

**12.0 SOURCES OF RAW MATERIALS :-**

Firms shall make bulk procurement of individual items required for sub assemblies or complete equipment from Approved sources of CLW/RDSO source only. Procurement from vendors/ suppliers whose capacity cum capability assessment & prototype testing has been successfully done and final inspection certificate is issued by CLW, can be made up to 20% of total procurable qty in a given procurement case. Firm shall keep all such procurement records and will submit the same to inspecting agency at the time of inspection to ensure that above procurement procedure is strictly adhered to.

**13.0 SCOPES OF SUPPLY & BILL OF MATERIAL FOR MANUFACTURING OF 3 PH TRACTION MOTOR WITH SCHEME-I TYPE ROTOR:-**

Alt-5

Alt-3

Alt-1

(Note: For all specification & drawings latest alteration /revision /modification to be verified from Dy.CEE/TMD's office after placement of valid purchase order)

Each Traction motor consists of the following items.

| SN | C&D NO   | DESCRIPTION OF ITEM                                                                  | DRG. NO. & SPECN. NO.<br>(latest Alt/Rev to be followed) | UNIT | QTY /<br>TM<br>(Indicative) |
|----|----------|--------------------------------------------------------------------------------------|----------------------------------------------------------|------|-----------------------------|
| 1  | 5712/322 | Mica Glass Fabric Tape<br>Mi/Gl-Gwb 18, size. 0.12x15 mm<br>(in roll of 30 m)        | 4TMS.096.098 (or latest)                                 | Mtr. | 2840                        |
| 2  | 5712/324 | Auto Adhesive tape (KAPTON)<br>Selbst Kl F11,<br>size 0.07x9.5 mm (in roll of 33m )  | 4TMS.096.097 Alt-1 (or latest)                           | Mtr. | 90                          |
| 3  | 5712/325 | Auto Adhesive tape (KAPTON)<br>Selbst Kl F11, size 0.07x19.1 mm<br>(in roll of 33m ) | 4TMS.096.097 Alt-1 (or latest)                           | Mtr. | 280                         |
| 4  | 5712/326 | Auto Adhesive tape (KAPTON)<br>Selbst Kl F11,size 0.076x50 mm<br>(in roll of 33m )   | 4TMS.096.097 Alt-1 (or latest)                           | Mtr. | 90                          |
| 5  | 5712/327 | Polyimide Foil (KAPTON)<br>PI F01 size 0.125x510mm<br>(in continuous roll of 50m)    | 4TMS.096.092 Rev-1 (or latest)                           | Mtr. | 10                          |
| 6  | 5716/023 | Polyamide Paper (Nomex), PAP1,<br>size 0.38x914 mm<br>(in continuous roll of 10m)    | 4TMS.096.091 Rev-1 Alt-1<br>(or latest)                  | Mtr. | 0.075                       |
| 7  | 5716/015 | Polyamide (NOMEX) PA Vlies 1<br>Size 2.5x1000<br>(in continuous roll of 10 m)        | 4TMS.096.028 Rev-1 (or latest)                           | Mtr. | 2.75                        |

**3-Ph Asynchronous Traction Motor (with  
Scheme-I type Rotor) Type 6FRA-6068 for 3 ph  
Electric Locomotives.**

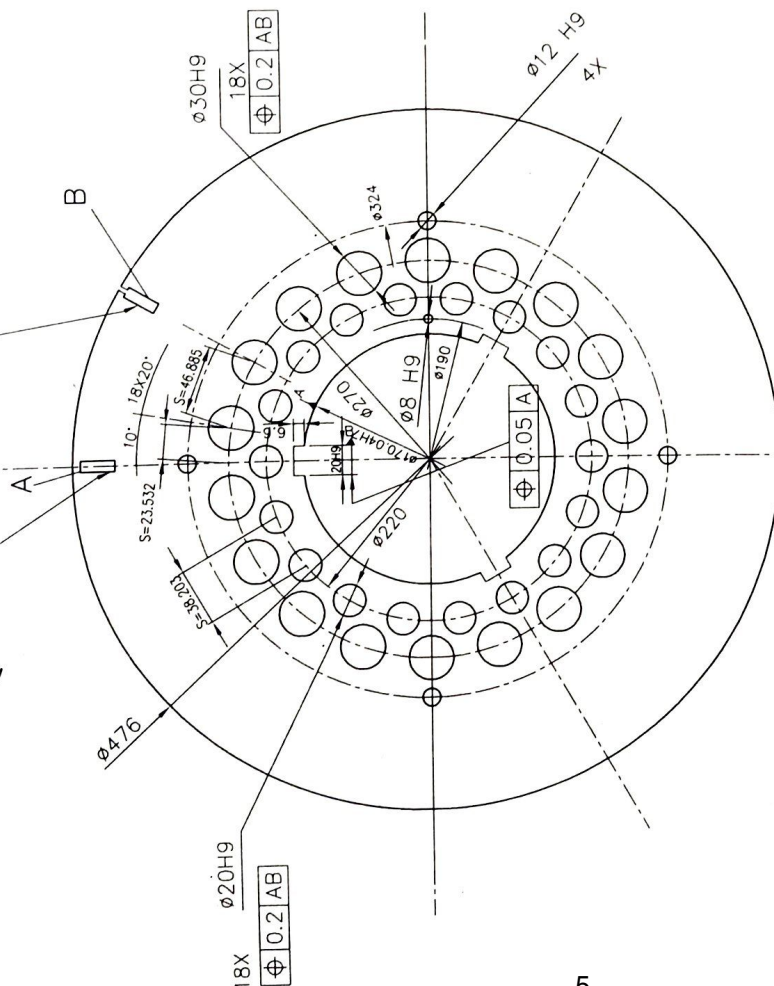
**CHITTARANJAN LOCOMOTIVE WORKS  
(W.B.)**

**No. 4TMS.096.080 Rev-1 Alt-5**  
Initial Issue Date : 12.07.2022

|                       |                 |                                                                                     |             |                |                                                                                       |
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| Prepared & Checked by | <b>SATRIPTO</b> | Digitally signed by<br>SATRIPTO<br>MANDAL<br>Date: 2026.06.22<br>14:26:03 +05'30' 4 | Reviewed by | <b>SHRAVAN</b> | Digitally signed by<br>SHRAVAN KUMAR<br>VERMA<br>Date: 2026.06.22<br>15:53:48 +05'30' |
| SSE/TMDO              | <b>MANDAL</b>   |                                                                                     | Dy.CEE/TMD  | <b>KUMAR</b>   |                                                                                       |
|                       |                 |                                                                                     |             | <b>VERMA</b>   |                                                                                       |

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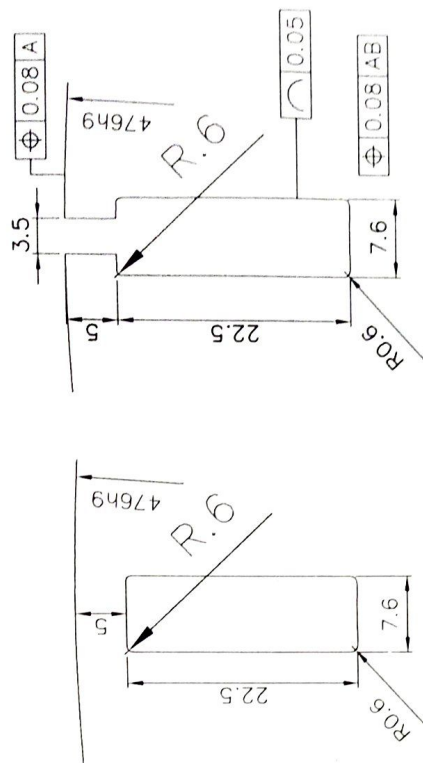
88 SLOTS EQUISPACED



STAMPING THICKNESS = 0.1mm

23/05/2023

DESCRIPTION



DETAIL A  
FOR REF: 1

DETAIL B  
FOR REF: 2

|                                                                                                                                                           |                                    |                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|----------------------------------------|
| 2                                                                                                                                                         | ZIRCONIUM COPPER STAMPING          | 22                                     |
| 1                                                                                                                                                         | MODIFIED ZIRCONIUM COPPER STAMPING | 4                                      |
| REF                                                                                                                                                       | DESCRIPTION                        | QTY IN NOS.                            |
| REF : SKEL-4693 Alt-1                                                                                                                                     |                                    | (FOR DG)                               |
|                                                                        |                                    | SCALE: NTS APPD.BY                     |
| SET OF ZIRCONIUM COPPER STAMPING FOR RESISTANCE RING FOR SHAFT MOUNTED DESIGN OF ROTOR FOR TRACTION MOTOR TYPE 6FRA6068 (SCHEME- 1) FOR WAG-9/WAP-7 LOCOS |                                    |                                        |
| June 2008<br>FIRST ISSUED<br>SKEL-4738 Alt-2<br>SUPERSEDES                                                                                                |                                    | SKEL-4738 Alt-2<br>SUPERSEDES          |
| RDSO ELECT. DTE                                                                                                                                           |                                    | SKEL<br>4738, Alt.'3'<br>SUPERSEDED BY |

44

## Specification No. RDSO/2008/EL/SPEC/0062(Rev'3')



Government of India  
Ministry of Railways

**Technical Specification for Zirconium Copper Stamping for Shaft Mounted Copper Stamping type Resistance Ring design of Rotor for Traction Motor type 6 FRA6068 for WAG9/WAP7 locos.**

Specification No. RDSO/2008/EL/SPEC/0062(Rev'3')  
Sept.2020

| Approved By | Signature |
|-------------|-----------|
| PEDSE       |           |

Issued by  
Research Designs and standards Organisation  
Lucknow-226011

| Prepared by   | Checked by | Issued by |
|---------------|------------|-----------|
| ML SSE/Elect. | DSE/ETM    | DSE/ETM   |

Signature Not  
Verified

Digitally signed by  
Pankaj Kumar  
Date: 2021.03.19  
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Reason: IREPS-CRIS  
Location: New Delhi  
File No: RDSO/2008/EL/SPEC/0062 (Misc)/349/2026-HEP-TXM20500 (Computer No. 350641)

|              |                      |                                          |
|--------------|----------------------|------------------------------------------|
| Page 2 of 11 | Issued on 16.09.2020 | Spec.No.RDSO/2008/EL/SPEC/0062 (Rev '3') |
|--------------|----------------------|------------------------------------------|

## Status of Revision

| SNo | Date of revision | Page Nos                | Revision | Reason for revision                                                                                                                                                                                                                                                                                                                  |
|-----|------------------|-------------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | September 2008   | NA                      | 1        | Older version                                                                                                                                                                                                                                                                                                                        |
| 2   | January 2010     | 2,3,5,6                 | 2        | To include ISO 6507-1, to correct hardness limit, to remove few type and routine tests which were not applicable                                                                                                                                                                                                                     |
| 3   | Sept 2020        | 1,2,3,4,5,6,7,8,9,10,11 | 3        | i) To include ASTMs B846, B224, B601, E255, E478 and relevant JIS and streamlining the specification as per ASTM B 747.<br>ii) SDG/VD RDSO note No.Spl.DG/VD/Mom dated 31.08.2020 , clause 2 (vi)&Vigilance Directorate note No.CVO/RDSO/Confdl/2020 dated 23.06.2020 at clause 2 (b) and CLW letter CLW/TM/17700(Part) dt 6.2.2019. |

|                                                                                     |                                                                                     |                                                                                       |
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## SPECIFICATION FOR ZIRCONIUM COPPER STAMPINGS FOR ROTORS OF THREE PHASE TRACION MOTORS TYPE 6FRA 6068 USED IN WAG9/WAP7 LOCOMOTIVES

### 1. SCOPE:

This specification covers the requirement of Zirconium Copper (C15100) Stampings for shaft mounted copper stamping type resistance ring design of rotors of the three phase traction motors type 6FRA 6068 used in WAG9/WAP7 Locomotives

### 2. GOVERNING SPECIFICATIONS:

In the preparation of this specification assistance has been taken from the following standards and specifications.

**Table 1**

| Standard No                            | Standard name                                                                                              |
|----------------------------------------|------------------------------------------------------------------------------------------------------------|
| ASTM:B747-20(Or latest)                | Standard Specification for Copper-zirconium alloy sheet and strip                                          |
| ASTM E 255-07(Or latest)               | Standard specification for Sampling Copper and Copper Alloys for the Determination of Chemical Composition |
| ASTM E 478 - 08(Or latest)             | Standard Test Methods for Chemical Analysis of Copper Alloys                                               |
| ASTM B 846-19a (Or latest)             | Standard terminology for copper and copper alloys                                                          |
| ASTM B 224 -16 (Or latest)             | Standard classification of coppers                                                                         |
| ASTM B 601- 18a (Or latest )           | Standard classification for temper Designation for copper and copper Alloys-Wrought and cast               |
| JIS H 3100 : 2006 (Or latest)          | Japanes industrial standard for Copper and copper alloy sheets, plates and strips                          |
| IS:1885 (pt. xxxiv) : 1993 (Or latest) | Electro technical Vocabulary :Rotating Machines.                                                           |
| IS:440 – 1964 (Or latest)              | Methods of chemical analysis of copper                                                                     |
| IS:2826-1986                           | Dimensions and Tolerances for Copper and Copper Alloys Rods and Bars                                       |
| IS 14811:2000 (Or latest)              | Rolled Copper Plate, sheet and strip and files for general engineering industrial purposes                 |
| IS:1608:2005 (Or latest)               | Mechanical testing of metals-Tensile testing                                                               |
| IS:1501 (Part 1):2013                  | Matellic materials-Vickers hardness                                                                        |

|                                                                                                    |                                                                                                   |                                                                                                    |
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2.1. Any deviation from this specification proposed by the tenderer to improve upon the performance of Zirconium Copper Stampings shall be considered only on this merits provided full particulars with justification and financial implication are furnished by the tenderer.

2.2. For the purpose of this specification, the definitions given in IS:1885(Pt. xxxiv) – 1993 and other Specifications mentioned in clause 2 shall apply.

### 3. ENVIRONMENTAL CONDITIONS:

Rotors are designed to work at a maximum temperature of 230°C and so all the relevant properties shall remain intact over the complete operating range of temperature.

### 4. MATERIAL:

The Copper Stampings shall be made from Zirconium Copper alloys conforming to "UNS No - C15100 (HO2 Temper) as per ASTM B747-15 (or latest). The composition of the copper shall be as given in Table-2

### 5. CHEMICAL COMPOSITION

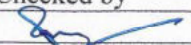
Chemical composition of Zr-Cu is given in Table 2 and tenderer must provide test result by spectrograph or any another suitable method at the time of prototype inspection and for each lot of stampings. The test report shall have clear traceability of raw material from which it is manufactured.

Table – 2

#### CHEMICAL COMPOSITION OF ZIRCONIUM COPPER

| Element                 | In percent/ppm |
|-------------------------|----------------|
| Cu + Ag                 | 99.80 % min    |
| Zr                      | 0.05% to 0.15% |
| O <sub>2</sub> (Oxygen) | 5PPM (Maximum) |

\* O<sub>2</sub> (Oxygen) content test will be carried out at NABL approved Lab.

|                                                                                                    |                                                                                                   |                                                                                                    |
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**6. PHYSICAL MECHANICAL AND ELECTRICAL PROPERTIES :****Table 3**

|                                           |                                     |
|-------------------------------------------|-------------------------------------|
| Properties                                | Zirconium Copper of C15100          |
| Temper                                    | H02 (Half Hard)                     |
| Composition                               | Cu+Ag 99.80% min and Zr 0.05%-0.15% |
| Electrical Conductivity                   | 95% IACS min at 20°C                |
| Resistivity in $\Omega$ -g/m <sup>2</sup> | 0.16134 (Maximum)                   |
| Tensile Strength in MPa                   | 295 to 350                          |
| Elongation in 50 mm gauge length          | 11 % minimum                        |
| Hardness                                  | Min 90HV-110HV                      |
| Sp gravity                                | 8.94                                |

**7. SOURCE OF RAW MATERIAL:**

The tenderer shall use raw material of only reputed source who can supply the raw material strictly as per specification as well as submit documentary proof regarding quality of raw materials. The Manufacturer of raw material shall be having experience of manufacturing Zirconium copper alloys and resistance ring/rotor bars/copper laminations manufactured with zirconium chromium copper alloys for induction motor applications. The raw material to be suitably processed to meet the requirement of standard as mentioned in Table 2 & 3. It is obligatory to attach a copy of the documentary evidence of the same with inspection certificate.

However, introduction of new source of raw material should only be after successful prototype testing as well as successful field trial over specified period.

**8. SIZE, SHAPES, DIMENSIONS, WEIGHTS AND OTHER PROPERTIES OF COPPER STAMPINGS:**

8.1. The size, shapes and dimensions for the Copper Stampings shall be as per RDSO Drg no. SKEL 4738 (Latest Rev.)

8.1.1. Dimension:- The dimensions shall be as per relevant drawings.

8.1.2. Sheet /Strip Thickness:- The nominal thickness of the sheet/Strip is 1.0 mm

8.1.3. Sheet/Strip Tolerance:- The permissible tolerance shall be  $\pm 0.04$  mm for nominal thickness of 1.0mm in both the directions i.e. perpendicular and along the direction of rolling.

NOTE:- Thickness shall be measured 40 mm away from the edge.

**8.2. JOINTS**

There shall be no joint in the Copper Stampings.

**8.3. FREEDOM FROM DEFECTS****8.3.1. SURFACE QUALITY OF COPPER SHEETS /STRIPS USED:-**

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|             |            | DSE/TM    |

8.3.1.1. **The surface of the copper sheets / strips used shall be smooth and bright as further treatment and processing must not result in any burrs or uneven spots of thickness more than 0.02 mm.**

8.3.1.2. The Sheets / strips must be easy to cut without bending and should not result in premature wear on the cutting tools.

8.3.2. The Copper Stampings shall be clean, smooth and free from all surface defects, such as scales, peelings, sharp edges and other defects .There shall be no die marks.

8.3.3. To check on this, suitable means shall be employed by the manufacturer by way of provision of a mirror or other suitable means and monitor at the time of pressing and punching of Copper Stampings.

8.3.4. The tenderers shall submit the process of drawing in the form of QAP.

## 9. QAP

The tenderer shall submit the process of manufacturing in the form of QAP. A sample QAP is enclosed as Annexure I, which includes quality plan from the stage of raw material procurement , through in process and final tests. Tenderer must submit their QAP along with the tender. After getting the order , QAP shall be duly approved by RDSO/CLW before going for prototype production.

## 10. TESTS

10.1 After a purchase order is placed for supply of Copper Stampings, the internal test results for all the tests specified in Clauses 8 &14 shall be furnished by the successful tenderer to the Director General (Electrical)/Research Designs & Standards Organisation, Manak Nagar, Lucknow – 226011, within the period stipulated for prototype approval in the order.

10.2 Any change required in the process of manufacture or the prototype as desired by the Director General (Electrical)/Research Designs & Standards Organisation, Manak Nagar, Lucknow-226011 (RDSO) shall be carried out expeditiously by the manufacturer.

## 11. Type Testing Schedule

11.1. Prior to giving a call to the Director General (Elect)RDSO for inspection and testing of the prototype, the manufacturer shall submit a detailed test schedule consisting of flow chart for each of the tests and the number of days required to complete all the tests at one stretch. Once the schedule is approved, the tests shall invariably be done accordingly. The prototype quantity shall be minimum one TM set (26 Nos). However, during the process of type testing or even later, the Director General (Elect)RDSO reserves the right to conduct any additional tests(s) besides those specified herein on Copper Stampings so as to test the Copper Stampings to his satisfaction or for gaining additional information and knowledge. In case any dispute or disagreement arises between the

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- 11.2. All the tests specified, unless otherwise mentioned elsewhere, in the specification shall be carried out preferably at manufacturer's works. However, these tests can also be carried out at NABL Labs or any other labs as recommended by Railways. The manufacturer shall arrange all the necessary machinery, apparatus, labor and assistance required for conducting the tests without any extra cost.

## 12. BULK MANUFACTURE

- 12.1. Only after clear written approval of the results of the tests on the prototype is communicated by the Director General (Elect)RDSO to the manufacturer, shall he take up bulk manufacture of the Copper Stampings which shall be strictly with the same material and process as adopted for the prototype.
- 12.2. Any Testing and approval by the purchaser of the design, drawing and prototype shall in no way absolve the supplier of his responsibilities under the terms and conditions of the contract.

## 13. TECHNICAL DATA

The tenderer shall furnish along with the offer the guaranteed performance data and other technical particulars of the Copper Stampings. The guaranteed values shall have to be proved by tests.

## 14. TESTS ON COPPER STAMPINGS

### 14.1. TYPE TESTS:

In addition to the Test Certificate and Guarantee Certificate (TC/GC) of raw material issued in original by OEM for lot offered, the following type tests shall be carried out on the samples of the Copper Stampings.

- 14.1.1 Visual Examination
- 14.1.2 Measurement of dimensions
- 14.1.3 Electrical Conductivity
- 14.1.4 Tensile test
- 14.1.5 Hardness
- 14.1.6 Chemical composition

### 14.2 Routine Test

In addition to the Test Certificate and Guarantee Certificate (TC/GC) of raw material issued in original by OEM for lot offered, the following acceptance tests shall be carried out on the samples of Copper Stampings

- 14.2.1 Visual Examination
- 14.2.2 Measurement of dimensions
- 14.2.3 Electrical Conductivity
- 14.2.4 Hardness
- 14.2.5 Chemical composition

The tender must submit a copy of the test certificate from the supplier of raw material for tensile strength, also along with other parameters.

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### 14.3 MANUFACTURER'S TESTS:

- 14.3.1 All the Copper Stampings shall be free from any piping, crow feet, indentations, foreign particles or inclusions, surface defects, twists and entanglements.
- 14.3.2 The manufacturer shall test every lot of Copper Stampings for tensile/elongation and hardness.
- 14.3.3 The manufacturer shall test every lot of Copper Stampings for chemical composition.
- 14.3.4 Records of the results of the tests shall be maintained by the manufacturer and checked by the Railway's Inspector.
- 14.3.5 In addition to the above TC, issued by OEM, lot wise and proof import/purchase documents, as the case may be, shall be maintained and checked by Railway's Inspector during acceptance test.

### 14.4 CRITERIA FOR ACCEPTANCE

Criteria for acceptance of the lot shall be in accordance with Table 2 & 3.

## 15 METHODS OF TESTS

### 15.1 VISUAL EXAMINATION:

The surface of Copper Stampings shall be fairly smooth, free from inclusions or foreign particles, indentation, surface defects, scales, twists, entanglements etc.

### 15.2 MEASUREMENT OF DIMENSIONS

Dimension of Copper Stampings shall be measured with the help of duly calibrated vernier calipers/micrometers and values shall be as per Clause 8 for respective rotor drawings/specifications.

### 15.3 TENSILE / ELONGATION TEST:

When tested in accordance with IS: 1608:1995, "Method for tensile testing of copper and alloy" for tensile strength and elongation. The material shall have a tensile strength and elongation as per table-3.

### 15.4 CHEMICAL COMPOSITION

The material shall have the chemical composition as given in Table-2. The copper shall be determined in accordance with IS: 440-2006. For oxygen content, certificate from the manufacturer of copper shall be furnished. At least one sample of finished product from each lot shall be tested for chemical composition.

|                                                                                                    |                                                                                                   |                                                                                                    |
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**15.5 HARDNESS TEST**

Hardness of sample of Copper Stampings shall be determined HV Vickers Hardness (5Kgf).

**15.6 ELECTRICAL RESISTANCE/CONDUCTIVITY TEST**

Conductivity of the sheet/strip shall be measured with help of calibrated Conductivity meters.

Note: The Inspector shall check the accuracy and calibration of the measuring equipment by resistance/conductivity of known value.

**16 SELECTION OF SAMPLE FOR TESTS AND CRITERIA OF APPROVAL**

The reports for the tests mentioned in these clauses shall be annexed to inspection certificates. Only NABL approved independent test laboratories shall be utilized for carrying out these tests. The cost of such tests shall be borne by the supplier.

**17 PACKING**

The finished product shall be suitable packed so as to ensure safe transportation of material without any damage.

**18 MARKING OF COPPER STAMPINGS**

The material shall be labeled securely and indelibly (i.e. with an adhesive label on an appendage) with the following information –

- a) Name of the manufacturer, purchase order reference and date.
- b) Name and trade mark of rolling agency
- c) Item, size, quantity, batch no., date of manufacture of the material.
- d) Special precaution for storage, if applicable for the material.

|                                                                                     |                                                                                     |                                                                                       |
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**ANNEXURE I****Manufacturing Quality Plan of Zirconium Copper Stamping****Sample QAP for****(A) RAW MATERIAL:**

| S.N | Material     | Characteristics to be checked | Process of Checking                         | Quantum of Checking | Reference documents/ Recording | Acceptance Norms                                 | Inspection agency |   |   | Remarks, if any |
|-----|--------------|-------------------------------|---------------------------------------------|---------------------|--------------------------------|--------------------------------------------------|-------------------|---|---|-----------------|
|     |              |                               |                                             |                     |                                |                                                  | P                 | W | V |                 |
| 1.0 | Copper strip | Dimension                     | By meter scale/tape                         | Per strip           | T.C. of vendor                 | Specification No. RDSO/2008/EL/EPE C/0062(Rev-3) | 2                 | - | 1 |                 |
|     |              | Chemical composition          | By Spectrometer/ weight analysis            | Per cast            | T.C. of vendor                 | Specification No. RDSO/2008/EL/EPE C/0062(Rev3)  | 2                 | - | 1 |                 |
|     |              | Temper condition              | By Hardness test                            | Per cast            | T.C. of vendor                 | Specification No. RDSO/2008/EL/EPE C/0062(Rev-3) | 2                 | - | 1 | Not applicable  |
|     |              | Mechanical testing            | By making test pieces as per IS:1608        | Per cast            | T.C. of vendor                 | Specification No. RDSO/2008/EL/EPE C/0062(Rev-3) | 2                 | - | 1 |                 |
|     |              | Chemical composition          | Spectrometer/ weight analysis               | Per cast            | T.C. of vendor                 | Specification No. RDSO/2008/EL/EPE C/0062(Rev-3) | 2                 | - | 1 |                 |
|     |              | Electrical conductivity       | Electrical conductivity measuring equipment | Per cast            | T.C. of vendor                 | Specification No. RDSO/2008/EL/EPE C/0062(Rev-3) | 2                 | - | 1 |                 |

**(B) IN PROCESS:**

|     |          |                      |                    |              |                                                 |   |   |   |  |
|-----|----------|----------------------|--------------------|--------------|-------------------------------------------------|---|---|---|--|
| 1.0 | Blanking | Die pressing Machine | By measuring scale | T.c of Vndor | Specification No. RDSO/2008/EL/EPEC/0062(Rev-3) | 2 | - | 1 |  |
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| Page 11 of 11 | Issued Sept2020 | Spec.No.RDSO/2008/EL/SPEC/0062 (Rev '2') |
|---------------|-----------------|------------------------------------------|

## (C) FINAL PRODUCT:

| S.N | Material/<br>Process | Characteristics to<br>be checked                     | Process of Checking | Quantum of<br>Checking | Reference<br>documents/<br>Recording | Acceptance<br>Norms                                    | Inspection<br>agency |   |   | Remarks,<br>if any |
|-----|----------------------|------------------------------------------------------|---------------------|------------------------|--------------------------------------|--------------------------------------------------------|----------------------|---|---|--------------------|
|     |                      |                                                      |                     |                        |                                      |                                                        | P                    | W | V |                    |
| 1.0 | Stamping             | Dimension                                            | By measuring scale  |                        | Drq no. SKEL<br>4738 (Latest<br>Alt) | Specification No.<br>RDSO/2008/EL/EP<br>EC/0062(Rev-2) | 2                    | - | 1 |                    |
|     |                      | Surface defect                                       | Visual              |                        | T.C. of vendor                       | Specification No.<br>RDSO/2008/EL/EP<br>EC/0062(Rev-2) | 2                    | - | 1 |                    |
| 2.0 | Final<br>Inspection  | Verification of<br>complete T.Cs &<br>Identification | By Record checking  | 100%                   | T.C. of vendor                       | Specification No.<br>RDSO/2008/EL/EP<br>EC/0062(Rev-2) | 2                    | - | 1 |                    |
| 3.0 | Packing              | Protection                                           |                     | 100%                   | T.C. of vendor                       | -                                                      | 2                    | - | - |                    |

## Legends :

- 1- Stands for inspecting agency(RDSO/CLW)  
 2- Stands for manufacturer  
 P- Perform  
 W- Witness  
 V- Verify

|                          |                                  |                                 |
|--------------------------|----------------------------------|---------------------------------|
| Prepared by<br><i>MZ</i> | Checked by<br><i>[Signature]</i> | Issued by<br><i>[Signature]</i> |
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# **BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL**

## **QUALITY ASSURANCE PLAN FOR RESISTANCE RING TO BHEL ORDERING SPECIFICATION/DRAWING AS PER PO**

QUALITY PLAN NO. – QAP/QTM/VENDOR QAP/2021-22/RESISTANCE RING REV 02 DTD 26.08.2022  
Reference Document- PO DRAWING/SPECIFICATION

Page : 1 of 3

| SL. NO | COMPONENT    | CHARACTERISTICS                                                                                                       | TYPE OF CHECK   | QUANTAM OF CHECK |              | REFERENCE DOCUMENT             | ACCEPTANCE NORMS               | FORMAT OF RECORD | INSPECTION AGENCY | REMARKS                                                                                                                 |
|--------|--------------|-----------------------------------------------------------------------------------------------------------------------|-----------------|------------------|--------------|--------------------------------|--------------------------------|------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------|
|        |              |                                                                                                                       |                 | TP               | TP/A         |                                |                                |                  |                   |                                                                                                                         |
| 1)     | Raw material | a) Chemical properties<br>b) Specific gravity<br>c) Oxygen content                                                    | TC verification | 100%<br>(VR)     | 100%<br>(VR) | As per specification           | As per specification           | MTC              | BHEL/TP/A         | SOURCES MENTIONED IN SPECIFICATION.<br>RAW MATERIAL TC to be co-related to finished material and to be verified by TP/A |
| 2)     | Dimension    | Dimension                                                                                                             | Measurement     | 20%              | 5% (w)       | As per drawing & specification | As per drawing & Specification | Supplier record  | BHEL/TP/A         | All reports to be submitted to BHEL                                                                                     |
| 3)     | Visual check | Free from any piping, crow feet, indentations, foreign particles or inclusion, surface defect, Twists & entanglements | Visual          | 100%             | 5% (w)       | As per drawing & specification | As per drawing & specification | Supplier record  | BHEL/TP/A         |                                                                                                                         |

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BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL

QUALITY ASSURANCE PLAN FOR RESISTANCE RING TO BHEL ORDERING SPECIFICATION/DRAWING AS PER PO

QUALITY PLAN NO. – QAP/QTM/VENDOR QAP/2021-22/RESISTANCE RING REV 02 DTD 26.08.2022

Reference Document- PO DRAWING/SPECIFICATION

|    |                         |                                                                                                   |         |                                                                                   |                          |                      |                      |                 |           |                                                                                |
|----|-------------------------|---------------------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------|--------------------------|----------------------|----------------------|-----------------|-----------|--------------------------------------------------------------------------------|
| 4) | Testing on finished bar | Chemical properties                                                                               | Testing | one sample per lot At NABL lab                                                    | RR                       | As per specification | As per specification | Supplier record | BHEL/TPIA | NABL LAB tested TC to be verified and co-related by TPJA and submitted to BHEL |
|    |                         | a) Cu + Ag<br>b) ZR<br>c) oxygen content                                                          |         |                                                                                   |                          |                      |                      |                 |           |                                                                                |
|    |                         | Mechanical properties<br>a) Tensile strength<br>b) Yield strength<br>c) Elongation<br>d) Hardness | Testing | one sample per lot At NABL lab                                                    | RR                       | As per specification | As per specification | Supplier record | BHEL/TPIA |                                                                                |
|    |                         | Electrical properties<br>a) Electrical Conductivity                                               | Testing | One sample per lot at NABL LAB & 100 % by supplier                                | 100 %<br>RR & 1% witness | As per specification | As per specification | Supplier record | BHEL/TPIA |                                                                                |
|    |                         | NDT testing:<br>2) ultrasonic testing/Eddy current testing                                        | Testing | 10 % per lot at NABL lab OR government approved LEVEL II operator at vendor works | 1% witness               | As per specification | As per specification | Supplier record | BHEL/TPJA | NABL LAB tested TC to be verified and co-related by TPJA and submitted to BHEL |

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# **BHARAT HEAVY ELECTRICALS LIMITED, BHOPAL**

## **QUALITY ASSURANCE PLAN FOR RESISTANCE RING TO BHEL ORDERING SPECIFICATION/DRAWING AS PER PO**

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| 5) | Identification<br>vendor name, PO &<br>job serial no.,<br>Hardware fitment | Visual | Visual | 100% | 10%<br>witness | As per<br>drawing &<br>specification | As per drawing &<br>Specification | Supplier record                  | BHEL/TPIA | Witness                                                                                                              |
|----|----------------------------------------------------------------------------|--------|--------|------|----------------|--------------------------------------|-----------------------------------|----------------------------------|-----------|----------------------------------------------------------------------------------------------------------------------|
| 6) | Packing to avoid<br>transit damage                                         | Visual | Visual | 100% | 20%            | As per<br>drawing &<br>specification | As per drawing &<br>specification | Packing list for<br>each kit box | BHEL/TPIA | Packing to be such that<br>no damages should<br>occur during transit. 1<br>kit items should be<br>placed in on 1 box |

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