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## 1. Scope

- 1) This document defines electrical low voltage feedthroughs to be used for feeding out low voltage, respectively low power signals in applications like
  - magnet cryostats,
  - cryogenic supply systems,
  - cryogenic transport systems,
  - cryogenic current lead boxes,
  - auxiliary cryogenic systems
 within FAIR accelerators.
- 2) This document applies to low frequency, low voltage and low power applications only.
- 3) This document is NOT related to any other purpose as aforementioned.

## 2. Definitions

- 1) A *low voltage application* in terms of this document shows a maximum operation voltage of  $U_{\max} \leq 60 \text{ V (DC)}$  respectively  $U_{\max} \leq 25 \text{ V (AC)}$  under any operation conditions.
- 2) A *low power application* in terms of this document shows a maximum operation power of  $P_{\max} \leq 0.1 \text{ W}$  under any conditions.

## 3. Codes and Standards

- 1) The defined properties of the feedthroughs must be proven following the standards stated in the text below.

#### 4. Requirements on electrical feedthroughs

- 1) The housing materials must be, for
  - Shell and collet nut                      Chrome plated brass
  - latch sleeve and mid pieces              Nickel plated brass
- 2) The insulator material must be PEEK
- 3) The feedthrough must be sealed vacuum tight with epoxy resin.
- 4) The electrical contacts must be made of bronze beryllium (QQC- 530) or bronze (UNS C 54400).
- 5) The electrical contacts must be plated with a metal film system of 0.5 μm Cu, 3 μm Ni and 1.5 μm Au.
- 6) The electrical contacts must show a maximum contact resistance (measured according to IEC 60512-2 test 2a [1]) of
  - 5.6 mΩ after 1000 mating cycles
  - 5.7 mΩ after 3000 mating cycles
  - 6.1 mΩ after 5000 mating cycles
- 7) The technical properties must comply with

Table 1: technical and physical properties

Characteristics	Value	Standard
Max. Matings	> 5000 cycles	IEC 60512-5 test 9a [2]
Humidity	up to 95% at 60° C	
Vibration	15 g [10 Hz - 2000 Hz]	
Shock Resistance	100 g [6 ms]	
Min. Shielding	75 dB@10 MHz, 40 dB@1 GHz	
Temperature range	- 20° C/+100° C	
Temperature range	- 20° C/+80° C	
Salt spray corrosion test	> 144h	IEC 60512-6 test 11f [3]
Climatical category	20/80/21	IEC 60068-1 [5]
Leakage rate (He)	< 10 <sup>-7</sup> mbar*L/s	IEC 60512-7 test 14b [4]
Maximum operating pressure	60 bar	IEC 60512-7 test 14d
IP Rating	68	

- 8) The atmosphere side socket must fit to the connector type of the LEMO<sup>®</sup> - plug types FFA.0S.xxx (see LEMO<sup>®</sup> product data) with the insert configuration
  - xxx = 302 for 2 - pin configuration
  - xxx = 303 for 3 – pin configuration
  - xxx = 304 for 4 – pin configuration
 dependent of its application.

- 9) The measured test voltage of the feedthroughs (measured according to the IEC 60512-2 test 4a standard [1]) must correspond to 75% of the mean breakdown voltage.
- 10) For feedthroughs mating to the different plug types (as listed in 4. paragraph 8) and 4.1. paragraph 1)) the test voltages must be
- for plug configuration 302 1.5 kV RMS; 2.1 kV DC
  - for plug configuration 303 and 304 1.0 kV RMS; 1.5 kV DC
- 11) For feedthroughs mating to the different plug types (as listed in 4. paragraph 8) and 4.1. paragraph 1)) the rated current must be
- for plug configuration 302 10 A
  - for plug configuration 303 and 304 7 A

#### 4.1. Feedthroughs with Socket Ending for Plug Connection

- 1) The vacuum side socket must fit to the connector type of the LEMO® - plug series FFA.0S.xxx (see LEMO® product data) with the insert configurations
- xxx = 302 for 2 - pin configuration
  - xxx = 303 for 3 – pin configuration
  - xxx = 304 for 4 – pin configuration
- dependent of its application.
- 2) As feedthroughs of the socket ending type the component types LEMO® SWH.0S.xxx.CLLPV or equivalent in construction, performance AND quality must be applied.

#### 4.2. Feedthroughs with Solder Cup Ending for Cable Connection

- 1) As feedthroughs of the solder cup ending type the component types LEMO® ERA.0S.xxx.CLL or equivalent in construction, performance AND quality must be applied.

### 5. Certificates and Documentation

- 1) An adequate certificate
- stating the conformity with the defined properties
  - dated and accredited
- must be delivered with each lot of components in use for production.

## 6. References

- [1] IEC 60512-2-1, "Connectors for electronic equipment - Tests and measurements - Part 2-1: Electrical continuity and contact resistance tests - Test 2a: Contact resistance - Millivolt level method"; International Electrotechnical Commission, Geneva, Switzerland; 2002
- [2] IEC 60512-5, "Electromechanical components for electronic equipment; basic testing procedures and measuring methods - Part 5: Impact tests (free components), static load tests (fixed components), endurance tests and overload tests"; International Electrotechnical Commission, Geneva, Switzerland; 1992
- [3] IEC 60512-6, "Electromechanical components for electronic equipment; basic testing procedures and measuring methods. Part 6: Climatic tests and soldering tests; International Electrotechnical Commission, Geneva, Switzerland"; 1984
- [4] IEC 60512-7, "Electromechanical components for electronic equipment; basic testing procedures and measuring methods - Part 7: Mechanical operating tests and sealing tests"; International Electrotechnical Commission, Geneva, Switzerland; 1993
- [5] IEC 60068-1, "Environmental testing. Part 1: General and guidance"; International Electrotechnical Commission, Geneva, Switzerland; 1988