0.4-177	4.191	8.001	0.406	0.610	0.203	302
SDS 10x4.2x0.4-177	4.191	10.008	0.406	0.711	0.330	298
SDS 10x4.2x0.5-177	4.191	10.008	0.508	0.762	0.279	507
SDS 10x4.2x0.6-177	4.191	10.008	0.610	0.838	0.254	770
SDS 12x4.2x0.4-177	4.191	11.989	0.406	0.787	0.381	289
SDS 12x4.2x0.5-177	4.191	11.989	0.508	0.838	0.432	503
SDS 12x4.2x0.6-177	4.191	11.989	0.610	0.991	0.381	774
SDS 10x5.2x0.4-177	5.207	10.008	0.406	0.711	0.279	280
SDS 10x5.2x0.5-177	5.207	10.008	0.508	0.762	0.254	471
SDS 12x5.2x0.5-177	5.207	11.989	0.508	0.889	0.381	467
SDS 12x5.2x0.6-177	5.207	11.989	0.610	0.940	0.330	721
SDS 12.5x5.2x0.5-177	5.207	12.497	0.508	0.838	0.406	467
SDS 15x5.2x0.4-177	5.207	15.011	0.406	1.067	0.660	258
SDS 15x5.2x0.5-177	5.207	15.011	0.508	0.991	0.610	454
SDS 15x5.2x0.6-177	5.207	15.011	0.610	1.041	0.559	716
SDS 15x5.2x0.7-177	5.207	15.011	0.711	1.092	0.508	1032
SDS 12x6.2x0.5-177	6.198	11.989	0.508	0.838	0.330	445
SDS 12x6.2x0.6-177	6.198	11.989	0.610	0.940	0.279	681
SDS 12.5x6.2x0.5-177	6.198	12.497	0.508	0.838	0.356	445
SDS 12.5x6.2x0.7-177	6.198	12.497	0.711	0.991	0.279	970
SDS 15x6.2x0.5-177	6.198	15.011	0.508	0.991	0.559	431
SDS 15x6.2x0.6-177	6.198	15.011	0.610	1.041	0.508	672
SDS 15x6.2x0.7-177	6.198	15.011	0.711	1.092	0.457	974
SDS 18x6.2x0.4-177	6.198	18.009	0.406	0.991	0.864	231
SDS 18x6.2x0.5-177	6.198	18.009	0.508	1.092	0.787	414
SDS 18x6.2x0.6-177	6.198	18.009	0.610	1.346	0.737	658
SDS 18x6.2x0.7-177	6.198	18.009	0.711	1.245	0.660	961
SDS 18x6.2x0.8-177	6.198	18.009	0.787	1.295	0.635	1232
SDS 14x7.2x0.35-177	7.188	13.995	0.356	0.787	0.508	173
SDS 14x7.2x0.5-177	7.188	13.995	0.508	0.889	0.432	418
SDS 14x7.2x0.8-177	7.188	13.995	0.787	1.092	0.330	1170
SDS 15x8.2x0.7-177	8.204	15.011	0.711	1.092	0.356	890
SDS 15x8.2x0.8-177	8.204	15.011	0.787	1.194	0.330	1125

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 16x8.2x0.4-177	8.204	16.002	0.406	0.889	0.483	227
SDS 16x8.2x0.6-177	8.204	16.002	0.610	1.041	0.483	614
SDS 16x8.2x0.7-177	8.204	16.002	0.711	1.143	0.432	890
SDS 16x8.2x0.8-177	8.204	16.002	0.787	1.194	0.406	1125
SDS 16x8.2x0.9-177	8.204	16.002	0.889	1.245	0.356	1486
SDS 18x8.2x0.5-177	8.204	18.009	0.508	1.092	0.686	383
SDS 18x8.2x0.7-177	8.204	18.009	0.711	1.245	0.559	881
SDS 18x8.2x0.8-177	8.204	18.009	0.787	1.295	0.533	1121
SDS 18x8.2x1-177	8.204	18.009	0.991	1.397	0.457	1917
SDS 20x8.2x0.5-177	8.204	19.990	0.508	1.168	0.838	369
SDS 20x8.2x0.6-177	8.204	19.990	0.610	1.295	0.787	592
SDS 20x8.2x0.7-177	8.204	19.990	0.711	1.346	0.711	867
SDS 20x8.2x0.8-177	8.204	19.990	0.787	1.397	0.686	1112
SDS 20x8.2x0.9-177	8.204	19.990	0.889	1.448	0.635	1490
SDS 20x8.2x1-177	8.204	19.990	0.991	1.549	0.584	1922
SDS 23x8.2x0.7-177	8.204	23.012	0.711	1.499	0.965	845
SDS 23x8.2x0.8-177	8.204	23.012	0.787	1.549	0.914	1090
SDS 23x8.2x0.9-177	8.204	23.012	0.889	1.600	0.864	1472
SDS 23x8.2x1-177	8.204	23.012	0.991	1.702	0.787	1913
SDS 18x9.2x0.45-177	9.195	18.009	0.457	1.041	0.660	285
SDS 18x9.2x0.7-177	9.195	18.009	0.711	1.194	0.533	850
SDS 18x9.2x1-177	9.195	18.009	0.991	1.397	0.406	1841
SDS 20x10.2x0.4-177	10.211	19.990	0.406	0.889	0.787	196
SDS 20x10.2x0.5-177	10.211	19.990	0.508	1.143	0.737	351
SDS 20x10.2x0.6-177	10.211	19.990	0.610	1.219	0.660	556
SDS 20x10.2x0.8-177	10.211	19.990	0.787	1.346	0.584	1041
SDS 20x10.2x0.9-177	10.211	19.990	0.889	1.448	0.533	1388
SDS 20x10.2x1-177	10.211	19.990	0.991	1.549	0.508	1788
SDS 20x10.2x1.1-177	10.211	19.990	1.092	1.549	0.457	2237
SDS 20x10.2x1.25-177	10.211	19.990	1.245	1.753	0.432	3002
SDS 20x10.2x1.5-177	10.211	19.990	1.499	1.803	0.356	4519
SDS 23x10.2x0.9-177	10.211	23.012	0.889	1.651	0.762	1374
SDS 23x10.2x1-177	10.211	23.012	0.991	1.702	0.711	1779
SDS 23x10.2x1.25-177	10.211	23.012	1.245	1.905	0.610	3034
SDS 25x10.2x1-177	10.211	24.994	0.991	1.753	0.838	1766
SDS 28x10.2x0.8-177	10.211	27.991	0.787	1.753	1.194	979
SDS 28x10.2x1-177	10.211	27.991	0.991	1.905	1.067	1744
SDS 28x10.2x1.25-177	10.211	27.991	1.245	2.057	0.940	3034
SDS 28x10.2x1.5-177	10.211	27.991	1.499	2.210	0.838	4697
SDS 22.5x11.2x0.6-177	11.201	22.504	0.610	1.397	0.813	529
SDS 22.5x11.2x0.8-177	11.201	22.504	0.787	1.448	0.711	996
SDS 22.5x11.2x1.25-177	11.201	22.504	1.245	1.753	0.533	2940
SDS 23x12.2x1-177	12.192	23.012	0.991	1.600	0.610	1686

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 23x12.2x1.25-177	12.192	23.012	1.245	1.854	0.533	2860
SDS 23x12.2x1.5-177	12.192	23.012	1.499	2.007	0.457	4341
SDS 25x12.2x0.7-177	12.192	24.994	0.711	1.600	0.889	738
SDS 25x12.2x0.9-177	12.192	24.994	0.889	1.600	0.787	1290
SDS 25x12.2x1-177	12.192	24.994	0.991	1.803	0.762	1672
SDS 25x12.2x1.25-177	12.192	24.994	1.245	1.956	0.660	2869
SDS 25x12.2x1.5-177	12.192	24.994	1.499	2.057	0.559	4381
SDS 28x12.2x1-177	12.192	27.991	0.991	1.956	0.965	1650
SDS 28x12.2x1.25-177	12.192	27.991	1.245	2.108	0.864	2860
SDS 28x12.2x1.5-177	12.192	27.991	1.499	2.261	0.762	4417
SDS 31.5x12.2x1.25-177	12.192	31.496	1.245	2.210	1.092	2838
SDS 31.5x12.2x1.5-177	12.192	31.496	1.499	2.362	0.991	4421
SDS 34x12.3x1-177	12.294	34.011	0.991	2.261	1.448	1583
SDS 34x12.3x1.25-177	12.294	34.011	1.245	2.362	1.295	2802
SDS 34x12.3x1.5-177	12.294	34.011	1.499	2.489	1.168	4399
SDS 28x14.2x0.8-177	14.199	27.991	0.787	1.803	0.991	894
SDS 28x14.2x1-177	14.199	27.991	0.991	1.803	0.864	1579
SDS 28x14.2x1.25-177	14.199	27.991	1.245	2.108	0.762	2727
SDS 28x14.2x1.5-177	14.199	27.991	1.499	2.159	0.660	4194
SDS 34x14.3x1.25-177	14.300	34.011	1.245	2.388	1.194	2669
SDS 34x14.3x1.5-177	14.300	34.011	1.499	2.540	1.067	4181
SDS 40x14.3x1.25-177	14.300	40.005	1.245	2.642	1.651	2598
SDS 40x14.3x1.5-177	14.300	40.005	1.499	2.743	1.499	4123
SDS 40x14.3x1.75-177	14.300	40.005	1.753	3.048	1.372	6027
SDS 40x14.3x2-177	14.300	40.005	2.007	3.150	1.143	8304
SDS 31.5x16.3x0.8-177	16.307	31.496	0.787	1.854	1.143	836
SDS 31.5x16.3x1.25-177	16.307	31.496	1.245	2.159	0.914	2598
SDS 31.5x16.3x1.5-177	16.307	31.496	1.499	2.388	0.813	4021
SDS 31.5x16.3x1.75-177	16.307	31.496	1.753	2.438	0.711	5760
SDS 31.5x16.3x2-177	16.307	31.496	2.007	2.743	0.635	7806
SDS 34x16.3x1.5-177	16.307	34.011	1.499	2.540	0.965	4012
SDS 34x16.3x2-177	16.307	34.011	2.007	2.845	0.787	7869
SDS 40x16.3x1.5-177	16.307	40.005	1.499	2.794	1.397	3950
SDS 40x16.3x1.75-177	16.307	40.005	1.753	3.099	1.270	5765
SDS 40x16.3x2-177	16.307	40.005	2.007	3.099	1.168	7931
SDS 48x16.3x1.5-177	16.307	48.006	1.499	2.997	2.032	3834
SDS 35.5x18.3x0.9-177	18.288	35.509	0.889	2.057	1.295	1068
SDS 35.5x18.3x1.25-177	18.288	35.509	1.245	2.261	1.092	2473
SDS 35.5x18.3x2-177	18.288	35.509	2.007	2.794	0.813	7597
SDS 40x18.3x2-177	18.288	40.005	2.007	3.150	1.092	7633
SDS 40x18.3x2.5-177	18.288	40.005	2.489	3.353	0.864	11276
SDS 50x18.4x1.25-177	18.390	50.013	1.245	2.845	2.235	2268
SDS 50x18.4x1.5-177	18.390	50.013	1.499	3.378	1.880	3265
SDS 50x18.4x2-177	18.390	50.013	2.007	3.505	1.778	7548
SDS 50x18.4x2.5-177	18.390	50.013	2.489	4.089	1.549	12619
SDS 50x18.4x3-177	18.390	50.013	2.997	4.394	1.372	19375

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 40x20.4x1-177	20.396	40.005	0.991	2.311	1.473	1317
SDS 40x20.4x1.5-177	20.396	40.005	1.499	2.642	1.194	3701
SDS 40x20.4x2-177	20.396	40.005	2.007	3.099	0.991	7366
SDS 40x20.4x2.25-177	20.396	40.005	2.261	3.150	0.914	9674
SDS 40x20.4x2.5-177	20.396	40.005	2.489	3.327	0.838	12014
SDS 50x20.4x2-177	20.396	50.013	2.007	3.505	1.676	7295
SDS 50x20.4x2.5-177	20.396	50.013	2.489	3.861	1.473	12174
SDS 60x20.5x2-177	20.498	59.995	2.007	4.089	2.438	7108
SDS 60x20.5x2.5-177	20.498	59.995	2.489	4.293	2.184	12076
SDS 60x20.5x3-177	20.498	59.995	2.997	4.699	1.930	18797
SDS 45x22.4x1.25-177	22.403	45.009	1.245	2.845	1.600	2224
SDS 45x22.4x1.75-177	22.403	45.009	1.753	3.048	1.346	5173
SDS 45x22.4x2.5-177	22.403	45.009	2.489	3.505	1.067	11756
SDS 50x22.4x2-177	22.403	50.013	2.007	3.607	1.600	7081
SDS 50x22.4x2.5-177	22.403	50.013	2.489	3.912	1.397	11792
SDS 70x24.5x3-177	24.511	70.002	2.997	5.283	2.464	17587
SDS 70x24.5x3.5-177	24.511	70.002	3.505	5.994	2.235	25505
SDS 50x25.4x1.25-177	25.400	50.013	1.245	2.845	1.600	2086
SDS 50x25.4x1.5-177	25.400	50.013	1.499	3.099	1.702	3340
SDS 50x25.4x2-177	25.400	50.013	2.007	3.404	1.448	6828
SDS 50x25.4x2.25-177	25.400	50.013	2.261	3.759	1.346	9052
SDS 50x25.4x2.5-177	25.400	50.013	2.489	3.912	1.245	11325
SDS 50x25.4x3-177	25.400	50.013	2.997	4.089	1.092	17285
SDS 60x25.5x2.5-177	25.502	59.995	2.489	4.394	1.930	11231
SDS 60x25.5x3-177	25.502	59.995	2.997	4.648	1.727	17423
SDS 70x25.5x2-177	25.502	70.002	2.007	4.496	2.972	6418
SDS 56x28.5x1.5-177	28.499	56.007	1.499	3.454	2.007	3149
SDS 56x28.5x2-177	28.499	56.007	2.007	3.607	1.727	6512
SDS 56x28.5x2.5-177	28.499	56.007	2.489	3.861	1.372	9861
SDS 56x28.5x3-177	28.499	56.007	2.997	4.293	1.321	16765
SDS 60x30.5x2.5-177	30.505	59.995	2.489	4.293	1.702	10635
SDS 60x30.5x2.75-177	30.505	59.995	2.743	4.750	1.600	13375
SDS 60x30.5x3-177	30.505	59.995	2.997	4.699	1.499	16431
SDS 60x30.5x3.5-177	30.505	59.995	3.505	5.004	1.499	23481
SDS 70x30.5x2.5-177	30.505	70.002	2.489	4.902	2.438	10431
SDS 80x30.5x2.5-177	30.505	80.010	2.489	5.309	3.200	10177
SDS 63x31x1.8-177	30.988	62.992	1.803	4.140	2.235	4764
SDS 63x31x2.5-177	30.988	62.992	2.489	4.242	1.880	10533
SDS 63x31x3-177	30.988	62.992	2.997	4.801	1.676	16346
SDS 63x31x3.5-177	30.988	62.992	3.505	4.902	1.499	23437
SDS 80x31x2.5-177	30.988	80.010	2.489	5.309	3.175	10128
SDS 80x31x3-177	30.988	80.010	2.997	5.512	2.896	16062
SDS 80x31x3.75-177	30.988	80.010	3.759	6.096	2.515	27693
SDS 80x31x4-177	30.988	80.010	3.988	6.096	2.438	31817
SDS 70x35.5x3-177	35.509	70.002	2.997	5.105	1.930	15612

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 70x35.5x3.5-177	35.509	70.002	3.505	5.309	1.753	22507
SDS 70x35.5x3.75-177	35.509	70.002	3.759	5.791	1.676	26426
SDS 70x35.5x4-177	35.509	70.002	3.988	5.791	1.600	30215
SDS 80x35.5x3.75-177	35.509	80.010	3.759	6.198	2.311	26461
SDS 80x35.5x4-177	35.509	80.010	3.988	6.198	2.235	30375
SDS 71x36x2-177	35.992	70.993	2.007	4.597	2.489	5818
SDS 71x36x2.5-177	35.992	70.993	2.489	4.496	2.210	9937
SDS 71x36x3.75-177	35.992	70.993	3.759	5.588	1.702	26323
SDS 71x36x4-177	35.992	70.993	3.988	5.588	1.626	30109
SDS 80x36x3-177	35.992	80.010	2.997	5.690	2.642	15332
SDS 80x36x4-177	35.992	80.010	3.988	5.690	2.210	30238
SDS 70x40.5x3.75-177	40.488	70.002	3.759	5.588	1.448	25362
SDS 70x40.5x4-177	40.488	70.002	3.988	5.588	1.397	28965
SDS 70x40.5x4.7-177	40.488	70.002	4.699	6.198	1.219	41660
SDS 70x40.5x5-177	40.488	70.002	5.004	6.198	1.168	47785
SDS 80x41x2.25-177	40.996	80.010	2.261	5.207	2.769	7366
SDS 80x41x3-177	40.996	80.010	2.997	5.309	2.388	14776
SDS 80x41x3.75-177	40.996	80.010	3.759	6.198	2.083	25287
SDS 80x41x4-177	40.996	80.010	3.988	6.198	1.981	28997
SDS 80x41x4.7-177	40.996	80.010	4.699	6.706	1.727	45276
SDS 80x41x5-177	40.996	80.010	5.004	6.706	1.676	48514
SDS 100x41x3.8-177	40.996	100.000	3.810	7.188	3.454	25678
SDS 100x41x4-177	40.996	100.000	3.988	7.188	3.378	28685
SDS 100x41x4.75-177	40.996	100.000	4.699	7.747	3.048	42447
SDS 100x41x5-177	40.996	100.000	5.004	7.747	2.921	49186
SDS 125x41x4-177	40.996	124.993	3.988	8.204	5.283	27773
SDS 90x46x2.5-177	45.999	89.992	2.489	5.690	3.150	8838
SDS 90x46x3.5-177	45.999	89.992	3.505	5.994	2.616	20550
SDS 90x46x4.7-177	45.999	89.992	4.699	7.010	2.159	40855
SDS 90x46x5-177	45.999	89.992	5.004	7.010	2.083	47153
SDS 100x51x2.7-177	51.003	100.000	2.692	6.198	3.556	10195
SDS 100x51x3.5-177	51.003	100.000	3.505	6.299	3.099	19669
SDS 100x51x3.8-177	51.003	100.000	3.810	7.010	2.972	24077
SDS 100x51x4-177	51.003	100.000	3.988	7.010	2.896	26861
SDS 100x51x4.75-177	51.003	100.000	4.699	7.798	2.591	39569
SDS 100x51x5-177	51.003	100.000	5.004	7.798	2.489	45774
SDS 100x51x5.6-177	51.003	100.000	5.588	8.204	2.311	58927
SDS 100x51x6-177	51.003	100.000	5.994	8.204	2.184	69037
SDS 100x51x6.5-177	51.003	100.000	6.553	8.611	2.032	84218
SDS 125x51x3.8-177	51.003	124.993	3.810	8.509	4.877	23107
SDS 125x51x4-177	51.003	124.993	3.988	8.509	4.775	25914
SDS 125x51x4.75-177	51.003	124.993	4.750	8.890	4.343	39921
SDS 125x51x5-177	51.003	124.993	5.004	8.890	4.216	45303
SDS 125x51x5.6-177	51.003	124.993	5.639	9.398	3.937	60315
SDS 125x51x6-177	51.003	124.993	5.994	9.398	3.785	69682
SDS 112x57x2.5-177	56.998	111.989	2.489	6.579	4.089	7032

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 112x57x3-177	56.998	111.989	2.997	6.909	4.013	12597
SDS 112x57x3.75-177	56.998	111.989	3.912	7.188	3.505	24468
SDS 112x57x4-177	56.998	111.989	3.988	7.188	3.454	25647
SDS 112x57x5.6-177	56.998	111.989	5.588	8.509	2.794	57077
SDS 112x57x6-177	56.998	111.989	5.994	8.509	2.515	67054
SDS 125x61x4.75-177	61.011	124.993	4.750	8.992	3.861	37835
SDS 125x61x5-177	61.011	124.993	5.004	8.992	3.734	42888
SDS 125x61x5.6-177	61.011	124.993	5.588	9.601	3.480	55751
SDS 125x61x6-177	61.011	124.993	5.994	9.601	3.327	65710
SDS 125x61x7.5-177	61.011	124.993	7.493	10.897	2.845	109505
SDS 125x61x8-177	61.011	124.993	8.001	10.439	2.438	126461
SDS 150x61x4.75-177	61.011	150.012	4.750	10.312	5.766	36656
SDS 150x61x5-177	61.011	150.012	5.004	10.312	5.613	41749
SDS 150x61x5.7-177	61.011	150.012	5.690	10.795	5.232	57295
SDS 150x61x6-177	61.011	150.012	5.994	10.795	5.080	65039
SDS 150x61x6.6-177	61.011	150.012	6.553	11.811	4.826	80567
SDS 125x64x4.75-177	64.008	124.993	4.699	8.509	3.734	36385
SDS 125x64x5-177	64.008	124.993	5.004	8.509	3.581	42309
SDS 125x64x5.6-177	64.008	124.993	5.588	9.601	3.353	54955
SDS 125x64x6-177	64.008	124.993	5.994	9.601	3.200	64741
SDS 125x64x6.5-177	64.008	124.993	6.553	10.008	2.997	79508
SDS 125x64x7.5-177	64.008	124.993	7.493	10.592	2.718	107726
SDS 125x71x5.6-177	70.993	124.993	5.588	9.296	3.023	53376
SDS 125x71x6-177	70.993	124.993	5.994	9.296	2.870	62801
SDS 125x71x7.4-177	70.993	124.993	7.442	10.897	2.438	102518
SDS 125x71x9.3-177	70.993	124.993	9.296	11.811	2.057	167134
SDS 150x71x5.6-177	70.993	150.012	5.588	10.795	4.775	52380
SDS 150x71x6-177	70.993	150.012	5.994	10.795	4.597	62058
SDS 150x71x7.5-177	70.993	150.012	7.493	11.989	3.988	105066
SDS 140x72x3.8-177	72.009	140.005	3.810	8.712	4.928	20496
SDS 140x72x4.7-177	72.009	140.005	4.699	8.992	4.420	34592
SDS 140x72x5-177	72.009	140.005	5.004	8.992	4.267	40339
SDS 140x72x7.5-177	72.009	140.005	7.493	11.201	3.302	104417
SDS 140x72x8-177	72.009	140.005	8.001	11.278	3.277	121875
SDS 150x81x8-177	81.001	150.012	8.001	11.709	3.378	117116
SDS 150x81x9.4-177	81.001	150.012	9.398	13.005	2.997	168166
SDS 160x82x4.15-177	81.991	159.995	4.140	9.906	5.766	23566
SDS 160x82x4.3-177	81.991	159.995	4.293	9.906	5.690	25838
SDS 160x82x5.6-177	81.991	159.995	5.588	10.490	4.978	49849
SDS 160x82x6-177	81.991	159.995	5.994	10.490	4.775	59114
SDS 160x82x9.4-177	81.991	159.995	9.398	13.487	3.531	168570
SDS 160x82x10.4-177	81.991	159.995	10.363	14.503	3.277	209737
SDS 200x82x7.5-177	81.991	200.000	7.493	14.199	6.985	98585
SDS 200x82x8.1-177	81.991	200.000	8.103	14.503	6.680	119206
SDS 200x82x9.4-177	81.991	200.000	9.398	15.494	6.096	169785
SDS 200x82x11.3-177	81.991	200.000	11.252	16.612	5.410	257980

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 200x82x12.1-177	81.991	200.000	12.090	16.510	5.131	303856
SDS 180x92x4.6-177	91.999	180.010	4.597	10.998	6.553	28863
SDS 180x92x4.8-177	91.999	180.010	4.801	10.998	6.426	32230
SDS 180x92x5.6-177	91.999	180.010	5.588	11.100	5.969	47224
SDS 180x92x6-177	91.999	180.010	5.994	11.100	5.740	56183
SDS 180x92x9.4-177	91.999	180.010	9.398	13.995	4.343	163428
SDS 180x92x10-177	91.999	180.010	10.008	14.173	4.166	188226
SDS 180x92x12.1-177	91.999	180.010	12.090	16.510	3.581	287972
SDS 200x92x9.4-177	91.999	200.000	9.398	15.596	5.639	163468
SDS 200x92x11.3-177	91.999	200.000	11.252	16.789	5.004	247834
SDS 200x92x13.1-177	91.999	200.000	13.056	18.110	4.470	346481
SDS 200x102x5.3-177	102.006	200.000	5.309	12.497	7.163	39329
SDS 200x102x5.5-177	102.006	200.000	5.512	12.497	7.036	43261
SDS 200x102x7.5-177	102.006	200.000	7.493	13.589	5.994	92483
SDS 200x102x7.8-177	102.006	200.000	7.798	14.300	5.842	101797
SDS 200x102x8.6-177	102.006	200.000	8.611	14.605	5.512	128907
SDS 200x102x9.4-177	102.006	200.000	9.398	15.596	5.207	158278
SDS 200x102x10.3-177	102.006	200.000	10.312	15.011	4.877	196183
SDS 200x102x11.3-177	102.006	200.000	11.252	16.205	4.572	239356
SDS 200x102x13.1-177	102.006	200.000	13.056	18.212	4.089	333996
SDS 200x102x14-177	102.006	200.000	13.995	17.704	3.708	349168
SDS 250x102x9.4-177	102.006	250.012	9.398	18.009	8.738	155547
SDS 250x102x11.3-177	102.006	250.012	11.252	18.999	7.874	239974
SDS 200x112x5.8-177	111.989	200.000	5.791	11.989	6.325	48087
SDS 200x112x11.3-177	111.989	200.000	11.252	16.205	4.166	232243
SDS 200x112x13.1-177	111.989	200.000	13.056	17.501	3.708	323378
SDS 200x112x14-177	111.989	200.000	13.995	18.009	3.505	376666
SDS 200x112x14.8-177	111.989	200.000	14.808	18.796	3.353	425923
SDS 225x112x6.2-177	111.989	224.993	6.198	13.589	8.077	54982
SDS 225x112x7.5-177	111.989	224.993	7.493	14.503	7.341	88373
SDS 225x112x11.3-177	111.989	224.993	11.252	16.993	5.715	233218
SDS 225x112x14.9-177	111.989	224.993	14.910	20.498	4.648	440806
SDS 250x127x6.7-177	127.000	250.012	6.706	14.808	8.941	63162
SDS 250x127x7.5-177	127.000	250.012	7.493	16.002	8.484	83569
SDS 250x127x9.4-177	127.000	250.012	9.398	16.993	7.493	145841
SDS 250x127x9.9-177	127.000	250.012	9.906	18.009	7.264	165523
SDS 250x127x10.3-177	127.000	250.012	10.312	18.796	7.087	182195
SDS 250x127x11.3-177	127.000	250.012	11.252	19.304	6.706	223881
SDS 250x127x12.2-177	127.000	250.012	12.192	19.609	6.350	269918
SDS 250x127x12.6-177	127.000	250.012	12.598	19.609	6.223	291166
SDS 250x127x13.6-177	127.000	250.012	13.589	19.990	5.893	346299
SDS 250x127x14-177	127.000	250.012	13.995	19.177	5.182	370563
SDS 250x127x14.9-177	127.000	250.012	14.910	21.793	5.512	427155
SDS 250x127x15.6-177	127.000	250.012	15.646	21.996	5.309	475856

SOLON DISC SPRINGS
DIN 2093

301 STAINLESS STEEL

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 15x7.2x1.25-301	7.188	15.189	1.270	1.930	0.203	2424
SDS 15x8.2x0.8-301	8.204	15.011	0.787	1.092	0.305	918
SDS 16x8.2x0.6-301	8.204	16.002	0.610	1.041	0.457	488
SDS 16x8.2x0.8-301	8.204	16.002	0.787	1.092	0.305	771
SDS 18x8.2x0.8-301	8.204	18.009	0.787	1.245	0.457	859
SDS 20x8.2x0.8-301	8.204	19.990	0.787	1.397	0.610	849
SDS 23x8.2x0.8-301	8.204	23.012	0.787	1.549	0.762	818
SDS 20x10.2x0.8-301	10.211	19.990	0.787	1.346	0.559	903
SDS 28x10.2x0.8-301	10.211	27.991	0.787	1.753	0.940	702
SDS 22.5x11.2x0.8-301	11.201	22.504	0.787	1.448	0.660	830
SDS 28x14.2x0.8-301	14.199	27.991	0.787	1.803	0.991	834
SDS 28x14.2x1-301	14.199	27.991	0.991	1.651	0.660	1303
SDS 31.5x16.3x0.8-301	16.307	31.496	0.787	1.854	1.041	701
SDS 31.5x16.3x1.75-301	16.307	31.496	1.753	2.286	0.533	3981
SDS 34x16.3x2-301	16.307	34.011	2.007	2.667	0.660	7055
SDS 40x16.3x2-301	16.307	40.005	2.007	2.896	0.889	5516
SDS 35.5x18.3x1.25-301	18.288	35.509	1.245	2.159	0.914	1799
SDS 40x20.4x2.5-301	20.396	40.005	2.489	3.124	0.635	9786
SDS 50x25.4x2-301	25.400	50.013	2.057	3.150	1.092	5871
SDS 71x36x2-301	35.992	70.993	2.108	4.597	1.880	4559

SOLON DISC SPRINGS
DIN 2093

AISI 6150 ALLOY STEEL

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 80x41x4	40.996	80.010	3.988	6.198	2.210	29121
SDS 125x51x3.8	51.003	124.993	3.810	8.509	4.496	22058

SOLON DISC SPRINGS
DIN 2093

50 CRV 4 (AISI 6150 EQUIVALENT)

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 6x2.7x0.5	2.692	5.994	0.508	0.711	0.203	934
SDS 6x3.2x0.3	3.200	5.994	0.305	0.457	0.152	153
SDS 8x3.2x0.2	3.200	8.001	0.203	0.406	0.203	30
SDS 8x3.2x0.3	3.200	8.001	0.305	0.559	0.254	126
SDS 8x3.2x0.4	3.200	8.001	0.406	0.610	0.203	238
SDS 8x3.2x0.5	3.200	8.001	0.508	0.711	0.203	342
SDS 10x3.2x0.3	3.200	10.008	0.305	0.660	0.356	108
SDS 10x3.2x0.4	3.200	10.008	0.406	0.711	0.305	220
SDS 10x3.2x0.5	3.200	10.008	0.508	0.762	0.254	357
SDS 8x4.2x0.2	4.191	8.001	0.203	0.457	0.254	42
SDS 8x4.2x0.3	4.191	8.001	0.305	0.559	0.254	142
SDS 8x4.2x0.4	4.191	8.001	0.406	0.610	0.203	269
SDS 10x4.2x0.4	4.191	10.008	0.406	0.711	0.305	232
SDS 10x4.2x0.5	4.191	10.008	0.508	0.762	0.254	377
SDS 10x4.2x0.6	4.191	10.008	0.610	0.838	0.254	652
SDS 12x4.2x0.4	4.191	11.989	0.406	0.787	0.406	206
SDS 12x4.2x0.5	4.191	11.989	0.508	0.838	0.356	352
SDS 12x4.2x0.6	4.191	11.989	0.610	0.991	0.406	694
SDS 10x5.2x0.25	5.207	10.008	0.254	0.559	0.305	63
SDS 10x5.2x0.4	5.207	10.008	0.406	0.711	0.305	257
SDS 12x5.2x0.5	5.207	11.989	0.508	0.889	0.406	424
SDS 12x5.2x0.6	5.207	11.989	0.610	0.940	0.356	641
SDS 12.5x5.2x0.5	5.207	12.497	0.508	0.838	0.356	337
SDS 15x5.2x0.4	5.207	15.011	0.406	0.940	0.559	181
SDS 15x5.2x0.5	5.207	15.011	0.508	0.991	0.508	321
SDS 15x5.2x0.6	5.207	15.011	0.610	1.041	0.457	499
SDS 15x5.2x0.7	5.207	15.011	0.711	1.092	0.406	704
SDS 12x6.2x0.5	6.198	11.989	0.508	0.838	0.356	404
SDS 12x6.2x0.6	6.198	11.989	0.610	0.940	0.356	699
SDS 12.5x6.2x0.35	6.198	12.497	0.356	0.787	0.457	160
SDS 12.5x6.2x0.5	6.198	12.497	0.508	0.838	0.356	363
SDS 12.5x6.2x0.7	6.198	12.497	0.711	0.991	0.305	855
SDS 15x6.2x0.5	6.198	15.011	0.508	0.991	0.508	334
SDS 15x6.2x0.6	6.198	15.011	0.610	1.041	0.457	519
SDS 15x6.2x0.7	6.198	15.011	0.711	1.092	0.406	733
SDS 18x6.2x0.4	6.198	18.009	0.406	0.991	0.610	137

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 18x6.2x0.5	6.198	18.009	0.508	1.092	0.610	267
SDS 18x6.2x0.7	6.198	18.009	0.711	1.397	0.686	854
SDS 18x6.2x0.8	6.198	18.009	0.787	1.499	0.711	912
SDS 14x7.2x0.35	7.188	13.995	0.356	0.787	0.457	131
SDS 14x7.2x0.5	7.188	13.995	0.508	0.889	0.406	338
SDS 14x7.2x0.8	7.188	13.995	0.787	1.092	0.305	1040
SDS 15x8.2x0.7	8.204	15.011	0.711	1.092	0.406	844
SDS 15x8.2x0.8	8.204	15.011	0.787	1.194	0.406	1261
SDS 16x8.2x0.4	8.204	16.002	0.406	0.889	0.508	165
SDS 16x8.2x0.6	8.204	16.002	0.610	1.041	0.457	503
SDS 16x8.2x0.7	8.204	16.002	0.711	1.143	0.457	798
SDS 16x8.2x0.8	8.204	16.002	0.787	1.194	0.406	1059
SDS 16x8.2x0.9	8.204	16.002	0.889	1.245	0.356	1319
SDS 18x8.2x0.5	8.204	18.009	0.508	1.092	0.610	288
SDS 18x8.2x0.7	8.204	18.009	0.711	1.245	0.559	725
SDS 18x8.2x0.8	8.204	18.009	0.787	1.295	0.508	984
SDS 18x8.2x1	8.204	18.009	0.991	1.499	0.508	1922
SDS 20x8.2x0.5	8.204	19.990	0.508	1.168	0.660	289
SDS 20x8.2x0.6	8.204	19.990	0.610	1.295	0.711	453
SDS 20x8.2x0.7	8.204	19.990	0.711	1.346	0.660	688
SDS 20x8.2x0.8	8.204	19.990	0.787	1.397	0.610	921
SDS 20x8.2x0.9	8.204	19.990	0.889	1.448	0.559	1201
SDS 20x8.2x1	8.204	19.990	0.991	1.549	0.559	1648
SDS 23x8.2x0.7	8.204	23.012	0.711	1.499	0.787	602
SDS 23x8.2x0.8	8.204	23.012	0.787	1.549	0.762	842
SDS 23x8.2x0.9	8.204	23.012	0.889	1.702	0.813	1277
SDS 23x8.2x1	8.204	23.012	0.991	1.702	0.711	1536
SDS 18x9.2x0.45	9.195	18.009	0.457	1.041	0.610	233
SDS 18x9.2x0.7	9.195	18.009	0.711	1.194	0.508	699
SDS 18x9.2x1	9.195	18.009	0.991	1.397	0.406	1631
SDS 20x10.2x0.4	10.211	19.990	0.406	0.889	0.483	104
SDS 20x10.2x0.5	10.211	19.990	0.508	1.143	0.660	268
SDS 20x10.2x0.8	10.211	19.990	0.787	1.346	0.559	929
SDS 20x10.2x0.9	10.211	19.990	0.889	1.448	0.559	1323
SDS 20x10.2x1	10.211	19.990	0.991	1.549	0.559	1815
SDS 20x10.2x1.1	10.211	19.990	1.092	1.549	0.457	1976
SDS 20x10.2x1.5	10.211	19.990	1.499	1.803	0.305	3340
SDS 23x10.2x0.9	10.211	23.012	0.889	1.651	0.762	1273
SDS 23x10.2x1	10.211	23.012	0.991	1.702	0.711	1629
SDS 23x10.2x1.25	10.211	23.012	1.245	1.905	0.660	2955
SDS 25x10.2x1	10.211	24.994	0.991	1.753	0.762	1436
SDS 28x10.2x0.8	10.211	27.991	0.787	1.753	0.940	723
SDS 28x10.2x1	10.211	27.991	0.991	1.905	0.889	1337
SDS 28x10.2x1.25	10.211	27.991	1.245	2.057	0.787	2322
SDS 28x10.2x1.5	10.211	27.991	1.499	2.210	0.711	3511

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 22.5x11.2x0.6	11.201	22.504	0.610	1.397	0.787	444
SDS 22.5x11.2x0.8	11.201	22.504	0.787	1.448	0.660	855
SDS 22.5x11.2x1.25	11.201	22.504	1.245	1.753	0.508	2509
SDS 25x12.2x0.7	12.192	24.994	0.711	1.600	0.889	635
SDS 25x12.2x0.9	12.192	24.994	0.889	1.600	0.711	1050
SDS 25x12.2x1.5	12.192	24.994	1.499	2.057	0.559	3821
SDS 28x12.2x1	12.192	27.991	0.991	1.956	0.940	1482
SDS 28x12.2x1.25	12.192	27.991	1.245	2.108	0.838	2590
SDS 28x12.2x1.5	12.192	27.991	1.499	2.261	0.762	3949
SDS 31.5x12.2x1	12.192	31.496	0.991	2.108	1.092	1309
SDS 31.5x12.2x1.5	12.192	31.496	1.499	2.362	0.838	3413
SDS 34x12.3x1	12.294	34.011	0.991	2.210	1.245	1258
SDS 34x12.3x1.25	12.294	34.011	1.245	2.362	1.092	2162
SDS 34x12.3x1.5	12.294	34.011	1.499	2.692	1.194	3397
SDS 28x14.2x0.8	14.199	27.991	0.787	1.803	0.991	859
SDS 28x14.2x1	14.199	27.991	0.991	1.803	0.787	1342
SDS 28x14.2x1.5	14.199	27.991	1.499	2.159	0.660	3680
SDS 34x14.3x1.25	14.300	34.011	1.245	2.388	1.143	2347
SDS 34x14.3x1.5	14.300	34.011	1.499	2.540	1.041	3704
SDS 40x14.3x1.25	14.300	40.005	1.245	2.642	1.397	1984
SDS 40x14.3x1.5	14.300	40.005	1.499	2.743	1.245	3061
SDS 40x14.3x1.75	14.300	40.005	1.753	3.048	1.295	5053
SDS 40x14.3x2	14.300	40.005	2.007	3.048	1.041	6096
SDS 31.5x16.3x0.8	16.307	31.496	0.787	1.854	1.041	722
SDS 31.5x16.3x1.5	16.307	31.496	1.499	2.388	0.889	4077
SDS 31.5x16.3x1.75	16.307	31.496	1.753	2.438	0.711	5036
SDS 31.5x16.3x2	16.307	31.496	2.007	2.743	0.762	8054
SDS 34x16.3x1.5	16.307	34.011	1.499	2.540	1.041	3908
SDS 34x16.3x2	16.307	34.011	2.007	2.845	0.838	7498
SDS 40x16.3x1.75	16.307	40.005	1.753	3.099	1.346	5409
SDS 48x16.3x1.5	16.307	48.006	1.499	2.997	1.499	2531
SDS 35.5x18.3x0.9	18.288	35.509	0.889	2.057	1.143	844
SDS 35.5x18.3x1.25	18.288	35.509	1.245	2.261	0.991	2059
SDS 50x18.4x1.25	18.390	50.013	1.245	2.845	1.600	1459
SDS 50x18.4x1.5	18.390	50.013	1.499	3.302	1.803	2837
SDS 50x18.4x2	18.390	50.013	2.007	3.658	1.651	6160
SDS 50x18.4x2.5	18.390	50.013	2.489	4.089	1.600	11672
SDS 50x18.4x3	18.390	50.013	2.997	4.394	1.397	17649
SDS 40x20.4x1	20.396	40.005	0.991	2.311	1.295	1072
SDS 40x20.4x2.25	20.396	40.005	2.261	3.150	0.889	8456
SDS 40x20.4x2.5	20.396	40.005	2.489	3.454	0.940	12242
SDS 50x20.4x2	20.396	50.013	2.007	3.505	1.499	5745
SDS 50x20.4x2.5	20.396	50.013	2.489	3.861	1.346	10097
SDS 60x20.5x2	20.498	59.995	2.007	4.191	2.210	5380
SDS 60x20.5x2.5	20.498	59.995	2.489	4.699	2.210	11004

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 60x20.5x3	20.498	59.995	2.997	5.258	2.184	19021
SDS 45x22.4x1.25	22.403	45.009	1.245	2.845	1.600	2007
SDS 45x22.4x1.75	22.403	45.009	1.753	3.048	1.295	4475
SDS 45x22.4x2.5	22.403	45.009	2.489	3.505	0.991	10037
SDS 50x22.4x2	22.403	50.013	2.007	3.607	1.600	6329
SDS 50x22.4x2.5	22.403	50.013	2.489	3.912	1.397	10816
SDS 70x24.5x3	24.511	70.002	2.997	5.283	2.286	14661
SDS 50x25.4x1.25	25.400	50.013	1.245	2.845	1.600	1646
SDS 50x25.4x1.5	25.400	50.013	1.499	3.099	1.600	2844
SDS 50x25.4x2	25.400	50.013	2.007	3.404	1.397	5898
SDS 50x25.4x2.25	25.400	50.013	2.261	3.759	1.499	8998
SDS 50x25.4x2.5	25.400	50.013	2.489	3.912	1.397	11518
SDS 60x25.5x2.5	25.502	59.995	2.489	4.394	1.905	9997
SDS 60x25.5x3	25.502	59.995	2.997	4.648	1.651	15001
SDS 70x25.5x2	25.502	70.002	2.007	4.496	2.489	4755
SDS 56x28.5x1.5	28.499	56.007	1.499	3.454	1.956	2766
SDS 56x28.5x2	28.499	56.007	2.007	3.607	1.600	5379
SDS 56x28.5x2.5	28.499	56.007	2.489	4.191	1.702	11164
SDS 56x28.5x3	28.499	56.007	2.997	4.293	1.295	14751
SDS 60x30.5x2.5	30.505	59.995	2.489	4.496	2.007	10288
SDS 60x30.5x2.75	30.505	59.995	2.743	4.750	2.007	15217
SDS 60x30.5x3	30.505	59.995	2.997	4.699	1.702	16791
SDS 60x30.5x3.5	30.505	59.995	3.505	5.004	1.499	23527
SDS 70x30.5x2.5	30.505	70.002	2.489	4.902	2.388	9360
SDS 70x30.5x3	30.505	70.002	2.997	5.105	2.108	14151
SDS 80x30.5x2.5	30.505	80.010	2.489	5.309	2.794	8038
SDS 63x31x1.8	30.988	62.992	1.803	4.140	2.362	4463
SDS 63x31x2.5	30.988	62.992	2.489	4.242	1.753	8904
SDS 63x31x3	30.988	62.992	2.997	4.801	1.803	15824
SDS 63x31x3.5	30.988	62.992	3.505	4.902	1.397	19544
SDS 80x31x2.5	30.988	80.010	2.489	5.309	2.794	8070
SDS 80x31x3	30.988	80.010	2.997	5.512	2.489	12450
SDS 80x31x3.75	30.988	80.010	3.759	6.096	2.108	24789
SDS 80x31x4	30.988	80.010	3.988	6.096	2.108	24790
SDS 70x35.5x3	35.509	70.002	2.997	5.105	2.108	15217
SDS 70x35.5x3.5	35.509	70.002	3.505	5.309	1.803	20714
SDS 70x35.5x3.75	35.509	70.002	3.759	5.791	1.803	30918
SDS 70x35.5x4	35.509	70.002	3.988	5.791	1.803	30917
SDS 80x35.5x3.75	35.509	80.010	3.759	6.198	2.210	28561
SDS 80x35.5x4	35.509	80.010	3.988	6.198	2.210	27088
SDS 71x36x2	35.992	70.993	2.007	4.597	2.591	5426
SDS 71x36x2.5	35.992	70.993	2.489	4.496	2.007	8152
SDS 71x36x3.75	35.992	70.993	3.759	5.588	1.600	26710
SDS 71x36x4	35.992	70.993	3.988	5.588	1.600	26711
SDS 80x36x3	35.992	80.010	2.997	5.690	2.692	14105

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 80x36x4	35.992	80.010	3.988	6.198	2.210	27244
SDS 70x40.5x3.75	40.488	70.002	3.759	5.588	1.829	30375
SDS 70x40.5x4	40.488	70.002	3.988	5.588	1.600	30374
SDS 70x40.5x4.7	40.488	70.002	4.699	6.198	1.194	44493
SDS 70x40.5x5	40.488	70.002	5.004	6.401	1.397	51908
SDS 80x41x2.25	40.996	80.010	2.261	5.207	2.946	6950
SDS 80x41x3	40.996	80.010	2.997	5.309	2.311	12843
SDS 80x41x3.75	40.996	80.010	3.759	6.198	2.210	29121
SDS 80x41x4.7	40.996	80.010	4.699	6.706	1.702	43951
SDS 80x41x5	40.996	80.010	5.004	6.706	1.702	43950
SDS 100x41x3.8	40.996	100.000	3.810	7.188	3.200	24544
SDS 100x41x4	40.996	100.000	3.988	7.188	3.200	24546
SDS 100x41x4.75	40.996	100.000	4.699	7.747	2.743	41197
SDS 100x41x5	40.996	100.000	5.004	7.747	2.743	41199
SDS 125x41x4	40.996	124.993	3.988	8.204	4.191	19728
SDS 90x46x2.5	45.999	89.992	2.489	5.690	3.200	8157
SDS 90x46x3.5	45.999	89.992	3.505	5.994	2.489	17486
SDS 90x46x4.7	45.999	89.992	4.699	7.010	2.007	40784
SDS 90x46x5	45.999	89.992	5.004	7.010	2.007	40784
SDS 100x51x2.7	51.003	100.000	2.692	6.198	3.505	9091
SDS 100x51x3.5	51.003	100.000	3.505	6.299	2.794	15842
SDS 100x51x3.8	51.003	100.000	3.810	7.010	2.997	25336
SDS 100x51x4	51.003	100.000	3.988	7.010	2.997	25337
SDS 100x51x4.75	51.003	100.000	4.699	7.798	2.794	46188
SDS 100x51x5	51.003	100.000	5.004	7.798	2.794	46187
SDS 100x51x5.6	51.003	100.000	5.588	8.204	2.616	71150
SDS 100x51x6.5	51.003	100.000	6.553	9.195	2.642	71150
SDS 125x51x4	51.003	124.993	3.988	8.509	4.496	22059
SDS 125x51x4.75	51.003	124.993	4.750	8.890	3.912	37341
SDS 125x51x5	51.003	124.993	5.004	8.890	3.912	37340
SDS 125x51x5.6	51.003	124.993	5.639	9.398	3.404	56249
SDS 125x51x6	51.003	124.993	5.994	9.398	3.404	56251
SDS 112x57x3	56.998	111.989	2.997	6.909	3.912	11063
SDS 112x57x3.75	56.998	111.989	3.912	7.188	3.200	21515
SDS 112x57x4	56.998	111.989	3.988	7.188	3.200	21517
SDS 112x57x5.6	56.998	111.989	5.588	8.509	2.489	56734
SDS 112x57x6	56.998	111.989	5.994	8.509	2.489	56734
SDS 125x61x4.75	61.011	124.993	4.750	8.992	3.988	41166
SDS 125x61x5	61.011	124.993	5.004	8.992	3.988	41168
SDS 125x61x5.6	61.011	124.993	5.588	9.601	3.607	64025
SDS 125x61x6	61.011	124.993	5.994	9.601	3.607	64025
SDS 125x61x7.5	61.011	124.993	7.493	10.897	2.896	120212
SDS 150x61x4.75	61.011	150.012	4.750	10.312	5.309	35206
SDS 150x61x5	61.011	150.012	5.004	10.312	5.309	35205
SDS 150x61x5.7	61.011	150.012	5.690	10.795	4.801	55097

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 150x61x6	61.011	150.012	5.994	10.795	4.801	55095
SDS 150x61x6.6	61.011	150.012	6.553	11.811	4.801	89245
SDS 125x64x3.5	64.008	124.993	3.505	8.001	4.496	16334
SDS 125x64x4.75	64.008	124.993	4.699	8.509	3.505	37038
SDS 125x64x5	64.008	124.993	5.004	8.509	3.505	37039
SDS 125x64x5.6	64.008	124.993	5.588	9.601	3.607	68575
SDS 125x64x6	64.008	124.993	5.994	9.601	3.607	65830
SDS 125x64x6.5	64.008	124.993	6.553	10.008	2.997	95788
SDS 125x64x7.5	64.008	124.993	7.493	10.592	3.099	111051
SDS 125x71x5.6	70.993	124.993	5.588	9.296	3.302	65203
SDS 125x71x6	70.993	124.993	5.994	9.296	3.302	65204
SDS 125x71x7.4	70.993	124.993	7.442	10.897	3.454	154924
SDS 125x71x9.3	70.993	124.993	9.296	11.811	2.515	163027
SDS 150x71x5.6	70.993	150.012	5.588	10.795	4.801	58367
SDS 150x71x6	70.993	150.012	5.994	10.795	4.801	58367
SDS 150x71x7.5	70.993	150.012	7.493	11.989	4.496	112481
SDS 140x72x3.8	72.009	140.005	3.810	8.712	4.902	18198
SDS 140x72x4.7	72.009	140.005	4.699	8.992	3.988	33840
SDS 140x72x5	72.009	140.005	5.004	8.992	3.988	33841
SDS 140x72x7.5	72.009	140.005	7.493	11.201	3.708	108808
SDS 150x81x7.5	81.001	150.012	7.493	11.989	4.496	112936
SDS 150x81x9.4	81.001	150.012	9.398	13.411	4.013	236007
SDS 160x82x4.15	81.991	159.995	4.140	9.906	5.588	23023
SDS 160x82x4.3	81.991	159.995	4.293	9.906	5.588	23021
SDS 160x82x5.6	81.991	159.995	5.588	10.490	4.496	50258
SDS 160x82x6	81.991	159.995	5.994	10.490	4.496	50258
SDS 160x82x9.4	81.991	159.995	9.398	13.487	4.089	178205
SDS 160x82x10.2	81.991	159.995	10.211	14.503	4.293	284143
SDS 200x82x7.5	81.991	200.000	7.493	14.199	6.680	92171
SDS 200x82x9.4	81.991	200.000	9.398	15.494	6.096	162053
SDS 200x82x11.3	81.991	200.000	11.252	16.612	4.597	235491
SDS 200x82x12.1	81.991	200.000	12.090	16.510	3.505	280286
SDS 180x92x4.6	91.999	180.010	4.597	10.998	6.198	27965
SDS 180x92x4.8	91.999	180.010	4.801	10.998	6.198	27965
SDS 180x92x5.6	91.999	180.010	5.588	11.100	5.105	44929
SDS 180x92x6	91.999	180.010	5.994	11.100	5.105	44928
SDS 180x92x9.4	91.999	180.010	9.398	13.995	3.988	160225
SDS 180x92x12.1	91.999	180.010	12.090	16.510	3.505	381572
SDS 200x92x9.4	91.999	200.000	9.398	15.596	5.588	171206
SDS 200x92x11.3	91.999	200.000	11.252	16.789	4.801	255430
SDS 200x92x13.1	91.999	200.000	13.056	18.110	4.089	346871
SDS 200x102x5.3	102.006	200.000	5.309	12.497	7.010	38422
SDS 200x102x5.5	102.006	200.000	5.512	12.497	7.010	38421
SDS 200x102x7.5	102.006	200.000	7.493	13.589	5.588	91247
SDS 200x102x7.8	102.006	200.000	7.798	14.300	5.994	114594

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 200x102x8.6	102.006	200.000	8.611	14.605	5.613	138595
SDS 200x102x9.4	102.006	200.000	9.398	15.596	6.198	179849
SDS 200x102x10.3	102.006	200.000	10.312	15.011	4.013	198692
SDS 200x102x11.3	102.006	200.000	11.252	16.205	4.953	235598
SDS 200x102x13.1	102.006	200.000	13.056	18.212	4.191	374974
SDS 250x102x9.4	102.006	250.012	9.398	18.009	8.001	149316
SDS 250x102x11.3	102.006	250.012	11.252	18.999	7.010	227306
SDS 200x112x5.8	111.989	200.000	5.791	11.989	5.994	45098
SDS 200x112x11.3	111.989	200.000	11.252	16.205	4.191	251096
SDS 200x112x13.1	111.989	200.000	13.056	17.501	3.505	334210
SDS 200x112x14	111.989	200.000	13.995	18.009	2.997	465176
SDS 200x112x14.8	111.989	200.000	14.808	19.812	5.004	699337
SDS 225x112x6.2	111.989	224.993	6.198	13.589	7.112	48145
SDS 225x112x7.5	111.989	224.993	7.493	14.503	7.010	81998
SDS 225x112x11.3	111.989	224.993	11.252	16.993	5.740	217614
SDS 225x112x14.9	111.989	224.993	14.910	20.498	4.496	572182
SDS 250x127x6.7	127.000	250.012	6.706	14.808	7.798	54281
SDS 250x127x7.5	127.000	250.012	7.493	16.002	8.001	83449
SDS 250x127x9.4	127.000	250.012	9.398	16.993	7.010	142455
SDS 250x127x9.9	127.000	250.012	9.906	18.009	7.493	185490
SDS 250x127x10.3	127.000	250.012	10.312	18.796	7.798	221991
SDS 250x127x11.3	127.000	250.012	11.252	19.304	8.052	257617
SDS 250x127x12.2	127.000	250.012	12.192	19.609	6.604	325785
SDS 250x127x12.6	127.000	250.012	12.598	19.609	6.096	345285
SDS 250x127x13.1	127.000	250.012	13.106	19.609	6.502	317383
SDS 250x127x13.6	127.000	250.012	13.589	19.990	5.512	395578
SDS 250x127x14.9	127.000	250.012	14.910	21.793	5.791	492034
SDS 250x127x15.6	127.000	250.012	15.646	21.996	5.207	611569

SOLON DISC SPRINGS
DIN 2093

INCONEL 718

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 12.5x6.2x0.7-718	6.198	12.497	0.737	0.991	0.254	934
SDS 18x6.2x0.5-718	6.198	18.009	0.508	1.194	0.686	431
SDS 16x8.2x0.9-718	8.204	16.002	0.889	1.219	0.330	1237
SDS 18x8.2x0.5-718	8.204	18.009	0.508	1.143	0.635	365
SDS 20x10.2x1-718	10.211	19.990	1.016	1.549	0.483	1695
SDS 20x10.2x1.25-718	10.211	19.990	1.270	1.676	0.406	2989
SDS 20x10.2x1.5-718	10.211	19.990	1.549	1.854	0.330	4092
SDS 25x10.2x1-718	10.211	24.994	1.016	1.803	0.787	1601
SDS 23x12.2x1-718	12.192	23.012	0.991	1.549	0.559	1561
SDS 23x12.2x1.5-718	12.192	23.012	1.524	1.956	0.432	4515
SDS 25x12.2x1.5-718	12.192	24.994	1.499	2.007	0.508	5960
SDS 28x14.2x1.25-718	14.199	27.991	1.270	1.956	0.686	2424
SDS 40X14.3X2-718	14.300	40.005	2.007	3.048	1.016	6716
SDS 31.5x16.3x0.8-718	16.307	31.496	0.787	1.803	1.016	770
SDS 31.5x16.3x1.25-718	16.307	31.496	1.270	2.159	0.838	2602
SDS 31.5x16.3x1.5-718	16.307	31.496	1.524	2.235	0.711	4021
SDS 31.5x16.3x1.75-718	16.307	31.496	1.753	2.388	0.635	4902
SDS 31.5x16.3x2-718	16.307	31.496	2.007	2.743	0.610	6605
SDS 34x16.3x2-718	16.307	34.011	2.007	2.743	0.737	6654
SDS 35.5x18.3x1.25-718	18.288	35.509	1.270	2.286	1.016	2260
SDS 35.5x18.3x2-718	18.288	35.509	2.007	2.743	0.737	6565
SDS 40x20.4x1.5-718	20.396	40.005	1.499	2.642	1.092	3194
SDS 40x20.4x2-718	20.396	40.005	2.007	2.896	0.889	9786
SDS 40x20.4x2.25-718	20.396	40.005	2.311	3.150	0.838	8509
SDS 40x20.4x2.5-718	20.396	40.005	2.489	3.327	0.813	10849
SDS 45x22.4x1.25-718	22.403	45.009	1.270	2.743	1.473	2015
SDS 45x22.4x1.75-718	22.403	45.009	1.753	3.048	1.295	4457
SDS 45x22.4x2.5-718	22.403	45.009	2.540	3.505	0.965	10497
SDS 50x25.4x1.5-718	25.400	50.013	1.549	3.048	1.524	2913
SDS 50X25.4X3-718	25.400	50.013	2.997	4.013	1.016	14883
SDS 60x25.5x2.5-718	25.502	59.995	2.489	4.394	1.930	11205
SDS 56x28.5x1.5-718	28.499	56.007	1.499	2.921	1.422	2891
SDS 56x28.5x2.5-718	28.499	56.007	2.540	3.886	1.346	9883
SDS 56x28.5x3-718	28.499	56.007	2.997	4.293	1.295	14363
SDS 60x30.5x3.5-718	30.505	59.995	3.505	4.724	1.219	20332
SDS 63x31x2.5-718	30.988	62.992	2.540	4.242	1.702	8674

Part Number	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
SDS 70x35.5x3-718	35.509	70.002	2.997	5.486	1.803	13344
SDS 70x35.5x4-718	35.509	70.002	4.064	5.486	1.422	31563
SDS 80x36x4-718	35.992	80.010	4.039	6.020	1.981	24197
SDS 70x40.5x4-718	40.488	70.002	4.039	5.283	1.245	23308
SDS 80x41x2.25-718	40.996	80.010	2.261	4.826	2.565	6334
SDS 80x41x3-718	40.996	80.010	2.997	5.309	2.311	12775
SDS 90x46x2.5-718	45.999	89.992	2.489	5.537	3.048	7691
SDS 100x51x4-718	51.003	100.000	3.988	6.731	2.743	23219
SDS 100x51x5-718	51.003	100.000	5.080	7.315	2.235	38253
SDS 125x51x5-718	51.003	124.993	5.004	8.890	4.216	45303
SDS 125x64x4-718	64.008	124.993	3.937	7.493	3.556	21110
SDS 140x72x5-718	72.009	140.005	5.004	8.992	3.988	32430

SOLON FLANGE WASHERS





FLANGE WASHER

Solon® Flange Washers help create a more reliable flange assembly by maintaining residual gasket/bolt load and evening load distribution. Typical flange washer materials are H-13 Tool Steel, 17-7 PH Stainless Steel, Inconel 718, 17-4, Waspaloy, Custom 450, etc.

SOLON FLANGE WASHERS (Industry Specific to Petrochemical /Oil & Gas)



Certain industries that utilize piping flange joint assemblies, such as petrochemical, dictate a low tolerance for fugitive emissions. Flange live loading, which is a process imperative to controlling gasket leaks in piping and refining operations, depends on the mission-critical performance. It is estimated that up to 92% of all flange leaks are caused by insufficient or loss of bolt preload. Solon Flange Washers are designed to maintain sufficient bolt tension and resultant gasket stresses in high temperature and high pressure applications where safety and emission containment take priority.

Solon Flange Washers are simply Belleville springs that are designed to be used in flange applications. The springs are engineered to fit into flange designs and the loads are typically higher than standard Belleville washers.

Solon Flange Washers withstand extreme temperatures as well as corrosive environments. Whether you have a custom material specification or unique application challenges, Solon's full-service design engineering and production teams can help you with your requirements.

FEATURES & BENEFITS OF THE SOLON FLANGE WASHERS:

- Once installed, they don't have to be retorqued
- Eliminate the effects of differential thermal expansion
- Increase the elasticity of the bolting system by a factor of 7 to 15 times
- Economical alternative to costly system enhancements
- Maintain bolt integrity by maintaining the contact pressure between the flange and gasket surfaces
- Comprehensive Risk Analysis – contact a Solon application engineer for a detailed application review

SIZES

IMPERIAL: Solon Flange Washers are available as standard Imperial sizes from 3/8"-4".
METRIC: Solon Flange Washers are available as standard metric sizes from 6mm-110mm.

SOLON FLANGE WASHERS

17-7 STAINLESS STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
6F80177	3/8	0.386	0.714	0.083	0.091	0.008	2800
7F80177	7/16	0.45	0.82	0.083	0.093	0.01	2800
8F80177	1/2	0.512	0.9	0.083	0.094	0.011	2775
8F89177	1/2	0.515	0.9	0.095	0.105	0.01	3700
10F125177	5/8	0.64	1.148	0.125	0.137	0.012	6400
10F95177	5/8	0.644	1.14	0.095	0.11	0.015	3585
10F112177	5/8	0.644	1.148	0.117	0.13	0.013	6500
12F112177	3/4	0.773	1.37	0.117	0.135	0.018	5500
12F131177	3/4	0.773	1.37	0.136	0.152	0.016	8500
14F150177	7/8	0.901	1.59	0.155	0.174	0.019	12500
16F150177	1	1.03	1.81	0.155	0.179	0.024	9600
16F168177	1	1.03	1.81	0.193	0.21	0.017	18000
16F160177	1	1.032	1.805	0.168	0.195	0.023	8600
18F187177	1 1/8	1.155	2.025	0.193	0.218	0.025	20000
20F206177	1 1/4	1.281	2.31	0.193	0.224	0.031	20000
20F270177	1 1/4	1.281	2.31	0.27	0.296	0.026	30000
22F225177	1 3/8	1.406	2.47	0.25	0.284	0.028	25000
22F375177	1 3/8	1.406	2.47	0.375	0.394	0.019	58000
24F187177	1 1/2	1.531	2.68	0.193	0.233	0.04	14500
24F244177	1 1/2	1.531	2.68	0.25	0.284	0.034	26000
26F262177	1 5/8	1.649	2.95	0.262	0.299	0.037	27000
26F468177	1 5/8	1.649	2.95	0.468	0.49	0.022	92000
28F281177	1 3/4	1.774	3.17	0.28	0.323	0.043	31000
28F470177	1 3/4	1.774	3.171	0.47	0.495	0.025	65685
30F300177	1 7/8	1.91	3.389	0.3	0.345	0.045	33000
32F500177	2	2.024	3.6	0.5	0.535	0.035	110000
32F318177	2	2.063	3.6	0.318	0.368	0.05	40000
34F318177	2 1/8	2.173	3.5	0.318	0.36	0.043	40000
36F356177	2 1/4	2.281	4.04	0.356	0.408	0.052	51000
37F318177	2 5/16	2.332	3.75	0.318	0.366	0.044	40000
40F394177	2 1/2	2.531	4.483	0.394	0.452	0.058	62000
44F431177	2 3/4	2.781	4.92	0.431	0.494	0.063	75000
48F468177	3	3.031	5.36	0.468	0.537	0.069	88000

SOLON FLANGE WASHERS

INCONEL 718

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
5F80718	5/16	0.322	0.58	0.077	0.084	0.005	2450
6F80718	3/8	0.386	0.714	0.08	0.088	0.008	2900
7F80718	7/16	0.45	0.82	0.077	0.087	0.01	2400
8F89718	1/2	0.515	0.9	0.09	0.1	0.01	3300
8F125718	1/2	0.515	0.9	0.125	0.133	0.008	6500
10F125718	5/8	0.644	1.148	0.125	0.137	0.012	6400
12F125718	3/4	0.773	1.37	0.125	0.142	0.017	6300
12F200718	3/4	0.773	1.37	0.193	0.204	0.011	12000
14F150718	7/8	0.901	1.59	0.156	0.175	0.019	9800
14F250718	7/8	0.901	1.59	0.25	0.267	0.012	26400
16F84718	1	1.03	1.8	0.084	0.122	0.038	2100
16F187718	1	1.03	1.81	0.187	0.207	0.02	14240
16F250718	1	1.03	1.81	0.25	0.27	0.015	26000
16F168718	1	1.032	1.805	0.172	0.196	0.027	11950
18F200718	1 1/8	1.155	2.025	0.193	0.226	0.024	15400
18F250718	1 1/8	1.155	2.025	0.25	0.274	0.019	25000
20F150718	1 1/4	1.281	2.31	0.156	0.194	0.038	9300
20F187718	1 1/4	1.281	2.31	0.187	0.235	0.031	15100
20F250718	1 1/4	1.281	2.31	0.255	0.28	0.025	25000
20F375718	1 1/4	1.281	2.31	0.375	0.397	0.017	59000
22F150718	1 3/8	1.406	2.47	0.156	0.199	0.043	9000
22F250718	1 3/8	1.406	2.47	0.25	0.278	0.028	25400
22F375718	1 3/8	1.406	2.47	0.375	0.394	0.019	58000
22F460718	1 5/8	1.406	2.47	0.46	0.479	0.019	87000
22F480718	1 3/8	1.406	2.47	0.48	0.499	0.019	98900
24F156718	1 1/2	1.531	2.68	0.156	0.204	0.054	9000
24F187718	1 1/2	1.531	2.68	0.187	0.241	0.041	13500
24F225718	1 1/2	1.531	2.68	0.225	0.26	0.035	20000
24F375718	1 1/2	1.531	2.68	0.375	0.397	0.022	58000
26F172718	1 5/8	1.649	2.95	0.172	0.226	0.054	10000
26F187718	1 5/8	1.65	2.95	0.193	0.242	0.049	14200
26F262718	1 5/8	1.65	2.95	0.262	0.3	0.038	27500
30F450718	1 7/8	1.899	3.389	0.45	0.481	0.031	84500
32F500718	2	2.024	3.6	0.5	0.532	0.032	103725
32F187718	2	2.031	3.57	0.193	0.264	0.071	13550
32F356718	2	2.032	3.6	0.356	0.4	0.044	51825
32F318718	2	2.063	3.6	0.318	0.363	0.045	40150

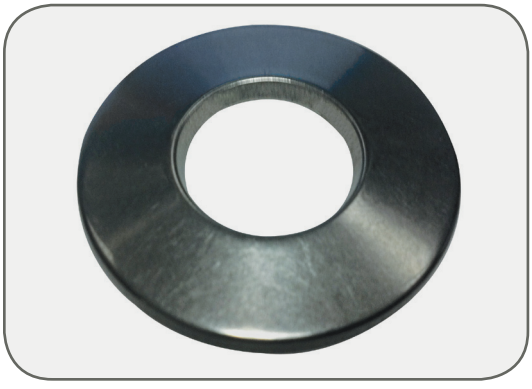
SOLON FLANGE WASHERS

H-13 TOOL STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
8F30	1/2	0.515	1.011	0.12	0.133	0.013	4245
8F45	1/2	0.515	1.011	0.141	0.153	0.012	6367
8F60	1/2	0.515	1.011	0.163	0.173	0.01	8490
10F30	5/8	0.644	1.148	0.142	0.157	0.015	6780
10F45	5/8	0.644	1.148	0.173	0.185	0.012	10170
10F60	5/8	0.644	1.148	0.2	0.211	0.011	13560
12F30	3/4	0.773	1.37	0.173	0.19	0.017	10020
12F45	3/4	0.773	1.37	0.211	0.225	0.014	15030
12F60	3/4	0.773	1.37	0.243	0.256	0.013	20040
14F30	7/8	0.901	1.59	0.204	0.224	0.02	13860
14F45	7/8	0.901	1.59	0.248	0.265	0.017	20790
14F60	7/8	0.901	1.59	0.285	0.3	0.015	27720
16F30	1	1.03	1.81	0.233	0.256	0.023	18180
16F45	1	1.03	1.81	0.283	0.302	0.019	27270
16F60	1	1.03	1.81	0.326	0.342	0.016	36360
18F30	1 1/8	1.155	2.025	0.266	0.291	0.025	23700
18F45	1 1/8	1.155	2.025	0.323	0.344	0.021	35550
18F60	1 1/8	1.155	2.025	0.372	0.39	0.018	47400
20F25	1 1/4	1.281	2.24	0.206	0.24	0.03	20000
20F30	1 1/4	1.281	2.31	0.301	0.33	0.029	30000
20F45	1 1/4	1.281	2.31	0.376	0.4	0.024	45000
20F60	1 1/4	1.281	2.31	0.422	0.443	0.021	60000
22F30	1 3/8	1.406	2.47	0.332	0.362	0.03	36990
22F45	1 3/8	1.406	2.47	0.404	0.429	0.025	55485
22F60	1 3/8	1.406	2.47	0.465	0.487	0.022	73980
24F30	1 1/2	1.531	2.68	0.364	0.396	0.032	44760
24F45	1 1/2	1.531	2.68	0.443	0.47	0.027	67140
24F60	1 1/2	1.531	2.68	0.51	0.533	0.023	89520
26F30	1 5/8	1.649	2.95	0.4	0.435	0.035	53400
26F45	1 5/8	1.649	2.95	0.487	0.516	0.029	80100
26F60	1 5/8	1.649	2.95	0.56	0.586	0.026	106800
28F30	1 3/4	1.774	3.17	0.432	0.47	0.038	62400
28F45	1 3/4	1.774	3.17	0.526	0.557	0.031	93600
28F60	1 3/4	1.774	3.17	0.605	0.633	0.028	124800
30F30	1 7/8	1.899	3.389	0.465	0.505	0.04	72300
30F45	1 7/8	1.899	3.389	0.566	0.599	0.033	108450
30F60	1 7/8	1.899	3.389	0.581	0.614	0.033	114475
32F30	2	2.024	3.6	0.498	0.54	0.042	83500
32F45	2	2.024	3.6	0.606	0.641	0.035	124650

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)	Deflection (h)	Flat Load
32F60	2	2.024	3.6	0.622	0.656	0.034	131575
34F30	2 1/8	2.156	3.773	0.531	0.572	0.041	96300
36F30	2 1/4	2.281	4.04	0.563	0.61	0.047	106800
36F45	2 1/4	2.281	4.04	0.686	0.725	0.039	160200
36F60	2 1/4	2.281	4.04	0.704	0.742	0.038	169100
40F30	2 1/2	2.531	4.483	0.629	0.681	0.052	133200
40F45	2 1/2	2.531	4.483	0.766	0.809	0.043	199800
40F60	2 1/2	2.531	4.483	0.786	0.828	0.042	210900
44F30	2 3/4	2.781	4.92	0.695	0.752	0.057	162900
44F45	2 3/4	2.781	4.92	0.847	0.894	0.047	244350
44F60	2 3/4	2.781	4.92	0.869	0.915	0.046	257925
48F15	3	3.031	4.94	0.5	0.568	0.068	84110
48F30	3	3.031	5.36	0.761	0.822	0.061	195300
48F45	3	3.031	5.36	0.951	1.003	0.051	292950
48F60	3	3.031	5.36	0.952	1.002	0.05	309225
52F30	3 1/4	3.306	5.81	0.77	0.837	0.067	202050
52F45	3 1/4	3.306	5.81	0.98	1.033	0.053	332872
52F60	3 1/4	3.306	5.81	1.037	1.087	0.05	551806
56F30	3 1/2	3.53	6.125	0.841	0.901	0.06	240354
56F45	3 1/2	3.53	6.125	1.024	1.08	0.056	360330
56F60	3 1/2	3.53	6.125	1.179	1.227	0.048	480458
60F30	3 3/4	3.812	6.671	0.871	0.948	0.077	274250
60F45	3 3/4	3.812	6.671	1.062	1.126	0.064	412800
60F60	3 3/4	3.812	6.671	1.222	1.278	0.056	550080
64F30	4	4.054	7.135	0.97	1.05	0.08	321415
64F45	4	4.054	7.135	1.18	1.247	0.067	481141
64F60	4	4.054	7.135	1.359	1.417	0.058	642053

SOLON FLAT WASHERS



FLAT WASHERS

FLAT WASHER - Flat or plain washers are also within Solon's capabilities. Designed for a more general purpose, flat washers provide a stable bearing surface for a Belleville washer, a nut, or bolt head. Distributing fastener loads over a greater surface reduces contact stress that can lead to relaxation and loosened joints. When used with a Solon Belleville Spring, a tighter and more precise fit can be achieved.

With an array of quantities and sizes available, Solon can provide a Belleville spring and flat washer combination based on your application requirements.

SIZES

IMPERIAL: Flat washers are available as standard Imperial sizes from ¼"-2" ID.

**It is ultimately user's responsibility to determine product suitability. Solon Manufacturing Co. is not responsible for product that is ordered incorrectly, misused, or misapplied. Contact a Solon engineer for recommended guidelines to product use.*

SOLON FLAT WASHERS

17-7PH STAINLESS STEEL

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)
4L61177F	1/4	0.258	0.563	0.062	0.062
5L70177F	5/16	0.322	0.688	0.072	0.072
5H70177F	5/16	0.322	0.938	0.073	0.073
6L61177F	3/8	0.386	0.813	0.062	0.062
6L80177F	3/8	0.386	0.813	0.083	0.083
7L70177F	7/16	0.450	0.938	0.072	0.072
7L89177F	7/16	0.450	0.938	0.095	0.095
7M80177F	7/16	0.450	1.073	0.083	0.083
8L80177F	1/2	0.515	1.063	0.083	0.083
8L98177F	1/2	0.515	1.063	0.095	0.095
818131177F	1/2	0.515	1.125	0.136	0.136
9L89177F	9/16	0.579	1.188	0.095	0.095
9L112177F	9/16	0.579	1.188	0.117	0.117
101428177F	5/8	0.627	0.870	0.025	0.025
10L98177F	5/8	0.644	1.313	0.095	0.095
10L131177F	5/8	0.644	1.313	0.136	0.136
10H131177F	5/8	0.644	1.760	0.136	0.136
1032187177F	5/8	0.644	2.000	0.193	0.193
121828177F	3/4	0.753	1.120	0.025	0.025
12L112177F	3/4	0.773	1.500	0.117	0.117
12L150177F	3/4	0.773	1.530	0.155	0.155
12-24-112-177F	3/4	0.813	1.531	0.135	0.135
14L131177F	7/8	0.901	1.750	0.136	0.136
14L168177F	7/8	0.901	1.750	0.193	0.193
14H168177F	7/8	0.901	2.260	0.193	0.193
16L187177F	1	1.030	2.000	0.193	0.193
16L150177F	1	1.030	2.030	0.155	0.155
16H187177F	1	1.030	2.500	0.193	0.193
18L168177F	1 1/8	1.155	2.250	0.193	0.193
18L206177F	1 1/8	1.155	2.250	0.193	0.193
18-36-157-177F	1 1/8	1.188	2.313	0.157	0.157
20L187177F	1 1/4	1.280	2.500	0.193	0.193
20L225177F	1 1/4	1.280	2.500	0.255	0.255
20M206177F	1 1/4	1.290	2.750	0.193	0.193
22L225177F	1 3/8	1.405	2.750	0.231	0.231
22L244177F	1 3/8	1.405	2.800	0.255	0.250
24-48-157-177F	1 1/2	1.625	3.063	0.157	0.157
26L281177F	1 1/2	1.650	3.250	0.281	0.281

Part Number	Bolt Size	ID Min	OD Max	THK (T)	Overall Height (H)
28-54-187-177F	1 3/4	1.875	3.438	0.187	0.187
30-56-187-177F	2	2.000	3.625	0.187	0.187
32-58-300-177F	2	2.063	3.650	0.300	0.300
32-60-187-177F	2	2.125	3.875	0.187	0.187

Belleville Spring Data Sheet

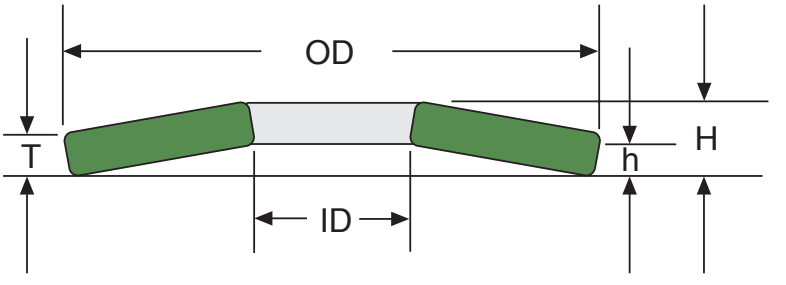
General Information

Company: _____
Contact: _____
Address: _____
_____
_____
Phone: _____
Email: _____

Application: _____
Bolt Size: _____
Required Load or Torque: _____
Aim Preload: _____
Available Space: _____
Material: _____
Operating Temperature: _____
Environment: _____

Additional Information

If currently using Belleville springs, what are the dimensions?
OD: _____ ID: _____ Thickness: _____ Height: _____
Competitor part number: _____
Type of tightening method: None: _____ +Torque: _____ Feel: _____
Estimated Annual Usage (EAU): _____
Additional notes: _____
_____
_____



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INDUSTRIES & APPLICATIONS

Solon Manufacturing Co. designs and manufactures Belleville springs which support a wide variety of industries and applications worldwide.

- **ACTUATORS OR MECHANISMS**
- **AEROSPACE**
  - o CATTO propellor
- **AGRICULTURE**
  - o Farm equipment
- **AUTOMATION**
- **CONSTRUCTION**
- **CRYOGENIC APPLICATIONS**
- **ENERGY**
  - o Coal / Carbon Handling
  - o Electrical Utilities
    - Transmission & Distribution
    - Substations
    - Electrical bus
  - o Mining
  - o Nuclear / Power Generation
  - o Oil & Gas
    - LNG
    - Offshore
    - Petrochemical
    - Refineries
  - o Mining
  - o Solar / Wind Turbines
- **ENTERTAINMENT**
  - o Camera track slider / camera trolley
  - o Movie set platforms
- **FLOW CONTROL**
- **FLUID SEALING, GASKETS, PACKING, VALVES**
- **HEAVY DUTY BOLTING**
- **HEAVY EQUIPMENT**
  - o Earth movers
  - o Bulldozers
  - o Front-end loaders
  - o Excavators
- **HEAT EXCHANGERS**
- **HIGH TEMPERATURE PIPE FLANGES**
- **HUNTING & FISHING EQUIPMENT**
  - o Target rifles
  - o Crossbows
  - o Paintball / air guns
  - o Fishing reels
- **MANUFACTURING**
  - o Factory maintenance
  - o Retrofit/reconditioning
  - o Material handling
  - o Steel mills
- **MEDICAL**
  - o Moveable Medical Equipment
- **OFF-ROAD EQUIPMENT**
- **PACKAGING**
  - o Plastics
  - o Thermoforming
  - o Blister
  - o Paper
- **PUMP & VALVE MANUFACTURING**
  - o Live loading of packing
  - o Live loading ball seats
  - o Flange/bonnet gasket live loading
- **TRANSPORTATION**
  - o Railroad Tracks/Joints
    - Tank Cars
    - Frog crossings
    - Turnouts
  - o Formula One racecars
- **STEEL MILL EQUIPMENT**
- **STRUCTURAL MEMBERS**
- **VIBRATORY EQUIPMENT**

Solon Belleville Springs should be used on valves to keep bolted joints tight when the bolted joint integrity is a concern.

Belleville springs maintain load on a seal, gasket or packing in valve actuators and other valve components. They can be easily retrofitted into existing valve designs with minimal revisions.

Valve Applications with Belleville Springs



Live Loading of Packing

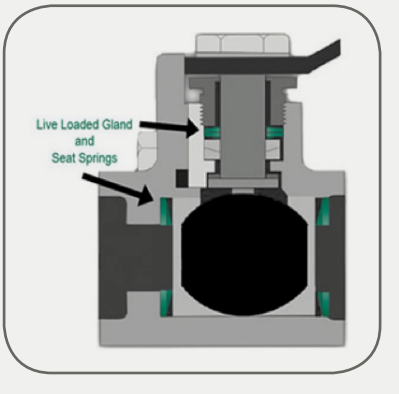
The term “live loading” means using a spring to maintain load on a seal. Many valves utilize studs or bolts to exert load onto the gland follower, which applies stress to the packing. As the valve is operated, the seal material consolidates during each operation. High temperature and thermal cycling can accelerate this loss. As this occurs, preload is lost on the seal. Once the preload falls below a certain threshold, a leak will occur. Since the stretch in the stud is small, loss of preload and packing stress can occur quickly.

Flange/Bonnet Gasket Live Loading

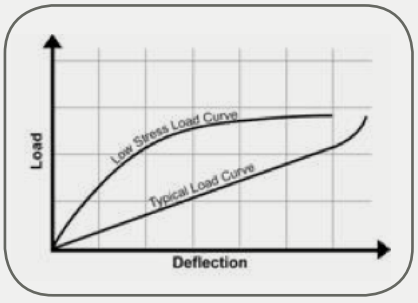
Flanges and bonnets are often sealed with a gasket. The gasket’s ability to seal partly depends on the stress maintained on its sealing surface. Flange bolts are tightened to a given preload to generate this sealing stress. Similar to valve packing, this original preload is lost over time due to effects such as differential thermal expansion and thermal cycling. Once a certain amount of preload is lost, a leak can occur. Therefore, Belleville washers are used to increase the elasticity of the fastening system to reduce this preload loss. Solon Flange washers are often used for bonnet applications.

Live Loading Ball Seats

Ball seats provide a seal between the ball and the valve’s body. An entire article can be devoted to seat design as there are many materials and styles to consider. The load on the seat must be within a certain range for the seat to be effective. If the load is too low, there will be leakage. If the load is too high, excessive wear will occur and/or the valve will not operate. Often, the seat will have little elasticity (especially metal seats). Since the valve components are generally machined to a set of tolerances, it is difficult to guarantee the seat is properly loaded.



The ball seat can be live loaded with a Belleville spring to ensure that the load is within the proper range. Since these loads are usually much lower than those used to seal packing stems or gaskets, the spring stresses can be lower.



Actuators or Mechanisms

Some low stress Bellevilles can be designed to “snap over.” This is similar to an “oil-can” effect. Some relief valves are designed with snap acting Bellevilles to open the valve quickly at a desired load.

We welcome the opportunity to quote your custom part.
Submit your drawing to our engineering team, techsupport@solonmfg.com.

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