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REPORT

on

COMPONENT – Heater, SPECIALTY

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DESCRIPTION

PRODUCT COVERED:

USR, CNR Component – Tubular Sheathed Type Heating Elements, RGS series.

ELECTRICAL RATINGS:

TABLE 1 - PHYSICAL CHARACTERISTICS AND ELECTRICAL RATINGS:

| Model/Series No. | RGS# | |
|---|---|---|
| Maximum Voltage (Vac) | 240 | |
| Maximum Rated Wattage(W) | 9000 | 6000 |
| Maximum Wattage Density ($W/cm^2$) | 31 | 35.1 |
| Intended usage medium (eg. air, immersed in water) | Immersed In Water | |
| Sheath Material(s) | Copper | |
| Min. Sheath Outer Diameter (mm) | 8.0 | |
| Minimum Sheath Inner Diameter, mm | 6.6 | |
| Minimum Bend Radius (@sheath ceterline) (mm) | 8.3 | |
| Maximum Number of Bends (one bend = 90 deg.) | 6 | |
| Minimum Sheath Wall Thickness (mm) | 0.7 | |
| (minimum MgO spacing) | 1.05 | |
| Resistance Wire Material(s) | 0cr25AL5, Ni80Cr20 | |
| Maximum Resistance Wire Outer Diameter(mm) | 0.6 | |
| Maximum Wire Coil Diameter(mm) | 3.5 | |
| Cold Pin Material(s) | Nickel Plated Iron, SUS304 | |
| Maximum Cold Pin Outer Diameter (mm) | 2.6 | |
| Minimum Cold Pin Length Inside Sheath (mm) | 50 | |
| End Seal Material(s) | See TABLE 2 for details | |

NOMENCLATURE:

| RGS | # |
|---|---|
| I | II |

I Design serial number

II #: Digit or letter or combination, unlimited number of words, reserved for the manufacturer's or customer’s internal code.

TECHNICAL CONSIDERATIONS (NOT FOR FIELD REPRESENTATIVE'S USE):

General – This component is sheathed type heating element with heater. The sheathed type heating elements consist of resistance wire embedded in magnesium oxide, enclosed by a metal sheath.

Use - The sheathed type heating device is intended for use only in (or with) complete equipment where the acceptability of the combination is determined by UL LLC.

USR indicates evaluation to the US Safety Scheme. Details of standard and version refer to Test Record.

CNR indicates evaluation to the Canadian Safety Scheme. Details of standard and version refer to Test Record.

Conditions of Acceptability - The following should be considered when determining the acceptability of the combination.

1. The complete part number and the heater electrical rating should be specified in the end-product description to identify the specific construction found acceptable.

2. Immersion Sheathed heating elements are intended for use in a specific operating medium and temperatures are likely to vary based upon the product configuration. Temperatures shall be monitored in the end-use equipment to determine suitability.

3. Performance under normal and abnormal operating conditions shall be evaluated in accordance with the requirements of the end product.

4. Electrical spacings between uninsulated live parts external to the sheath and uninsulated live parts and dead-metal parts within the end product shall be as specified in the end-product standard.

5. The heating element is to be enclosed in accordance with the requirements of the end-product and the acceptability of the construction with respect to a suitable enclosure, spacings, type and size of the lead wires, leads voltage and temperature ratings, electrical connections, grounding means shall be determined in the end product standard.

6. These heating elements have been evaluated for use in the operating medium/media specified under Table 2 "PHYSICAL CHARACTERISTICS AND ELECTRICAL RATINGS" only. Use of these elements other than as specified should be the subject of further investigation.

7. The end seal material is not considered such that the whole heating elements are suitable for immersion in water totally.

8. A Temperature Test needs to be conducted under the end product evaluation. The following sheath temperature limits shall not be exceeded during normal operation in the end-use equipment:

Table 2:

| Item | Material | Maximum Temperature Limit |
|---|---|---|
| Sheath | Copper | 177°C |
| End Seal | RTV, type 5299(#) | 150°C |
| Terminal Plate Bracket | PP, type FB51(+) | 130°C |

9. If grounding/bonding is required in the end-use equipment, the suitability and reliability of the grounding connections must meet the requirements of the end product standard and be evaluated accordingly.

10. The Electrical Connection Means has not been evaluated and should be subject of further investigation under the end product evaluation.

11. These devices are intended for factory wiring only (terminations not suitable for field wiring).

12. This heating element has not been investigated for exposure to unusual environmental conditions such as chemicals, water, oil, UV radiation, or x-rays, such condition shall be evaluated with end product.

CONSTRUCTION DETAILS:

Section General – The following items are described in Section General.

- Spacings
- Corrosion Protection
- Markings
- Watt density determination

MARKINGS:

In addition to markings requirements in Section General, the word "CAUTION: For use only submersed in water", should be marked on the element or the container in which the element is shipped.

For Canada market, a bilingual caution marking (i.e., English and French) is necessary.

FIGURES AND ILLUSTRATIONS:

FIGURE INDEX:

| Fig. No. | Description |
|---|---|
| 1 | Overview of series RGS# |

ILLUSTRATION INDEX:

| Ill. No. | Description |
|---|---|
| 1 | Engineering drawing of series RGS# |

Model, RGS - FIG. 1 & ILL. 1

General – Fig. 1 & Ill. 1 show the Construction of Model RGS.

1. Sheath – As indicated and tabulated on Table 1 and see Ill. 1 for dimensions details.

2. Resistance Wire – Resistance wire, as indicated and tabulated on Table 1, helically coiled, Maximum 3.5 mm OD. Insulated from Sheath by compacted magnesium oxide. The length can vary for different models.

3. Fill Material/ Refractory Material – Cavity inside Sheath filled with magnesium oxide powder, at least 1.0 mm thick between the resistance element and the inside of the sheath. The spacing between End Seal and magnesium oxide powder is filled with refractory insulation glue and minimum 2.0 mm thick between Cold Pin and the inside of the sheath.

4. End Seal – R/C (QMFZ2/8), Guangzhou Huitian New Material Co Ltd (E306078), RTV, type 5299(#), rated V-0, 150°C. Close contact with magnesium oxide, terminals are sealed by Silicone.

5. Cold Pins – Two provided. As indicated and tabulated on Table 1 and see Ill. 1 for dimensions details.

6. Threaded Flange – One provided, brass. Hexagonal flange with an externally threaded boss, welded to Sheath body. See Ill. 1 for the dimension details.

7. Terminal Plate Bracket – R/C (QMFZ2/8), Hanwha TotalEnergies Petrochemical Co Ltd (E140331), PP, type FB51(+), rated V-2, 130°C. Measured 28.5 by 24.5 by 14.5 mm (L x W x H), 1.6 mm thick. Sandwiched between Threaded Flange and Terminal Plate. See Ill. 1 for details.

8. Terminal Plate - Nickel plated steel, 1.0 mm thick. Two provided, welded on the end of Cold Pins. Two M5 screws holes with two and half threads provided for electrical connection.