# Salem Specialty Ball Company, Incorporated

Supplier of Specialty Balls Orbiting the Earth.



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The information in this catalog is intended for guidance only. We accept no liability for deficiencies or damage arising from the use of this data, and customers should determine the suitability of a material or product by conducting practical tests under realistic conditions.

Salem Specialty Ball Company, Inc. P.O. Box 584, 259 Albany Turnpike, Canton, CT 06019 USA TOLL FREE PHONE#: (877) 844-4885 or (860) 693-7808, FAX#: (860) 693-7811 & (860) 693-7818 On the Web: http://www.salemball.com , E-Mail: salem@salemball.com

# Salem Specialty Ball Company, Incorporated

Our staff's fifty years of combined experience allows us to provide you with quality technical support and engineering consultation. We supply balls in any size, any material and any grade. There is **no minimum charge or order**. You can order from one ball to millions. Most orders are shipped the same day. And if it isn't in stock we can make it for you in a matter of days. In addition, you will find that our prices are very competitive.

Our friendly and knowledgable salespeople are waiting to assist you with any question you might have. Avoid all the confusion of voice mail and entering phone extension numbers. Customer's needs come first at Salem Specialty Ball. Call TOLL FREE today at (877) 844-4885. We will be glad to assist you with any questions you might have.



Phil Martinelli, C.E.O. of Salem Specialty Ball Company, Inc.

# Two main considerations when purchasing balls:

#### 1. Type of Material

The type of material generally depends on the application in question. Various temperatures or the fact that balls will come into contact with food, play a decisive role. When air humidity is high, *for example*, hardened stainless steel balls are used. In aggressive media, such as acids and alkaline solutions, softer stainless steel balls are used because they are highly resistant to corrosion.

#### 2. Dimensional Accuracy Required

The size of the ball is determined by:*Nominal Ball Diameter:* The diameter value that is used for the purpose of general identification of a ball size; e.g. 1/4", 6mm, etc.*Ball Grade:* A specific combination of dimensional form and surface tolerance. *Basic Diameter Tolerance:*The maximum allowable deviation from the basic diameter.



Salem Specialty Ball's headquarters.

Letter	Means	Letter	Means
Α	Excellent	D	Poor
В	Good	F	Not Suitable
С	Fair		

# **Corrosion Resistance**

	Chrome	440SS	302SS	316SS	Brass	Monel
Industrial Environment	С	в	в	в	С	С
Domestic Water	D	В	Α	Α	С	Α
Steam	D	В	Α	Α	В	Α
Salt Air	F	С	Α	Α	С	Α
Sea Water	F	F	Α	Α	С	В
Food Products	F	В	Α	Α	D	D
Dairy Products	F	С	Α	Α	D	С
Fruit & Vegatable Juices	F	В	В	Α	D	D
Hot Sulfite	F	F	Α	В	С	Α
Dye	F	D	D	D	D	Α
Nitric Acid	F	F	F	F	F	F
Phosphoric Acid	F	F	F	Α	С	С
Ammonia	В	С	Α	Α	F	Α

# A.F.B.M.A. Ball Grades and Tolerances

Grade	Sphericity	Basic Diameter Tolerance
3	.000003"	+/00003"
5	.000005"	+/00005"
10	.000010"	+/0001"
25	.000025"	+/0001"
50	.000050"	+/0002"
100	.0001"	+/0005"
200	.0002"	+/0010"
500	.0005"	+/002"
1000	.001"	+/005"

**Grade:** The guaranteed sphericity expressed in millionths of an inch. For example, a grade 25 ball is spherically accurate within 25 millionths of an inch.

**Sphericity:** The difference between the largest diameter and the smallest diameter on a single ball.

**Basic Diameter Tolerance:** The maximum allowable deviation from the basic diameter.

# **Rockwell Hardness**

Material	Rockwell Hardness
Chrome Steel 52100	Rc 60-67
Corrosion Resisting Hardened Steel 440 420	Rc 58-65 Rc 52 min
Corrosion Resisting Unhardened Steel 302 304 316	Rc 25-39 Rc 25-39 Rc 25-39
Carbon Steel	Rc 60min
Aluminum 2017	Rb 54-72
Aluminum Bronze	Rb 94-98
Brass	Rb 75-87
Bronze	Rb 75-98
Monel 400	Rb 85-95
K-Monel	Rc 27 min
Tungsten Carbide	Ra 84-91.5

To Convert:	Into:	Multiply by:
Pounds	Grams	453.5924
Pounds	Kilograms	0.4536

# Weight of Balls, Pounds Per Thousand Balls

Inches	SS440 SS420	C/S	Carbon	SS302	SS316	T/C
1/32	.004	.005	.005	.005	.005	.009
1/16	.035	.036	.036	.037	.037	.069
3/32	.120	.122	.123	.123	.124	.233
1/8	.283	.289	.290	.292	.295	.552
5/32	.553	.565	.567	.571	.575	1.08
3/16	.956	.977	.980	.987	.994	1.86
7/32	1.52	1.55	1.56	1.57	1.58	2.96
1/4	2.27	2.32	2.32	2.34	2.36	4.42
9/32	3.23	3.30	3.31	3.33	3.35	6.29
5/16	4.43	4.52	4.54	4.57	4.60	8.63
11/32	5.89	6.02	6.04	6.08	6.13	11.5
3/8	7.65	7.81	7.84	7.90	7.95	14.9
13/32	9.72	9.93	9.97	10.0	10.1	19.0
7/16	12.1	12.4	12.5	12.5	12.6	23.7
15/32	14.9	15.3	15.3	15.4	15.5	29.1
1/2	18.1	18.5	18.6	18.7	18.8	35.3
17/32	21.7	22.2	22.3	22.5	22.6	42.4
9/16	25.8	26.4	26.5	26.7	26.8	50.3
19/32	30.4	31.0	31.1	31.3	31.6	59.2
5/8	35.4	36.2	36.3	36.6	36.8	69.0
21/32	41.0	41.9	42.0	42.3	42.6	79.9
11/16	47.1	48.1	48.3	48.7	49.0	91.9
23/32	53.9	55.0	55.2	55.6	56.0	105
3/4	61.2	62.5	62.7	63.2	63.6	119
25/32	69.2	70.7	70.9	71.4	71.9	135
13/16	77.8	79.5	79.8	80.3	80.9	152
27/32	87.1	89.0	89.3	89.9	90.6	170
7/8	97.2	99.3	99.6	100	101	189
29/32	108	110	111	111	112	210

To Convert:	Into:	Multiply by:
Ounces	Pounds	0.0625
Kilograms	Pounds	2.205

# Weight of Balls, Pounds Per Thousand Balls

Inches	SS440 SS420	C/S	Carbor	SS302	SS316	T/C
15/16	120	122	123	123	124	233
31/32	132	135	135	136	137	257
1	145	148	149	150	151	283
1-1/8	207	211	212	213	215	403
1-1/4	283	289	290	292	295	552
1-3/8	377	385	387	389	392	735
1-1/2	489	500	502	505	509	954
1-5/8	622	636	638	643	647	1,210
1-3/4	777	794	797	803	808	1,520
1-7/8	956	977	980	987	994	1,860
2	1,160	1,190	1,190	1,200	1,210	2,260
2-1/8	1,390	1,420	1,430	1,440	1,450	2,710
2-1/4	1,650	1,690	1,690	1,710	1,720	3,220
2-3/8	1,940	1,990	1,990	2,010	2,020	3,790
2-1/2	2,270	2,320	2,320	2,340	2,360	4,420
2-5/8	2,620	2,680	2,690	2,710	2,730	5,110
2-3/4	3,020	3,080	3,090	3,110	3,140	5,880
2-7/8	3,450	3,520	3,530	3,560	3,580	6,720
3	3,920	4,000	4,010	4,040	4,070	7,630
3-1/8	4,430	4,520	4,540	4,570	4,600	8,630
3-1/4	4,980	5,090	5,100	5,140	5,180	9,710
3-3/8	5,580	5,700	5,720	5,760	5,800	10,900
3-1/2	6,220	6,350	6,380	6,420	6,470	12,100
3-5/8	6,910	7,060	7,080	7,130	7,180	13,500
3-3/4	7,650	7,810	7,840	7,900	7,950	14,900
3-7/8	8,440	8,620	8,650	8,710	8,770	16,500
4	9,280	9,480	9,520	9,580	9,650	18,100
4-1/8	10,200	10,400	10,400	10,500	10,600	19,800
4-1/4	11,100	11,400	11,400	11,500	11,600	21,700
4-3/8	12,100	12,400	12,500	12,500	12,600	23,700
4-1/2	13,200	13,500	13,600	13,600	13,700	25,800

To Convert	Into	Multiply by
Millimeters	Decimals	.03937

# **Millimeter Conversion Chart**

ММ	Inches	ММ	Inches	ММ	Inches	ММ	Inches
1	.0394	26	1.0236	51	2.0079	76	2.9921
2	.0787	27	1.0630	52	2.0472	77	3.0315
3	.1181	28	1.1024	53	2.0866	78	3.0709
4	.1575	29	1.1417	54	2.1260	79	3.1102
5	.1969	30	1.1810	55	2.1654	80	3.1496
6	.2362	31	1.2205	56	2.2047	81	3.1890
7	.2756	32	1.2598	57	2.2441	82	3.2283
8	.3150	33	1.2992	58	2.2835	83	3.2677
9	.3543	34	1.3386	59	2.3228	84	3.3071
10	.3937	35	1.3780	60	2.3622	85	3.3465
11	.4331	36	1.4173	61	2.4016	86	3.3858
12	.4724	37	1.4567	62	2.4410	87	3.4252
13	.5118	38	1.4961	63	2.4803	88	3.4645
14	.5512	39	1.5354	64	2.5197	89	3.5039
15	.5906	40	1.5748	65	2.5591	90	3.5433
16	.6299	41	1.6142	66	2.5984	91	3.5827
17	.6693	42	1.6535	67	2.6378	92	3.6220
18	.7087	43	1.6929	68	2.6772	93	3.6614
19	.7480	44	1.7323	69	2.7165	94	3.7008
20	.7874	45	1.7717	70	2.7559	95	3.7402
21	.8268	46	1.8110	71	2.7953	96	3.7795
22	.8661	47	1.8504	72	2.8347	97	3.8189
23	.9055	48	1.8898	73	2.8740	98	3.8583
24	.9449	49	1.9291	74	2.9134	99	3.8976
25	.9843	50	1.9685	75	2.9528	100	3.9370
			*		* *		*

NOTE: All millimeter and decimal numbers have been rounded off when the digit is 5 or more

To Convert	Into	Multiply by
Decimals	Millimeters	25.40

# Fraction / Decimal / Millimeter Conversion Chart

Fraction	Decimal	Millimeter	Fraction	Decimal	Millimeter	Fraction	Decimal	Millimeter
1/64	.0156	.3968	23/64	.3594	9.128	45/64	.7031	17.86
1/32	.0312	.7937	3/8	.3750	9.525	23/32	.7187	18.26
3/64	.0468	1.191	25/64	.3906	9.922	47/64	.7344	18.65
1/16	.0625	1.587	13/32	.4062	10.32	3/4	.7500	19.05
5/64	.0781	1.984	27/64	.4219	10.72	49/64	.7656	19.45
3/32	.0937	2.381	7/16	.4375	11.11	24/32	.7812	19.84
7/64	.1094	2.778	29/64	.4531	11.51	51/64	.7969	20.24
1/8	.1250	3.175	15/32	.4688	11.91	13/16	.8125	20.64
9/64	.1406	3.571	31/64	.4844	12.30	53/64	.8281	21.03
5/32	.1562	3.968	1/2	.5000	12.70	27/32	.8437	21.43
11/64	.1719	4.366	33/64	.5156	13.10	55/64	.8594	21.83
3/16	.1875	4.762	17/32	.5312	13.49	7/8	.8750	22.22
13/64	.2031	5.159	35/64	.5469	13.89	57/64	.8906	22.62
7/32	.2187	5.556	<b>9/16</b>	.5625	14.29	29/32	.9062	23.02
15/64	.2343	5.953	37/64	.5781	14.68	59/64	.9219	23.41
1/4	.2500	6.350	19/32	.5937	15.08	15/16	.9375	23.81
17/64	.2656	6.747	39/64	.6094	15.48	61/64	.9531	24.21
9/32	.2812	7.144	5/8	.6250	15.87	31/32	.9687	24.61
19/64	.2969	7.541	41/64	.6406	16.27	63/64	.9843	25.00
5/16	.3125	7.937	21/32	.6462	16.67	1	1.00	25.40
21/64	.3281	8.334	43/64	.6719	17.06			
11/32	.3437	8.731	11/16	.6875	17.46			

NOTE: All millimeter and decimal numbers have been rounded off when the digit is 5 or more

#### ALUMINUM

Aluminum Balls are light and exhibit excellent heat and electrical conductivity. Aluminum is highly resistant to corrosion, but has a low mechanical strength. There are many types of Aluminum available, including:

Aluminum	1100	Aluminum	2024
Aluminum	2011	Aluminum	6061
Aluminum	2017	Aluminum	7074

Aluminum 7075

We also carry Aluminum Bronze.

#### BRASS

*Brass* offers resistance to the corrosion caused by ambient air and sea water. *Brass* resists corrosion from petroleum products and alcohol, however it can be unstable in acids and bases. *Brass* exhibits excellent electrical conductivity, making it a popular material in the electronics field.

#### BRONZE

*Bronze* is a high quality alloy created for environments subjected to attack by gasoline, water and other solvents. *Bronze* offers resistance to corrosion and is an excellent electrical conductor. *Bronze* is widely used in the electronics industry and in the manufacture of various valves.

#### LOW CARBON STEEL

The main feature of this case hardened ball is the carburised case with a soft core. This design lends resistance to shock loads and surface wear while providing good load carrying ability. Balls of this type are generally used in applications where there are only moderate loads and slow rotating parts.

#### HIGH CARBON STEEL

*High Carbon Steel Balls* have the advantage of being through hardened and will take higher loads and provide longer life than case hardened balls, for such applications as the cycle industry. These balls are substantially less expensive than balls manufactured from high carbon chrome alloy steels.

#### CHROME STEEL

*Chrome Steel-52100* is a universal material for many applications. *Chrome Steel* contains chromium and due to through hardening has an excellent surface quality and high load bearing. Throughout the manufacturing process, statistical process control assures tolerance accuracy, fine surface finish and a consistent high quality.

#### CERAMICS

Balls manufactured from a variety of ceramic materials are extremely resistant to corrosion and abrasion. *Ceramic Balls* exhibit low thermal conductivity and resistance to extreme temperatures (some in excess of 3250°F). Bearing friction is less likely to increase as temperature increases when using ceramics and heat absorption is considerably less than other materials allowing lower cooling requirements. These qualities make ceramic balls useful for flow control, metering and bearing applications in harsh environments. **Precision Ceramic Balls are available in the following materials:** 

Alumina Oxide is resistant to most corrosive materials, however it is not recommended for environments containing hydrochloric and hydrofluoric acids or strong alkaline solutions. *Alumina Oxide's* maximum useful temperature is 3180° F.

**Ruby Sapphire** is opaque red in color and frequently used in gauging devices. *Ruby Sapphire* is resistant to most corrosive material even at very high temperatures. *Ruby Sapphire's* maximum useful temperature is 3250° F.

**Silicon Nitride** is a new material suitable for applications where high loads, high speeds and extreme temperatures are factors. Long life and the need for no lubrication makes this material very suitable for aviation applications. *Silicon Nitride* is anti-magnetic and resistant to corrosion by most substances.

**Zirconia** is inert to corrosive materials with the exception of hydrofluoric acid and hot, concentrated sulfuric acid. *Zirconia* has a maximum useful temperature of 1800° F.

#### **COBALT (Stellite)**

*Cobalt* is used in applications requiring extreme wear and temperature particularly where lubrication is marginal. *Cobalt* is highly resistant to corrosion. Please note that larger *cobalt* alloy balls (1.5" and up) will have a lower hardness than smaller balls.

#### COPPER

*Copper* is best known for it's electrical and heat conductivity and is used extensively in the electronics industry. *Copper* is sensitive to corrosion from a variety of agents and is a relatively soft metal. *Copper* has found use in artistic applications as well, but is not recommended where exposure to corrosive agents or high mechanical stress are factors.

## <u>GLASS</u>

*Glass Balls* are dimensionally stable, resist corrosion and chemical absorption and can withstand high temperatures (up to 600° F.) Density varies depending on the type of glass used to manufacture the ball. **We provide high precision balls from the following types of glass:** 

**Black Glass** is used in a variety of functions, however, it is most common in instrumentation. *Black Glass* is used in flow-meters and aircraft slip and turn indicators. *Black Glass* is moderately resistant to corrosion.

**Borosilicate** is highly resistant to corrosion and most acids. Strong resistance to thermal shock and extended exposure to temperatures of up to  $600^{\circ}$  F (  $290^{\circ}$  C ).

**Soda-Lime** is used in economical check valves that are not subjected to thermal mechanical shock. Highly resistant to high alkaline solutions.

#### HASTELLOY

*Hastelloy* is resistant to strong oxidizing agents such as free chlorine and aqueous solutions of ferric and cupric salts. Hastelloy exhibits excellent resistance to the following types of acids:

Acetic	Nitric
Formic	Phosphoric
Hydrochloric	Sulfuric
Hydrofluoric	

*Hastelloy* is highly resistant to mixtures of zinc and ammonium chlorides. It is also used extensively in check valves where resistance to corrosion and wear is critical.

#### K-MONEL

*K-Monel* is similar to *Monel*, however, it is superior in mechanical properties and in its resistance to corrosion caused by alkalis. *Please see Monel for more information.* 

#### <u>M-50</u>

This alloy has excellent resistance to softening at high service temperatures ( $800^{\circ}$ F). M-50 has a good degree of oxidation resistance and features the high compressive strength characteristics of high-speed tool steels. *M-50* has found wide use in the manufacture of bearings and in missile construction. It is also used in aircraft engines where it must retain high wear resistance and strength up to  $800^{\circ}$ F.

#### MONEL

*Monel* is recommended for applications requiring a very high resistance to corrosion. Balls made of *Monel* are impervious to the effects of steam, gas, salt water, ammonia, calcium chloride, and the acids associated with food products even at high temperatures.

### PLASTICS

*Plastics* are ideal for light load bearings and flow control applications. *Plastic Balls* are often used in the construction of office furniture and medical equipment because of their quiet operation. *Plastic balls* are often used extensively in pharmaceutical, food and chemical production. *Plastic Balls* have low friction and require virtually no lubrication. They are much lighter than metal balls and are resistant to corrosion and abrasion. Many plastics are also resistant to high temperatures up to 600° F. There are a variety of plastics available and each has different characteristics, so feel free to contact us and we will help you select the polymer best suited for your application and budget.

**Nylon** (*Zytel, Polymide*) is used in check valves, light load bearings, knobs and togle switches and other applications where low cost and resiliency are more important than hardness. *Nylon* has good resistance to alkalis, petroleum products and various mild chemicals.

**Polyoxymethane** (*Delrin, Acetal*) is similar to nylon but slightly harder and denser. Recommended for applications where these properties and low water absorption are required.

**Polypropylene** is characterized by low weight and water absorption and resistance to corrosion. Typical applications include fluid level gauges, flow meters, valves, blood transfusion kits, vapor and evaporation shields for electrolytic solutions.

**Polyurethane** is a relatively soft material that provides a good seal at low pressure in non return valves and excellent wear resistance. *Polyurethane* is not recommended for use with acids and alkalis.

**Polytetrafluorethylene** (*Teflon*) is a well known non-friction material which is resistant to most corrosive reagents and is electrically nonconductive. *Teflon* is particularly suitable for use in apparatus designed to handle cryogenic liquids and acids.

**Rubber** is a soft 70 durometer *Buna-N* nitrile compound which is highly recommended for all applications where the ball is exposed to a variety of popular hydraulics in fluids of water. *Rubber* balls are ground to a very close tolerances to provide outstanding performance in critical sealing applications.

Grade	Tolerance	Sphericity
1	+/001"	.0005"
2	+/002"	.001"
3	+/005"	.005"

## **Plastic Grades and Tolerances**

## 302 STAINLESS STEEL

302 Stainless Steel provides extreme toughness and corrosion resistance from oxidizing solutions and many organic compounds in an unhardened state. In its annealed condition it withstands attacks by foodstuffs, dyes, sterilizing solutions and nitric acid. Not recommended for sulfuric or halogen applications. 302 is slightly magnetic.

#### **304 STAINLESS STEEL**

304 Stainless Steel is an austentistic, unhardened stainless steel with excellent resistance to corrosion by oxidizing agents, most organic chemicals, food stuffs and sterilizing solutions. 304 Stainless Steel has a lower carbon content than 302 Stainless Steel. 304 is slightly magnetic. Ask us about our special packaging for surface protection.

#### 316 STAINLESS STEEL

316 Stainless Steel provides resistance to sulfurous acid compounds and other highly corrosive environments. 316 Stainless Steel is used in the presence of sulfuric, phosphoric, and acetic acids. 316 is the least magnetic of the 300 series. Ask us about our special packaging for surface protection.

#### **316L STAINLESS STEEL**

316L Stainless Steel has the same properties as 316, except that it has a lower carbon content. It is also easier to machine.

## 420 STAINLESS STEEL

420 Stainless Steel offers good hardness and surface finish. It is generally used for all applications requiring resistance to corrosion from water, steam, air and gasoline. 420 is not recommended for applications requiring resistance to most chemical solutions. 420 is also magnetic. **We are one of the few suppliers of 420 in millimeters.** 

#### 440 STAINLESS STEEL

440 Stainless Steel is a martenistic-type stainless steel which is used extensively in bearing applications that require hardness, dimensional stability, corrosion resistance and toughness. 440 Stainless Steel is also used for corrosion-resistant ball and check valves. 440 is resistant to corrosion from fresh water, steam, crude oil, gasoline, perspiration, alcohol, blood and food stuffs. Maximum resistance to corrosion and tarnishing is only achieved when 440 is fully hardened and surfaces are polished to a high luster. 440 is also magnetic.

## TUNGSTEN CARBIDE

*Tungsten Carbide* is used where extreme hardness and wear resistance is required; in such applications as bearings, ball screws, valves and flow meters. These balls are also used for coining and as pivots, detents and tips for gauges and tracers. *Tungsten Carbide* itself is practically inert and extremely strong. Any attack is usually on the binder. Since other material is less expensive, the selection of *Tungsten Carbide* solely for corrosion resistance is usually not justified. In highly corrosive conditions, *Carbides* with a more resistant binder can be supplied. *We also have Tungsten Carbide in grade 5 and 3.* 

### MISCELLANEOUS BALLS

We can produce balls from any workable material to meet specific requirements for weight, magnetic properties, self-lubrication and abrasion resistance. We can also manufacture to meet the specialized requirements for service at extreme temperatures or under the conditions of noise and radioactivity.

The materials suitable for manufacturing range in the hundreds. In addition to supplying balls of special materials we also offer engineering consultation to assist you with the selection of the right ball for a specific application.

Alumina	Piezoelectric Quartz
Bisilicite	Platinum
Black Phenolic	Rockbit
Boron Carbide	Silver
Burnishing Balls	Sintered Ferrite
Chrome Carbides	Tantalum
Cobalt Nickel Tungsten	Thermoelasomers
Diamond	Tin
Filled Resins	Titanium
Gold	Titanium Carbides
Haynes LT-1B	Titanium Dibori
Hollow Balls	Tooling Balls
Inconel	Vanadium
Iridium	Viton
Large Spheres	Wrought Chrome
Molybdenum	Ytrium
Niobium	Zinc Oxide.

#### Here are some examples of the materials and products available:

#### Notes:

#### Notes:

# NO MINIMUM CHARGE OR ORDER

Buy only what you need

You can order from one ball to millions

No order too big No order too small

Salem Specialty Ball Company, Inc. P.O. Box 584 259 Albany Turnpike Canton, CT 06019

TOLL FREE Phone: (877) 844-4885 or (860) 693-7808 Fax: (860) 693-7811 & (860) 693-7818

Web: http://www.salemball.com E-Mail: salem@salemball.com