



CORPORATE STANDARD

AA0674107

Rev. No. 04

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PROCESS FOR ELECTROPLATING OF ZINC ON STEEL SURFACES FROM CYANIDE BATH

1 GENERAL

This standard details the process for high-speed bright zinc plating on steel surfaces from cyanide zinc solution bath by tank or barrel to provide protection against corrosion and to give a bright attractive finish to the surface.

2 APPLICATION

Used for components like fasteners, nuts, bolts, electronic panels etc. This process is not suitable for plating on cast iron surfaces.

3 COMPLIANCE WITH NATIONAL STANDARDS

This Standard has reference to the following Indian Standards regarding surface condition and quality of deposit.

IS 1340 : 1977 : Code of Practice for chromate conversion coating on Zinc and Cadmium coated articles and zinc base alloys.

IS 1573 : 1986 : Electroplated coatings of Zinc on Iron and Steel.

IS 3203 : 1982: Methods of Testing Local Thickness of Electroplated Coatings.

IS 9844 : 1981: Method of testing of corrosion resistance of Electroplated and Anodized Aluminium coatings by neutral salt spray test.

4 MATERIALS

| Material | CPS No./IS No./Available from |
|---|--|
| Sodium cyanide for electroplating | AA55610 |
| Caustic Soda (Tech.) | AA54201 |
| Nitric Acid (Tech.) | AA54102 |
| Zinc Anodes (99.98% Purity, Min.) (Grade 1) | IS 2605 |
| Bright Zinc Salts | M/s. Ronuk Industries Ltd. Mumbai |
| Zinc Brightener Zn-21 | |
| Zinc Brightener Zn-22 | |
| Zinc Purifier | |
| Zinc Brite 16 Salt | M/s. Grauer & Weil (I) Ltd., Mumbai |
| Zinc Brite 20 Brightener | |
| Monicol Purifier | |
| Zinek Salt - 501 | M/s. Platewel Processes & Chemicals Ltd., Vadodara |
| Super Zinc Brightener – 505 | |
| Supra Zinc Brightener 555 | |
| Zincad Purifier - 503 | |
| Teknobrite CZ 920 Salt | M/s. Artek Surfin Chemicals (P) Ltd., Mumbai |

Revisions: As per clause 28.16.6 of MOM of 28th MRC (CPO)

APPROVED:
INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (CPO&NM)

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| Rev. No. 04 | Amd. No. 02 | Reaffirmed | Prepared HEP, Bhopal | Issued Corp. R&D | Dt. of 1 st Issue 01-01-1985 |
| Dt: 15-10-2000 | Dt: 15-10-2002 | Year: 2021 | | | |

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| Teknobrite CZ 920 Brightener | M/s. Artek Surfin Chemicals (P) Ltd., Mumbai |
| Purisol | |

5 EQUIPMENT

5.1 Plating Tank / Vat

The Tank/vat shall be made of plain welded steel sheets with rubber lining. The vat shall be provided with an insulated frame on top fitted with insulators for holding the anode and cathode rods. The tank shall also be provided with exhaust system.

5.2 Barrel

The plating barrel shall be constructed out of polypropylene perspex and shall be so driven as to rotate at 5 to 12 rpm.

5.3 Rinsing Tanks

Mild steel tank lined with rubber / FRP / PVC.

5.4 Hot Water Rinsing Tank (Optional)

Mild steel tank with rubber / FRP lining and heating arrangements.

6 COMPOSITION OF ELECTROLYTE AND OPERATING INSTRUCTIONS

6.1 Composition of Electrolyte (Bath Solution) and Operating Conditions

The electrolyte shall be prepared according to any one of the following compositions and operated at the conditions specified below:

| | Parameter | Composition | | | |
|---------|------------------------------------|-------------|--------------|-----------------|--------------------|
| | | I RONUK | II G&W | III PLATEWEL | IV ARTEK SURFIN |
| Sl. No. | Name of salt | Bright Zinc | Zinek. Brite | Zinek 501 | Tekno Brite CZ 920 |
| | Salt Content | | | | |
| | For vat | 180-200 | 200 | 200 | 200 |
| | For barrel | 200-220 | 200 | 200 | 200 |
| 1 | Zinc Brightener Zn-21, ml/l | 1.5 | --- | --- | --- |
| 2 | Zinc Brightener Zn-22, ml/l | 2.5 | --- | --- | --- |
| 3 | Super zinc | --- | --- | 6-8 | --- |
| | Brightner-505, ml/l | --- | --- | 3-5 | --- |
| 4 | Supra Zinc | | | | |
| | Brightener 555, ml/l | --- | 3-5 | --- | --- |
| 5 | Zinc Brite 20 | | | | |
| | Brightener, ml/l | --- | 3-5 | --- | --- |
| 6 | Tekno Brite CZ 920 Brightener | --- | --- | --- | 2-4 |
| 7 | Monicol Purifier, ml/l | --- | 5 | --- | --- |
| 8 | Zincad Purifier-503, ml/l | --- | --- | 5 | --- |
| 9 | Purisol, ml/l | --- | --- | --- | 4 |
| 10 | Temperature | Room-55 | 20-45 | 25-55 | 20-45 |
| 11 | Anode to Cathode Ratio | 1:1 | 1:1 | 1:1 | 1:1 |
| 12 | Current density, A/dm ² | | | | |
| | a) For vat | 1.5-4.5 | 2-5 | 2-5 | 2-5 |
| | b) For barrel | 1.5-4.5 | 0.5-2 | 0.5-2 | 0.5-2 |

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|----|---|--------------|--------------|--------------|--------------|
| 13 | Voltage, (Volts) a) For vat b) For barrel | 6-8 12-15 | 2-6 10-15 | 3-6 12-16 | 2-5 10-15 |
|----|---|--------------|--------------|--------------|--------------|

6.2 Preparation of Electrolyte

6.2.1 The vat/barrel shall be filled with water, preferably with demineralised water, to about two-thirds of its capacity.

6.2.2 The required amount of salt shall be added to the bath in small quantities with stirring.

6.2.3 The temperature of the solution should not raise beyond 70°C.

6.2.4 Stirring shall be continued until all the salts get dissolved.

6.2.5 The solution shall then be brought upto the working level by adding cold demineralised water. At this stage the temperature of the bath shall be at the working range.

6.2.6 The requisite amount of purifier shall now be added to the solution and stirred thoroughly. If necessary, filtration at this stage shall be carried out. Then requisite amount of brightener shall be added.

6.3 Analysis of the Electrolyte

The solution shall be analysed initially after make up and subsequently at suitable intervals.

6.4 Maintenance of the Electrolyte

6.4.1 The concentration of the electrolyte shall be maintained as below:

| Parameter | Composition | | | |
|------------------------------|-------------|-----------|-----------|-----------|
| | I | II | III | IV |
| | RONUK | G&W | Platewel | ARTEK |
| Zinc as metal, g/l | 33-40 | 30-40 | 30-34 | 30-40 |
| Total Sodium Cyanide, g/l | 90-105 | 75-140 | 80-90 | 75-140 |
| Total Sodium Hydroxide, g/l | 75-93 | 65-85 | 70-80 | 65-85 |
| Sodium Cyanide to Zinc ratio | 2.5-3:1 | 2.5-3.5:1 | 2.7-3.2:1 | 2.5-3.5:1 |

6.4.2 Addition of Brighteners

Brightness of the deposit shall be maintained by adding brighteners for every 1000 ampere-hours as shown below:

| Brightener | Composition | | | |
|------------------------------|-------------|---------|----------|---------|
| | I | II | III | IV |
| | RONUK | G&W | PLATEWEL | ARTEK |
| Brightener Zn-21, ml | 60 | --- | --- | --- |
| Brightener Zn-22, ml | 100 | --- | --- | --- |
| Zinc Brite 20 Brightener: | | | | |
| i) For vat, ml | --- | 100-150 | --- | --- |
| ii) For barrel, ml | --- | 150-200 | --- | --- |
| Super Zinc Brightner-505: | | | | |
| i) For vat, ml | --- | --- | 150 | --- |
| ii) For barrel, ml | --- | --- | 200 | --- |
| Supra Zinc Brightener – 555 | --- | --- | 100 | --- |
| Teknobrite CZ 920 Brightener | --- | --- | --- | 100-250 |

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Brighteners may be added directly into the bath and stirred well. Excess of brightner must be avoided.

6.4.3 Bath shall be analyzed periodically and if the values do not lie in the limits as given in 6.3.1, required chemicals shall be added to the bath to bring the composition to the required level.

6.4.4 Purification of Electrolyte:

The electrolyte shall be filtered at least once in a week or as required addition of 0.25 ml of zinc purifier per litre of solution for Composition-I, 0.1 to 0.2 ml of Monicol per litre for Composition-II and 0.1 to 0.2 ml of Zincad-503 purifier for Composition-III shall be made daily and stirred well to eliminate impurities in the solution and also to settle before resuming the work.

7 PROCESS:

7.1 Cleaning

All articles shall be properly cleaned as described in BHEL Standard AA0673601: Process for cleaning and preparation of metal surfaces prior to electroplating or BP0673693: Electroplating of zinc on steel surface from Acid bath.

7.2 Rinsing

All articles shall be rinsed thoroughly after cleaning to avoid contamination of the plating solution.

7.3 Plating

It shall be ensured that the current is on before the articles are put into barrel or tank.

All articles shall be plated at the specified current density for a duration, which will depend on the thickness of the deposit required.

7.4 Cold Rinsing

After removal from the plating bath, all articles shall be rinsed thoroughly in cold running water till all the traces of solution are removed.

7.5 Drying

The rinsed articles shall be dried using a centrifugal drier or hot air blower /hot air oven.

8 HEAT TREATMENT: (Whenever required)

Note : Steels of tensile strength of 100 kgf/mm² or corresponding hardness should be heat treated.

8.1 Stress Relieving Before Plating: (IS 1573)

In accordance with IS 1573.

8.2 Stress Relieving after Plating: (IS 1573)

In accordance with IS 1573.

9 PASSIVATION

Electroplated heat treated articles shall be passivated as per AA0673604 : Process for Passivation of Zinc And Cadmium Plated Articles.

10 CARE OF ANODES

Anodes shall be removed from the bath when the bath is idle.

Ensure that the anodes are bright in luster while plating is on.

11 PRECAUTIONS

11.1 While preparing the solution the operator shall use rubber hand gloves, apron and respirator mask to avoid irritation of skin and suffocation due to fumes. The safety precautions for electroplating shop and handling of chemicals given in AA0462801 shall be followed.

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11.2

Solution shall be kept covered when not in use.

11.3

Any chemical that may be necessary to be added shall be dissolved in a part of the original solution (except brighteners) before adding it to the vat/barrel. It shall be poured through a filter or perforated bucket.

11.4

Any metal that may be deposited on any part of the vat/barrel shall be removed immediately.

11.5

Any article that becomes lodged in any part of the vat / barrel shall be removed immediately.

11.6

Remove Zinc Anode at the end of shift so as to avoid dissolution of zinc metal during idle period.

12

INSPECTION AND QUALITY OF DEPOSIT

When tested in accordance with the test methods shown against each, the deposit shall conform to the norms specified below:

12.1

SAMPLING

Minimum of 1% of each batch of tank/barrel load of part there of shall be taken at random for testing with a minimum of 5 samples. When plated components are big and cannot be subjected to any of the specified test, a test panel of suitable size of the same basis metal shall be plated along with component under identical conditions for the purpose of testing. For corrosion resistance tests, test piece of minimum 150 mm. length, and 100 mm width and approximately 1 mm thick shall be used.

12.2

Condition of Surface

The plated surface shall appear as a smooth and continuous film over the basis metal and shall be free from defects such as pits, stains, cracks, blisters, nodules, pinholes, un-plated areas and other superficial blemishes visible to the unaided eye. The plated surface shall be bright with required passivation.

12.3

Thickness of Deposit (IS 3203)

The minimum thickness shall be as specified on relevant drawing on BHEL order.

12.4

Adhesion (IS 1573)

Flaking and blistering of the coating is not acceptable and the coating shall continue to adhere to the base metal after this test.

12.5

Humidity test (IS 1573)

Breakdown of the film or appearance of white corrosion products after two cycles of the test shall be taken as failure.

13

ADDITIONAL TESTS

Whenever required, the following test shall be conducted as per the test methods shown against each and the norms of acceptance shall be as specified below:

13.1

SALT SPRAY TEST (IS 9844)

When tested in accordance with IS 9844 white corrosion products shall not be visible within 96 hours on plated and passivated components.

14

REJECTION

If the samples taken do not comply with clauses 12.2 to 12.5 and 13, a further quantity not less than twice the number originally taken, shall be subjected to these tests. If any one of these samples also fails, the whole batch shall be rejected.

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CORPORATE STANDARD**15 REFERRED STANDARDS (Latest Publications Including Amendments)**

- 1) IS 1573
- 2) IS 2605
- 3) IS 9844
- 4) AA54102
- 5) AA54201
- 6) AA55610
- 7) AA0673601
- 8) AA0673604



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AA0673604

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PROCESS FOR PASSIVATION OF ZINC AND CADMIUM PLATED ARTICLES

1 GENERAL

This standard details the compositions of the passivation solution and the procedure for passivation of zinc and cadmium electroplated articles.

2 APPLICATION

To increase resistance to corrosion and finger marking.

3 COMPLIANCE WITH NATIONAL STANDARDS

This standard has reference to the following Indian standards regarding the quality of the passivated film:

IS 1340 : 1977: Code of practice for chromate conversion coating on zinc and cadmium coated articles and zinc base alloys

IS 1573 : 1986: Electroplated coating of zinc on iron and steel.

4 MATERIAL

| Material | CPS No. / IS No. / Available From |
|-----------------------------------|---|
| Sulphuric Acid (Technical) | AA54101 |
| Nitric Acid (Technical) | AA54102 |
| Chromic Acid-Electroplating Grade | AA54104 |
| Sodium Bichromate (Technical) | AA55612 |
| Ginthox - Q.982 (L) | M/s Grauer & Weil (I) Ltd., Mumbai. |
| Ginthos – 995 | |
| Kempas – 755 | M/s Artek surfen Chemicals (P) Ltd., Mumbai |
| Zinc chrome 62L | M/S Platewel & process chemicals, Vadodara |

5 EQUIPEMENT

5.1 Passivating Rinsing Tank

FRP/PVC lined mild steel tank preferable with heating arrangements.

5.2 Cascade Rinsing Tank

FRP/PVC lined mild steel tank with suitable partitions and provided with running water facilities, water cascading from one partition to the other

5.3 Acid Treatment Tank (Optional)

FRP/PVC lined mild steel tank

5.4 Rinsing Tank - After Acid Treatment - (optional)

FRP/PVC lined mild steel tank

Revisions: As per 40th MOM of MRC-CPO

APPROVED:
INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC (CPO&NM)

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|----------------|----------|------------|----------------------------|---------------------|--|
| Rev. No. 05 | Amd. No. | Reaffirmed | Prepared HEEP, Haridwar | Issued Corp. R&D | Dt. of 1 st Issue 01-02-1986 |
| Dt: 26-05-2012 | Dt: | Year: 2021 | | | |

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CORPORATE STANDARD**5.5 Hot Air Oven**

Hot air oven suitable for heating 50-70°C

5.6 Centrifugal Drier

A standard centrifugal drier suitable for drying barrel components

6 COMPOSITION/PREPARATION OF SOLUTIONS & OPERATING INSTRUCTIONS**6.1 Passivating Solution****6.1.1 Composition and Operating Conditions**

The passivating solution shall be made of any one of the following compositions and operating conditions

6.2 Preparation of solution

6.2.1 The tank shall be filled with water preferably demineralised water to about two-thirds of its capacity.

6.2.2 The required amount of salt/chemical shall be added to the bath in small quantities with stirring.

6.2.3 After complete dissolution, the required quantity of recommended acid shall be poured to the solution with stirring.

6.2.4 Finally, the solution shall be brought to the operating level by adding water.

6.3 Maintenance of the solution

Any deficiency of the acid from the above composition shall be corrected by cautious addition of concentrated acid.

After the solution has been working from some time/and or any deficiency in the solution, if observed, then the passivating chemicals shall be added to keep the solution upto the working strength, or if required a fresh solution shall be prepared. While making the addition the salt shall be dissolved in the separate acid resisting container with the required quantity and then added to the tank.

7 PROCESS**7.1 Acid Treatment**

7.1.1 Zinc/cadmium plated, heat treated articles after proper rinsing, shall be dipped in 0.4 to 0.5% nitric acid solution for 5-10 seconds.

7.1.2 After acid treatment, the articles shall be rinsed in clean cold running water.

7.2 Passivation

7.2.1 The articles shall then be immersed in the passivating solution as specified in clause 6.1.1 for 10 to 30 seconds.

7.2.2 The articles shall be drained for about 30 seconds after passivation.

7.2.3 The passivated articles shall be double rinsed in cold water for a period sufficient to ensure that water draining from the articles contains no trace of yellow colouration. The total rinsing time shall not be longer than 5 minutes.

7.2.4 After rinsing, the articles shall be dried off using air oven/compressed air. In case of barrel plating, the articles shall be dried by means of centrifugal drier.

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7.3 Age Hardening

No article shall be used in assemblies within 24 hours of age hardening after passivation.

Note:

After passivation, no heat treatment of the plated articles shall be done.

8 INSPECTION

8.1 Visual

All the jobs shall be tested visually the passivated film shall have a greenish iridescent or greenish yellow iridescent appearance, free from areas of unconverted zinc or cadmium plating.

8.2 Adhesion (IS 8602)

Adherence may be determined after age hardening by rubbing the surface with white paper. The paper must not show more than a slight trace of stain and the treated surface shall not show signs of having been rubbed through.

8.3 Chromate Film Test (IS 1573)

The chromate film shall be free from bare (unconverted zinc) patches and shall be adherent.

9 REFERRED STANDARDS (Latest Publications Including Amendments)

- 1) IS 1340
- 2) IS 1573
- 3) IS 8602
- 4) AA54101
- 5) AA54102
- 6) AA54104
- 7) AA55612



CORPORATE PURCHASING SPECIFICATION

AA10301

Rev No.05

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COLD DRAWN SPRING STEEL WIRE - ZINC COATED

1.0 GENERAL:

This specification governs the quality of requirements of Zinc coated cold drawn carbon steel wire.

2.0 APPLICATION:

Suitable for the manufacture of cold formed helical springs, spring-rings and wire forms subjected to moderate load cycles-statically stressed.

3.0 CONDITION OF DELEVERY;

Wire shall be supplied in the form of coils in Zinc Coated, Cold drawn condition.

4.0 Compliance with National Standards:

The material shall comply, in general, with requirements of the following National standards and also meet the requirements of this specification.

IS: 4454, Part 1- 2001, Gr.: SM : Steel wires for mechanical springs.

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

The material shall be supplied to the dimensions specified on BHEL order.

Wires above 0.30 mm and upto and including 20.0 mm in diameter only shall be ordered to this specification

5.2 Tolerances:

5.2.1 The tolerances of the wire shall comply with Table-4 of IS: 4454, Part-1.

5.2.2 The cross-section of the round wire shall be circular to within half the tolerance of the permitted diameter tolerance, specified above.

Revisions:
Cl. 26.6.22 of MOM of MRC-S&GPS

APPROVED:
INTERPLANT MATERIAL RATIONALISATION
COMMITTEE – MRC(S&GPS)

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| Rev No.05 | Amd No. | Reaffirmed | Prepared | Issued | Dt. of 1 st Issue |
| Dt:15-01-2004 | Dt: | Year:2020 | HEP, Bhopal | Corp.R&D | August, 1976 |

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CORPORATE PURCHASING SPECIFICATION



6.0 MANUFACTURE:

Steel for springs shall be manufactured by the open heath, electric, basic oxygen or a combination of these processes. If any other process is employed, prior approval of BHEL shall be obtained.

Material shall be manufactured form killed steel.

The wire shall be drawn in the galvanised condition.

7.0 FREEDOM FROM DEFECTS:

The surface of the wire shall be smooth and free from defects such as grooves, seams, pits, die marks, tears, rust, scale, scratches and any harmful defects which may have a noticeable adverse effect on application of the wire.

8.0 SAMPLING:

Unless otherwise agreed to method of drawing representative sample of material and criteria for conformity shall be as per Annex. C of IS: 4454, Part 1.

9.0 CHEMICAL COMPOSITION:

The melt analysis of steel and the permissible variation in the composition of the finished product form the melt analysis shall be as follows:

| Element | Melt analysis | | Permissible variation, percent, in product analysis |
|------------|---------------|--------|---|
| | % Min. | % Max. | |
| Carbon | 0.35 | 1.0 | ± 0.02 |
| Silicon | 0.10 | 0.30 | ± 0.03 |
| Manganese | 0.30 | 1.20 | + 0.05 |
| Sulphur | --- | 0.03 | + 0.005 |
| Phosphorus | --- | 0.03 | + 0.005 |
| Copper | --- | 0.20 | -- |

NOTE:

- i) P + S = 0.055%, max.
- ii) Cu + Ni + Cr = 0.35%, max

10.0 ZINC COATING:

Zinc Coating Process (Hot dip galvanising) shall be as per IS: 2629

The final weight of zinc coating shall not be less than 60 gm/m² on any size of wire when tested as per IS: 6745

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|  | <h1 style="text-align: center;">CORPORATE PURCHASING SPECIFICATION</h1> | AA10301 |
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11.0 WRAPPING TEST:

The wire shall be bent or wrapped round a mandrel of appropriate diameter given below without cracking of the base wire, or cracking or flaking of the coating to such an extent that any zinc can be removed by rubbing with bare fingers.

| Diameter of wire, mm | Minimum complete turns of wrap | Mandrel diameter |
|------------------------------|--------------------------------|------------------|
| 3.80 and under | 6 | 4 D* |
| Over 3.80 up to and incl.7.5 | 6 | 5 D |
| Over 7.5 | $\frac{1}{4}$ (one 90° bend) | 5 D |

* Diameter of wire = D

12.0 MECHANICAL PROPERTIES:

12.1 Tensile:

The tensile test shall be carried out in accordance with IS: 1608.

The tensile strength and percentage reduction of area obtained from the test pieces shall comply with those given in Table 5 of IS: 4454, Part 1.

12.2 Wrapping:

The wrapping test shall be applicable to wires with nominal diameter less than 3mm. Wrapping test when carried out in accordance with IS:1755 shall not show on visual examination any sign of fracture upon closely coiled for at least four turn around a mandrel of diameter equal to diameter of wire.

12.3 Torsion:

For wires of diameter 0.5 mm and up to and including 10.0 mm.

The sample piece of length equal to 100 times the wire diameter, but not exceeding 500mm shall be twisted in accordance with IS: 1717. The test piece shall withstand, without failure, the minimum number of turns given in Table 6 of IS: 4454, Part I. The fracture shall be perpendicular to the wire axis and surface shall not split. Any secondary helical fracture shall be ignored.

12.4 Cast of Wire:

As per IS: 4454

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CORPORATE PURCHASING SPECIFICATION



13.0 INSPECTION AT SUPPLIER'S WORKS:

Whenever specified tests and inspection are to be conducted in the presence of BHEL's representative.

The supplier shall offer BHEL's representative all reasonable facilities, without charge to satisfy the latter that the material is being furnished in accordance with this specification

The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangements for carrying out the prescribed test elsewhere. The supplier shall notify BHEL in advance about the readiness of the material for inspection and testing.

BHEL reserves the right to test the material at BHEL's works and the final acceptance of the material shall be based on these test results.

14.0 TEST CERTIFICATES:

Three copies of test certificates shall be supplied, unless otherwise stated on the order.

In addition, to the above, the supplier shall ensure to enclose one copy of the test certificate along with their despatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA10301: Rev. No. 05: COLD DRAWN SPRING STEEL WIRE - ZINC COATED

BHEL order No:

Supplier's Reference:

Name:

Identification No:

Cast No./Lot No:

Results of Tests:

Results of chemical mechanical and Zinc coating tests.

15.0 PACKING AND MARKING:

The wires shall be supplied in coils having a maximum weight of 50kg. The wires shall be coiled in such a way that the coils remain flat when the ties are cut. The coils shall be suitably packed to prevent corrosion and damage during transit.

A metal label shall be securely attached to each bundle and shall bear the following information:

AA10301: COLD DRAWN SPRING STEEL WIRE - ZINC COATED

BHEL Order No:

Consignment/Identification No:

Size and Weight:

Supplier's Name:

16.0 REFERRED STANDARDS (Latest publications including amendments):

1) IS: 1608

2) IS: 1717

3) IS: 1755

4) IS: 2629

5) IS: 4454, Part1

6) IS: 6745



CORPORATE PURCHASING SPECIFICATION

AA 121 14

Rev. No. 03

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FREE CUTTING BRASS BARS, RODS, WIRES AND SECTIONS (HALF HARD)

1.0 GENERAL:

This specification governs the quality requirements of Free cutting Brass Bars, Rods, Wires and Sections.

2.0 APPLICATION:

For screws and bushes.

3.0 CONDITION OF DELIVERY:

"Half Hard" wires upto 6mm diameter may be supplied in coils.

4.0 COMPLIANCE WITH NATIONAL STANDARDS:

The material shall comply with the requirements of the following national standard and also meet the requirements of this specification.

IS : 319 - 89 (Reaffirmed 1996) : Free cutting Brass Bars, Rods and Sections
Gr: 1 (HB) - Half hard

IS: 8364-1989 (Reaffirmed 1996) : Free cutting Rods and Sections
Gr: 1 (HB) - Half hard

5.0 DIMENSIONS AND TOLERANCES:

5.1 Sizes:

The material shall be supplied to the dimensions specified in BHEL order:

5.2 Tolerances:

5.2.1 Wires:

Tolerances shall be as per Table-1 of IS:9861.

5.2.2 Bars/Rods and Sections:

Tolerances for round, square, rectangular and hexagonal rods shall be as given in Table-1, 2, 3 and 4 respectively of IS:2826.

Revisions :

Cl: 17.11.25 of MOM of MRC-NFCW+HE

APPROVED :

INTERPLANT MATERIAL RATIONALISATION
COMMITTEE-MRC (NFCW+HE)

Rev. No. 03

Amd.No.

Reaffirmed

Prepared

Issued

Dt. of 1 st Issue

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**6.0 MANUFACTURE:**

By rolling / extrusion / drawing.

7.0 FREEDOM FROM DEFECTS:

The material shall be clean, smooth free from surface defects, reasonably straight and free from twists.

8.0 CHEMICAL COMPOSITION:

The analysis of copper when analysed in accordance with IS:3685 (Method for chemical analysis of brasses) or any other conventional/Instrumental methods shall be as follows:

| Element | Percent | |
|---------------------------------------|-----------|------|
| | Min. | Max |
| Copper plus incidental nickel | 56 | 59.0 |
| Lead | 2.0 | 3.5 |
| *Iron | ---- | 0.35 |
| *Total Impurities (excluding Iron) | ---- | 0.7 |
| Zinc | Remainder | |

Note: These elements need not be determined, when the materials supplied conform with mechanical properties specified.

9.0 TEST SAMPLES:

9.1 One sample per heat shall be taken for chemical analysis.

9.2 One sample per heat per size shall be taken for other tests.

10.0 MECHANICAL PROPERTIES:

When tested in accordance with IS 1608, (Mechanical testing of metals-Tensile testing), the material shall show the following properties. The fractured test piece shall be free from pipes and such other defects.



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| Cross sectional dimension, mm | | Ultimate tensile strength, in N/mm ² | Percent, elongation |
|----------------------------------|--------------|--|------------------------|
| Over | upto & incld | min. | min. |
| - | 10 | 410 | 4.0 |
| 10 | 12 | 405 | 4.0 |
| 12 | 25 | 395 | 6.0 |
| 25 | 50 | 355 | 12.0 |
| 50 | --- | 325 | 17.0 |

- Upto 10 mm size, guage length shall be 100 mm. Above 10mm size gauge length shall be $5.65\sqrt{S_o}$.

11.0 MERCUROUS NITRATE TEST:

The mercurous nitrate test shall be carried out on a piece cut from each bar/rod selected for testing. When tested in accordance with IS: 2305, the test piece shall not show any sign of cracking. Should any specimen fail under mercurous nitrate test, all bars/rods submitted for inspection at the same time shall be withdrawn but may be resubmitted for inspection after stress relieving treatment.

12.0 OPTIONAL TEST:

If specified in the order/drawing, the material shall be tested for its electrical conductivity. The electrical conductivity shall be as per mutual agreement within BHEL and manufacturer. Refer ASTM B 193, clause 6 for temperature correction factor.

13.0 RETEST:

Should any of the test pieces first selected, fail to pass the prescribed tests mentioned under various clauses in this specification, two further samples from the same batch shall be selected for testing one of which shall be from the same component from which the original test sample was taken, unless that component has been withdrawn by the supplier.

Should the test pieces from both these additional samples pass, the batch represented by the test sample shall be accepted. Should the test pieces from either of these additional samples fail, the batch represented by the test samples shall be rejected.

14.0 INSPECTION AT SUPPLIER ' WORKS:

When ever specified, tests and inspection are to be conducted in the presence of BHEL's representative..

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The supplier shall offer BHEL's representative all reasonable facilities, without charge to satisfy the latter that the material is being furnished in accordance with this specification. The supplier shall prepare and provide necessary test specimens for testing to be carried out at his premises. If facilities are not available at his works, the supplier shall make necessary arrangements for carrying out the prescribed test elsewhere. The supplier shall notify BHEL in advance about the readiness of the material for inspection and testing.

BHEL reserves the right to test the material at BHEL's works and the final acceptance of the material shall be based on these test results.

15.0 TEST CERTIFICATES:

Unless other wise stated, three copies of certificates shall be supplied along with each consignment.

In addition, the supplier shall ensure to send one copy of test certificates along with the dispatch documents to facilitate quick clearance of the material.

The test certificate shall bear the following information:

AA 12114 (Rev.03) Free cutting brass bars, rods, wires and sections (Half hard)
 BHEL Order No.
 Manufacturer 's/Supplier's Name:
 Lot/Identification/Batch/Melt No.
 Sizes and Quantity Supplied
 Results of dimensional inspection, chemical analysis, mechanical and all other tests as called for.

16.0 PACKING AND MARKING:

The material shall be suitably packed in crates to prevent corrosion and damage during transit. Each package or crate shall be legibly marked with the following information:

AA 12114 :
 BHEL Order No.
 Identification No:
 Size
 Weight
 Supplier's Reference and Name

17.0 REFERRED STANDARDS : (Latest Publications Including Amendments):

- | | | |
|-------------|---------------|-------------|
| 1. IS:319 | 2. IS: 1608 | 3. IS: 3205 |
| 4. IS: 2826 | 5. IS: 3685 | 6. IS: 8364 |
| 7. IS: 9861 | 8. ASTM B 193 | |