



Business Machines



## BRAIN BEHIND THE COMPANY

*Business Machines was started by Mr. Vijay Gulati & Mr. R. G. Mehta in 1980's. Business Machines primarily was a supplier of automotive parts to O.E.M. customers. They have changed the business profile and organization many times but have never compromised with their quality & product performance to their valued customers and had been successful in maintaining the same till date. The complete credit goes to the people behind the company.*

### Mr. Vijay Gulati

*Mr. Vijay Gulati, a Mechanical Engineer from Pune, worked in Tata motors from 1975 to 1984 as an Engineer in Tool Room, Design, and Vendor Development & Material Purchase departments. He then started his own automotive components manufacturing company in 1984 in Pune (India). Later, with the aim to expand the reach, he set up another manufacturing unit in Chennai (India) in 1991. Apart from that he started another company in 1990 in Pune to manufacture electronic components specifically for connector manufacturers, domestic appliances, aerospace, etc. Later he started yet another unit in Pune to manufacture components for Special connectors in 2009. Today he has also set up a plant in Goa for Solar Energy Products in Verna Goa (India).*

### Mr. R. G. Mehta

*Mr. R G Mehta played a vital role with Mr. Vijay Gulati in the year 1984 since the startup and has immensely contributed to the firms started by Mr. Vijay Gulati with his marketing skills and innovation to new ideas. He has not only added valued customers in and around India but has also been a helping hand in developing and innovating new products and technologies with brighter ideas for the company.*



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## THE COMPANY

Business Machines, founded in year 1980 by young & dynamic mechanical engineers having more than 3 decades of hands-on experience, is one of the India's leading manufacturers of Coupling Ring Retainers, Snap Rings, Spring Steel & Stainless Wave Spring Washers etc., and has earned recognition in producing high quality and dependable products in this category.

The Founder members of Business machines are qualified engineers and have been working for giant automobile company, TELCO. They have the varied experience in design, manufacturing, source development, etc and have successfully promoted the number of components to cater to the automobile and related engineering industry requirements.

Over a period of time we have emerged as a no-nonsense production facility with a steady, year on year growth in terms of number of finished products manufactured as well as with respect to customer satisfaction and retention. We cater to the needs of large number of Original Equipment Manufacturers [OEMs] and have established ourselves as a force to reckon with.



Today, coil spring industry has evolved to a level where there is a shift in outlook from traditional coil spring to crescent springs. Crescent springs, due to their inherent advantages, are preferred in most scenarios where space saving and cost reduction is to be achieved.

We, at Business Machines, invest our resources in research and development proactively and hence it puts us in a position where we can develop custom products within shortest possible period. This ability has offered us an opportunity to successfully develop special components to suit requirements of customers from automobile, connectors, electronics and related sector.

Business Machines is poised to handle effectively, customers' requirement with any level of complexity. The high levels of quality and production standards followed by us enables us to meet requirement on "Just-in-time" basis which is a de facto method of inventory control followed by many manufacturing units to minimize stock carrying and other associated costs.

Finally, we take it upon us to assure our existing and potential customers that in order to serve you better and establish mutually beneficial relationship. Business Machines is committed to provide you hassle free customer service. We intend to delight our customers with our quality products and services, which however, cannot be achieved without your valuable feedback.



Since inception our primary focus was on delivering exceptional high quality products and we believe that in order to sustain in the demanding and competitive market, much is needed to be accomplished than our peers and unless extensive research and development is undertaken, achieving supremacy in the market place would be difficult.

After over a period of 3 decades we have still maintained our quest for excellence and our approach has always been to employ innovative new techniques towards product quality enhancement. We constantly invest our resources in developing new products and have grown from a meager 20 products to 1500 plus finished and final products.

Our motto has always been to provide the best quality. Our reliable process and workflow management ensures that the quality remains high all the time. We triumph in this stage where others struggle to manage. It is our endeavor to make continuous improvement in technical skills and customer service to meet the challenges and trust placed upon us by our valued customers.

Our clientele belong to companies serving the aerospace, automobile, power generation and associated industries having their own stringent quality control requirements, placing on us very tight tolerances with no scope for errors. We have successfully met their expectations with flying colors and have been awarded repeat business thus enabling us to instill long lasting trust and mutually agreeable kinship with our clients.

Products manufactured at our facilities are in accordance with the requirements of ISO 9001-2008 standards and we adopt best manufacturing practices followed by the world leaders. Each and every product that gets dispatched from our premises is thoroughly checked for specifications, tolerances and finish.

In this ever-changing wave spring industry, lack of technical acumen is unpardonable. However, Business Machines places an unending thrust upon updating and upgrading its work forces' technical skills. The employees are provided extensive hands-on training to tackle any requirement placed on them in timely and most effective fashion. We use latest technology and statistical data to analyze the needs so that any problem can be anticipated and intercepted before it causes us to waste our valuable resources and efforts.

Business Machines also has elaborate documentation process for handling processes which enables us to go about managing our production and distribution activity in a most orderly manner. Our customers appreciate the fact that this greatly reduces or at-times even eliminate their involvement in terms of inspection and approval, saving them valuable time and cost. Most of our customers have placed their confidence on us by revising their procurement policy of sourcing from multiple vendors and entirely depend on Business Machines as their single point of supply.





## QUALITY TESTS



Our quality tests are based on various parameters for each and every product / product type that we manufacture considering the application where our product is going to be used. Business Machines carry all the tools and tackles, testing methodologies, measurement criteria's, and all such procedures to carefully monitor each and every step of the manufacturing process.

Every time the material enters the premises or finished products are dispatched to our customers, we keep an eye on each and every procedure of quality tests. Incoming material is carefully checked for adherence to chemical composition, dimensional requirements and responsiveness to heat-treating. We are capable of checking all the phases of mechanical and metallurgical properties involved in the manufacturing process. Each and every item passes through the dimensional checks, dust, pitch and burr limitation tests, salt spray tests to verify the integrity of corrosion resistant coatings, temperature tests to check the maximum operating temperature limits, and all such test which are required and acceptable standards for industry and government.



### QUALITY POLICY

Business Machines has established and is continuously upgrading its quality Policies to meet the following objectives:

- Strict adherence to ISO 9001-2008 Standards
- Superior products quality with high performance values.
- Effective interaction at every aspect of pre-sale, design, manufacturing, sales and customer service.
- Conformity of specifications of our customers requirements.
- Prompt, on-time delivery, every time.
- Use of latest technology and harness its power to go in our products towards quality enhancement.
- Adopt ways and means to produce cost effective products without compromising quality standards.



We are manufacturing our products by edge winding wherein the pre-tempered flat wire is formed on circular edge mandrels. This gives the product a circular grain flow metallurgy resulting in our production having higher strength, stability and dimensions for superior to the die-stamped products wherein the grain metallurgy is cut. Also there is no wastage of material and hence costs are much lower.

The advantage of edge winding process over the die stamped components are:

No	Edge Winding Process	Die Stamped Components
1.	Better Strength	Lower Strength
2.	Grain flow circular and continuous	Grain flow cut
3.	Low cost	Higher cost
4.	No material wastage	Material wastage
5.	Better Dimensional accuracy	Dimensional accuracy changes due to heat treatment
6.	No burrs	Likelihood of burrs
7.	No toolings	Expensive toolings
8.	No tool maintenance	Tool maintenance cost
9.	Faster development and delivered	Delay in delivery due to tool manufacturing
10.	Better Surface finish	Expensive Surface finish treatment





## DEVELOPMENT BENEFITS TO CUSTOMER

Since there is no expensive toolings involved in the edge winding process, we can arrange to deliver the samples in a very short lead time. We can also undertake to make necessary changes in component after seeing the function / application requirements. This is a great advantage as cost / time of development is reduced.

### Out of the Shelf - Ready Inventory

Business Machines has invented and developed so many ranges of products / components and is always ready with the stocks for the items that you require at any given point of time and which you can really pick out-of-the-shelf. You just need to mention the component with desired material specifications. We use a special developed web based inventory system for us that help us in maintaining minimum and maximum stock levels, no matter where we are present on the globe. Mostly we have the ready stocks but if not then our special software system gives us a clear picture on what kind of raw material we have in stock and what would be least time to deliver the said components to our clients if not in stock.



### Customer Satisfaction / Service

We are very successful as a single source satisfying our customers completely due to:

1. Lower costs
2. Uncompromising quality requirements
3. Effective guidance in selection of raw material pertaining to the use of our product.
4. Lower lead time
5. No tooling cost
6. Personal care / Secrecy
7. All activities from wire development / toolings to finished products under one roof.
8. Critical dimensions understood and taken care of.
9. ISO 9001-2008 certification & following of these norms very rigidly.
10. Vast experience in the relevant industry.





## Retainer / Snap Rings

(Single & double coil in Spring steel & Stainless steel)

Retaining Rings are precision engineered components that are designed to be applied on shafts or in bores and provide a shoulder that accurately positions, locates and retains other parts of an assembly. BM, an expertise in manufacturing the retaining / snap rings, have developed different types over the years, each a solution to a specific problem / issues such as: tolerance take-up, clearance diameter, thrust load capacity, flexible installation, rpm capacity, impact loading, non-removable lock-rings, groove-less push-on fastening and radial installation.

BM rings can be economically produced in carbon steel & stainless steel as these are been manufactured by coiling from flat wire, hence no burrs and no scrap. We offer thousands of parts available in both carbon and stainless steel with no tooling cost for your designs.

### Benefits of Retaining Rings:

- Retaining rings fasten assemblies on shafts or in housing/bores.
- They are installed into a groove creating a shoulder that retains the assembly.
- Retaining rings are more efficient and cost-effective than traditional fasteners like screws, nuts, bolts, cotter pins, washers and more.
- Functions with a minimum amount of surface preparation to either shaft or housing.

### Applications:

- Automobile Industry – Applicable in many components
- Military, Aerospace applications



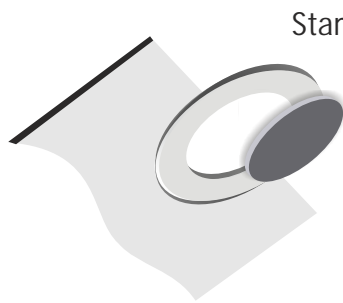


### Wave Spring / Washers

**(Spring Steel & Stainless Steel in 2 / 3 / 4 waves, gap type, overlap type, double wave type)**

A wave spring is made from coiled flat wire with waves added to give it a spring effect. The on-edge-coiling process creates a circle with one or more turns to specifications in any diameter and any number of specific designed waves. When compared with typical coil springs, wave springs have equal performance with about half of the overall free height. This not only provides for space savings, but also smaller assemblies that use less materials, hence lower production costs. Wave springs are a precision spring and available in many styles and materials.

Wave Washers are solid washers that have pressed waves. These items are typically used to offer preload to bearings and bolts.



Stamping Process



Flat Wire Coiling

#### Flat Wire Wave Springs versus Conventional Stampings

- No material waste compared to stamped parts
- Rolled flat wire features edges with a radius—NO DAMAGE TO SHAFT/BORE
- No stamping burrs eliminates the grinding process
- No stamping through the metal grain--microstructures remain intact
- Microstructure offers better strength because the line of force in circumferential direction is not disturbed; risk of fatigue cracking and inconsistent loading in a lot is minimized

#### Applications

- Quick Connectors for military, aerospace and industrial applications
- Centrifugal Pump
- Bearing Retention
- Fluid Power Assemblies
- Mechanical seals
- Automotive Air assemblies
- Sprinkler Device
- Inflation component
- Flashlight assembly





## Chain Assemblies

(Stainless steel, nylon cord, stainless steel cord as per Military or customer specifications)

Various other standard chain assemblies are available or custom assemblies can be built to order for special projects. Our expert engineering staff can assist in designing a new system for your needs.



## Circlips

Business Machines offers a full selection of Circlips. Basic internal, external, inverted lug types, E-Rings, C-Rings, push-on rings and others comprise the mix of Circlip Style Rings that we have readily available from stock.





### Special press parts



Special press parts components made as per customer designs / specifications to meet very high tolerances and dimensions. These components are made from a variety of materials as per the customer requirements and application standards. Business Machines keep these items in stocks that are required by our customer on regular basis and also can be made as and when required.

### Load Springs



Load springs are used for push and pull connectors as per the standards and customer designs / specifications to meet very high tolerances and dimensions. These components are made from a variety of materials as per the customer requirements and application standards. Business Machines keep these items in stocks that are required by our customer on regular basis and also can be made as and when required.

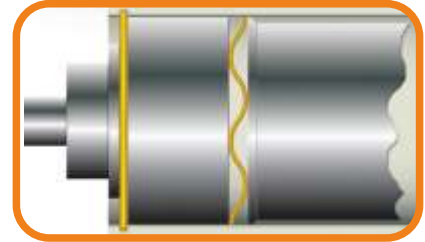
### Special Copper Components



Beryllium copper are shaped wire products in coiled form and are having variety of shapes. Press components in copper are mainly socket heads and mounting brackets. Business Machines keep these items in stocks that are required by our customer on regular basis and also can be made as and when required.



Connector Industry



Valve Manufacturers



Automobile Industry



Bearing Manufacturers



Pump Manufacturers



Oil Plants

Power Plants

Chemical Plants





# WAVE WASHERS - OVERLAP TYPE (WVO)

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
3 Waves						
BM-WWO-0050	12.700	9.906	1.270	2.159	0.203	1.016
BM-WWO-0062	15.875	12.192	1.270	2.413	0.254	1.473
BM-WWO-0075	19.050	12.700	1.575	4.064	0.254	1.981
BM-WWO-0087	22.225	15.748	1.575	3.302	0.305	2.388
BM-WWO-0100	25.400	19.812	1.575	4.064	0.305	2.388
BM-WWO-0112	28.575	21.336	1.981	3.302	0.406	3.378
BM-WWO-0125	31.750	24.384	1.981	3.810	0.406	3.378
BM-WWO-0137	34.925	27.686	1.981	4.826	0.406	3.378
BM-WWO-0150	38.100	29.718	1.981	4.318	0.457	3.632
BM-WWO-0162	41.275	33.274	1.981	5.080	0.457	3.632

Light Series

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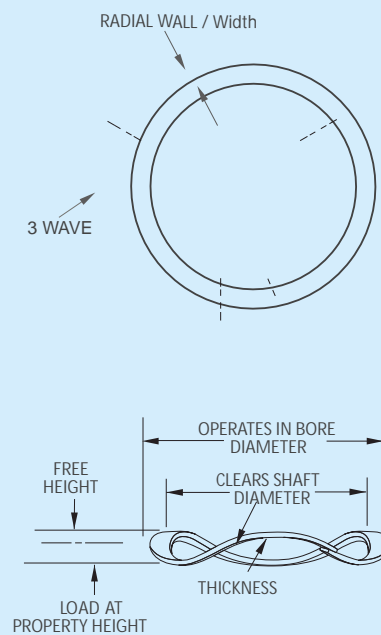
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## Product Dimensions

All dimensions in millimeters



# WAVE WASHERS - OVERLAP TYPE (WWO)



Light Series

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
4 Waves						
BM-WWO-0175	44.450	36.576	1.981	3.556	0.457	3.632
BM-WWO-0187	47.625	39.624	1.981	3.810	0.457	3.632
BM-WWO-0200	50.800	42.672	2.362	3.556	0.610	3.810
BM-WWO-0212	53.975	45.720	2.362	3.810	0.610	3.810
BM-WWO-0225	57.150	49.022	2.362	4.318	0.610	3.810
BM-WWO-0237	60.325	50.546	2.362	4.064	0.610	4.521
BM-WWO-0250	63.500	53.848	2.362	4.318	0.610	4.521
BM-WWO-0262	66.675	56.896	2.362	4.826	0.610	4.521
BM-WWO-0275	69.850	59.436	2.769	4.318	0.762	4.775
BM-WWO-0287	73.025	62.738	2.769	4.572	0.762	4.775
BM-WWO-0300	76.200	65.786	2.769	4.826	0.762	4.775
BM-WWO-0312	79.375	68.834	2.769	5.334	0.762	4.775
BM-WWO-0325	82.550	69.850	2.769	5.080	0.762	5.918
BM-WWO-0337	85.725	72.136	2.769	5.588	0.762	5.918
BM-WWO-0350	88.900	76.200	2.769	5.842	0.762	5.918
BM-WWO-0362	92.075	79.248	2.769	6.096	0.762	5.918
BM-WWO-0375	95.250	82.550	2.769	6.604	0.762	5.918
BM-WWO-0387	98.425	85.598	2.769	7.620	0.762	5.918
5 Waves						
BM-WWO-0400	101.600	88.900	2.769	4.826	0.762	5.918
BM-WWO-0412	104.775	91.948	2.769	5.080	0.762	5.918
BM-WWO-0425	107.950	94.996	2.769	5.334	0.762	5.918
BM-WWO-0437	111.125	98.044	2.769	5.334	0.762	5.918
BM-WWO-0450	114.300	101.346	2.769	5.842	0.762	5.918
BM-WWO-0462	117.475	104.394	3.175	6.858	0.762	5.918
BM-WWO-0475	120.650	107.696	3.175	7.874	0.762	5.918
BM-WWO-0487	123.825	110.998	3.175	7.366	0.762	5.918
BM-WWO-0500	127.000	114.046	3.175	7.874	0.762	5.918
BM-WWO-0512	130.175	117.094	3.175	8.636	0.762	5.918
BM-WWO-0525	133.350	120.396	3.175	9.398	0.762	5.918
BM-WWO-0537	136.525	123.444	3.175	9.652	0.762	5.918

Stock items available in carbon steel, stainless steel and copper.



# WAVE WASHERS - OVERLAP TYPE (WWO)

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
6 Waves						
BM-WWO-0550	139.700	126.746	3.175	6.350	0.762	5.918
BM-WWO-0562	142.875	129.794	3.175	6.858	0.762	5.918
BM-WWO-0575	146.050	133.096	3.175	7.112	0.762	5.918
BM-WWO-0587	149.225	136.144	3.175	7.620	0.762	5.918
BM-WWO-0600	152.400	139.446	3.175	7.620	0.762	5.918
BM-WWO-0612	155.575	142.494	3.175	7.874	0.762	5.918
BM-WWO-0625	158.750	145.542	3.175	8.636	0.762	5.918
BM-WWO-0637	161.925	148.844	3.175	8.890	0.762	5.918
BM-WWO-0650	165.100	151.892	3.175	9.906	0.762	5.918
BM-WWO-0675	171.450	158.242	3.175	10.668	0.762	5.918
BM-WWO-0700	177.800	156.464	3.962	8.128	0.813	9.525
BM-WWO-0725	184.150	163.576	3.962	8.890	0.813	9.525
BM-WWO-0750	190.500	169.926	3.962	9.144	0.813	9.525
BM-WWO-0775	196.850	176.276	3.962	9.652	0.813	9.525
BM-WWO-0800	203.200	182.626	3.962	9.906	0.813	9.525
BM-WWO-0825	209.550	188.976	3.962	10.922	0.813	9.525
7 Waves						
BM-WWO-0850	215.900	195.072	3.962	8.636	0.813	9.525
BM-WWO-0875	222.250	201.422	3.962	8.636	0.813	9.525
9 Waves						
BM-WWO-0900	228.600	207.772	3.962	7.366	0.813	9.525
BM-WWO-0950	241.300	220.472	3.962	6.096	0.813	9.525
BM-WWO-1000	254.000	232.918	3.962	7.366	0.813	9.525
BM-WWO-1050	266.700	245.618	3.962	7.874	0.813	9.525
BM-WWO-1100	279.400	258.318	3.962	8.890	0.813	9.525
BM-WWO-1150	292.100	270.764	3.962	9.144	0.813	9.525
BM-WWO-1200	304.800	283.464	3.962	11.176	0.813	9.525

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Stock items available in carbon steel, stainless steel and copper.



# WAVE WASHERS - OVERLAP TYPE (WWO)



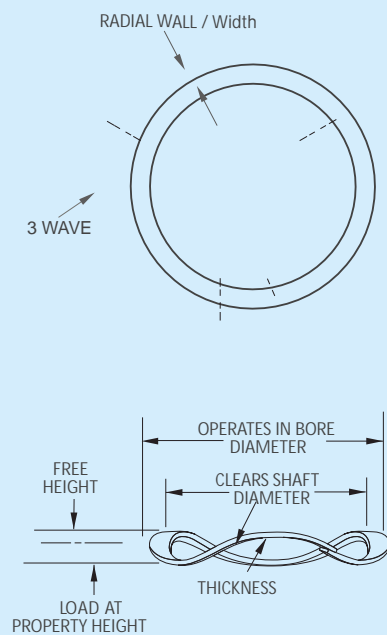
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Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
10 Waves						
BM-WWO-1250	317.500	296.164	3.962	8.890	0.813	9.525
BM-WWO-1300	330.200	308.864	3.962	10.414	0.813	9.525
BM-WWO-1350	342.900	321.310	3.962	10.922	0.813	9.525
12 Waves						
BM-WWO-1400	355.600	334.010	3.962	7.620	0.813	9.525
BM-WWO-1450	368.300	346.710	3.962	8.128	0.813	9.525
BM-WWO-1500	381.000	358.902	3.962	8.890	0.813	9.525
13 Waves						
BM-WWO-1550	393.700	371.856	3.962	7.874	0.813	9.525
BM-WWO-1600	406.400	384.556	3.962	8.636	0.813	9.525

Stock items available in carbon steel, stainless steel and copper.

## Product Dimensions

All dimensions in millimeters





# WAVE WASHERS - FLAT SECTION (WWF) (Gap type)

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
4 Waves						
BM-WWF-0325	82.550	71.628	2.769	5.080	0.762	4.775
BM-WWF-0337	85.725	74.676	2.769	5.588	0.762	4.775
BM-WWF-0350	88.900	77.978	2.769	6.604	0.762	4.775
BM-WWF-0362	92.075	81.026	2.769	6.858	0.762	4.775
BM-WWF-0375	95.250	84.328	2.769	7.112	0.762	4.775
BM-WWF-0387	98.425	87.376	2.769	7.874	0.762	4.775

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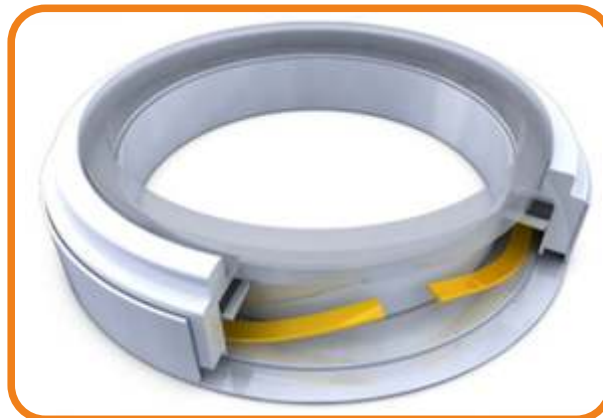
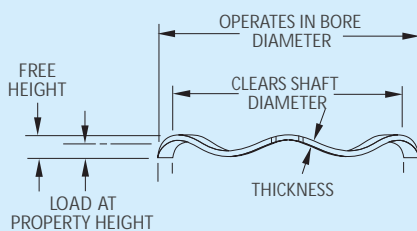
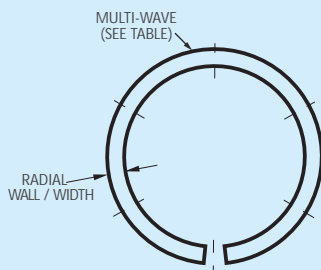
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Stock items available in carbon steel, stainless steel and copper.

## Product Dimensions

All dimensions in millimeters



# WAVE WASHERS - FLAT SECTION (WWF) (Gap Type)



## Heavy Series

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
5 Waves						
BM-WWF-0400	101.600	90.678	2.769	5.080	0.762	4.775
BM-WWF-0412	104.775	93.726	2.769	5.080	0.762	4.775
BM-WWF-0425	107.950	97.028	2.769	6.096	0.762	4.775
BM-WWF-0437	111.125	100.076	2.769	5.334	0.762	4.775
BM-WWF-0450	114.300	103.378	2.769	7.112	0.762	4.775
BM-WWF-0462	117.475	106.426	3.175	6.858	0.762	4.775
BM-WWF-0475	120.650	109.728	3.175	8.128	0.762	4.775
BM-WWF-0487	123.825	112.776	3.175	8.128	0.762	4.775
BM-WWF-0500	127.000	116.078	3.175	8.890	0.762	4.775
BM-WWF-0512	130.175	119.126	3.175	8.890	0.762	4.775
BM-WWF-0525	133.350	122.428	3.175	9.144	0.762	4.775
BM-WWF-0537	136.525	125.476	3.175	11.176	0.762	4.775
6 Waves						
BM-WWF-0550	139.700	128.778	3.175	7.112	0.762	4.775
BM-WWF-0562	142.875	131.826	3.175	7.366	0.762	4.775
BM-WWF-0575	146.050	135.128	3.175	8.636	0.762	4.775
BM-WWF-0587	149.225	138.176	3.175	8.636	0.762	4.775
BM-WWF-0600	152.400	141.478	3.175	8.636	0.762	4.775
7 Waves						
BM-WWF-0612	155.575	144.526	3.175	7.112	0.762	4.775
BM-WWF-0625	158.750	147.828	3.175	7.112	0.762	4.775
BM-WWF-0637	161.925	150.876	3.175	7.620	0.762	4.775
BM-WWF-0650	165.100	154.178	3.175	7.620	0.762	4.775
BM-WWF-0675	171.450	160.528	3.175	7.620	0.762	4.775
BM-WWF-0700	177.800	164.592	3.962	8.128	0.762	5.918
BM-WWF-0725	184.150	170.942	3.962	8.382	0.762	5.918
BM-WWF-0750	190.500	177.292	3.962	9.144	0.762	5.918
BM-WWF-0775	196.850	183.642	3.962	9.652	0.762	5.918

Stock items available in carbon steel, stainless steel and copper.



# WAVE WASHERS - ROUND WIRE (WWR)

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness
3 Waves					
BM-WWR-0050	12.700	10.363	1.321	1.575	0.787
BM-WWR-0062	15.875	13.132	1.626	1.956	0.965
BM-WWR-0075	19.050	15.951	1.930	2.337	1.143
BM-WWR-0087	22.225	18.796	2.184	2.642	1.295
BM-WWR-0100	25.400	21.717	2.413	2.946	1.422
BM-WWR-0112	28.575	24.562	2.591	3.226	1.524
BM-WWR-0125	31.750	27.457	2.794	3.505	1.651
4 Waves					
BM-WWR-0137	34.925	31.064	2.413	3.073	1.422
BM-WWR-0150	38.100	34.011	2.591	3.251	1.524
BM-WWR-0162	41.275	36.678	2.794	3.480	1.651
BM-WWR-0175	44.450	39.726	2.870	3.658	1.702
BM-WWR-0187	47.625	42.723	3.023	3.937	1.778
BM-WWR-0200	50.800	45.796	3.150	4.191	1.829
BM-WWR-0212	53.975	48.412	3.277	4.115	1.930
BM-WWR-0225	57.150	51.384	3.454	4.267	2.032
BM-WWR-0237	60.325	54.381	3.581	4.521	2.108
BM-WWR-0250	63.500	57.429	3.658	4.699	2.159
BM-WWR-0262	66.675	60.300	3.886	5.156	2.286
BM-WWR-0275	69.850	63.424	3.912	5.385	2.311
BM-WWR-0287	73.025	66.497	4.013	5.334	2.362
5 Waves					
BM-WWR-0300	76.200	70.282	3.581	4.547	2.108
BM-WWR-0312	79.375	73.101	3.658	4.674	2.159
BM-WWR-0325	82.550	75.997	3.886	4.826	2.286

Stock items available in carbon steel, stainless steel and copper.

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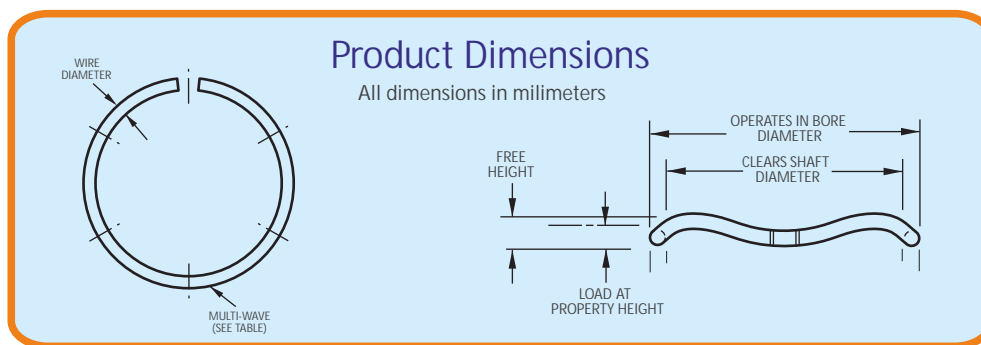
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# WAVE WASHERS - ROUND WIRE (WWR)



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Stock items available in carbon steel, stainless steel and copper.

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness
BM-WWR-0337	85.725	79.121	3.912	4.953	2.311
BM-WWR-0350	88.900	82.194	4.013	5.105	2.362
BM-WWR-0362	92.075	85.242	4.089	5.232	2.413
BM-WWR-0375	95.250	88.265	4.216	5.385	2.489
BM-WWR-0387	98.425	91.313	4.318	5.283	2.540
BM-WWR-0400	101.600	94.437	4.318	5.715	2.540
BM-WWR-0412	104.775	97.206	4.445	5.613	2.667
BM-WWR-0425	107.950	100.279	4.521	5.715	2.667
BM-WWR-0437	111.125	103.200	4.750	6.096	2.794
BM-WWR-0450	114.300	106.299	4.750	6.274	2.794
BM-WWR-0462	117.475	109.474	4.750	6.426	2.794
BM-WWR-0475	120.650	112.547	4.826	6.528	2.845
BM-WWR-0487	123.825	115.697	4.826	6.706	2.845
BM-WWR-0500	127.000	118.669	4.953	6.731	2.946
BM-WWR-0512	130.175	121.209	5.080	6.960	2.997
BM-WWR-0525	133.350	124.282	5.182	7.087	3.048
6 Waves					
BM-WWR-0537	136.525	127.940	4.750	6.223	2.794
BM-WWR-0550	139.700	131.115	4.750	6.375	2.794
BM-WWR-0562	142.875	134.188	4.826	6.223	2.845
BM-WWR-0575	146.050	137.312	4.826	6.375	2.845
BM-WWR-0587	149.225	140.310	5.004	6.655	2.946
BM-WWR-0600	152.400	143.358	5.080	6.807	2.997





# WAVE WASHERS - FOR BEARINGS (WWB)

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
3 Waves						
BM-WWB-0063	16.00	11.28	1.57	2.29	0.250	1.980
BM-WWB-0075	19.00	14.28	1.57	3.05	0.250	1.980
BM-WWB-0087	22.00	16.46	1.57	2.79	0.300	2.390
BM-WWB-0095	24.00	18.46	1.57	3.56	0.300	2.390
BM-WWB-0102	26.00	18.22	1.98	2.54	0.410	3.380
BM-WWB-0110	28.00	20.22	1.98	2.79	0.410	3.380
BM-WWB-0118	30.00	22.22	1.98	3.30	0.410	3.380
BM-WWB-0126	32.00	24.22	1.98	3.81	0.410	3.380
BM-WWB-0138	35.00	27.22	1.98	4.57	0.410	3.380
BM-WWB-0146	37.00	28.72	1.98	3.81	0.460	3.630
BM-WWB-0158	40.00	31.72	1.98	5.08	0.460	3.630
4 Waves						
BM-WWB-0165	42.00	33.72	1.98	3.05	0.460	3.630
BM-WWB-0185	47.00	38.72	1.98	3.81	0.460	3.630
BM-WWB-0205	52.00	43.11	2.36	3.56	0.610	3.810
BM-WWB-0217	55.00	46.11	2.36	3.81	0.610	3.810
BM-WWB-0244	62.00	51.69	2.36	4.32	0.610	4.520
BM-WWB-0268	68.00	57.17	2.77	4.32	0.760	4.780
BM-WWB-0276	70.00	59.17	2.77	4.32	0.760	4.780
BM-WWB-0284	72.00	61.17	2.77	4.57	0.760	4.780
BM-WWB-0295	75.00	64.17	2.77	5.08	0.760	4.780
BM-WWB-0315	80.00	68.66	2.77	5.59	0.760	4.780
BM-WWB-0335	85.00	71.38	2.77	5.59	0.760	5.920
BM-WWB-0354	90.00	76.38	2.77	6.35	0.760	5.920
BM-WWB-0374	95.00	81.38	2.77	7.37	0.760	5.920

Available in Overlap Type & Gap Type Series

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Stock items available in carbon steel, stainless steel and copper.

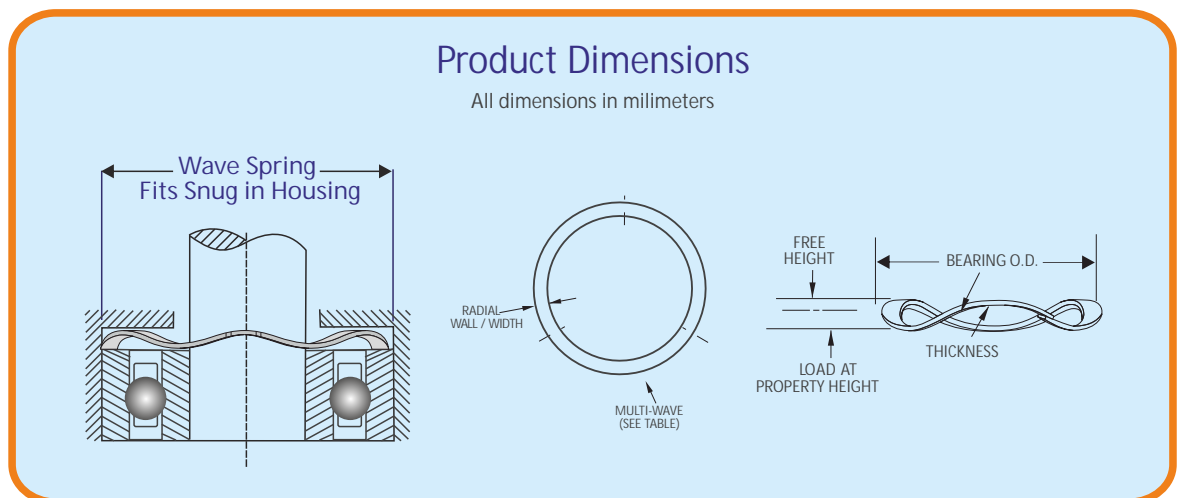




Available in Overlap Type & Gap Type Series

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
5 Waves						
BM-WWB-0394	100	86.38	2.77	4.57	0.76	5.920
BM-WWB-0413	105	91.38	2.77	5.08	0.76	5.920
BM-WWB-0433	110	96.38	2.77	5.33	0.76	5.920
BM-WWB-0453	115	101.38	3.18	6.35	0.76	5.920
BM-WWB-0472	120	106.38	3.18	7.11	0.76	5.920
BM-WWB-0492	125	111.38	3.18	7.62	0.76	5.920
BM-WWB-0512	130	116.38	3.18	8.64	0.76	5.920
BM-WWB-0532	135	121.38	3.18	9.4	0.76	5.920
6 Waves						
BM-WWB-0551	140	126.38	3.18	6.86	0.76	5.920
BM-WWB-0571	145	131.38	3.18	7.37	0.76	5.920
BM-WWB-0591	150	136.38	3.18	7.87	0.76	5.920
BM-WWB-0630	160	146.38	3.18	9.4	0.76	5.920
BM-WWB-0650	165	151.38	3.18	10.41	0.76	5.920
BM-WWB-0669	170	156.38	3.18	11.18	0.76	5.920
BM-WWB-0689	175	154.16	3.96	8.13	0.81	9.530
BM-WWB-0709	180	159.16	3.96	8.64	0.81	9.530
BM-WWB-0728	185	164.16	3.96	9.14	0.81	9.530
BM-WWB-0748	190	169.16	3.96	9.91	0.81	9.530

Stock items available in carbon steel, stainless steel and copper.





# WAVE WASHERS - FOR BEARINGS (WWB)

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
7 Waves						
BM-WWB-0787	200	179.16	3.96	7.11	0.81	9.530
BM-WWB-0807	205	184.16	3.96	7.37	0.81	9.530
BM-WWB-0827	210	189.16	3.96	7.87	0.81	9.530
BM-WWB-0847	215	194.16	3.96	8.38	0.81	9.530
BM-WWB-0866	220	199.16	3.96	8.64	0.81	9.530
8 Waves						
BM-WWB-0886	225	204.16	3.96	7.11	0.81	9.530
9 Waves						
BM-WWB-0906	230	209.16	3.96	6.1	0.81	9.530
BM-WWB-0925	235	214.16	3.96	6.35	0.81	9.530
BM-WWB-0945	240	219.16	3.96	6.35	0.81	9.530
BM-WWB-0984	250	229.16	3.96	6.86	0.81	9.530
BM-WWB-1024	260	239.16	3.96	7.37	0.81	9.530
BM-WWB-1043	265	244.16	3.96	7.62	0.81	9.530
BM-WWB-1063	270	249.16	3.96	8.13	0.81	9.530
BM-WWB-1102	280	259.16	3.96	8.64	0.81	9.530
BM-WWB-1142	290	269.16	3.96	9.4	0.81	9.530
BM-WWB-1181	300	279.16	3.96	10.41	0.81	9.530
BM-WWB-1221	310	289.16	3.96	7.11	1.07	9.530
BM-WWB-1260	320	299.16	3.96	7.62	1.07	9.530
BM-WWB-1339	340	319.16	3.96	8.64	1.07	9.530
BM-WWB-1378	350	329.16	3.96	9.4	1.07	9.530

Available in Overlap Type & Gap Type Series

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Stock items available in carbon steel, stainless steel and copper.





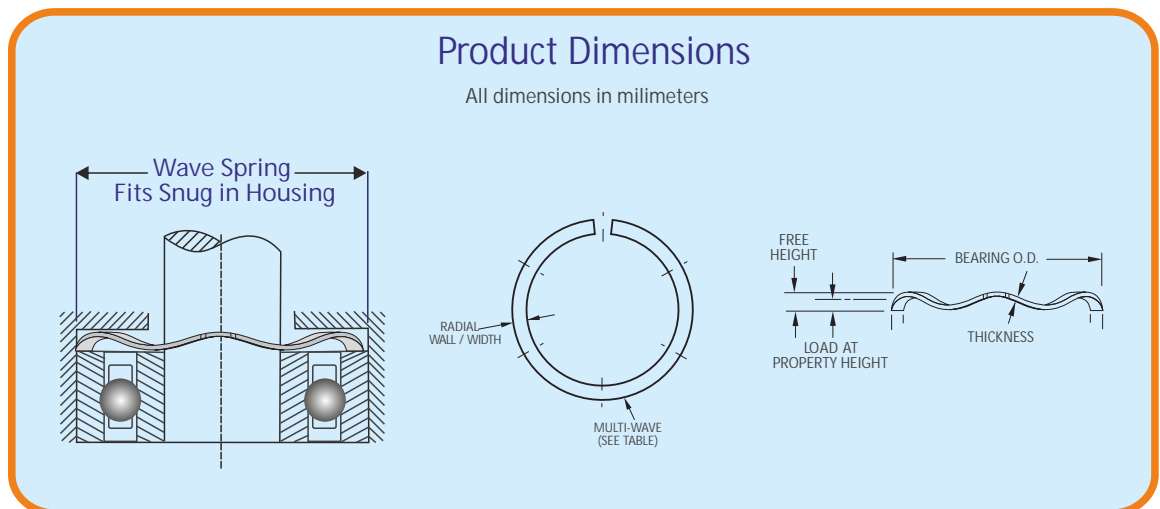


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Available in Overlap Type & Gap Type Series

Part Number	Operates in Bore Diam.	Clear Shaft Diam.	Operating Height	Free Height	Wire Thickness	Radial Wall / Width
10 Waves						
BM-WWB-1417	360	339.16	3.96	7.62	1.07	9.530
BM-WWB-1457	370	349.16	3.96	8.13	1.07	9.530
BM-WWB-1496	380	359.16	3.96	8.64	1.07	9.530
BM-WWB-1535	390	369.16	3.96	9.14	1.07	9.530
BM-WWB-1575	400	379.16	3.96	9.65	1.07	9.530
BM-WWB-1614	410	382.82	3.96	8.38	1.07	12.700
BM-WWB-1654	420	392.82	3.96	8.89	1.07	12.700
11 Waves						
BM-WWB-1693	430	402.82	3.96	7.62	1.07	12.700
BM-WWB-1732	440	412.82	3.96	8.13	1.07	12.700
BM-WWB-1811	460	432.82	3.96	8.89	1.07	12.700
12 Waves						
BM-WWB-1890	480	452.82	3.96	8.13	1.07	12.700
BM-WWB-1969	500	472.82	3.96	8.89	1.07	12.700
13 Waves						
BM-WWB-2126	540	512.82	3.96	8.89	1.07	12.700
14 Waves						
BM-WWB-2284	580	552.82	3.96	8.89	1.07	12.700

Stock items available in carbon steel, stainless steel and copper.





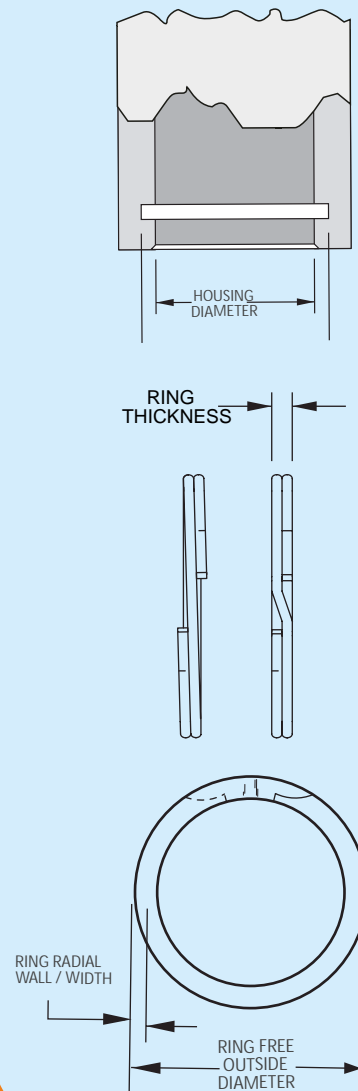
# SNAP RINGS - INTERNAL (SRI) (Aerospace Rings)

Part Number	Housing Diameter	RING		
		Diameter	Width	Thickness
BM-SRI-0012	12.00	12.890	1.14	0.60
BM-SRI-0013	13.00	13.950	1.14	0.89
BM-SRI-0014	14.00	15.070	1.40	0.89
BM-SRI-0015	15.00	16.140	1.40	0.89
BM-SRI-0016	16.00	17.150	1.40	0.89
BM-SRI-0017	17.00	18.320	1.65	0.89
BM-SRI-0018	18.00	19.390	1.65	0.89
BM-SRI-0019	19.00	20.480	1.65	0.89
BM-SRI-0020	20.00	21.510	1.91	0.89
BM-SRI-0021	21.00	22.560	1.91	0.89
BM-SRI-0022	22.00	23.650	1.91	1.07
BM-SRI-0023	23.00	24.690	2.16	1.07
BM-SRI-0024	24.00	25.730	2.16	1.07
BM-SRI-0025	25.00	27.030	2.16	1.07
BM-SRI-0026	26.00	28.070	2.16	1.07
BM-SRI-0027	27.00	29.110	2.64	1.27
BM-SRI-0028	28.00	30.100	2.64	1.27
BM-SRI-0029	29.00	31.210	2.64	1.27
BM-SRI-0030	30.00	32.280	2.64	1.27
BM-SRI-0031	31.00	33.320	2.64	1.27
BM-SRI-0032	32.00	34.230	2.64	1.27
BM-SRI-0034	34.00	36.460	3.00	1.27
BM-SRI-0035	35.00	37.550	3.00	1.27
BM-SRI-0036	36.00	38.680	3.00	1.27
BM-SRI-0037	37.00	39.600	3.00	1.27
BM-SRI-0038	38.00	40.770	3.00	1.27
BM-SRI-0040	40.00	42.910	3.25	1.57
BM-SRI-0042	42.00	45.010	3.25	1.57
BM-SRI-0045	45.00	48.130	3.25	1.57
BM-SRI-0046	46.00	49.280	3.25	1.57

Stock items available in carbon steel, stainless steel and copper.

## Product Dimensions

All dimensions in millimeters



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# SNAP RINGS - INTERNAL (SRI) (Aerospace Rings)



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Part Number	Housing Diameter	RING			Part Number	Housing Diameter	RING		
		Diameter	Width	Thickness			Diameter	Width	Thickness
BM-SRI-0047	47.00	50.320	4.01	1.57	BM-SRI-0100	100.00	103.830	5.28	1.55
BM-SRI-0048	48.00	51.460	4.01	1.57	BM-SRI-0102	102.00	106.000	5.54	1.55
BM-SRI-0050	50.00	53.660	4.01	1.57	BM-SRI-0105	105.00	109.000	5.54	1.55
BM-SRI-0052	52.00	54.300	3.25	1.25	BM-SRI-0108	108.00	112.220	5.79	1.55
BM-SRI-0053	53.00	55.320	3.25	1.25	BM-SRI-0110	110.00	114.250	5.79	1.55
BM-SRI-0055	55.00	57.380	3.51	1.25	BM-SRI-0112	112.00	116.440	6.05	1.55
BM-SRI-0056	56.00	58.400	3.51	1.25	BM-SRI-0115	115.00	119.440	6.05	1.55
BM-SRI-0058	58.00	60.430	3.51	1.25	BM-SRI-0120	120.00	124.540	6.35	1.83
BM-SRI-0059	59.00	61.540	3.51	1.25	BM-SRI-0125	125.00	129.590	6.35	1.83
BM-SRI-0060	60.00	62.570	3.51	1.25	BM-SRI-0130	130.00	134.710	6.35	1.83
BM-SRI-0061	61.00	63.650	3.81	1.25	BM-SRI-0135	135.00	139.740	6.35	1.83
BM-SRI-0062	62.00	64.700	3.81	1.25	BM-SRI-0140	140.00	144.870	6.35	1.83
BM-SRI-0063	63.00	65.700	3.81	1.25	BM-SRI-0145	145.00	150.040	6.35	1.83
BM-SRI-0064	64.00	66.770	3.81	1.25	BM-SRI-0150	150.00	155.070	6.35	1.83
BM-SRI-0065	65.00	67.820	3.81	1.25	BM-SRI-0155	155.00	160.720	7.92	2.18
BM-SRI-0066	66.00	68.800	3.81	1.25	BM-SRI-0160	160.00	165.740	7.92	2.18
BM-SRI-0067	67.00	69.900	3.81	1.25	BM-SRI-0165	165.00	170.770	7.92	2.18
BM-SRI-0068	68.00	70.940	4.01	1.25	BM-SRI-0170	170.00	176.050	7.92	2.18
BM-SRI-0069	69.00	71.940	4.01	1.25	BM-SRI-0175	175.00	181.050	7.92	2.18
BM-SRI-0070	70.00	72.940	4.01	1.25	BM-SRI-0180	180.00	186.380	7.92	2.18
BM-SRI-0071	71.00	73.990	4.01	1.25	BM-SRI-0185	185.00	191.100	7.92	2.18
BM-SRI-0072	72.00	75.040	4.27	1.25	BM-SRI-0190	190.00	196.450	7.92	2.18
BM-SRI-0075	75.00	78.070	4.27	1.25	BM-SRI-0195	195.00	201.740	7.92	2.18
BM-SRI-0078	78.00	81.210	4.27	1.55	BM-SRI-0200	200.00	206.760	7.92	2.18
BM-SRI-0080	80.00	83.220	4.52	1.55	BM-SRI-0210	210.00	217.100	9.53	2.18
BM-SRI-0082	82.00	85.280	4.52	1.55	BM-SRI-0220	220.00	227.400	9.53	2.18
BM-SRI-0085	85.00	88.380	4.78	1.55	BM-SRI-0230	230.00	237.730	9.53	2.18
BM-SRI-0088	88.00	91.450	4.78	1.55	BM-SRI-0240	240.00	247.800	9.53	2.18
BM-SRI-0090	90.00	93.580	5.03	1.55	BM-SRI-0250	250.00	258.100	9.53	2.18
BM-SRI-0092	92.00	95.660	5.03	1.55	BM-SRI-0260	260.00	268.430	9.53	2.18
BM-SRI-0095	95.00	98.690	5.03	1.55	BM-SRI-0270	270.00	278.500	9.53	2.18
BM-SRI-0098	98.00	101.830	5.28	1.55	BM-SRI-0280	280.00	288.820	9.53	2.18

Stock items available in carbon steel, stainless steel and copper.

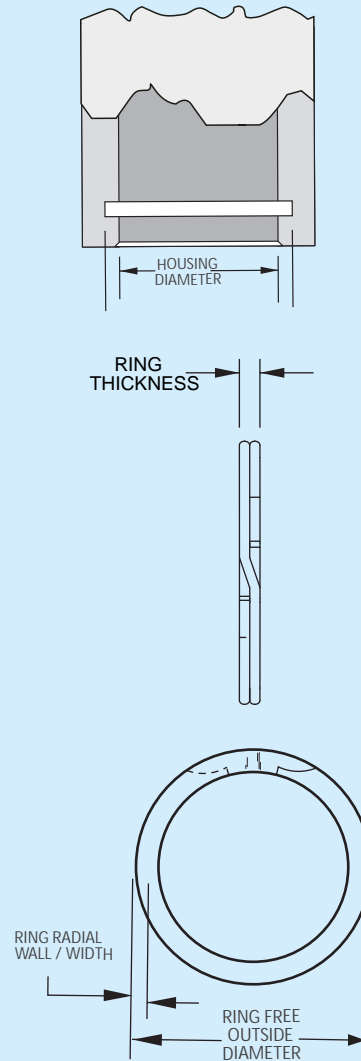


# SNAP RINGS - INTERNAL DIN (SRID)

Part Number	Housing Diameter	RING		
		Diameter	Width	Thickness
BM-SRID-0013	13.00	13.720	1.40	0.99
BM-SRID-0014	14.00	14.750	1.40	0.99
BM-SRID-0015	15.00	15.850	1.40	0.99
BM-SRID-0016	16.00	16.970	1.65	0.99
BM-SRID-0017	17.00	17.980	1.65	0.99
BM-SRID-0018	18.00	19.180	1.91	0.99
BM-SRID-0019	19.00	20.190	1.91	0.99
BM-SRID-0020	20.00	21.210	1.91	0.99
BM-SRID-0021	21.00	22.230	1.91	0.99
BM-SRID-0022	22.00	23.230	1.91	0.99
BM-SRID-0023	23.00	24.330	2.18	1.14
BM-SRID-0024	24.00	25.450	2.18	1.14
BM-SRID-0025	25.00	26.450	2.18	1.14
BM-SRID-0026	26.00	27.480	2.18	1.14
BM-SRID-0027	27.00	28.680	2.41	1.14
BM-SRID-0028	28.00	29.690	2.41	1.14
BM-SRID-0029	29.00	30.710	2.41	1.14
BM-SRID-0030	30.00	31.710	2.41	1.14
BM-SRID-0031	31.00	33.020	2.41	1.14
BM-SRID-0032	32.00	34.040	2.41	1.14
BM-SRID-0033	33.00	35.050	2.41	1.14
BM-SRID-0034	34.00	36.070	3.25	1.44
BM-SRID-0035	35.00	37.380	3.25	1.44
BM-SRID-0036	36.00	38.390	3.25	1.44
BM-SRID-0037	37.00	39.400	3.25	1.44
BM-SRID-0038	38.00	40.410	3.25	1.44
BM-SRID-0040	40.00	42.930	4.01	1.69
BM-SRID-0041	41.00	43.940	4.01	1.69
BM-SRID-0042	42.00	44.960	4.01	1.69
BM-SRID-0045	45.00	47.980	4.01	1.69
BM-SRID-0047	47.00	49.990	4.01	1.69
BM-SRID-0048	48.00	51.000	4.01	1.69
BM-SRID-0050	50.00	53.540	5.08	1.93
BM-SRID-0051	51.00	54.540	5.08	1.93
BM-SRID-0052	52.00	55.550	5.08	1.93

## Product Dimensions

All dimensions in millimeters



Stock items available in carbon steel, stainless steel and copper.

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# SNAP RINGS - INTERNAL DIN (SRID)



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Part Number	Housing Diameter	RING			Part Number	Housing Diameter	RING		
		Diameter	Width	Thickness			Diameter	Width	Thickness
BM-SRID-0055	55.00	58.570	5.08	1.93	BM-SRID-0135	135.00	140.030	6.73	3.89
BM-SRID-0056	56.00	59.590	5.08	1.93	BM-SRID-0140	140.00	145.110	6.73	3.89
BM-SRID-0057	57.00	60.600	5.08	1.93	BM-SRID-0145	145.00	150.110	6.73	3.89
BM-SRID-0058	58.00	61.620	5.08	1.93	BM-SRID-0150	150.00	156.130	7.92	3.89
BM-SRID-0060	60.00	63.630	5.08	1.93	BM-SRID-0155	155.00	161.190	7.92	3.89
BM-SRID-0062	62.00	65.660	5.08	1.93	BM-SRID-0160	160.00	166.220	7.92	3.89
BM-SRID-0063	63.00	66.670	5.08	1.93	BM-SRID-0165	165.00	171.270	7.92	3.89
BM-SRID-0064	64.00	67.670	5.08	1.93	BM-SRID-0170	170.00	176.330	7.92	3.89
BM-SRID-0065	65.00	68.670	5.08	2.41	BM-SRID-0175	175.00	181.360	7.92	3.89
BM-SRID-0067	67.00	70.670	5.08	2.41	BM-SRID-0180	180.00	186.390	7.92	3.89
BM-SRID-0068	68.00	71.670	5.08	2.41	BM-SRID-0185	185.00	191.440	7.92	3.89
BM-SRID-0070	70.00	73.670	5.08	2.41	BM-SRID-0190	190.00	196.470	7.92	3.89
BM-SRID-0072	72.00	75.670	5.08	2.41	BM-SRID-0195	195.00	201.520	7.92	3.89
BM-SRID-0075	75.00	78.680	5.08	2.41	BM-SRID-0200	200.00	206.580	7.92	3.89
BM-SRID-0076	76.00	79.680	5.08	2.41	BM-SRID-0210	210.00	217.580	9.53	4.86
BM-SRID-0078	78.00	81.690	5.08	2.41	BM-SRID-0220	220.00	227.660	9.53	4.86
BM-SRID-0080	80.00	84.190	6.05	2.41	BM-SRID-0230	230.00	237.720	9.53	4.86
BM-SRID-0082	82.00	86.200	6.05	2.41	BM-SRID-0240	240.00	247.800	9.53	4.86
BM-SRID-0085	85.00	89.200	6.05	2.91	BM-SRID-0250	250.00	257.890	9.53	4.86
BM-SRID-0088	88.00	92.210	6.05	2.91	BM-SRID-0260	260.00	269.930	11.18	4.86
BM-SRID-0090	90.00	94.210	6.05	2.91	BM-SRID-0270	270.00	280.010	11.18	4.86
BM-SRID-0092	92.00	96.220	6.05	2.91	BM-SRID-0280	280.00	290.090	11.18	4.86
BM-SRID-0095	95.00	99.240	6.05	2.91	BM-SRID-0290	290.00	300.150	11.18	4.86
BM-SRID-0098	98.00	102.260	6.05	2.91	BM-SRID-0300	300.00	310.240	11.18	4.86
BM-SRID-0100	100.00	104.290	6.05	2.91	BM-SRID-0310	310.00	322.250	12.70	5.87
BM-SRID-0102	102.00	106.790	6.73	3.89	BM-SRID-0320	320.00	332.330	12.70	5.87
BM-SRID-0105	105.00	109.790	6.73	3.89	BM-SRID-0330	330.00	342.420	12.70	5.87
BM-SRID-0108	108.00	112.800	6.73	3.89	BM-SRID-0340	340.00	352.500	12.70	5.87
BM-SRID-0110	110.00	114.830	6.73	3.89	BM-SRID-0350	350.00	362.560	12.70	5.87
BM-SRID-0112	112.00	116.840	6.73	3.89	BM-SRID-0360	360.00	372.640	12.70	5.87
BM-SRID-0115	115.00	119.860	6.73	3.89	BM-SRID-0370	370.00	382.730	12.70	5.87
BM-SRID-0120	120.00	124.920	6.73	3.89	BM-SRID-0380	380.00	392.790	12.70	5.87
BM-SRID-0125	125.00	129.970	6.73	3.89	BM-SRID-0390	390.00	402.840	12.70	5.87
BM-SRID-0127	127.00	131.970	6.73	3.89	BM-SRID-0400	400.00	412.930	12.70	5.87
BM-SRID-0130	130.00	135.000	6.73	3.89					

Stock items available in carbon steel, stainless steel and copper.

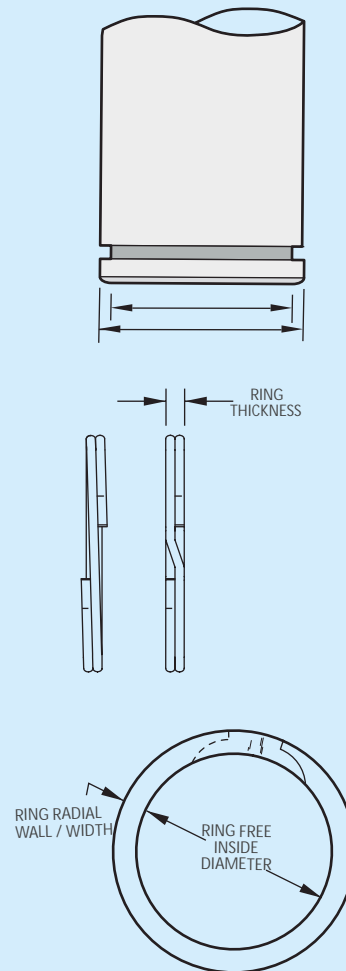


# SNAP RINGS - EXTERNAL (SRE) (Aerospace Rings)

Part Number	Shaft Diameter	Inner Diameter	Width	Thickness
BM-SRE-0012	12.00	11.180	1.14	0.60
BM-SRE-0013	13.00	12.130	1.27	0.89
BM-SRE-0014	14.00	13.060	1.27	0.89
BM-SRE-0015	15.00	13.980	1.27	0.89
BM-SRE-0016	16.00	14.900	1.40	0.89
BM-SRE-0017	17.00	15.820	1.40	0.89
BM-SRE-0018	18.00	16.800	1.65	1.07
BM-SRE-0019	19.00	17.730	1.65	1.07
BM-SRE-0020	20.00	18.620	1.65	1.07
BM-SRE-0021	21.00	19.570	1.65	1.07
BM-SRE-0022	22.00	20.450	1.91	1.07
BM-SRE-0023	23.00	21.390	1.91	1.07
BM-SRE-0024	24.00	22.350	1.91	1.07
BM-SRE-0025	25.00	23.250	2.16	1.07
BM-SRE-0026	26.00	24.210	2.16	1.07
BM-SRE-0027	27.00	25.040	2.64	1.27
BM-SRE-0028	28.00	26.000	2.64	1.27
BM-SRE-0029	29.00	26.950	2.64	1.27
BM-SRE-0030	30.00	27.920	2.64	1.27
BM-SRE-0031	31.00	28.840	2.64	1.27
BM-SRE-0032	32.00	29.770	2.64	1.27
BM-SRE-0034	34.00	31.540	3.00	1.27
BM-SRE-0035	35.00	32.440	3.00	1.27
BM-SRE-0036	36.00	33.400	3.00	1.27
BM-SRE-0037	37.00	34.240	3.00	1.27
BM-SRE-0038	38.00	35.180	3.00	1.27
BM-SRE-0040	40.00	37.150	3.25	1.57
BM-SRE-0042	42.00	39.020	3.25	1.57
BM-SRE-0045	45.00	41.770	3.25	1.57
BM-SRE-0046	46.00	42.670	3.25	1.57
BM-SRE-0047	47.00	43.810	4.01	1.57
BM-SRE-0048	48.00	44.480	4.01	1.57
BM-SRE-0050	50.00	46.690	4.01	1.57

## Product Dimensions

All dimensions in millimeters



Stock items available in carbon steel, stainless steel and copper.

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# SNAP RINGS - EXTERNAL (SRE) (Aerospace Rings)



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Part Number	Shaft Diameter	Inner Diameter	Width	Thickness	Part Number	Shaft Diameter	Inner Diameter	Width	Thickness
BM-SRE-0052	52.00	49.620	3.25	1.25	BM-SRE-0105	105.00	100.940	5.54	1.55
BM-SRE-0053	53.00	50.620	3.25	1.25	BM-SRE-0110	110.00	105.750	5.79	1.55
BM-SRE-0054	54.00	51.620	3.25	1.25	BM-SRE-0115	115.00	110.590	6.05	1.55
BM-SRE-0055	55.00	52.620	3.51	1.25	BM-SRE-0120	120.00	115.490	6.35	1.83
BM-SRE-0056	56.00	53.620	3.51	1.25	BM-SRE-0125	125.00	120.440	6.35	1.83
BM-SRE-0058	58.00	55.430	3.51	1.25	BM-SRE-0130	130.00	125.340	6.35	1.83
BM-SRE-0059	59.00	56.430	3.51	1.25	BM-SRE-0135	135.00	130.200	6.35	1.83
BM-SRE-0060	60.00	57.430	3.51	1.25	BM-SRE-0140	140.00	135.140	6.35	1.83
BM-SRE-0061	61.00	58.360	3.51	1.25	BM-SRE-0145	145.00	140.000	6.35	1.83
BM-SRE-0062	62.00	59.300	3.76	1.25	BM-SRE-0150	150.00	145.000	6.35	1.83
BM-SRE-0063	63.00	60.300	3.76	1.25	BM-SRE-0155	155.00	149.330	7.92	2.18
BM-SRE-0064	64.00	61.250	3.76	1.25	BM-SRE-0160	160.00	154.310	7.92	2.18
BM-SRE-0065	65.00	62.200	3.76	1.25	BM-SRE-0165	165.00	159.230	7.92	2.18
BM-SRE-0066	66.00	63.160	3.76	1.25	BM-SRE-0170	170.00	164.000	7.92	2.18
BM-SRE-0067	67.00	64.160	3.76	1.25	BM-SRE-0175	175.00	169.000	7.92	2.18
BM-SRE-0068	68.00	65.080	4.01	1.25	BM-SRE-0180	180.00	173.780	7.92	2.18
BM-SRE-0069	69.00	66.060	4.01	1.25	BM-SRE-0185	185.00	178.700	7.92	2.18
BM-SRE-0070	70.00	67.080	4.01	1.25	BM-SRE-0190	190.00	183.700	7.92	2.18
BM-SRE-0071	71.00	68.040	4.01	1.25	BM-SRE-0195	195.00	188.430	7.92	2.18
BM-SRE-0072	72.00	69.000	4.27	1.25	BM-SRE-0200	200.00	193.430	7.92	2.18
BM-SRE-0075	75.00	71.930	4.27	1.25	BM-SRE-0210	210.00	202.930	9.53	2.18
BM-SRE-0078	78.00	74.840	4.27	1.55	BM-SRE-0220	220.00	212.650	9.53	2.18
BM-SRE-0080	80.00	76.800	4.52	1.55	BM-SRE-0230	230.00	222.600	9.53	2.18
BM-SRE-0082	82.00	78.720	4.52	1.55	BM-SRE-0240	240.00	232.320	9.53	2.18
BM-SRE-0085	85.00	81.620	4.78	1.55	BM-SRE-0250	250.00	241.830	9.53	2.18
BM-SRE-0088	88.00	84.530	4.78	1.55	BM-SRE-0260	260.00	251.570	9.53	2.18
BM-SRE-0090	90.00	86.430	5.03	1.55	BM-SRE-0270	270.00	261.300	9.53	2.18
BM-SRE-0095	95.00	91.370	5.03	1.55	BM-SRE-0280	280.00	271.040	9.53	2.18
BM-SRE-0100	100.00	96.100	5.28	1.55					

Stock items available in carbon steel, stainless steel and copper.

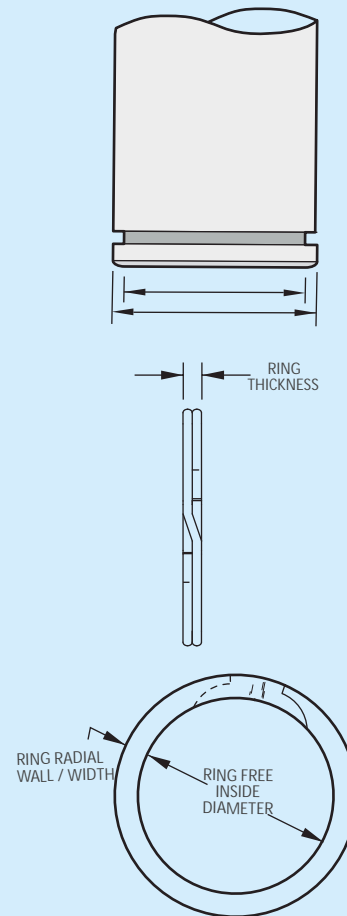


# SNAP RINGS - EXTERNAL DIN (SRED)

Part Number	Shaft Diameter	Inner Diameter	Width	Thickness
BM-SRED-0013	13.00	12.270	1.40	0.99
BM-SRED-0014	14.00	13.260	1.40	0.99
BM-SRED-0015	15.00	14.150	1.40	0.99
BM-SRED-0016	16.00	15.040	1.65	0.99
BM-SRED-0017	17.00	16.040	1.65	0.99
BM-SRED-0018	18.00	16.830	1.91	1.14
BM-SRED-0019	19.00	17.830	1.91	1.14
BM-SRED-0020	20.00	18.820	1.91	1.14
BM-SRED-0021	21.00	19.790	1.91	1.14
BM-SRED-0022	22.00	20.780	1.91	1.14
BM-SRED-0023	23.00	21.770	1.91	1.14
BM-SRED-0024	24.00	22.660	2.18	1.14
BM-SRED-0025	25.00	23.650	2.18	1.14
BM-SRED-0026	26.00	24.640	2.18	1.14
BM-SRED-0027	27.00	25.340	2.18	1.14
BM-SRED-0028	28.00	26.340	2.39	1.44
BM-SRED-0029	29.00	27.330	2.39	1.44
BM-SRED-0030	30.00	28.320	2.39	1.44
BM-SRED-0032	32.00	30.000	3.25	1.44
BM-SRED-0033	33.00	30.990	3.25	1.44
BM-SRED-0034	34.00	31.980	3.25	1.44
BM-SRED-0035	35.00	32.660	3.25	1.44
BM-SRED-0036	36.00	33.650	4.01	1.69
BM-SRED-0038	38.00	35.640	4.01	1.69
BM-SRED-0040	40.00	37.110	4.01	1.69
BM-SRED-0042	42.00	39.090	4.01	1.69
BM-SRED-0045	45.00	42.060	4.01	1.69
BM-SRED-0046	46.00	43.050	4.01	1.69
BM-SRED-0047	47.00	44.040	4.01	1.69
BM-SRED-0048	48.00	45.030	4.01	1.69
BM-SRED-0050	50.00	46.530	5.08	1.93
BM-SRED-0052	52.00	48.510	5.08	1.93
BM-SRED-0054	54.00	50.500	5.08	1.93

## Product Dimensions

All dimensions in millimeters



Stock items available in carbon steel, stainless steel and copper.

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# SNAP RINGS - EXTERNAL DIN (SRED)



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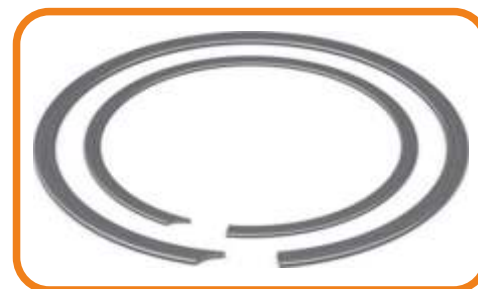
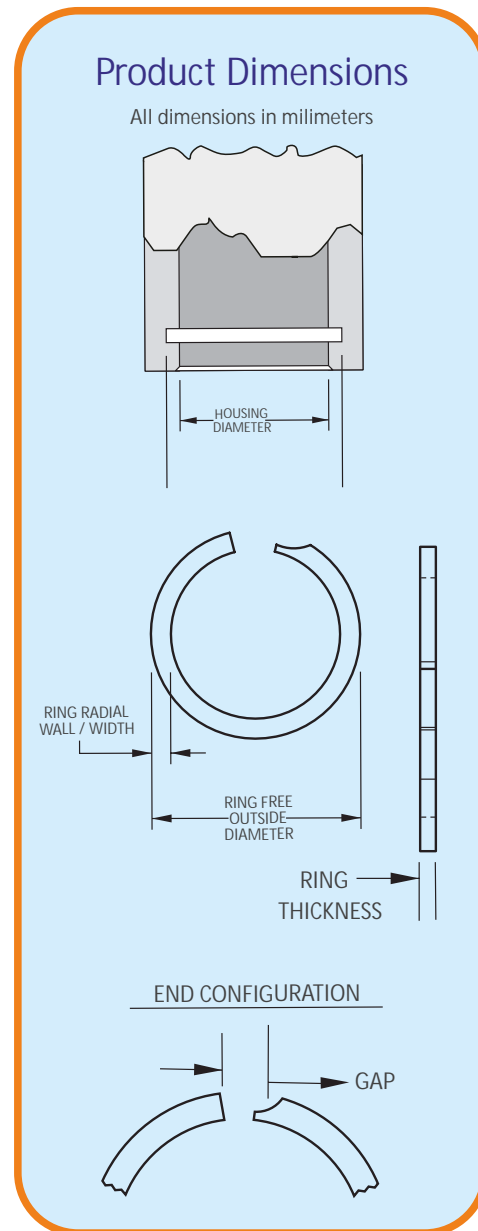
Part Number	Shaft Diameter	Inner Diameter	Width	Thickness	Part Number	Shaft Diameter	Inner Diameter	Width	Thickness
BM-SRED-0055	55.00	51.490	5.08	1.93	BM-SRED-0150	150.00	143.910	7.92	3.89
BM-SRED-0056	56.00	52.480	5.08	1.93	BM-SRED-0155	155.00	148.890	7.92	3.89
BM-SRED-0058	58.00	54.430	5.08	1.93	BM-SRED-0160	160.00	153.850	7.92	3.89
BM-SRED-0060	60.00	56.420	5.08	1.93	BM-SRED-0165	165.00	158.800	7.92	3.89
BM-SRED-0062	62.00	58.420	5.08	1.93	BM-SRED-0170	170.00	163.750	7.92	3.89
BM-SRED-0063	63.00	59.390	5.08	1.93	BM-SRED-0175	175.00	168.730	7.92	3.89
BM-SRED-0065	65.00	61.390	5.08	2.41	BM-SRED-0180	180.00	173.690	7.92	3.89
BM-SRED-0067	67.00	63.370	5.08	2.41	BM-SRED-0185	185.00	178.660	7.92	3.89
BM-SRED-0068	68.00	64.340	5.08	2.41	BM-SRED-0190	190.00	183.590	7.92	3.89
BM-SRED-0070	70.00	66.340	5.08	2.41	BM-SRED-0195	195.00	188.540	7.92	3.89
BM-SRED-0072	72.00	68.330	5.08	2.41	BM-SRED-0200	200.00	193.540	7.92	3.89
BM-SRED-0075	75.00	71.330	5.08	2.41	BM-SRED-0205	205.00	197.540	11.18	4.86
BM-SRED-0077	77.00	73.330	5.08	2.41	BM-SRED-0210	210.00	202.540	11.18	4.86
BM-SRED-0078	78.00	74.330	5.08	2.41	BM-SRED-0220	220.00	212.470	11.18	4.86
BM-SRED-0080	80.00	75.810	6.05	2.41	BM-SRED-0230	230.00	222.400	11.18	4.86
BM-SRED-0082	82.00	77.810	6.05	2.41	BM-SRED-0240	240.00	232.330	11.18	4.86
BM-SRED-0085	85.00	80.800	6.35	2.91	BM-SRED-0250	250.00	242.240	11.18	4.86
BM-SRED-0088	88.00	83.800	6.35	2.91	BM-SRED-0260	260.00	250.190	12.70	4.86
BM-SRED-0090	90.00	85.800	6.35	2.91	BM-SRED-0270	270.00	260.150	12.70	4.86
BM-SRED-0095	95.00	90.800	6.35	2.91	BM-SRED-0280	280.00	270.080	12.70	4.86
BM-SRED-0098	98.00	93.790	6.35	2.91	BM-SRED-0290	290.00	279.980	12.70	4.86
BM-SRED-0100	100.00	95.790	6.35	2.91	BM-SRED-0300	300.00	289.920	12.70	4.86
BM-SRED-0102	102.00	97.290	6.73	3.89	BM-SRED-0310	310.00	297.840	15.88	5.87
BM-SRED-0105	105.00	100.280	6.73	3.89	BM-SRED-0320	320.00	307.840	15.88	5.87
BM-SRED-0108	108.00	103.250	6.73	3.89	BM-SRED-0330	330.00	317.750	15.88	5.87
BM-SRED-0110	110.00	105.230	6.73	3.89	BM-SRED-0340	340.00	327.690	15.88	5.87
BM-SRED-0115	115.00	110.190	6.73	3.89	BM-SRED-0350	350.00	337.640	15.88	5.87
BM-SRED-0120	120.00	115.160	6.73	3.89	BM-SRED-0360	360.00	347.570	15.88	5.87
BM-SRED-0125	125.00	120.120	6.73	3.89	BM-SRED-0370	370.00	357.480	15.88	5.87
BM-SRED-0130	130.00	125.070	6.73	3.89	BM-SRED-0380	380.00	367.410	15.88	5.87
BM-SRED-0135	135.00	130.020	6.73	3.89	BM-SRED-0390	390.00	377.340	15.88	5.87
BM-SRED-0140	140.00	134.980	6.73	3.89	BM-SRED-0400	400.00	387.250	15.88	5.87
BM-SRED-0145	145.00	139.930	6.73	3.89					

Stock items available in carbon steel, stainless steel and copper.



# RETAINER RINGS - INTERNAL DIN (RRID)

Part Number	Housing Diameter	RING		
		Diameter	Width	Thickness
BM-RRID-0013	13.00	13.730	1.40	0.94
BM-RRID-0014	14.00	14.740	1.40	0.94
BM-RRID-0015	15.00	15.850	1.40	0.94
BM-RRID-0016	16.00	16.900	1.65	0.94
BM-RRID-0017	17.00	17.970	1.65	0.94
BM-RRID-0018	18.00	19.180	1.90	0.94
BM-RRID-0019	19.00	20.250	1.90	0.94
BM-RRID-0020	20.00	21.200	1.90	0.94
BM-RRID-0021	21.00	22.210	1.90	0.94
BM-RRID-0022	22.00	23.220	1.90	0.94
BM-RRID-0023	23.00	24.230	1.90	0.94
BM-RRID-0024	24.00	25.400	2.15	1.15
BM-RRID-0025	25.00	26.450	2.15	1.15
BM-RRID-0026	26.00	27.460	2.15	1.15
BM-RRID-0027	27.00	28.470	2.38	1.15
BM-RRID-0028	28.00	29.680	2.38	1.15
BM-RRID-0029	29.00	30.690	2.38	1.15
BM-RRID-0030	30.00	31.790	2.38	1.15
BM-RRID-0031	31.00	33.010	2.38	1.15
BM-RRID-0032	32.00	33.930	2.38	1.15
BM-RRID-0033	33.00	35.030	2.38	1.15
BM-RRID-0034	34.00	36.040	3.25	1.44
BM-RRID-0035	35.00	37.350	3.25	1.44
BM-RRID-0036	36.00	38.360	3.25	1.44
BM-RRID-0037	37.00	39.370	3.25	1.44
BM-RRID-0038	38.00	40.440	3.25	1.44
BM-RRID-0040	40.00	42.860	4.01	1.69
BM-RRID-0041	41.00	43.910	4.01	1.69
BM-RRID-0042	42.00	44.920	4.01	1.69
BM-RRID-0045	45.00	47.880	4.01	1.69
BM-RRID-0047	47.00	49.970	4.01	1.69
BM-RRID-0048	48.00	50.980	4.01	1.69
BM-RRID-0050	50.00	53.500	5.08	1.93



Stock items available in carbon steel, stainless steel and copper.

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# RETAINER RINGS - INTERNAL DIN (RRID)



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Part Number	Housing Diameter	RING			Part Number	Housing Diameter	RING		
		Diameter	Width	Thickness			Diameter	Width	Thickness
BM-RRID-0051	51.00	54.430	5.08	1.93	BM-RRID-0112	112.00	117.120	6.73	3.89
BM-RRID-0052	52.00	55.520	5.08	1.93	BM-RRID-0115	115.00	120.150	6.73	3.89
BM-RRID-0055	55.00	58.550	5.08	1.93	BM-RRID-0120	120.00	125.600	6.73	3.89
BM-RRID-0056	56.00	59.560	5.08	1.93	BM-RRID-0125	125.00	130.250	6.73	3.89
BM-RRID-0057	57.00	60.680	5.08	1.93	BM-RRID-0127	127.00	132.270	6.73	3.89
BM-RRID-0058	58.00	61.580	5.08	1.93	BM-RRID-0130	130.00	135.300	6.73	3.89
BM-RRID-0060	60.00	63.600	5.08	1.93	BM-RRID-0135	135.00	140.350	6.73	3.89
BM-RRID-0062	62.00	65.580	5.08	1.93	BM-RRID-0140	140.00	145.260	6.73	3.89
BM-RRID-0063	63.00	66.630	5.08	1.93	BM-RRID-0145	145.00	150.450	6.73	3.89
BM-RRID-0064	64.00	67.640	5.08	2.41	BM-RRID-0150	150.00	156.500	8.03	3.89
BM-RRID-0065	65.00	68.700	5.08	2.41	BM-RRID-0155	155.00	161.550	8.03	3.89
BM-RRID-0067	67.00	70.540	5.08	2.41	BM-RRID-0160	160.00	166.600	8.03	3.89
BM-RRID-0068	68.00	71.840	5.08	2.41	BM-RRID-0165	165.00	171.700	8.03	3.89
BM-RRID-0070	70.00	73.640	5.08	2.41	BM-RRID-0170	170.00	176.700	8.03	3.89
BM-RRID-0072	72.00	75.720	5.08	2.41	BM-RRID-0175	175.00	181.750	8.03	3.89
BM-RRID-0075	75.00	78.750	5.08	2.41	BM-RRID-0180	180.00	186.800	8.03	3.89
BM-RRID-0076	76.00	79.880	5.08	2.41	BM-RRID-0185	185.00	191.850	8.03	3.89
BM-RRID-0078	78.00	81.730	5.08	2.41	BM-RRID-0190	190.00	197.150	8.03	3.89
BM-RRID-0080	80.00	84.300	6.02	2.41	BM-RRID-0195	195.00	201.950	8.03	3.89
BM-RRID-0082	82.00	86.320	6.02	2.41	BM-RRID-0200	200.00	207.000	8.03	3.89
BM-RRID-0085	85.00	89.350	6.30	2.91	BM-RRID-0210	210.00	217.930	9.48	4.87
BM-RRID-0088	88.00	92.380	6.30	2.91	BM-RRID-0220	220.00	228.200	9.48	4.87
BM-RRID-0090	90.00	94.700	6.30	2.91	BM-RRID-0230	230.00	238.300	9.48	4.87
BM-RRID-0092	92.00	96.500	6.30	2.91	BM-RRID-0240	240.00	248.400	9.48	4.87
BM-RRID-0095	95.00	99.620	6.30	2.91	BM-RRID-0250	250.00	258.500	9.48	4.87
BM-RRID-0098	98.00	102.710	6.30	2.91	BM-RRID-0260	260.00	270.770	11.05	4.87
BM-RRID-0100	100.00	104.500	6.30	2.91	BM-RRID-0270	270.00	280.700	11.05	4.87
BM-RRID-0102	102.00	107.270	6.73	3.89	BM-RRID-0280	280.00	290.570	11.05	4.87
BM-RRID-0105	105.00	109.960	6.73	3.89	BM-RRID-0290	290.00	300.900	11.05	4.87
BM-RRID-0108	108.00	113.090	6.73	3.89	BM-RRID-0300	300.00	311.000	11.05	4.87
BM-RRID-0110	110.00	115.100	6.73	3.89					

Stock items available in carbon steel, stainless steel and copper.

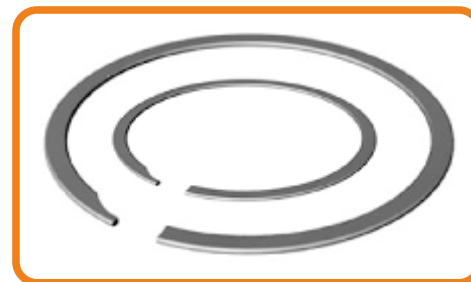
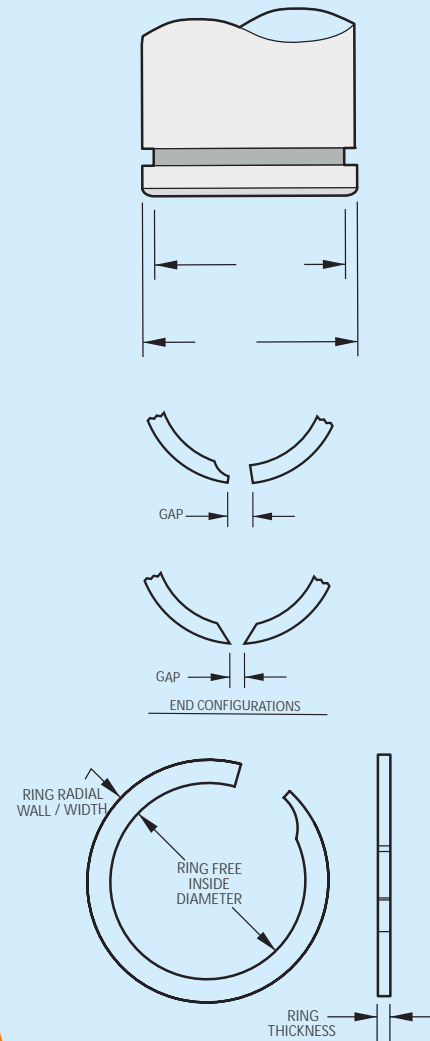


# RETAINER RINGS - EXTERNAL DIN (RRED)

Part Number	Shaft Diameter	Inner Diameter	Width	Thickness
BM-RRED-0013	13.00	12.270	1.40	0.94
BM-RRED-0014	14.00	13.310	1.40	0.94
BM-RRED-0015	15.00	14.150	1.40	0.94
BM-RRED-0016	16.00	14.980	1.65	0.94
BM-RRED-0017	17.00	16.060	1.65	0.94
BM-RRED-0018	18.00	16.820	1.90	1.15
BM-RRED-0019	19.00	17.810	1.90	1.15
BM-RRED-0020	20.00	18.800	1.90	1.15
BM-RRED-0021	21.00	19.790	1.90	1.15
BM-RRED-0022	22.00	20.830	1.90	1.15
BM-RRED-0023	23.00	21.770	1.90	1.15
BM-RRED-0024	24.00	22.500	2.15	1.15
BM-RRED-0025	25.00	23.700	2.15	1.15
BM-RRED-0026	26.00	24.640	2.15	1.15
BM-RRED-0027	27.00	25.500	2.15	1.15
BM-RRED-0028	28.00	26.320	3.25	1.44
BM-RRED-0029	29.00	27.150	3.25	1.44
BM-RRED-0030	30.00	28.350	3.25	1.44
BM-RRED-0032	32.00	29.870	3.25	1.44
BM-RRED-0033	33.00	31.070	3.25	1.44
BM-RRED-0034	34.00	31.960	3.25	1.44
BM-RRED-0035	35.00	32.570	3.25	1.44
BM-RRED-0036	36.00	33.640	4.01	1.69
BM-RRED-0038	38.00	35.620	4.01	1.69
BM-RRED-0040	40.00	37.020	4.01	1.69
BM-RRED-0042	42.00	39.080	4.01	1.69
BM-RRED-0045	45.00	42.050	4.01	1.69
BM-RRED-0046	46.00	43.100	4.01	1.69
BM-RRED-0047	47.00	44.030	4.01	1.69
BM-RRED-0048	48.00	44.890	4.01	1.69
BM-RRED-0050	50.00	46.500	5.08	1.93
BM-RRED-0052	52.00	48.480	5.08	1.93
BM-RRED-0054	54.00	50.460	5.08	1.93

## Product Dimensions

All dimensions in millimeters



Stock items available in carbon steel, stainless steel and copper.

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# RETAINER RINGS - EXTERNAL DIN (RRED)



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Part Number	Shaft Diameter	Inner Diameter	Width	Thickness	Part Number	Shaft Diameter	Inner Diameter	Width	Thickness
BM-RRED-0055	55.00	51.450	5.08	1.93	BM-RRED-0125	125.00	119.750	6.73	3.89
BM-RRED-0056	56.00	52.440	5.08	1.93	BM-RRED-0130	130.00	124.700	6.73	3.89
BM-RRED-0058	58.00	54.420	5.08	1.93	BM-RRED-0135	135.00	129.650	6.73	3.89
BM-RRED-0060	60.00	56.550	5.08	1.93	BM-RRED-0140	140.00	134.420	6.73	3.89
BM-RRED-0062	62.00	58.320	5.08	1.93	BM-RRED-0145	145.00	139.550	6.73	3.89
BM-RRED-0063	63.00	59.370	5.08	1.93	BM-RRED-0150	150.00	143.500	8.03	3.89
BM-RRED-0065	65.00	61.350	5.08	2.41	BM-RRED-0155	155.00	148.450	8.03	3.89
BM-RRED-0067	67.00	63.350	5.08	2.41	BM-RRED-0160	160.00	153.400	8.03	3.89
BM-RRED-0068	68.00	64.450	5.08	2.41	BM-RRED-0165	165.00	158.400	8.03	3.89
BM-RRED-0070	70.00	66.220	5.08	2.41	BM-RRED-0170	170.00	163.300	8.03	3.89
BM-RRED-0072	72.00	68.280	5.08	2.41	BM-RRED-0175	175.00	168.250	8.03	3.89
BM-RRED-0075	75.00	71.250	5.08	2.41	BM-RRED-0180	180.00	173.200	8.03	3.89
BM-RRED-0077	77.00	73.230	5.08	2.41	BM-RRED-0185	185.00	177.620	8.03	3.89
BM-RRED-0078	78.00	74.060	5.08	2.41	BM-RRED-0190	190.00	183.350	8.03	3.89
BM-RRED-0080	80.00	75.700	6.02	2.41	BM-RRED-0195	195.00	188.050	8.03	3.89
BM-RRED-0082	82.00	77.680	6.02	2.41	BM-RRED-0200	200.00	193.000	8.03	3.89
BM-RRED-0085	85.00	80.650	6.30	2.91	BM-RRED-0205	205.00	196.950	11.05	4.87
BM-RRED-0088	88.00	83.620	6.30	2.91	BM-RRED-0210	210.00	201.670	11.05	4.87
BM-RRED-0090	90.00	85.800	6.30	2.91	BM-RRED-0220	220.00	211.800	11.05	4.87
BM-RRED-0095	95.00	90.680	6.30	2.91	BM-RRED-0230	230.00	221.700	11.05	4.87
BM-RRED-0098	98.00	93.700	6.30	2.91	BM-RRED-0240	240.00	231.890	11.05	4.87
BM-RRED-0100	100.00	95.500	6.30	2.91	BM-RRED-0250	250.00	241.500	11.05	4.87
BM-RRED-0102	102.00	97.230	6.30	2.91	BM-RRED-0260	260.00	249.590	12.70	4.87
BM-RRED-0105	105.00	99.830	6.73	3.89	BM-RRED-0270	270.00	259.300	12.70	4.87
BM-RRED-0108	108.00	102.870	6.73	3.89	BM-RRED-0280	280.00	268.830	12.70	4.87
BM-RRED-0110	110.00	104.900	6.73	3.89	BM-RRED-0290	290.00	279.100	12.70	4.87
BM-RRED-0115	115.00	109.850	6.73	3.89	BM-RRED-0300	300.00	289.000	12.70	4.87
BM-RRED-0120	120.00	115.060	6.73	3.89					

Stock items available in carbon steel, stainless steel and copper.



## MATERIAL USED FOR MANUFACTURING

Selection of the correct material bases upon application can enhance the quality of finished work. Specifying the correct material can prevent additional cost and failure in operation. Stainless steel is more expensive than carbon steel but has better corrosion resistant and can operate at high temperature.



### Carbon Steel (Spring Steel):

Pre-tempered carbon steel has good tensile strength / yield strength. Due to cold working and wire formation the grain structure is far superior as compared to stamped component. Carbon steel is highly magnetic. Carbon steel, known for its high strength and reliability and retaining ring applications, offers following advantages:



- High Strength — the heat treating process assures the rings are ware resistant.
- Ductility — the heat treating process also assures the spring characteristic of the ring, enabling it to return to its original shape after it is deformed.
- Corrosion Protection Option — it is possible to apply a finish to carbon steel for corrosion resistance

### Stainless Steel

- 302 stainless steel is used mainly for retainer rings. It has better corrosion resistance and physical properties. We get the spring qualities by cold working. Though non-magnetic, but due to cold working, it becomes slightly magnetic. It is not hardenable by heat treatment. In fatigue and high stress applications, 302 outperforms even than the highest grade of carbon steel.
- 316 Stainless steel: Nearly identical in physical properties and heat resistance to 302, 316 provide additional corrosion resistance, particularly against pitting. It has better corrosion resistance than 302 stainless steel due to molybdenum. It is less magnetic than 302 and is used where non-magnetic / less magnetic products are required for specific applications.





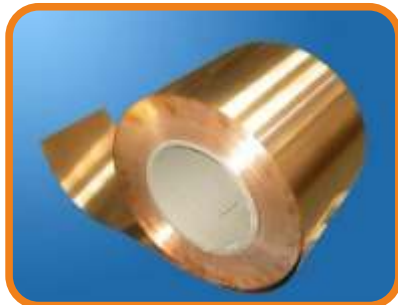
## Beryllium Copper:

It has higher strength and excellent spring qualities. It is non-magnetic and a good electrical conductivity. It can be used at higher temperature. Applications that require conductivity are best served by this material. It is also characterized by excellent corrosion resistance and is particularly effective in sea air and sea water atmospheres.



## Phosphor Bronze:

It is the cost effective material with lower spring properties, hence has little lesser strength in performance compared to Beryllium copper. But many of the industries and specific applications require products manufactured from this material and Business machines can offer the same to our customers.



## MATERIAL CONSIDERATION

Depending on the cross section of the ring, internal stresses during coiling may not allow for parts to be made from pre-hardened wire. Special shapes require a soft material. Small sections also distort during heat treating and lend the product to pre-hardened material. Cut-off requirements also limit material choices.

### PRE HARDENED MATERIAL:

- Specified by tensile strength & hardness
- Specified by raw material processing (Hard Drawn or Oil Tempered)
- Pre-hardened product has cost benefits due to fewer manufacturing processes.

### POST HEAT TREATED / (AUSTEMPERED)

- Specified by Steel Grade and Hardness.
- Steel hardness range should be equivalent to tapered section rings of the same thickness.
- All product is hardened by an austempering process.
- Heat treating gives parts the proper hardness and dimensional stability.



### Black Oxide (Hot & Cold Blackening)

Black Oxide finishes are typically done in 2 methodologies: Hot Oxide and Cold Oxide (Room Temperature Blackening). BM use special methodologies to form an appealing black finish on steel, aluminum and zinc alloys. A black oxide finish offers a combination of properties that cannot be provided any other way. This conversion coating does not change the dimensional, physical or mechanical properties of the surface treated. The finish is inexpensive and easy to apply. It has an excellent appearance and is abrasion resistant. Black oxide is intended more for cosmetic appearance than for corrosion resistance.

Cold / Room Temperature Blackening - The room temperature blackening process offer energy savings and convenience over hot black oxide while sacrificing some corrosion resistance and durability when compare to the finish formed by a hot black oxide process.

#### Features and Benefits:

- No dimensional change
- Suitable for cell manufacturing
- Increased corrosion resistance
- Low energy costs
- Reduced light glare
- Decorative Finish
- Provides anti-galling properties
- Base for organic coatings



### Passivation for Stainless Steel

Passivation process ensures corrosion resistance and removes free ion contamination left on the SS surface from fabricating and machinery. These contaminants are prospective corrosion sites resulting in premature corrosion, ultimately resulting in decline of component if not removed. The process typically begins with a thorough cleaning cycle. It removes oils, greases, forming compounds, lubricants, coolants, cutting fluids and other undesirable organic and metallic residue left behind because of fabrication and machining processes.

Proper Passivation of SS and weld seams offers qualities such as:

- Good and decorative metallic appearance
- Improved corrosion resistance of Stainless Steel components
- Optimum restoration of chromium oxide passive layer
- Surface that is metallurgically pure & free from scaling & discolouration







## Oil Tempered

High carbon tempered spring steel is the standard material for coupling rings and wave springs. This is the standard finish for all Business Machine products produced from carbon steel. The oil provides resistance to corrosion in transport and normal storage. The oil dip finish should not be considered a permanent finish.

## Zinc plating (Yellow, Blue or green finish)

Zinc plating involves the electrolytic application of zinc by immersing clean steel parts in a zinc salt solution and applying an electric current. Zinc coatings prevent oxidation of the protected metal by forming a barrier. Zinc electroplating process is used to make a clean, smooth and corrosion resistant surface. Zinc electroplating is one of the most common forms of electroplating and popular because of its relatively low cost, protective nature and attractive appearance. The coating done through this process gives corrosion protection to ferrous components and it can give colors like yellow, blue, green etc, by post treatment.



## **SURFACE FINISHES**

Business Machine's products can be delivered in several different surface finishes. To describe a surface appearance correctly one has to indicate both its appearance and the roughness.

In the table below, surface appearances are defined in the brightness and color. Stainless steel is usually color tempered and are therefore not delivered in yellow or blue color.

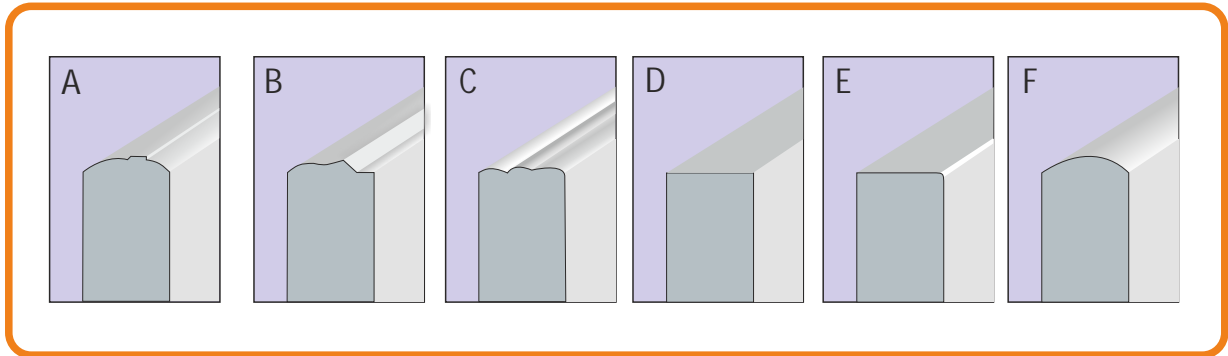
Code	Surface	Definition
A	No requirements	Normally an oxidized surface for which there are no appearance requirements.
B	Dull	Dull smooth surface
C	Bright	Normal bright smooth surface
D	Very Bright	Mirror surface meeting very stringent requirements on uniform appearance
E	Yellow	Yellow, oxidized surface with uniform color
F	Blue	Blue, oxidized surface with uniform color
G	White	Surface free from oxide discoloration and with uniform Color
H	Special	Surface as specified by the customer



## MATERIAL FINISHES

### EDGES

Business Machines products can be delivered in a variety of edge finishes to suit customer requirements. The choice of edge finish depends on the application; however the ability of the finishes is dependent on the size and tolerance. For example in the drawing below, image "d" is with sharp cornered square edge while image "e" is a square edge with round corners and image "f" is completely round.



### ULTIMATE TENSILE STRENGTH

To check the spring properties of wire, ultimate tensile strength is the preferred test method over hardness at various indentation points. As a result of cold rolling the top and the bottom surfaces become harder as they are more severely worked than the edges. Tensile test are more consistent as they evaluate the entire cross section and not a single point as in the hardness test.





Lined area for taking notes, consisting of horizontal grey lines on a white background.



## PRODUCTS

- *standard and specialized*



## INDUSTRY APPLICATIONS

- *never the limit*



## MATERIAL & FINISHES

- *no compromise*



## QUALITY

- *that you can trust*



## BM ADVANTAGES

- *life long...unlimited*

[www.businessmachines.in](http://www.businessmachines.in)

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