LEADERSHIP IN HIGH PRECISION BALLS & ROLLERS

N. GANDHI & CO.

An ISO 9001:2015 Certified Company

ngc™
HIGH PRECISION BALLS & ROLLERS

Having provided tailored solutions for Precision Balls for more than 3 decades, N. Gandhi & Co. is considered as a trusted source for industries like the Automobile, Aeronautic Sector, Cosmetic, Chemical and Mechanical domains. NGC balls are used in a multitude of ways: ball bearings, safety valves, body jewellery, steering column, safety belt applications, and so on.

The company has broadened its product base over the years to include Grinding media and Rollers along with metallic and non-metallic balls including ceramic, glass & plastic. The long standing commitment to excellence and dedication to our customers has earned us advanced expertise and a thorough understanding of hundreds of very specific applications and processes in industries which has helped us in providing customized solutions in all materials, sizes and tolerances.

All the balls we provide are produced in accordance with the standards required by the (DIN), (ABMA) and (ISO). Our quality assurance is also certified by the International Organization of Standardization, Standard 9001 : 2015 by BSI.

The company's commitment to its customers and business integrity reflects in its widespread popularity - with a client base that's not only spread all across India but also in other parts of the world.

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HIGH PRECISION BALLS & ROLLERS

APPLICATIONS

Aerosol Pumps
Automotive Door Assembly
Ball Bearings
Ball Pen
Ball Screw
Ball Transfer Unit
Ball Valves
Bicycles
Bobbin Holder
Body Jewellery
Castor Wheels
Cosmetics
Gas Regulator
Household Appliances
Jewellery
Liner Motion Bearing
Rod End
Steering Column
Safety Belts
Toys
Watches
Wind Mill Bearing

PRECISION BALLS - FERROUS METALS

Low Carbon Steel (Case Hardened)

General Information
Balls of this type are generally used in applications where there are only moderate loads and slow rotating parts. for example Castors, Conveyors and Non-Precision Bearings. The main feature of this type of ball is the Carburised case with a soft core giving resistance to surface wear.

International Equivalents
AISI 1010, JIS SWRM 12, EN32 ASTM A/29, Wks 1.0010

Composition

C	0.10 - 0.15%
Mn	0.30 - 0.60%
P	0.045% Max
S	0.045% Max
Si	0.1 - 0.4% Max

Hardness

HRc	60 min

Mechanical Properties

Tensile Strength	53,000 psi
Yield Strength	44,000 psi
Density	0.284 lbs/cu.in

Size Range - 1.588mm (1/16") to 12.700mm (1/2")

Standard Grades Available
100, 200, 500, 1000

High Carbon Steel (Through Hardened)

General Information
Balls of this material have the advantage of being through hardened to HRc 60 min and will take higher loads and provide longer life than case hardened carbon balls, for such applications as the Cycle Industry.

International Equivalents
AISI 1065-86, EN8-9, C85 Wks 1.1269

Composition (AISI 1085)

C	0.85%
Si	0.35%
Mn	0.60%
P	0.022%
S	0.022%

Hardness

HRc	60 min

Mechanical Properties

Tensile Strength	106,400 psi
Density	0.284 lbs/cu.in

Size Range - 3.175mm (1/8") to 38.1mm (1.1/2")

Standard Grades Available
100, 500, 1000

Minimum Case Depth

Ball Dia	Case Depth	Ball Dia	Case Depth
1.5mm - 2mm	0.4mm	9.5mm - 11mm	1.4 mm
2.1mm - 3mm	0.5mm	11.1mm - 12.5mm	1.7 mm
3.1mm - 4.5mm	0.6mm	12.6mm - 14mm	1.8 mm
4.6mm - 5.5mm	0.8mm	14.1mm - 19mm	1.9 mm
5.6mm - 6.5mm	0.9mm	19.1mm - 38mm	2.0 mm
6.6mm - 9.5mm	1.1mm		

Crushing Loads

Ball Dia	Load	Ball Dia	Load
1/8"	375 kgs	9/32"	2200 kgs
5/32"	800 kgs	5/16"	2700 kgs
3/16"	1100 kgs	11/32"	3200 kgs
1/4"	1800 kgs	3/8"	3900 kgs

High Carbon Chrome Alloy

General Information
This is an oil hardened steel, which is universally used by the ball and roller bearing industry. The steel has high hardness and good resistance to deformation and excellent wear resistance. Usually vacuum degassed and uniformly through hardened in atmospherically controlled electric furnaces.

International Equivalents
AISI 52100, SUJ2 ASTM 100CR6, W 1.3505

Composition

C	0.95 - 1.1%
Cr	1.30 - 1.60%
Mn	0.25 - 0.45%
Si	0.15 - 0.30%
P	0.025% Max
S	0.025% Max

Hardness

HRc	60-67

Mechanical Properties

Tensile Strength	325,000 psi
Yield Strength	295,000 psi
Density	0.283 lbs/cu.in

Size Range - 0.635mm (0.025") to 101.60mm (4")

Standard Grades Available
5, 10, 25, 100, 500

Crushing Loads for Chrome Steel

Diameter		Minimum Crushing Load Kg	Diameter		Minimum Crushing Load Kg	Diameter		Minimum Crushing Load Kg
Inch	mm		Inch	mm		Inch	mm	
1/8	3.175	666	31/64	12.303	7350	1	25.400	26600
-	3.500	792	1/2	12.700	7780	1 1/16	26.987	29600
5/32	3.968	990	17/32	13.494	8660	1 1/8	28.575	32800
-	4.000	1000	9/16	14.288	9590	1 3/16	30.162	36100
-	4.500	1240	-	15.000	10500	1 1/4	31.750	39500
3/16	4.762	1370	19/32	15.081	10600	1 5/16	33.337	43100
-	5.000	1490	5/8	15.875	11600	1 3/8	34.925	46800
7/32	5.556	1800	21/32	16.668	12600	1 7/16	36.512	50600
15/64	5.593	2020	11/16	17.462	13700	1 1/2	38.100	54600
-	6.000	2060	23/32	18.256	14800	1 5/8	41.275	62900
1/4	6.350	2280	3/4	19.050	16000	1 3/4	44.450	71700
17/64	6.746	2535	25/32	19.843	17200	1 7/8	47.625	81100
9/32	7.144	2810	-	20.000	17400	2	50.800	90900
5/16	7.938	3380	13/16	20.637	18400	2 3/16	55.562	106500
11/32	8.731	4000	27/32	21.431	19700	2 1/4	57.150	112000
3/8	9.525	4670	7/8	22.225	21000	2 5/16	58.735	116500
-	10.000	5090	29/32	23.018	22300	2 1/2	63.500	135000
13/32	10.318	5380	15/16	23.812	23700	2 3/4	69.850	159800
7/16	11.112	6140	31/32	24.606	25100	3	76.200	186500
15/32	11.906	6940	-	25.000	25900	4	101.600	309500

PRECISION BALLS - FERROUS METALS

Stainless Steel AISI 440C (Martensitic)

General Information
These balls give maximum hardness with good corrosion resistance to fresh water, steam, crude oil, gasoline, alcohol, food environment, blood and perspiration. In addition this material is ferro-magnetic and makes a fair permanent magnet. Balls are deep freeze stabilised after heat treatment.

International Equivalents
AISI 440C, DINX105 CR Mo17, SUS 440C, W 1.4125

Composition

C	0.95 - 1.20%
Cr	16 - 18%
Si	1.00% Max
Mn	1.0% Max
P	0.040% Max
S	0.030% Max
Mo	0.40 - 0.80% Max

Hardness

HRc	58 - 63

Mechanical Properties

Tensile Strength	285,000 psi
Yield Strength	275,000 psi
Density	0.277 lbs/cu.in

Size Range - 0.635mm (0.025") to 101.60mm (4")

Standard Grades Available
10, 25, 50, 1000

Stainless Steel AISI 420, 420C (Martensitic)

General Information
Balls of this material have a lower chrome content than 440C, and are used in applications where the more rigid corrosion resistance requirements can be relaxed. They have fair resistance to fresh water, steam, oil, gasoline, blood, perspiration, alcohol and food environment. However will not pass 40 hours salt spray test.

International Equivalents
AISI 420, SUS 420, X47Cr13, EN56D, W 1.3541

Composition	420	420C
C	0.15% Min	0.40 - 0.50%
Cr	12 - 14%	12.5 -14.5%
Si	1.0% Max	1.0% Max
Mn	1.0% Max	1.0% Max
P	0.04% Max	0.04% Max
S	0.03% Max	0.03% Max
Ni	-	1.0% Max
Hardness		
HRc	48-53	53-58

Mechanical Properties

Tensile Strength	275,000 psi
Specific Weight	0.280 lbs/cu.in

Size Range - 0.6mm (0.024") to 76.2mm (3")

Standard Grades Available
10, 16, 24, 48, 100, 200

Stainless Steel AISI 302,304,304L (Austenitic)

General Information
AISI 302 and 304 balls are for applications where material toughness and resistance to corrosion are more important than hardness. They have good corrosion resistance to the food environment, oxidising solutions and most organic chemicals. Applications are Valves, Aerosol and Finger Pumps. Corrosion resistance is higher after annealing and passivation. Not resistant to sulphuric acids.

International Equivalents
DIN X5 CR Ni 18.09, JIS SUS 304, W 1.4301

Composition	302	304	304L
C	0.12% Max	0.08% Max	0.03% Max
Cr	17 - 19%	18 - 20%	18 - 20%
Ni	8 - 11%	8 - 10.5%	8 - 10.5%
Si	1.0% Max	1.0% Max	1.0% Max
Mo	1.0% Max	-	-
Mn	2.0% Max	2.0% Max	2.0% Max
P	0.045% Max	0.045% Max	0.045% Max
S	0.03% Max	0.03% Max	0.03% Max

Hardness
Soft (Annealed)

Mechanical Properties

Tensile Strength	100,000 to 180,000 psi
Yield Strength	50,000 to 150,000 psi
Density	0.286 lbs/cu.in

Size Range - 1.588mm (1/16") to 76.2mm (3")

Standard Grades Available
24, 48, 100, 200, 1000

Stainless Steel AISI 316, 316L (Austenitic)

General Information
Similar to AISI 302/304 but, with the addition of molybdenum improves corrosion resistance particularly to sulphuric acid compounds. These balls are used extensively in applications where contact is made with inks, photographic chemicals, bleaches, dyes and nitric acids. This is the only austenitic steel for ball manufacture and can be Magnetic and Non Magnetic.

International Equivalents
DIN X5 CR NI M0 17122, W 1.4401, JIS SUS 316

Composition	316	316L
C	0.08% Max	0.08% Max
Cr	16 - 18%	16 - 18%
Ni	10 - 14%	10 - 14%
Si	1.0% Max	1.0% Max
Mo	2 - 3%	2 - 3%
Mn	2.0% Max	2.0% Max
P	0.045% Max	0.045% Max
S	0.03% Max	0.03% Max

Hardness
Soft (Annealed)

Mechanical Properties

Tensile Strength	180,000 psi
Yield Strength	150,000 psi
Density	0.290 lbs/cu.in

Size Range - 1.588mm (1/16") to 76.2mm (3")

Standard Grades Available
24, 48, 100, 200, 1000

Tungsten Carbide Cobalt Binder

General Information
Tungsten Carbide materials have a unique combinations of properties, high compressive strength, hardness and resistance to wear, as well as an ability to withstand shock and impact. Typical applications are Valves, Flowmeters, Ball Screws and Linear Bearings. Balls from this material are also used for Ballizing, Gauging and Ball Pens.

Composition

Tungsten Carbide	93 - 95%
Co	5 - 7%

Hardness

Hra	90.5 - 91.5

Mechanical Properties (Typical)

Density	14.947 - 15.0% g/cm3
Thermal Conductivity	100 W/m/oC
Electrical Resistivity	20 µW/cm

Size Range - 0.6 mm (0.024") to 50.8 mm (2")

Standard Grades Available
5, 10, 25, 100

Tungsten Carbide Nickel Binder

General Information
Conventional Tungsten Carbides (with Cobalt binder) has limited corrosion resistance, which makes them unsuitable for applications in which the wear parts are operating under both severe abrasive and corrosive conditions. As a general rule straight Tungsten Carbide (with Cobalt Binder) is resistant to corrosion down to pH 7. By comparison, tests have shown that our Tungsten Carbide (with Nickel binder) material is resistant to corrosion down to pH 2 or 3.

Composition (IS) -K16C)

Tungsten Carbide	90 - 92%
Nickel Base Binder	8 - 10%

Hardness

Hra	88 - 89

Size Range - 0.635 mm (0.025") to 50.8 mm (2")

Standard Grades Available
10, 25, 100

Titanium Alloys

General Information
Titanium balls provide low weight, good mechanical features, thermal properties and corrosion resistance. They are used even in aesthetic applications. Grade 1 and Grade 2 belongs to the Commercially pure Titanium Alloys family.

Applications
Titanium balls are used in Aviation, Aerospace, Military, Chemical, Petrochemical Industry, in the Medical Field, Jewelry, Calibration of Measurement Instruments, Piercing purposes.

Chemical Composition

C	0.080% Max
N	0.030% Max
Ti	balance
Fe	0.20% Max
O	0.18% Max
H	0.015% Max

Hardness

HRc	28-42

Size Range 1mm - 12mm

Standard Grades Available
100, 200

Hastelloy C276 Alloy Balls

General Information
Ni based alloy balls, they show very good crevice, pitting and stress corrosion resistance, both on oxidating and reducing environments. Good wear resistance. Balls are provide in the passivated condition.

Applications
Special pumps and valves, they are applied in the Foodstuff, Paper, Chemical, Pharmaceutical, Naval, Petrol, Textile industry. Devices for Waste Treatment, Pollution Check, Flue Gas Desulfurization, Turbines.

Chemical Composition

Cr	14.5-16.5%
W	3-4.5%
Mo	15-17%
Fe	4-7%
Co	2.5% max.
Ni	Balance

Hardness

HRc	32-48

Size Range 3/64" - 4" max

Standard Grades Available
100, 200

Inconel 825 Alloy Balls

General Information
Austentic NiCrFe alloy balls, they provide excellent corrosion resistance in aggressive environments, both general and localized.

Applications
Special Valves for the Chemical Industry.

Chemical Composition

C	0.050% Max
Si	0.50 Max
Mn	1.00% Max
P	0.020% Max
S	0.030% Max
Cr	19.50 - 23.50 %
Ni	38.00 - 46.00 %
Mo	2.50 - 3.50 %
Cu	1.50 - 3.00 %
Ti	0.60 - 1.20 %
Al	0.20% Max
Fe	22.00 % Min

Hardness
HRc 25-30

Mechanical Properties
Tensile Strength 850-950 Mpa
Density 8.14 g/cm3

Size Range 3/64" - 4" max

Standard Grades Available
100, 200, 500, 1000

Inconel 625 Alloy Balls

General Information
Ni based alloy with high corrosion resistance properties, even in very aggressive environments. Balls are provide in the passivated condition.

Applications
Sea Water Applications, Compressors, Heat Exchangers, Turbines, Special Pumps and Valves. They are used in Aerospace, Chemical, Naval, Military, Nuclear, Oil and Gas Industry, High Temperature Applications.

Chemical Composition

C	0.100% Max
Si	0.50% Max
Mn	0.50% Max
P	0.015% Max
S	0.015% Max
Cr	20.00 - 23.00 %
Ni	58.00% min
Cu	0.50 Max
Mo	8.00-10.00%
Nb	3.15-4.15%
Co	1.00% Max
Al	0.40% Max
Ti	0.40% Max
Fe	5.00% Max

Hardness
HRc 30-35

Mechanical Properties
Tensile Strength 1000-1100 Mpa
Density 8.42 g/cm3

Size Range 3/64" - 4" max

Standard Grades Available
100, 200, 500, 1000

Monel K 400 Alloy Balls

General Information
Ni-Cu based alloys with good mechanical characteristics and excellent corrosion resistance. Balls are provided in the passivated condition.

Applications
Special Pumps and Valves, Flue Gas Desulfurization, Heat Exchangers. They are used in the Paper, Chemical, Pharmaceutical, Naval, Petrol and Textile Industry.

Chemical Composition

C	0.30% Max
Si	0.50 Max
Mn	2.00% Max
S	0.024% Max
Ni	63.00 - 70.00 %
Cu	28.00 - 34.00 %
Co	1.00% Max
Fe	2.50 % Max

Hardness
HRc 17-22

Mechanical Properties
Tensile Strength 670-770 Mpa
Density 8.82 g/cm3

Size Range 3/64" - 4" max

Standard Grades Available
25, 100, 200

Monel K 500 Alloy Balls

General Information
Ni-Cu precipitation hardening ally, it presents higher hardness and load resistance with respect to Monel 400 alloy but same corrosion resistance. Balls are provide in the passivated state.

Applications
Special Pumps and Valves, they are used in Paper, Chemical, Electronic, Pharmaceutical, Naval, Oil and Gas Industry, Textile industry.

Chemical Composition

C	0.25% Max
Si	0.50% Max
Mn	1.50% Max
S	0.010% Max
Ni	63.00-70.00% Max
Cu	27.00-33.00% Max
Ti	0.35-0.85%
Al	2.30-3.15%
Fe	2.00% Max

Hardness
HRB 75-90

Mechanical Properties
Tensile Strength 920-1020 Mpa
Density 8.42 g/cm3

Size Range 3/64" - 4" max

Standard Grades Available
28, 40, 100, 200, 500, 1000

PRECISION BALLS - NON FERROUS METALS

Copper Balls

General Information
Nearly pure copper balls, they show good mechanical and corrosion resistance properties, excellent thermal and electric conductivity.
Small amounts of alloying elements as Cr, Zr, Ag, Cd, Mg, Sn allow to improve the mechanical properties.

Applications
Copper balls are used in Galvanic Applications and in the field of Electronic Industry.

Chemical Composition
Cu 99.900 % min
Other 0.010 max

Hardness
HV 40-120

Mechanical Properties
Tensile Strength 220-320 Mpa
Density 8.91 g/cm3

Size Range 3/64" - 1.5/8" max

Standard Grades Available
100, 200, 500, 1000

Brass Balls

General Information
Brass balls show fairish mechanical performance, good corrosion resistance, excellent electrical properties. They generate low frictions.

Applications
Special Valves, Industrial Pumps and Valves, Electronic Devices, Safety Switches, Heating Units, Appliances, Furniture Rails.
They are used in the Automotive, Electronic and Petrochemical Industry.

Chemical Composition

Cu	68.50-71.50% (C26000)
	63.00-68.50% (C27000)
	59.00-63.00% (C28000)
Zn	balance (C26000)
	balance (C27000)
	balance (C28000)
Pb	0.070 Max (C26000)
	0.090 Max (C27000)
	0.090 Max (C28000)
Fe	0.050 Max (C26000)
	0.070 Max (C27000)
	0.070 Max (C28000)

Hardness
HRB 75-87

Mechanical Properties
Tensile Strength 500-600 Mpa
Density 8.49 g/cm3

Alloy 20 Balls

General Information
Alloy 20, is a nickel-iron-chromium austenitic alloy that was developed for maximum resistance to acid attack, specifically sulfuric acid. This super alloy has excellent resistance to general corrosion, pitting, and crevice corrosion in chemicals containing chlorides and sulfuric, phosphoric, and nitric acids. It also contains niobium for stabilization against sensitization and resultant inter granular corrosion.

Applications
Special Bearings, Pumps and Valves, in all applications where high wear, corrosion and temperature resistance are demanded.

Chemical Composition

Ni	32.00-38.00%
Fe	Balance
Cr	19.0-21.0%
Cu	3.0-4.0%
Mo	2.0-3.0%
Nb	8xC-1.0% max
C	.07% max
Mn	2.0% max
P	.045% max
S	.035% max
Si	1.0% max

Mechanical Properties

Tensile Min.	80 ksi
Yield Min. (.2% offset)	35 ksi
Elongation Min.	30%
Reduction of Area Min.	50%

Size Range 3/64" - 4" max

Standard Grades Available
28, 40, 100, 200

Dimensional Conversion Chart

Inch Fractions	Inch Decimals	Metric mm	Weight per 1000 balls kg	Inch Fractions	Inch Decimals	Metric mm	Weight per 1000 balls kg
1/64	.0156	0.397	.00026	-	.7480	19.000	27.98
-	.0197	0.500	.00051	3/4	.7500	19.050	28.20
1/32	.0312	0.794	.00210	25/32	.7812	19.844	31.87
-	.0394	1.000	.00407	-	.7874	20.000	32.63
3/64	.0469	1.190	.00688	13/16	.8125	20.637	35.85
-	.0472	1.200	.00704	-	.8268	21.000	37.77
-	.0590	1.500	.01377	27/32	.8437	21.431	40.15
1/16	.0625	1.588	.01632	-	.8661	22.000	43.43
5/64	.0781	1.984	.03187	7/8	.8750	22.225	44.78
-	.0787	2.000	.0326	-	.9055	23.000	49.63
3/32	.0937	2.381	.0550	29/32	.9062	23.019	49.75
-	.0984	2.500	.0638	15/16	.9375	23.812	55.07
7/64	.1094	2.778	.0875	-	.9449	24.000	56.39
-	.1181	3.000	.1101	31/32	.9687	24.606	60.77
1/8	.1250	3.175	.1305	-	.9842	25.000	63.73
-	.1378	3.500	.1749	1	1.0000	25.400	66.84
9/64	.1406	3.572	.1859	-	1.0236	26.000	71.69
5/32	.1562	3.969	.2550	1 1/16	1.0625	26.987	80.17
-	.1575	4.000	.2610	-	1.1024	28.000	89.54
11/64	.1719	4.366	.3394	1 1/8	1.1250	28.575	95.17
-	.1772	4.500	.3716	-	1.1811	30.000	110.10
3/16	.1875	4.762	.4406	1 3/16	1.1875	30.162	111.90
-	.1968	5.000	.5099	1 1/4	1.2500	31.750	130.50
-	.2165	5.500	.6786	-	1.2598	32.000	133.70
7/32	.2187	5.556	.6996	1 5/16	1.3125	33.337	151.10
15/64	.2344	5.953	.8605	-	1.3386	34.000	160.30
-	.2362	6.000	.8810	1 3/8	1.3750	34.925	173.80
1/4	.2500	6.350	1.044	-	1.3780	35.000	174.90
-	.2559	6.500	1.120	-	1.4173	36.000	190.30
17/64	.2656	6.747	1.253	1 7/16	1.4375	36.512	198.50
-	.2756	7.000	1.399	-	1.4960	38.000	223.80
9/32	.2812	7.144	1.487	1 1/2	1.5000	38.100	225.60
-	.2953	7.500	1.721	1 9/16	1.5625	39.687	255.00
19/64	.2969	7.541	1.749	-	1.5748	40.000	261.00
5/16	.3125	7.938	2.040	1 5/8	1.6250	41.275	286.00
-	.3150	8.000	2.088	1 11/16	1.6875	42.862	321.20
-	.3346	8.500	2.505	1 3/4	1.7500	44.450	358.20
11/32	.3437	8.731	2.715	-	1.7716	45.000	371.70
-	.3543	9.000	2.973	1 13/16	1.8125	46.037	398,00
23/64	.3594	9.128	3.102	1 7/8	1.8750	47.625	440.60
-	.3740	9.500	3.497	1 15/16	1.9375	49.212	486.10
3/8	.3750	9.525	3.525	-	1.9685	50.000	509.90
25/64	.3906	9.922	3.983	2	2.0000	50.800	534.70
-	.3937	10.000	4.079	2 1/8	2.1250	53.975	641.40
13/32	.4062	10.319	4.481	-	2.1653	55.000	678.60
-	.4331	11.000	5.429	2 1/4	2.2500	57.150	761.30
7/16	.4375	11.112	5.597	-	2.3622	60.000	881.00
-	.4528	11.500	6.203	2 3/8	2.3750	60.325	895.40
29/64	.4531	11.509	6.219	2 ½	2.5000	63.500	1044.40
15/32	.4687	11.906	6.884	-	2.5590	65.000	1120.10
-	.4724	12.000	7.048	2 5/8	2.6250	66.675	1209.00
31/64	.4844	12.303	7.596	2 ¾	2.7500	69.850	1390.10
½	.5000	12.700	8.355	-	2.7559	70.000	1484.70
-	.5118	13.000	8.961	2 7/8	2.8750	73.025	1588.40
17/32	.5312	13.494	10.02	-	2.9528	75.000	1720.70
-	.5512	14.000	11.19	3	3.0000	76.200	1804.70
9/16	.5625	14.288	11.90	3 1/8	3.1250	79.375	2039.80
-	.5905	15.000	13.77	-	3.1500	80.000	2088.30
19/32	.5937	15.081	13.99	3 ¼	3.2500	82.550	2294.40
5/8	.6250	15.875	16.32	-	3.3464	85.000	2530.90
-	.6299	16.000	16.70	3 ½	3.5000	88.900	2865.70
21/32	.6562	16.669	18.89	-	3.5433	90.000	2993.40
-	.6693	17.000	20.04	-	3.7401	95.000	3521.10
11/16	.6875	17.462	21.72	3 ¾	3.7500	95.250	3524.70
-	.7087	18.000	23.79	-	3.9370	100.000	4078.80
23/32	.7187	18.256	24.82	4	4.0000	101.600	4277.70

The weight shown are based on chrome alloy steel balls, approximate weight for other materials can be obtained by multiplying the weight per 1000 balls by the following figures:

Carbon Steel	1.004	Stainless Steel AISI 302/304	1.011	Brass	1.074
Stainless Steel AISI 420/420	0.979	Stainless Steel AISI 316	1.025	Tungsten Carbide	1.907

Technical Data

Tolerances by Grade for Individual Balls

	Ball Grade	Allowable Ball Diameter Variation	Allowable Deviation From Spherical Form	Maximum Surface Roughness Arithmetic Average
Inch	Grade			
	3	.000003	.000003	0.5
	5	.000005	.000005	0.8
	10	.000010	.000010	1
	16	.000016	.000016	1
	24	.000024	.000024	2
	48	.000048	.000048	3
	100	.0001	.0001	5
	200	.0002	.0002	8
	500	.0005	.0005	*
	1000	.001	.001	*
Metric µm	3	0.08	0.08	0.012
	5	0.13	0.13	0.02
	10	0.25	0.25	0.025
	16	0.4	0.4	0.025
	24	0.6	0.6	0.05
	48	1.2	1.2	0.08
	100	2.5	2.5	0.125
	200	5	5	0.2
	500	13	13	*
	1000	25	25	*

Definitions

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.

Single Diameter of a Ball. The distance between two parallel planes tangent to the surface of the ball.

Mean Diameter of a Ball. The arithmetic mean of the largest and the smallest actual single diameters of the ball.

Ball Diameter Variation. The difference between the largest and the smallest actual single diameters of one ball.

Deviation from Spherical Form. The greatest radial distance in any radial plane between a sphere circumscribed around the ball surface and any point on the ball surface.

Lot. A definite quantity of balls manufactured under conditions which are presumed uniform and which is considered and identified as an entity.

Lot Mean Diameter. The arithmetic mean of the mean diameter of the largest ball and that of the smallest ball in the lot.

Lot Diameter Variation. The difference between the mean diameter of the largest ball and that of the smallest ball in the lot.

Nominal Ball Diameter Tolerance. The maximum allowable deviation of any ball lot mean diameter from the nominal Ball Diameter.

Specific Diameter. The amount by which the lot mean diameter differs from the nominal diameter , accurate to the marking increment for that grade.

Ball Grade. A specific combination of dimensional form and surface roughness tolerances. A ball grade is designated by a grade number.

Ball Gauge. The prescribed small amount by which the lot mean diameter should differ from nominal diameter, this amount being one of an established series of amounts.

Ball Gauge Deviation. The difference between the lot mean diameter and the sum of the nominal diameter and the ball gauge.

Surface Roughness. Surface roughness consists of all those irregularities which form surface relief and which are conventionally defined within the area where deviations of form and waviness are eliminated.

Waviness. The more widely spaced circumferential component of surface texture.

Hardness. The measure of resistance to penetration of the ball surface or truncated flat of the ball by a specific indenting shape as determined by specified methods.

Case Depth. The distance measured radially from the surface of the ball to a point where the hardness becomes the equivalent of Rc 50. This term is applicable to case hardened balls only.

Passivation. A chemical treatment to remove corrodible surface impurities and to provide a protective film. This term is applicable to corrosion resisting balls only.

Ceramic Balls

Ceramic balls are particularly suited to harsh environments. Their main advantages over steel is that they have a density of 40% tower than steel. Have 29% lower thermal expansion and are 150% harder. In certain high-speed applications their life is extended by as much as a hundred times. The three main materials used are Alumina Oxide, Zircona Oxide and Silicon Nitride. The following chart shows comparisons between the three.

Si_3N_4 SILICON NITRIDE:

The most widely used type of ceramic due to very high resistance to wear and abrasion in general. It has a micro - structure specially designed for applications subject to great stress. It does not require lubrication, it is resistant to corrosion, anti magnetic and electrically insulating, and it continues to be efficient at high temperatures up to +1400 oC. It combines extreme hardness with a high precision ball. Si3N4 balls are widely used in high precision bearings in the airspace industry, for machine tools, measurement instruments, mechanical centrifuges, radar and missiles, pumps and compressors.

Al_2O_3 99.50% ALUMINA (ALUMINA OXIDE):

The material has a multi-crystal structure and excellent resistance to abrasion and high temperatures. It is resistant to most corrosive agents, but it is not recommended for use in contact with hydrochloric and hydrofluoric acid or strong alcaline solutions. Al_2O_3 balls are used in valves, pumps and ball bearings.

ZrO_2 ZIRCONIUM OXIDE:

The material, compared has a high degree of compactness and considerable flexural strength, which makes it very reliable. It also has a low modulus of elasticity, close to that of steel, together with an extraordinarily low thermal conductivity.

Al_2O_3 99.99% RUBY:

This material has a non porous single crystal structure used where particular hardness and extreme resistance to wear are required together with a low specific weight and properties of chemical inertia. The material consists of pure aluminium oxide with a small percentage of chromo oxide which gives it its characteristic red colour, which is the most visible feature of these balls in many applications as measurement and control instruments, valves and pumps.

Al_2O_3 99.99% SAPPHIRE:

This material has a single crystal structure and unlike ruby is transparent. Because of its optical properties and high refraction index. Balls made of this material are currently used as chemically inert lenses.

CERAMIC BALLS - PROPERTIES OF MATERIALS

PHYSICAL PROPERTIES	SAPPHIRE AND RUBY	ALUMINA OXIDE	SILICON NITRIDE	ZIRCONIUM OXIDE
STRUCTURE	single crystal	multi-crystal	multi-crystal	multi-crystal
CHEMICAL FORMULA	Al_2O_3	Al_2O_3	Si_3N_4	ZrO_2
PURITY %	99.99	99.8	95.00	97.00
DENSITY g/cm$_3$	3.99	3.90	3.20	5.50
OPERATING TEMPERATURE °C		1800	1100	1000
MELTING POINT	2050 °C	2050 °C	1900 °Ñ	
SOFTENING POINT	1800 °C	1725 °Ñ	1400 °Ñ	
SPECIFIC HEAT AT 25 °C (CAL/g/°C) THERMAL CONDUCTIVITY	0.18 36 W/m°k	0.25 29 W/m°k	0.17 29 W/m°k	9 W/m°k
MECHANICAL PROPERTIES	SAPPHIRE AND RUBY	ALUMINA OXIDE	SILICON NITRIDE	ZIRCONIUM OXIDE
VICKERS Hv10 HARDNESS (N/mm2)	17000	16500	24000	20000
MODULUS OF ELASTICITY (N/mm2)	4,3õ10^5	3,5õ10^5	3,1õ10^5	2õ10^5
BREAKING MODULUS AT 25 °C (N/mm2)	392	470	700	600
COMPRESSIVE STRENGTH AT 25 °C (N/mm2)	2060	2354	2500	2100

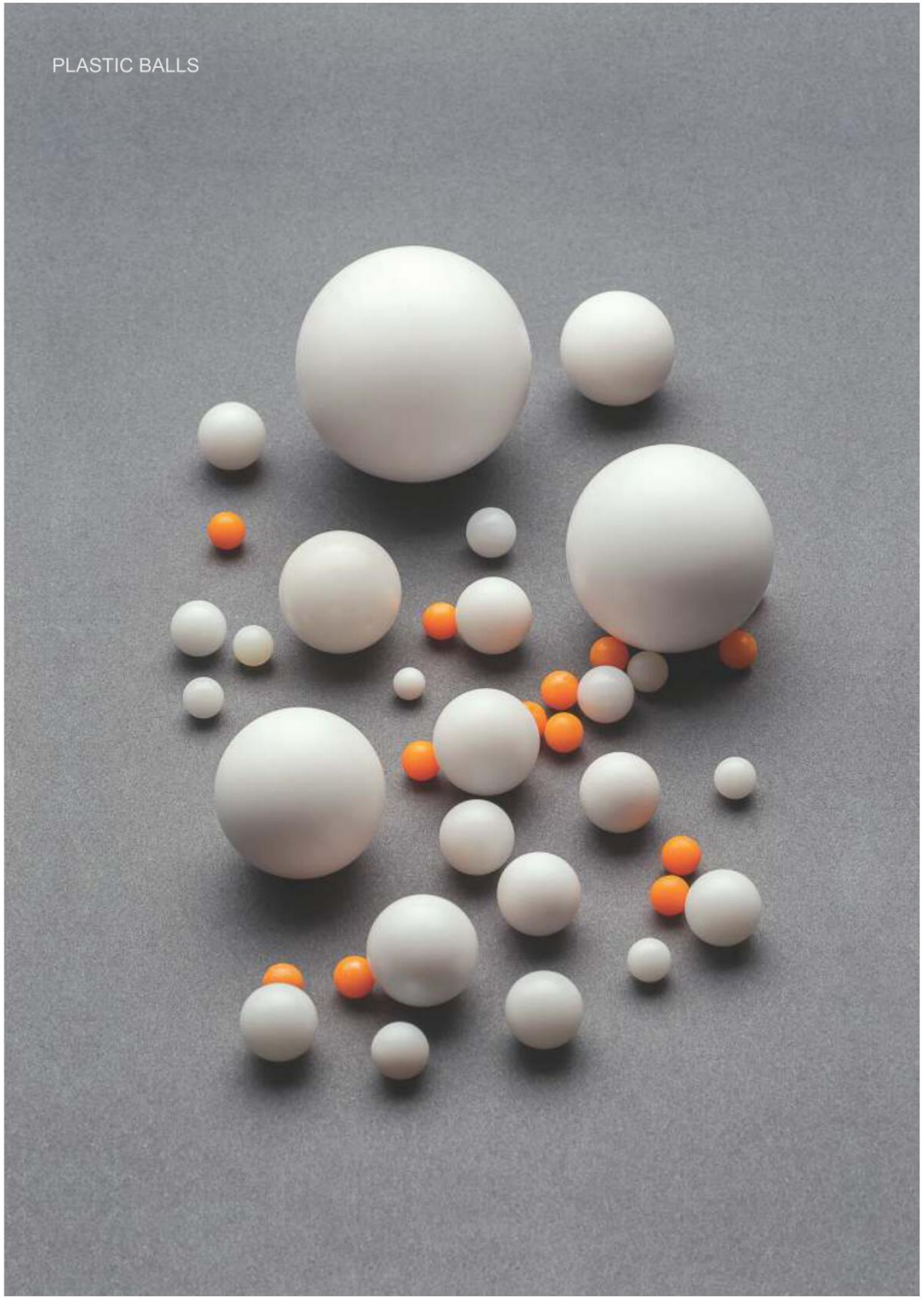
CHEMICAL RESISTANCE

SAPPHIRE / RUBY:
inert to most acids at very high temperatures.

ALUMINA (OXIDE):
inert to most acids, but not recommended in environments with hydrochloric or hydrofluoric acids or strong alkaline solutions

SILICON NITRIDE:
inert to most acids.

ZIRCONIUM OXIDE:
inert except to hydrofluoric acid and strong concentrations of sulphuric acid.



Plastic Balls

Plastic balls are manufactured from standard and specially polymer resins in size from 3/32'' - (2.381 mm) to 5'' - (127 mm). Balls above 1" - (25.4 mm) are manufactured from extruded rod.

Plastic balls are a cost-effective substitute for metallic balls in low load bearings. They are also used as agitators in aerosol spray cans, lightweight check valves, medical diagnostics and a wide variety of other applications.

Tolerances to +/-0.0005" (+-0.0125 mm) are possible for certain materials such as nylon and acetal. Surfaces can be tailored from rough to highly polished finishes.

PROPERTIES	ACETAL	POLYAMIDE	POLYETHYLENE LOW DENSITY	POLYETHYLENE HIGH DENSITY	PTFE FLUROCARSON
PHYSICAL					
SPECIFIC GRAVITY	1.42	1.13-1.15	0.910-0.925	0.941-0.965	2.14-2.20
WATER ABSORPTION 24HR (1/8 IN: THICK SPECIMEN)% SATURATION	0.25-0.40 500 (90ML)	1.0-1.3 8.5	<0.01	<0.01	<0.01
DIELECTRIC STRENGTH (1/8 IN: THICK SPECIMEN) SHORT TIME V./MIL	500 (90ML)	600[B]	450-1000	450-500	480
MECHANICAL					
TENSILE STRENGTH AT BREAK,PSI		12.000[B]11.000[C]	600-2300	3100-5500	2000-5000
ELONGATION AT BREAK,%	25-75	60[B], 300[C]	90-800	20-130	200-400
TENSILE YIELD STRENGTH,PSI	95000-12.000	8000[B] , 6500[C]	800-1200	3000-4000	
COMPRESSIVE STRENGTH (RUPTURE OR YIELD) PSI	18.000@10%	15.000[B] (YLD.)		2700-3600	1700
FLEXURAL STRENGTH (RUPTURE OR YIELD) PSI	14.000	17.000[B] , 6100[C]			
TENSILE MODULUS 10^3 PSI	520		14-38	60-180	58-80
COPRESSIVE MODULUS 10^3 PSI	670				60
FLEXURAL MODULUS 10^3 PSI 73°F 200°F 250°F 300°F	380-430	420[B] , 185[C]	8-60	100-260	80
IZOD IMPACT. FT-LB/.I.OF NOTCH (1/8-IN.THICK SPECIMEN)	1.3-2.3	0.8-1.0[B], 2.1[C]	NO BREAK	0.5-20	3
HARDNESS ROCKWELL SHORE	M94	R120[B] M83[B]	D40-51	D60-70	D-50-55
THERMAL					
COEF. OF LINER THERMAL EXPANSION 10^6IN./IN°C	100	80	100-2220	110-130	
DEFLECTION TEMPERATURE 264PSI FLEXURAL LOAD. °F	255	167[B]	90-105	110-130	
66PSI	338	474[B]	100-121	140-190	250
THERMAL CONDUCTIVITY 10-CAL.-CM/SEC-CM²-°C	5.5	5.8	8	11-12	6.0

	SPHERICITY		TOLERANCE		
GRADE	INCHES	MM	INCHES	MM	SURFACE
0*	0.0005	0.0125	±0.0005	0.0125	POLISHED
I	0.0005	0.0125	±0.001	0.025	POLISHED
II	0.001	0.025	±0.002	0.050	UNPOLISHED
III	0.005	0.125	±0.005	0.125	UNPOLISHED

*Only available in certain materials

Glass Balls

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:

SODA-LIME GLASS

Material resistant to high alkaline solutions. Soda-lime glass balls are mainly used for applications not subjected to strong mechanical or thermal shocks, such as plastic bearings, flow meters, measurement and control equipment, instruments and ink cartridges.

BOROSILICATE GLASS

Due to its excellent chemical inertia to most acids, this kind of glass is particularly suitable for metering pumps and valves against strong oxidising concentrations.

BLACK GLASS

A kind of glass often used for medical and chemical flow meters and for general measurement and control instruments.

CHEMICAL COMPOSITION %						
MATERIAL	SiO_2	NA_2O	CaO	Al_2O_3	A_2O_3	MgO
Soda-Lime Glass	67	16	7	5	3	2
Borosilicate Glass	81	4	-	2	13	-
Black Glass	69.7	15.2	3.4	-	1.3	-

PROPERTIES	SODA-LIME GLASS	BOROSILICATE GLASS	BLACK GLASS
Specific Weight	2.50	2.23	2.55
Hardness (KNOOP-KHN)	465	418	405
Melting Point °C	695	820	650

MAX TEMPARATURE USE (mechanical)			
Normal °C	110	230	110
Extreme °C	460	490	380
Resistance to Thermal Stress	17° C	53° C	18° C

Burnishing Media

Burnishing Media can be balls or peculiar shapes which are used for polishing the rough surfaces of many different metal components. The different shapes are designed to get into the varying crevices and contours of diverse metal products.

CASE HARDENED CARBON STEEL		AISI 1010 / 1018	HARDNESS HRC 60
THROUGH HARDNESS CARBON STEEL		AISI 1070	HARDNESS HRC 80
CHROME STEEL		EN31 / AISI E 52100	HARDNESS HRC 60-66
STAINLESS STEEL		AISI 420	HARDNESS HRC 48-55
STAINLESS STEEL	MAGNETIC	AISI 304 / 316	HARDNESS HRC 25-39
	NON MAGNETIC	AISI 304 / 316	HARDNESS - NA
ZIRCONIA CERAMIC		ZrO_2	HARDNESS 1100 HV

Shapes

TYPE		SIZE RANGE	MATERIAL
BALLS		1/16"- 4"	ALL
BALL CONES		1/8" - 3/8"	AISI 1010 / 1018 AISI 1070 AISI 420 AISI 304 / 316
BARRELS		1/8" - 3/8"	AISI 1070 AISI 420 AISI 304 / 316
OVALS		1/8" - 5/16"	AISI 1010 / 1018 AISI 420 AISI 304 / 316
DIAGONALS		1/8" - 3/8"	AISI 1010 / 1018 AISI 420 AISI 304 / 316
PINS		1.5 mm x 10 mm	EN 31 AISI 420 AISI 304 / 316
FLAT PINS		1.2mm x 2.5mm x 10mm	EN 31 AISI 420 AISI 304 / 316

CERAMIC BALLS - GRINDING MEDIA

Zirconia Toughened Alumina

Description:
Zirconia Toughened Alumina bead was sintered from alumina powder and zirconium silicate powder. Compared to the alumina beads, it is an economic ceramic bead to replace kaolin bead, silica sand and other natural grinding media.

Chemical Composition:

Composition	Al_2O_3	ZrO_2	SiO_2
Wt%	65-75	6-12	6-8

Physical Properties:

Specific Gravity 3.1-3.2kg/dm3	Bulk Density 2.0-2.2kg/L	Micro hardness 900kg/mm2
Compressive Strength 80kgf(2mm)	Wear Rate <70g/T	Color Shell

Zirconium Silicate Beads

Description:
Zirconium silicate beads are made from the high grade Australian zircon sand with granulating shaped method and hardened by sintering. The unique formula and producing procedure offer you a middle density and hardness, high wear resistance middle hard particles in the low to middle viscosity range slurries.

Chemical Composition:

Composition	Al_2O_3	SiO_2	ZrO_2
Wt%	60-64	30-33	7-9

Physical Properties:

Specific Gravity 4.0-4.2kg/dm3	Bulk Density 2.5-2.6kg/L		Micro hardness 1000kg/mm2
Hardness Mohs 7.3	Compressive Strength 1100kgf(2mm)	Wear Rate <40g/T	Color Off-white

Microcrystal Alumina Beads

Description:
Microcrystal alumina bead is made from high purity alumina powder and silica powder with sintering method. The micro size of polycrystals contributes to wear resistance and idea strength. It is a wise choice to replace the carbon steel beads to grind the metallic and non-metallic mineral.

Chemical Composition:

Composition	Al_2O_3	SiO_2	Others
Wt%	91-93	6	1-2

Physical Properties:

Specific Gravity 3.5-3.7kg/dm3	Bulk Density 2.2-2.3kg/L	Micro hardness 1350kg/mm2
Compressive Strength 120kgf(2mm)	Wear Rate <200g/T	Color White

Alumina Toughened Zirconia

Description:
Alumina Toughened Zirconia bead was granulated from the ultra fine zirconium dioxide and alumina powder. The consistent micro poly-crystal benefits high compressive strength and wear resistance of beads. Although there is a lower density than T-TZP (yttria-Tetragonal Zirconia polycristal), the lower unit cost is an obvious plus. It can replace it in more application and is competent the mills with high tip speed up to 14m/s.

Chemical Composition:

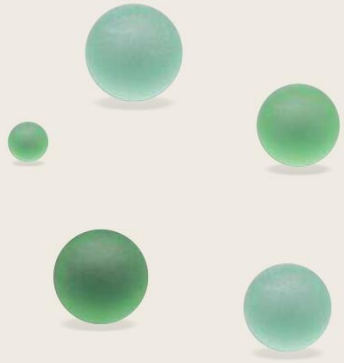
Composition	Al_2O_3	ZrO_2	SiO_2
Wt%	65-75	6-12	6-8

Physical Properties:

Specific Gravity 3.1-3.2kg/dm3	Bulk Density 2.0-2.2kg/L	Micro hardness 900kg/mm2
Compressive Strength 80kgf(2mm)	Wear Rate <70g/T	Color Shell

GLASS BALLS - GRINDING MEDIA

	Chemical Composition	
Soda Lime Glass Balls	SiO2 Na2O CaO MgO Al2O3 others	72.50 % 13.00 % 9.06 % 4.22 % 0.58 %
Aluminium Borosilicate Ballls	SiO2 CaO Al2O3 B2O3 MgO others	53.50 % 20.10% 14.80 % 8.11 % 2.33 %
Soda Lime	SiO2 Na2O CaO Al2O3 B2O3 others	66.70 % 14.00 % 7.59 % 3.46 % 2.90 %



Figures are reference values.

Available Standard Sizes

Size Range (mm)	Bulk Density (kg/l)	Pieces/1000 gr	Size Range (mm)	Bulk Density (kg/l)	Pieces/1000 gr
0.25-0.50	1.46	14486600	1.70-2.10	1.52	111370
0.40-0.60	1.47	6111500	2.00-2.40	1.53	71740
0.50-0.75	1.49	3129100	2.40-2.90	1.53	41050
0.75-1.00	1.50	1140300	2.85-3.45	1.53	24440
1.00-1.30	1.51	502300	3.40-4.00	1.53	15080
1.25-1.65	1.51	250580	3.80-4.40	1.53	11080
1.55-1.85	1.52	155490			

0-400µm microbeads available in different tolerances

Available Standard Sizes

Size Range (mm)	Bulk Density (kg/l)	Pieces/1000 gr	Size Range (mm)	Bulk Density (kg/l)	Pieces/1000 gr
0.50-0.75	1.55	3020370	2.00-2.50	1.53	64730
0.75-1.00	1.54	1100710	2.50-3.00	1.53	35450
1.00-1.40	1.53	426730	2.80-3.40	1.52	24750
1.30-1.70	1.53	218480	3.30-3.90	1.51	15800
1.70-2.10	1.53	107500	3.90-4.40	1.50	10310

Available Standard Sizes

Size Range (mm)	Bulk Density (kg/l)	Pieces/1000 gr	Size Range (mm)	Bulk Density (kg/l)	Pieces/1000 gr
1.5 mm+/-0.2 mm	1.50	226350	4.5 mm+/-0.3 mm	1.50	8380
2.0 mm+/-0.2 mm	1.50	95490	5.0 mm+/-0.3 mm	1.50	6110
2.5 mm+/-0.2 mm	1.50	48890	6.0 mm+/-0.3 mm	1.48	2220
3.0 mm+/-0.3 mm	1.50	28290	7.0 mm+/-0.3 mm	1.48	1490
3.5 mm+/-0.3 mm	1.50	17810	8.0 mm+/-0.4 mm	1.48	1040
4.0 mm+/-0.3 mm	1.50	11930	9.0 mm+/-0.4 mm	1.45	

Special sizes are available upon request. Figures of Bulk Density are reference Values.

AISI S-2 TOOL STEEL BALLS

General Information
S-2 Tool steel balls are design to achieve extreme ruggedness. The ball surface has smooth ground and polished finish. These balls provide the toughness and strength necessary for severe shock loads. S-2 Tool steel balls are hardened throughout and have unusually good wear characteristics. S-2 Tool Steel Balls find most frequent use in oil field equipment and offshore drilling operations. They provide goo service in withstanding the abrasion of pulverized rock and mud slurries.

International Equivalents
ASTM A681, UNS T-4190

Chemical Composition

C	0.47-0.52%
Si	0.90-1.10%
Mn	0.40-0.50%
P	0.025% Max
S	0.25% Max
Cu	0.20% Max
Cr	0.045% Max
Mo	0.035% Max
Ni	0.50% Max
V	0.025% Max

Hardness

HRc	55-58

BEARING STEEL ROLLERS

Types of Rollers

Cylindrical Rollers

Taper Rollers

Needle Rollers

Applications

· Bearings for construction and heavy duty machinery

· Hinge in technical applications

· Wind energy

· Linear slide - guidance

· Shafts, arbour or axles

Ball Valve Component

We manufacture following components for Ball Valves Following are:

Valve Balls

TYPES WE OFFER :-2 Way, L Port, T Port, FB, RB etc

SIZES WE OFFER : 3/8″ to 4″ &As per Customer Requirement

MATERIAL: Any material

Ball Valve Seat Rings

TYPES WE OFFER :-

As per customer requirements

SIZES WE OFFER:
3/8″ to 4″ & As per Customer Requirement

Ball Valve Stem Pin

TYPES WE OFFER :- 1PC, 2PC, 3PC, Screwed End, Forged Steel,Extended, Flush Bottom, Trunion, Antistatic etc.

SIZES WE OFFER: 3/8″ to 12″

MATERIAL: 304, 316, Hastelloy, Monel, Inconel, Duplex.

Fasteners

Fasteners are several parts of any machine whether it is big or small. These parts are joined in different ways according to their role and position in a machine.

Temporary Fastening

When parts of a machine are joined in such a way that these can be disjointed or joined again easily, it is called temporary fastening. There is no harm to the machine or its parts in temporary fastening.

In temporary fastening Nuts, Bolts, Screws, Lock Pin, and Washer are used. These things are called fasteners.

We are making Fastening in below mentioned Material

1. SS 316L
2. SS 304
3. Monel
4. Inconel
5. Hastelloy

Nuts

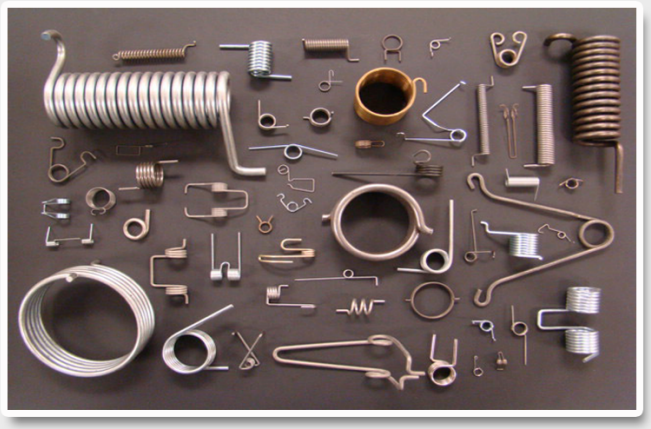
Bolts

Washers

Springs

We make All types of spring with material specialty like

1. Inconel – 750
2. Spring Steel G2, G3
3. Monel



Torsion springs

Compression Springs

Spiral Springs

Disk Springs

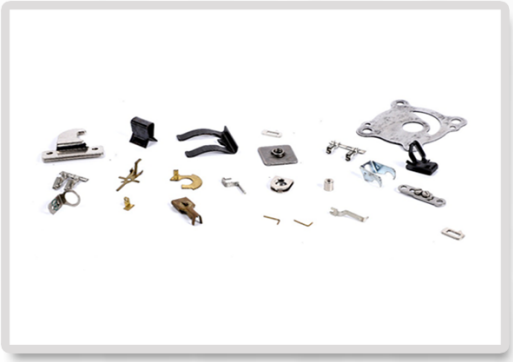
Measuring Instruments

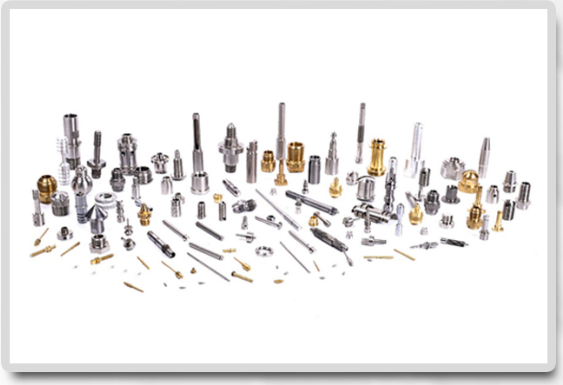
Benefits

The main benefits of specification as per customer specification are accuracy and efficiency.

The Right Choice

The main benefits of specification as per customer specification are accuracy and efficiency.





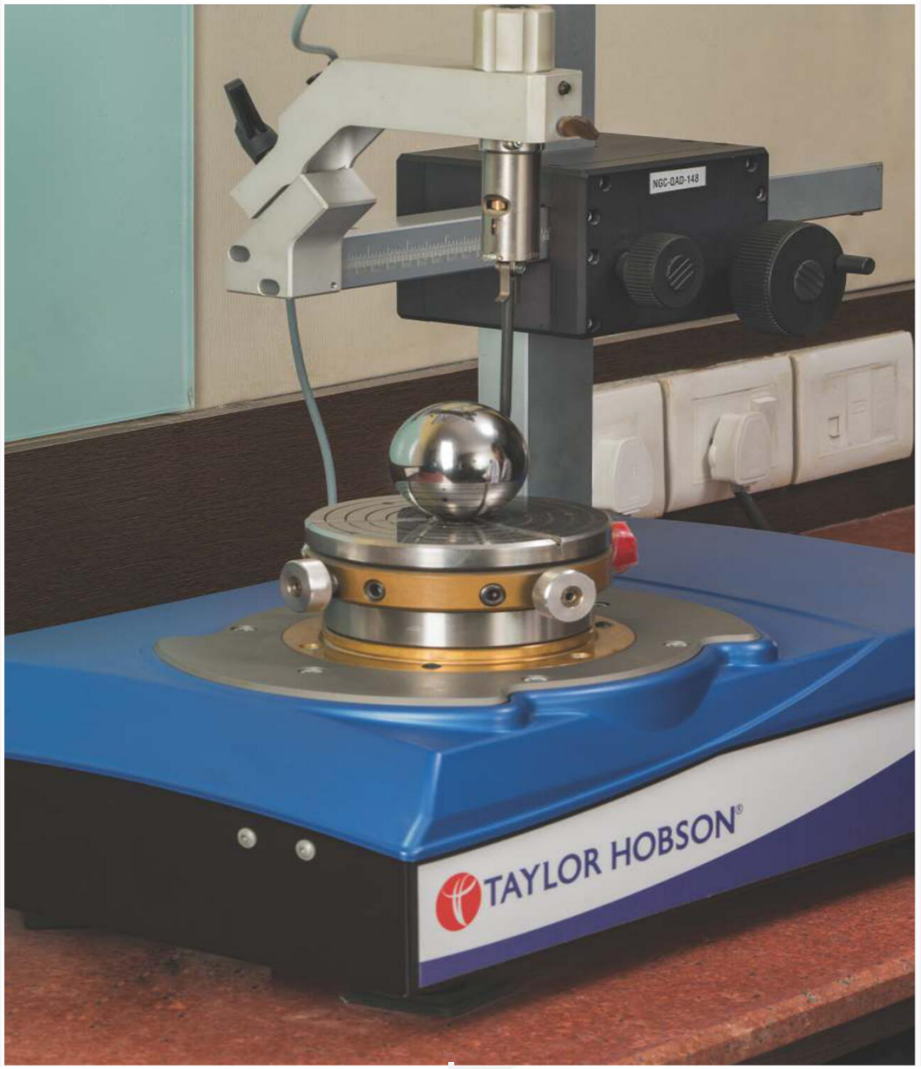
Machine Component

Components As Per Design And Specification

It is a type of contract manufacturing that refers to the process of building products to client work instructions. This is commonly used to manufacture components or pieces of equipment. In this process, a client will provide a product drawing that has been created by an engineer and contain exact specifications down to the millimetre or inch. The design will also outline the necessary materials needed to create the product, and then the product is created.

Machine Components As Per Customer Specification

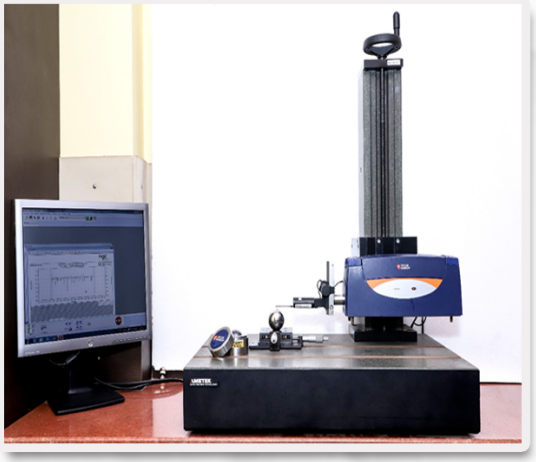
Design and spec refer to the process of building products from scratch, according to a client's need, function, or size requirements. Design and spec can help clients develop solutions for the problems they have. After discussing the desire and coming up with a solution, the manufacturer will assist in designing and creating a product. In the design and spec process, we will assist clients see a project through from beginning to end.

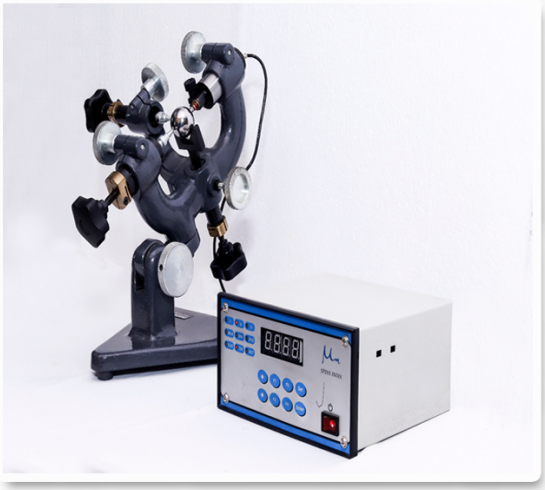


Lab & list of Instruments

The Company is ISO 9001:2008 certified and our QC Dept is quipped with high tech control machines to meet a broad spectrum of needs and guarantee best quality at all times. We follow Intensive Quality Analysis and provide certificates for each batch inspected.

ngc™
HIGH PRECISION BALLS & ROLLERS





WAREHOUSE

The specific strength and power of our Group is as a one point contact to respond to all your needs and demands. Quipped with all essential infrastructures, our warehouses are constantly filled with more than 1,000 Tons of inventory in the widest range of sizes, materials and grades, completely available in one source of supply to satisfy the requirements of our worldwide customers in the shortest terms.

In addition to special and open orders, we have over 250 standard balls of different types and sizes in stock.

HIGH PRECISION BALLS & ROLLERS

N. GANDHI & CO.

An ISO 9001:2015 Certified Company

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