

## Technical Specification for HVOF Coating Powder WC10Co4Cr

### Technical Specification No: FBM/WD&T/TS06 Rev 07

Date: 02, DEC 2020

| S. No | Description                                                       | Requirement                                                                                                                                                                         | Vendor                                                                                                                                                    | Offered | Deviation<br>(if any) | Remark |
|-------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------------|--------|
| 1     | <b>Purpose</b>                                                    | WC10Co4Cr HVOF Coating powder to be used with Sulzer Metco system with Woka Star 600/610 (Liquid Fuel Gun) and DJ-2600 (Hydrogen fuel Gun) for coating on Hydro Turbine components. |                                                                                                                                                           |         |                       |        |
| 2     | <b>Country of Origin</b>                                          | Vendor to Specify country of origin                                                                                                                                                 | Original Powder Manufacturer to specify                                                                                                                   |         |                       |        |
| 3     | <b>Properties</b>                                                 |                                                                                                                                                                                     |                                                                                                                                                           |         |                       |        |
| 3.1   | <b>Chemical Composition Nominal Range in percentage by weight</b> | WC-10Co-4Cr<br>Cobalt: 8.5 % - 11.5 %<br>Chromium: 3 % - 5%<br>Carbon: 4.8% - 6%<br>Total All Others: 0.5 % (max)<br>Tungsten: Balance                                              | Vendor to confirm & provide details.<br>(Any sample TC or Detailed Technical catalogue/data sheet with mention of properties to be submitted with offer.) |         |                       |        |
| 3.2   | <b>Manufacturing</b>                                              | Agglomerated and Sintered                                                                                                                                                           |                                                                                                                                                           |         |                       |        |
| 3.3   | <b>Shape</b>                                                      | Spheroidal                                                                                                                                                                          |                                                                                                                                                           |         |                       |        |
| 3.4   | <b>Particle size:</b>                                             | - 45 to + 15 microns                                                                                                                                                                |                                                                                                                                                           |         |                       |        |
| 3.5   | <b>WC Particle Size</b>                                           | ≤ 0.8 microns                                                                                                                                                                       |                                                                                                                                                           |         |                       |        |
| 3.6   | <b>Apparent Density</b>                                           | > 4.5 g/cc                                                                                                                                                                          |                                                                                                                                                           |         |                       |        |
| 3.7   | <b>Flowability</b>                                                | Free flow type                                                                                                                                                                      | Original Powder Manufacturer to confirm                                                                                                                   |         |                       |        |
| 3.8   | <b>Physical Properties of powder</b>                              | Vendor may provide parameters for Wokastar 600 Gun of M/s Oerlikon Metco Make system (formerly known as Sulzer Metco) to achieve below properties.                                  |                                                                                                                                                           |         |                       |        |
| 3.8.1 | <b>Hardness (0.3 Kg Load)</b>                                     | 1250-1500 Hv 0.3                                                                                                                                                                    | Vendor to confirm & provide details.<br>(Any sample TC or Detailed Technical catalogue/data sheet with mention of properties to be submitted with offer.) |         |                       |        |
| 3.8.2 | <b>Porosity</b>                                                   | < 1%                                                                                                                                                                                |                                                                                                                                                           |         |                       |        |
| 3.8.3 | <b>Bond Strength:</b>                                             | 10000 Psi or more (ASTM C 633)                                                                                                                                                      |                                                                                                                                                           |         |                       |        |
| 3.8.4 | <b>Roughness:</b>                                                 | < 6 Ra                                                                                                                                                                              |                                                                                                                                                           |         |                       |        |

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| 3.8.5 | Deposition Efficiency                                                                       | > 45%                                                                                                                                                                                                                                                                                                               | Vendor to confirm.<br>(Detailed Technical catalalogue/data sheet with mention of properties to be submitted with offer.) |  |  |  |
| 3.8.6 | Service temperature                                                                         | Vendor to Specify                                                                                                                                                                                                                                                                                                   | Original Powder Manufacturer to Specify                                                                                  |  |  |  |
| 3.8.7 | Wear Rate                                                                                   | Vendor to Specify                                                                                                                                                                                                                                                                                                   | Original Powder Manufacturer to provide data on wear rate                                                                |  |  |  |
| 3.9   | The above powder should be compatible with liquid fuel based and Gas fuel based HVOF system |                                                                                                                                                                                                                                                                                                                     | Original Powder Manufacturer to confirm                                                                                  |  |  |  |
| 4.1   | Essential Conditions for technical evaluation of bids                                       | Vendot to provide Free Sample (approximately 10 Kg) of quoted Make and Brand for technical evaluation of bids.<br>Interested vendors should ensure that free samples reach BHEL within 15 days of BHEL intimation (Via E-mail)                                                                                      | Vendor to confirm                                                                                                        |  |  |  |
| 4.2   | Sample testing at BHEL for technical evaluation of bids                                     | Submitted free samples (As per S No 4 of this spec) shall be tested as per S.No 4.3.1 to S.No 4.3.4 of this specification                                                                                                                                                                                           | Vendor to agree                                                                                                          |  |  |  |
| 4.3.1 | Coating Properties of powder                                                                | Properties (As per S. No 4.3.2 to 4.3.4 of this specification) to be achieved at 500 micron-coating thickness. (Vendor may suggest the recommended parameters for BHEL equipment, however, BHEL will coat the powders at parameters suitable to the BHEL equipment.BHEL equipment details are mentioned at S.No 1 . | Original Powder Manufacture to confirm                                                                                   |  |  |  |
| 4.3.2 | Physical properties of powder                                                               | As per 3.8.1 to 3.8.5                                                                                                                                                                                                                                                                                               | Vendor to confirm                                                                                                        |  |  |  |
| 4.3.3 | Wear Rate:                                                                                  | < 4 mm <sup>3</sup> (ASTM G 65 B)                                                                                                                                                                                                                                                                                   | Vendor to confirm                                                                                                        |  |  |  |
| 4.3.4 | Silt Erosion                                                                                | All the coated samples will be tested for silt erosion test as per BHEL standard test method for comparision.                                                                                                                                                                                                       | Vendor to agree                                                                                                          |  |  |  |
| 4.4   | Testing of Samples:                                                                         | BHEL will coat the samples and testing will be done at BHEL Lab or any other lab selected by BHEL. The test results of labs selected by BHEL will be final.                                                                                                                                                         | Vendor to agree                                                                                                          |  |  |  |

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| 5                                                                                                                                                                        | <b>Authorisation Correspondence &amp; Documentation</b>                                                                                                                                                                                                                |                                                                                                                                           |                                                                  |  |  |  |
| 5.1                                                                                                                                                                      | In case, an authorized vendor quotes for the tender, then it has to provide authorized dealer certificate valid for 1 year(from date of enquiry) , and the original powder manufacturer to take guarantee of the product quoted, otherwise the offer will be rejected. |                                                                                                                                           | Vendor to confirm & provide details                              |  |  |  |
| 5.2                                                                                                                                                                      | All Technical correspondence shall be done with their principal supplier (original powder manufacturer). Contact details of Original powder manufacturer to be provided with the offer.                                                                                |                                                                                                                                           | Original Powder Manufacturer to confirm                          |  |  |  |
| 5.3                                                                                                                                                                      | All the test Certificates /Technical catalogues/Data Sheet that to be submitted alongwith offer and prior to dispatch of material shall be from Original Powder manufacturer                                                                                           |                                                                                                                                           | Original Powder Manufacturer to confirm                          |  |  |  |
| 5.4                                                                                                                                                                      | All correspondence and documents including Test certificates/Data Sheets shall be in english language.                                                                                                                                                                 |                                                                                                                                           | Vendor to confirm                                                |  |  |  |
| 5.5                                                                                                                                                                      | If any document provided by vendor is in language other than english, it must be supported with valid english translation.                                                                                                                                             |                                                                                                                                           | Vendor to confirm                                                |  |  |  |
| 5.6                                                                                                                                                                      | BHEL reserves the right to verify all information provided by vendor and verification process may also include visit of manufacturing facility of powder                                                                                                               |                                                                                                                                           | Vendor to confirm                                                |  |  |  |
| 6                                                                                                                                                                        | <b>Liability</b>                                                                                                                                                                                                                                                       | All liability shall be of principal in the event of default by the authorized agent/dealer.                                               | Original Powder Manufacturer to confirm                          |  |  |  |
| 7                                                                                                                                                                        | <b>Conditions for acceptance of material at BHEL Bhopal</b>                                                                                                                                                                                                            | Review(By BHEL) of test certificates (for each batch/Lot of powder) for properties mentioned at S.No 3.1 ,3.4 & 3.6 of this specification | Vendor to agree and provide details prior to dipatch of material |  |  |  |
| <b>Note: Original Powder Manufacturer may provide response in lieu of vendor wherever required as per this technical specification however vice-versa is not allowed</b> |                                                                                                                                                                                                                                                                        |                                                                                                                                           |                                                                  |  |  |  |