**KUMTOR GOLD COMPANY CJSC REQUIREMENTS FOR THE SUPPLY OF STEEL GRINDING BALLS FOR BALL AND TOWER MILLS**

**1. Terms and definitions**

1.1 Drum ball mill: Device for grinding of materials, the working element of which is a horizontal rotating drum filled with grinding balls and the material to be milled.

1.2 Tower ball mill: Device for grinding of materials, the working element of which is a vertical drum with a rotating rotor filled with grinding balls and the material to be milled.

1.3 Grinding balls: Ball-shaped products which grind the material in ball mills by abrasion.

1.4 Rated ball diameter: Rounded off to the standard range of ball diameters.

1.5 Nominal ball diameter: The diameter against which the limit deviations are determined.

1.6 Limit diameter deviation: Difference between the limit diameter and the nominal diameter.

1.7 Volumetric hardness: Calculated hardness value that summarizes hardness values over the volume of the grinding ball.

**2. Classification and symbolic notation**

1.1 According to hardness balls are divided into groups:

I - Of normal hardness;

II - Of higher hardness;

III - Of high hardness;

IV - Of high hardness, with normalized hardness at the depth of 0,5 of the ball radius;

V - High surface hardness with normalized volumetric hardness.

1.1 Symbolic notations of balls:

Ball 12.7-13.0 mm - GOST 7524-89: Balls Ø 12.7-13.0 mm of increased surface hardness group >3:

Ball 15 mm - GOST 7524-89: Balls Ø 15 mm of increased surface hardness group >3;

Ball 20 mm - GOST 7524-89: Balls Ø 20 mm of high surface hardness of group >3;

Ball 30 mm - GOST 7524-89: Balls Ø 30 mm of high hardness surface of group >3;

Ball 60 mm - GOST 7524-89: Balls Ø 60 mm of high hardness surface of group >3;

Balls 114 mm - GOST 7524-89: Balls Ø 114 mm of increased hardness of surface group >3.

1. **Technical requirements**

Main characteristics

3.1 Balls should be manufactured in accordance with GOST 7524-89.

3.2 Dimensions of the balls and limit deviations are given in Table 1.

*Table 1*

|  |  |  |
| --- | --- | --- |
| Rated diameter, mm | Nominal diameter, mm | Limit deviations from nominal diameter, mm |
|  |  |  |
|  |  |  |
| 12.7-13.020  15  20  30  60  114 | 13,0  15,0  20,0  30,0  60,0  114,0 | ±1,0 |

* 1. The hardness of balls after heat treatment must comply with the standards given in Table 2.

*Table 2*

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Rated diameter of ball, mm | Hardness group of balls | | | | | | |
| 1 | 2 | 3 | 4 | | 5 | |
| Hardness, HRC/HB, not less than | | | | | | |
| Ball surface | | | | Depth of 0,5 of ball radius | Ball surface | Volumetric |
| From 12.7 to 45 inclusive | 45/415 | 49/461 | 55/534 | 55/534 | 45/415 | 61/601 | 57/555 |
| From 50 to 70 inclusive | 43/401 | 48/453 | 53/514 | 53/514 | 43/401 | 60/590 | 53/514 |
| Over 110 to 120 inclusive | 35/302 | 38/331 | 50/477 | 50/477 | 35/302 | 56/545 | 43/401 |

* 1. Balls shall be made of steel, in which the carbon content and the carbon equivalent shall correspond to the values given in Table 3.

*Table 3*

|  |  |  |  |
| --- | --- | --- | --- |
| Rated diameter of the ball, mm | Hardness group of balls | Weight ratio of carbon, %, not less than | Carbon equivalent |
| From 12.7 to 30 inclusive | 3 | 0,50 | 0,50 |
| 4.0 | 0,60 | 0,70 |
| 4,5 | 0,75 |
| Over 60 to 70 inclusive | 3 | 0,50 | 0,70 |
| 4.0 | 0,60 | 0,75 |
| 4,5 |  | 0,80 |
| Over 80 to 120 inclusive | 3 | 0,50 | 0,70 |
| 4.0 | 0,60 | 0,75 |
| 4,5 |  | 0,85 |
|  | | | |

3.5 Cracks and defects on the surface of balls which take the dimensions of the balls beyond the limit deviations are not allowed.

3.6 By agreement between the manufacturer and the consumer, balls of hardness groups 4 and 5 may be supplied with an impact resistance test. The manufacturer shall have an approved impact resistance test procedure.

**4. Marking**

4.1 The marking of the balls is not compulsory.

4.2 Transportation marking must be made in accordance with GOST 14192.

**5. Packaging**

5.1 Balls with a diameter of 12.7-13, 15 and 20 mm should be supplied packed in packing containers: metal or soft "big-bag" type containers, wooden crates or other packaging.

5.2 Balls with diameters of 30, 60 and 114 mm - in bulk without packing.

**6. Acceptance rules**

6.1 Balls will be accepted and delivered in batches.

2.2 The controlled lot shall consist of balls of the same size, the same hardness group and have a weight not exceeding 150 tons.

6.3 A supplied lot may consist of several controlled lots of balls of the same size and hardness group.

2.4 The batch must be accompanied by a quality document containing: name of the manufacturer, product identification number, batch number, weight of the shipped batch, hardness test results on the balls, stamp of the service providing product quality control.

6.5 If the shipped batch consists of several controlled batches, the accompanying document shall specify the minimum hardness value obtained by testing the balls from the controlled batches.

**7. Transportation and storage**

7.1 Balls must be transported by all kinds of transport in accordance with the current rules of cargo transportation.

7.2 When transporting it is not allowed to mix balls of different sizes and hardness groups.

7.3 Transportation and storage of balls is carried out according to GOST 7566, in terms of exposure to climatic factors of the environment - according to GOST 15150.

**8. Quality control of ball conformity**

8.1 Inspection of dimensions, quality and surface hardness of balls will be carried out on ten balls selected from at least five different locations in the batch. Allow no more than 10% of the balls tested that do not meet the size and surface quality requirements of this standard. If you receive unsatisfactory test results for at least one of the indicators, it will be re-inspected on twice the number of balls taken from the same batch. The results of the re-test will be extended to the entire batch under control.

8.2 Compliance control of balls of hardness group III will be carried out by sampling at the delivery of balls to the mine "Kumtor" and testing in an independent laboratory. Kumtor CJSC has the right to test the balls for compliance with GOST 7524-89, in case of non-compliance to reject the supplied batch. In this case, the supplier must take the balls to their own territory at their own expense.

8.3 The chemical composition of steel will be determined by the results of fusion analysis or in the incoming inspection of products.

8.4 Goods not conforming to the declared quality are subject to return at the supplier's expense.

8.5 If during the use of grinding balls, quality deterioration of the supplied balls (low hardness of the surface of the balls, friability, bubbles, cracks, delamination, slag inclusions) is detected, which lead to the destruction, breakage of the balls during operation before the end of their service life, Kumtor JSC shall return the defective, broken balls to the supplier. The Supplier, in turn, undertakes to reimburse 70% of the weight of the rejected, broken balls with new whole balls on a free of charge basis.

1. **General Requirements.**

Suppliers providing bids must meet the following requirements:

- have full civil legal capacity for the conclusion of the contract and special legal capacity (availability of licenses, permits, attestation, certification, the possibility of obtaining them if necessary) to carry out activities under the contract;

- not be insolvent or bankrupt, be in the process of liquidation; the Supplier's property, which is essential for the fulfillment of the Contract, shall not be seized, economic activities of the Supplier shall not be suspended;

- have the necessary professional knowledge, experience and managerial competence, and resource capabilities (financial, material and technical, manufacturing, labor) and a positive business reputation;

- to be an enterprise - the manufacturer / supplier of this type of products;

- to have quality passports and certificates of conformity for manufactured products;

- to have a quality control system for manufactured products.