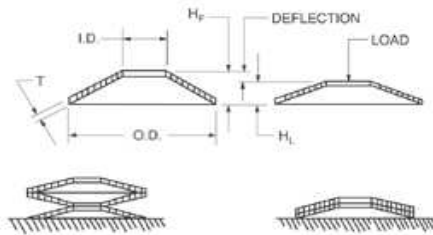


AUTOMOTIVE INDUSTRY FASTENERS

Conical or Belleville Washers



A Belleville washer, also known as a conical spring washer, is a type of non-flat washer. It has a slight cone shape which gives the washer a spring like characteristic. Belleville washers are typically used as springs, or to apply a pre-load or flexible quality to a bolted joint.

In certain applications with low dynamic loads, these washers may be used as locking devices. Belleville washers are seen on Formula One cars, as they provide extremely thorough tuning ability. Another example where they aid in locking is a joint that experiences a large amount of thermal expansion and contraction. They will supply the required pre-load, but the bolt may require an additional locking mechanism, such as Loctite, that would fail without the Belleville.

Multiple Belleville washers may be stacked to modify the spring constant or amount of deflection. Stacking in the same direction will add the spring constant in parallel, creating a stiffer joint (with the same deflection). Stacking in an alternating direction is the same as adding springs in series, resulting in a lower spring constant and great deflection. Mixing and matching directions allow a specific spring constant and deflection capacity to be designed.

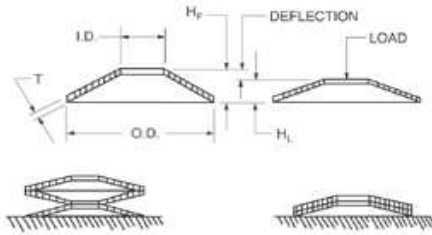
Example: 1 Spring is considered to be 1 in Parallel, 1 in Series. (This notation is needed for load calculations)

Available Standard Sizes — Belleville Washers Spring Steel

Part #	Inside Diameter Min-Max	Outside Diameter Min-Max	Free Height Min—Max	Thickness Min –Max	Material
CB2-375025	.091-.095	.373-.377	.058-.060	.025	Spring Steel
CB2-250015	.092-.097	.245-.255	.026-.030	.015	Spring Steel
CB2-182006	.093-.103	.177-.187	.013	.006	Spring Steel
CB2-182010	.093-.103	.177-.187	.015	.010	Spring Steel
CB3-302012	.109-.112	.300-.305	.050-.060	.012	Spring Steel
CB4-312032	.120-.130	.302-.322	.042-.058	.032	Spring Steel
CB4-242031	.122	.242	.047	.031	Spring Steel
CB4-245009	.125-.135	.240-.250	.017	.009	Spring Steel
CB4-245013	.125-.135	.240-.250	.020	.013	Spring Steel
CB4-370018	.125-.135	.365-.375	.029	.018	Spring Steel
CB4-245008	.129	.245	.021	.008	Spring Steel
CB4-300013	.129-.136	.295-.305	.036-.050	.013	Spring Steel
CB4-246007	.132	.246	.020	.007	Spring Steel
CB4-250020	.132	.250	.045	.020	Spring Steel
CB6-375025	.138-.143	.365-.385	.055-.070	.025	Spring Steel

AUTOMOTIVE INDUSTRY FASTENERS

Conical or Belleville Washers



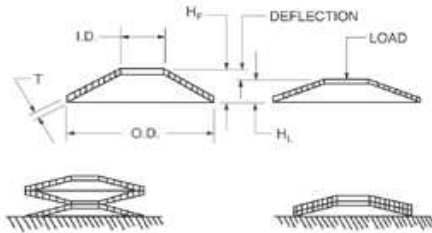
Available Standard Sizes — Belleville Washers

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Part #	Inside Diameter Min-Max	Outside Diameter Min-Max	Free Height Min—Max	Thickness Min -Max	Material
CB6-278015	.139	.278	.029	.015	Spring Steel
CB6-277020	.142	.277	.037	.020	Spring Steel
CB6-277014	.144	.277	.024	.014	Spring Steel
CB6-278012	.144	.278	.033	.010	Spring Steel
CB6-300012	.145	.300	.053	.012	Spring Steel
CB6-320025	.147	.320	.049	.025	Spring Steel
CB6-312015	.155	.312	.026	.015	Spring Steel
CB6-307010	.156-.166	.302-.312	.021	.010	Spring Steel
CB6-307016	.156-.166	.302-.312	.025	.016	Spring Steel
CB6-313016	.157	.313	.028	.016	Spring Steel
CB6-308010	.160	.308	.024	.010	Spring Steel
CB6-308023	.160	.308	.035	.023	Spring Steel
CB8-437031	.164-.170	.433-.443	.062-.070	.031	Spring Steel
CB8-347017	.165	.341	.033	.017	Spring Steel
CB8-100064	.166	1.000	.220	.064	Spring Steel
CB8-339018	.171	.339	.035	.018	Spring Steel
CB8-348040	.174	.348	.095	.040	Spring Steel
CB8-438040	.174	.438	.056	.042	Spring Steel
CB8-5000-30	.180	.500	.058	.030	Spring Steel
CB8-5100-30	.180	.511	.048	.028	Spring Steel
CB10-132032	.190	1.321	.046	.032	Spring Steel
CB10-562040	.190-.195	.552—.572	.070-.090	.040	Spring Steel
CB10-370015	.190-.200	.365-.375	.027	.015	Spring Steel
CB10-370018	.190-.200	.365-.375	.028	.018	Spring Steel

AUTOMOTIVE INDUSTRY FASTENERS

Conical or Belleville Washers



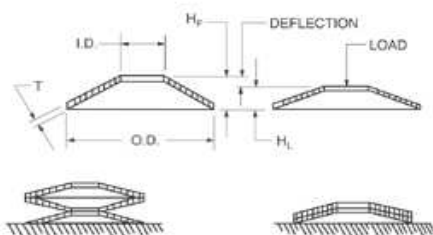
Available Standard Sizes — Belleville Washers

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Part #	Inside Diameter Min-Max	Outside Diameter Min-Max	Free Height Min—Max	Thickness Min -Max	Material
CB10-370020	.190-.200	.365-.375	.030	.020	Spring Steel
CB10-557028	.190-.200	.552-.562	.042	.028	Spring Steel
CB10-313015	.192	.313	.031	.015	Spring Steel
CB10-366008	.192	.366	.028	.008	Spring Steel
CB10-373013	.194	.373	.030	.013	Spring Steel
CB10-373019	.194	.373	.030	.019	Spring Steel
CB10-374015	.195	.374	.030	.015	Spring Steel
CB10-559030	.196	.559	.045	.030	Spring Steel
CB10-373020	.198	.373	.034	.020	Spring Steel
CB10-371015	.202	.371	.027	.015	Spring Steel
CB10-439018	.202	.439	.035	.018	Spring Steel
CB10-560027	.202	.560	.040	.027	Spring Steel
CB10-421029	.205	.421	.070	.029	Spring Steel
CB10-503008	.206	.503	.095	.008	Spring Steel
CB10-426034	.207	.426	.055	.034	Spring Steel
CB10-428034	.208	.428	.068	.031	Spring Steel
CB10-596017	.208	.596	.075	.017	Spring Steel
CB10-424040	.215	.424	.058	.040	Spring Steel
CB10-500026	.222	.500	.042	.026	Spring Steel
CB14-750025	.250-.255	.740-.760	.035-.040	.025	Spring Steel
CB14-750062	.250-.255	.740-.760	.090-.011	.062	Spring Steel
CB14-437020	.253	.437	.050	.020	Spring Steel
CB14-494020	.253	.495	.034	.020	Spring Steel
CB14-751040	.253	.751	.066	.040	Spring Steel
CB14-437016	.253-.260	.432-.442	.040-.050	.016	Spring Steel

AUTOMOTIVE INDUSTRY FASTENERS

Conical or Belleville Washers



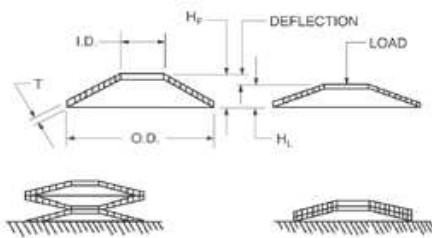
Available Standard Sizes — Belleville Washers

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Part #	Inside Diameter Min-Max	Outside Diameter Min-Max	Free Height Min—Max	Thickness Min -Max	Material
CB14-495018	.255-.265	.490-.500	.034	.018	Spring Steel
CB14-495022	.255-.265	.490-.500	.036	.022	Spring Steel
CB14-495025	.255-.265	.490-.500	.038	.025	Spring Steel
CB14-495038	.255-.265	.495-.500	.047	.038	Spring Steel
CB14-745036	.255-.265	.740-.750	.054	.036	Spring Steel
CB14-562015	.256-.267	.552-.572	.031-.040	.015	Spring Steel
CB14-496018	.257	.496	.038	.018	Spring Steel
CB14-498060	.257	.498	.085	.060	Spring Steel
CB14-498026	.258	.498	.058	.026	Spring Steel
CB14-750016	.258	.750	.054	.016	Spring Steel
CB14-483020	.260	.483	.034	.020	Spring Steel
CB14-498024	.260	.498	.040	.024	Spring Steel
CB14-499061	.260	.499	.075	.061	Spring Steel
CB14-740040	.260-.270	.730-.745	.080-.100	.040	Spring Steel
CB14-501015	.261	.501	.041	.015	Spring Steel
CB14-501022	.261	.501	.040	.022	Spring Steel
CB14-449015	.265	.449	.024	.015	Spring Steel
CB14-505005	.265	.565	.038	.025	Spring Steel
CB14-490020	.273	.490	.035	.020	Spring Steel
CB14-500016	.273	.500	.044	.016	Spring Steel
CB14-952076	.273	.952	.100	.076	Spring Steel
CB16-500050	.281-.286	.490-.510	.080-.090	.050	Spring Steel
CB16-750075	.282	.750	.099	.075	Spring Steel
CB16-493048	.314	.493	.078	.048	Spring Steel
CB16-600031	.316	.600	.043	.031	Spring Steel

AUTOMOTIVE INDUSTRY FASTENERS

Conical or Belleville Washers



Available Standard Sizes — Belleville Washers

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Part #	Inside Diameter Min-Max	Outside Diameter Min-Max	Free Height Min—Max	Thickness Min -Max	Material
CB16-628058	.316	.628	.082	.058	Spring Steel
CB18-620022	.317-.327	.615-.625	.042	.022	Spring Steel
CB18-620032	.317-.327	.615-.625	.048	.032	Spring Steel
CB18-932045	.317-.327	.927-.937	.067	.045	Spring Steel
CB18-625032	.320	.625	.050	.032	Spring Steel
CB18-625030	.320	.625	.062	.031	Spring Steel
CB18-493050	.322	.493	.073	.050	Spring Steel
CB18-500010	.323	.500	.020	.010	Spring Steel
CB18-609013	.324	.609	.071	.013	Spring Steel
CB18-620030	.324	.620	.047	.030	Spring Steel
CB18-620050	.324	.620	.067	.050	Spring Steel
CB18-719028	.324	.719	.050	.028	Spring Steel
CB18-812075	.324	.812	.106	.075	Spring Steel
CB18-624056	.340	.624	.017	.056	Spring Steel
CB18-625009	.376	.625	.034	.009	Spring Steel
CB20-755050	.380	.755	.064	.050	Spring Steel
CB20-745028	.380-.390	.740-.750	.051	.028	Spring Steel
CB20-745034	.380-.390	.740-.750	.055	.034	Spring Steel
CB20-745040	.380-.390	.740-.750	.059	.040	Spring Steel
CB20-745056	.380-.390	.740-.750	.070	.056	Spring Steel
CB20-112053	.380-.390	1.115-1.125	.080	.053	Spring Steel
CB20-746040	.381	.746	.067	.040	Spring Steel
CB20-749033	.383	.749	.052	.033	Spring Steel
CB20-125065	.384-.398	1.240-1.260	.110-.120	.065	Spring Steel
CB20-746034	.385	.746	.062	.034	Spring Steel