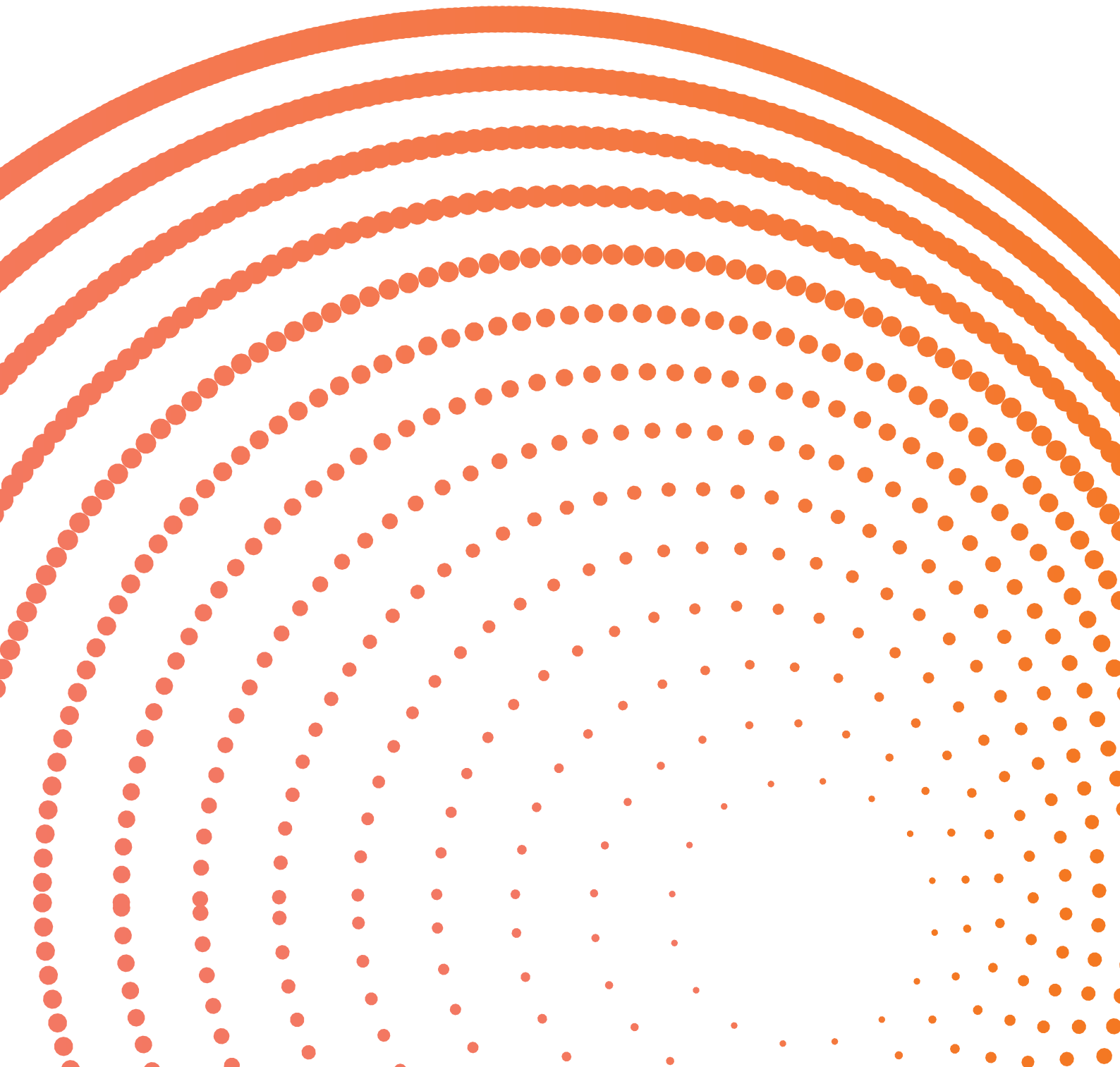


# SAG Balls Technical Specifications



Semi-Autogenous Grinding

Milling





Nominal Ball Diameter in (inch) & Mass in (g)			Nominal Ball Diameter in (mm) & Mass in (g)		
Ball Diameter (in)	Minimum Mass (g)	Maximum Mass (g)	Ball Diameter (mm)	Minimum Mass (g)	Maximum Mass (g)
3.5	2869	3156	94	3392	3731
4.0	4283	4712	105	4728	5201
4.5	6099	6708	115	6211	6832
5.0	8366	9202	125	7977	8774
5.25	9684	10653	133	9608	10569
5.5	11135	12248	140	11207	12327
6.0	14456	15902	150	13784	15162
6.25	16339	17973	160	16728	18401

**Chemistry (Weight %)**

Ball Diameter		C		Mn		Si		Cr		Mo	
in.	mm.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
3.5	94	0.75	1.00	0.75	1.25	0.10	0.50	0.50	1.00	0.00	0.10
4.0	105	0.75	1.00	0.75	1.25	0.10	0.50	0.50	1.00	0.00	0.10
4.5	115	0.70	0.90	0.75	1.25	0.10	0.50	0.50	1.00	0.00	0.10
5.0	125	0.70	0.90	0.75	1.25	0.10	0.50	0.75	1.25	0.00	0.10
5.25	133	0.70	0.90	0.75	1.25	0.10	0.50	0.75	1.25	0.00	0.10
5.5	140	0.70	0.90	0.75	1.25	0.10	0.50	0.75	1.25	0.00	0.20
6.0	150	0.70	0.90	0.75	1.25	0.10	0.50	0.75	1.25	0.00	0.20
6.25	160	0.70	0.90	0.75	1.25	0.10	0.50	0.75	1.25	0.00	0.20
S Max (0.040)						P Max (0.035)					

**Hardness (Rockwell C)**

Ball Diameter		Average Surface Hardness		Average Volumetric Hardness	
in.	mm.	Min.	Max.	Min.	Max.
3.5	94	55	61	55	61
4.0	105	55	61	55	61
4.5	115	55	61	55	61
5.0	125	55	61	55	61
5.25	133	55	61	55	61
5.5	140	55	61	55	61
6.0	150	53	61	53	61
6.25	160	53	61	53	61

The above is intended as a guide only. Individual ball hardness readings may fall outside the range listed above.

## SAG Milling

Molycop manufactures balls for grinding operations (using high carbon alloy steel bars as the raw material) through special bar heating, forging and heat treatment processes, the objective of which is to obtain optimum wear and impact resistance. The SAG ball series is used primarily for SAG ore grinding operations in which high impact breakage resistance and high wear resistance are the main ball attributes required.

## Product Specifications

### Sizes

Molycop manufactures SAG balls, equal or larger than 3.5 inch or 94 mm and smaller than 6.25 inch or 160mm. Common nominal sizes are 3.5, 4.0, 4.5, 5.0, 5.25, 5.5, 6.0 and 6.25 inch or 94, 105, 115, 125, 133, 140, 150 and 160mm. The tolerance for the mass of the balls is - 0; +10% overweight.

### Chemistry

The chemistry ranges for each diameter ball designed to optimise the microstructure and hardness after appropriate heat treatment. The hardenability parameter  $D_1$ , which depends on the chemistry, is equal to or larger than the diameter of the ball to be made with alloy. Careful selection of steel bar suppliers through agreed process assessment, process qualification and continuous monitoring of supplier capability, ensures ball chemistry is optimized within the specification. The mean composition may vary with the ball diameter.

### Surface and volumetric hardness

The wear resistance and the impact breakage resistance of the balls depend on the microstructure developed in the steel by carefully selected heat treatment variables, specifically designed for each alloy. The control variable of the finished product – although not totally determining the final performance in their application – is the hardness range achieved.

## Supply and Quality Guarantee

Long established strategic relationships with local and foreign raw material suppliers allow us to ensure all balls supplied to our customers are made from the highest quality products and meet strict Molycop specifications. This combined with our global manufacturing network gives our customers the confidence in the quality of the product that only Molycop is able to assure.

## Packaging Options



### Bulk

Balls can be transported in bulk open top trucks, open top rail cars, or in standard 20ft containers.



### Bags

Balls can be supplied in polypropylene bags which have secure bag straps to reduce time and effort in loading and unloading. While bags are treated to resist UV rays, bags should be protected from direct sunlight to maximize shelf life.



### Drums

Recycled drums can also be supplied. Drums are more efficient for some modes of transportation and can also be delivered on wooden pallets.



If you're interested in exploring Molycop's products and services, we're here to help.



[molycop.com](https://molycop.com)

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