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| PS GSG_73 |       | <b>Specifications<br/>for<br/>SF6 GAS AND CYLINDERS</b>                                                                                                                                                                                                                                                     | No.        | PSGSG- 073 |
|           |       |                                                                                                                                                                                                                                                                                                             | Date:      | 28.11.14   |
|           |       |                                                                                                                                                                                                                                                                                                             | Product:   | General    |
|           |       |                                                                                                                                                                                                                                                                                                             | Sheet:     | 1/3        |
| 1.0       |       | <b>General Description:</b>                                                                                                                                                                                                                                                                                 |            |            |
|           | 1.1   | This specification governs the technical and statutory requirements of SF6 gas filled and stored in cylinders.                                                                                                                                                                                              |            |            |
| 2.0       |       | <b>APPLICATION :</b><br>For SF6 circuit breakers and gas insulated power equipments.                                                                                                                                                                                                                        |            |            |
| 3.0       |       | <b>COMPLIANCE WITH STANDARDS :</b>                                                                                                                                                                                                                                                                          |            |            |
|           | 3.1   | SF6 Gas: SF6 (Sulphur Hexafluoride) gas shall conform to IEC: 60376 and IS -13072                                                                                                                                                                                                                           |            |            |
|           | 3.2   | Gas Cylinders: SF6 gas cylinders shall conform to the relevant standard indicated against each manufacturer listed in Annexure-I.                                                                                                                                                                           |            |            |
|           | 3.3   | Cylinder Valves: The valves fitted to the cylinders shall conform to ANSI: B57.1 or BS: 341 Part I or IS: 3224.                                                                                                                                                                                             |            |            |
| 4.0       |       | <b>TECHNICAL :</b>                                                                                                                                                                                                                                                                                          |            |            |
|           | 4.1   | <b>Gas Cylinders &amp; Valves:</b> SF6 gas shall be supplied with NEW cylinders and valves manufactured and inspected by the approved suppliers/inspection agencies listed in Annexure-I. Other cylinders and valves manufacturers, whose are not in the list but have the approval of competent authority. |            |            |
|           | 4.2   | <b>Cylinder Capacity:</b> Preferred water capacity of the cylinders supplied shall be around 40 liters and weight of SF6 gas in each cylinder shall be approximately 50kg.                                                                                                                                  |            |            |
|           | 4.3   | <b>Filling Ratio:</b> The filling ratio (The ratio of weight of liquefiable gas introduced in the cylinder to the weight of the water the cylinder will hold at 15 °C) shall be around 1.20.                                                                                                                |            |            |
|           | 4.4   | <b>Design &amp; Test Pressures:</b>                                                                                                                                                                                                                                                                         |            |            |
|           | 4.4.1 | The cylinders shall have a minimum designed working pressure of around 130 kgf/cm2 (gauge).                                                                                                                                                                                                                 |            |            |
|           | 4.4.2 | The test pressure for hydraulic stretch test shall be at least 210 kgf/cm2 (gauge).                                                                                                                                                                                                                         |            |            |
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| 5.0       |     | <b>STATUTARY REQUIREMENTS :</b><br><br>The chief Controller of Explosives, Department of Explosives, and Government of India are the statutory authority regulating the importation and use of SF6 gas cylinders. A license has to be obtained by the users from this Authority for importation and use of SF6 gas cylinders. Hence, the suppliers shall comply with the regulations of the above authority, as indicated in this specification and separately communicated from time to time. |            |
| 6.0       |     | <b>DOCUMENTS TO BE SUBMITTED WITH QUOTATION :</b><br><br>In order to make a preliminary assessment as to whether the SF6 gas cylinders will meet the regulations of the Department of Explosives, the supplier shall submit a SAMPLE set of documents as listed below along with the quotation.                                                                                                                                                                                                |            |
|           | 6.1 | Specification to which the cylinders are manufactured and the name and address of the manufacturer and Inspecting Agency.                                                                                                                                                                                                                                                                                                                                                                      |            |
|           | 6.2 | Record of chemical analysis of the material used for the cylinders.                                                                                                                                                                                                                                                                                                                                                                                                                            |            |
|           | 6.3 | Record of Physical tests of the material used for the cylinders.                                                                                                                                                                                                                                                                                                                                                                                                                               |            |
|           | 6.4 | Record of the Hydraulic stretch test conducted in respect of each cylinder.                                                                                                                                                                                                                                                                                                                                                                                                                    |            |
|           | 6.5 | Specifications to which the valves are manufactured.                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |
|           | 6.6 | Inspection agency's certificate pertaining to the valves giving results of chemical analysis, Physical tests of the material used for the valves etc.                                                                                                                                                                                                                                                                                                                                          |            |
|           | 6.7 | Filler's certificate indicating filling ratio at which each cylinder has been filled.                                                                                                                                                                                                                                                                                                                                                                                                          |            |
|           | 6.8 | Name and address of the manufacturer of SF6 gas and record of tests conducted to establish that the SF6 gas conforms to IEC 60376.                                                                                                                                                                                                                                                                                                                                                             |            |
|           | 6.9 | A statement in duplicate showing the serial number of the cylinders.                                                                                                                                                                                                                                                                                                                                                                                                                           |            |
| 7.0       |     | <b>DOCUMENTS TO SUPPLIED BEFORE SHIPMENT :</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            |
|           | 7.1 | Documents necessary for obtaining the approval of the chief controller of Explosives for License to import the SF6 gas cylinders shall be supplied at the appropriate time. If the chief controller of Explosives asks for additional information or suggests any change in the cylinders or valves, the same shall be complied by the supplier.                                                                                                                                               |            |
| PS GSG_73 |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Signature: |
|           |     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Date:      |

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| 7.0       | 7.2  | <u>THE SUPPLIER SHALL NOT SHIP THE CYLINDERS FILLED WITH SF6 GAS UNTIL WE OBTAIN THE LICENCE FROM THE CHIEF CONTROLLER OF EXPLOSIVES AND THE SAME IS COMMUNICATED BY US IN WRITING.</u>                                                                                                  |  |
|           | 7.3  | In case the gas is imported by the local representative and he has complied with above regulations, the supplier shall submit a copy of above document for ready reference of BHEL prior to supply.                                                                                      |  |
| 8.0       |      | <b>MARKING :</b>                                                                                                                                                                                                                                                                         |  |
|           | 8.1  | Identification Marking: Each cylinder shall be durably and legibly marked by stamping, engraving or similar process with the following, preferably at the valve end and off the cylindrical part.                                                                                        |  |
|           | 8.2  | Other Markings: Each cylinder shall be marked by stamping, engraving or similar process with the following details:<br><br>a) Manufacturer’s mark.<br>b) Inspection agency’s mark<br>c) Rotation No. (Serial No.)<br>Other specification details as prescribed in the relevant standard. |  |
| 9.0       |      | <b>SHIPMENT :</b>                                                                                                                                                                                                                                                                        |  |
|           |      | Cylinders can be shipped on the deck in conformance with shipping regulations.                                                                                                                                                                                                           |  |
| 10.0      |      | <b>Guarantee:</b>                                                                                                                                                                                                                                                                        |  |
|           | 10.1 | Against faulty material and workman ship.                                                                                                                                                                                                                                                |  |
| PS GSG_73 |      |                                                                                                                                                                                                                                                                                          |  |
|           |      | Signature:                                                                                                                                                                                                                                                                               |  |
|           |      | Date:                                                                                                                                                                                                                                                                                    |  |

# ANNEXURE – A

## LIST OF APPROVED MANUFACTURERS/INSPECTION AGENCIES OF SF6 GAS CYLINDERS.

| Country      | Manufacturer                                  | Specification                               | Inspecting Agency                |
|--------------|-----------------------------------------------|---------------------------------------------|----------------------------------|
| U.S.A.       | HARRISBURG STEEL CO                           | DOT 3AA 2015<br>And above                   | R.W. HUNT CO.                    |
| “            | TAYLOR WHARTON                                | “                                           | PITTSBURG TESTING CO.            |
| “            | NATIONAL TUBE                                 | “                                           | T.H.COCHROME LAB                 |
| “            | MWALTER KIDDE                                 | “                                           | INDUSTRIAL ANALYSIS              |
| “            | PRESSED STEEL TANK CO.                        | “                                           | ARROW HEAD                       |
| “            | MORRIS THERMADOR                              | “                                           | COLPY-CHRISTIE SCHOFIELD         |
| “            | MARISON                                       | “                                           | LINDER CO.                       |
| JAPAN        | SHOWA KOATSU KOGYO CO. LTD.                   | DOT 3AA 2015<br>(AND ABOVE)<br>OR JIS B8241 | KHK OR LLOYD’S OR BUREAU VERITAS |
| “            | SUMIKIN KIKO CO. LTD                          | “                                           | “                                |
| “            | SUMITOMO METAL INDUSTRIES                     | “                                           | “                                |
| “            | NIHON KUATSU YOKI                             | “                                           | “                                |
| “            | TOTSKUKA HIGH PRESSURE GAS CYLINDER CO. TOKYO | DOT 3AA 2015<br>AND ANOVE                   | “                                |
| “            | KANTO KOATSU YOKI MANUFCTURING CO.LTD         | “                                           | “                                |
| “            | TOKA, HIGHPRESSURE CYLINDER CO. LTD           | “                                           | “                                |
| WEST GERMANY | MANNESMANN                                    | DOT 3AA 2015<br>AND ABOVE                   | LLOYD’S OR BUREAU VERITAS        |
| “            | INDUSTRIE WERKE KARLSRUHE, AUGSBURG           | “                                           | “                                |
| U.K.         | CHESTERFIELD TUBE CO.                         | BS: 5045, Pt.I                              | LLOYD’S                          |
| ITALY        | ACCIAIERIAE TUBIFICIO DI BRESCIA              | DOT 3AA 2015<br>AND ABOVE                   | BUREAUVERITAS                    |
| INDIA        | BHARAT PUMPS & COMPRESSORSLTD NAINI, ALLHABAD | IS: 7285                                    | ISI / LLOYD’S                    |