



Fraunhofer

**TESTED[®]
DEVICE**

HELUKABEL GmbH
Series CLEANFLEX-HF
Report No. HE 1204-594

DUPLICATE

Statement of
Qualification

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Customer: HELUKABEL GmbH
Dieselstraße 8-12
71282 Hemmingen
Germany

Component tested:

Category: Energy Supply
Subcategory: Cable Systems
Type: Series CLEANFLEX-HF
Tested components:
• TP01: CLEANFLEX-HF UL 20233 4x0.25 QMM BLACK
• TP02: CLEANFLEX-HF UL 20233 4G0.5 QMM BLACK
• TP03: CLEANFLEX-HF UL 20233 4G0.75 QMM BLACK

Random check measurements of particle emission (airborne) at representative points

Test procedure: According to VDI 2083 Part 9.1

Measuring instruments being used: Optical Particle Counter:
Model LasAir II 110 manufactured by PMS with measuring channels of
≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

Test parameters of the test environment:

- Cleanroom Air Cleanliness Class (according to ISO 14644-1):..... ISO 1
- Air flow velocity:..... 0.45 m/s
- Air flow guidance:vertical unidirectional air flow
- Temperature:22 °C ± 0.5 °C (71.6 °F ± 0.9 °F)
- Relative humidity: 45 % ± 5 %

Test parameters of the test execution:

- Cable length: $l_{TP01} = 1070$ mm
..... $l_{TP02} = 1020$ mm
..... $l_{TP03} = 1050$ mm
- Bending diameter of the chain: $d = 100$ mm
- Stroke length: $s = 820$ mm
- Parameter set 1: $v_1 = 0.5$ m/s; $a_1 = 1.0$ m/s²
- Parameter set 2: $v_2 = 1.0$ m/s; $a_2 = 2.0$ m/s²
- Parameter set 3: $v_3 = 2.0$ m/s; $a_3 = 4.0$ m/s²

Test results / Classification:
(according to ISO 14644-1)
The series CLEANFLEX-HF is suitable for use in cleanrooms fulfilling Air Cleanliness Class 3.

Emission chamber measurements with thermodesorption and gas chromatography in combination with mass spectrometry (TD-GC/MS)

Tested component: TP03: CLEANFLEX-HF UL 20233 4G0.75 QMM BLACK

Test procedure: ISO 16000-6,-9,-11; VDI 2083 part 17

Measuring instruments being used:

- VOC:
 - Working place: PerkinElmer Clarus 600, Clarus 600T, ATD 650
 - Sample chamber: Markes International µCTE

Test parameters of the sample pre-conditioning:

- Temperature:22 °C ± 0.5 °C
- Purge gas:Ultra pure air, VOC-filtered
- Relative humidity of purge gas:..... 45 % ± 5 %
- Duration: 2 months

Test parameters of the test execution:

- Temperature: 23 °C/90 °C
- Purge gas: Ultra pure nitrogen, VOC-filtered
- Relative humidity of purge gas:..... 45 % ± 5 %

Test results / Classification:

(according to ISO 14644-8, VDI 2083 part 17)

The following specific emission rates were detected:

Test temperature	Contaminant group	Specific emission rates [g/m ² s]	ISO-AMC _m class (x)
23 °C	VOC	< 8.2 x 10 ⁻¹⁰	< -9.1
90 °C	VOC	< 4.9 x 10 ⁻⁹	--

The detection limit during measurement amounts ISO-AMC_m class -9.1 (VOC). The ISO-AMC_m class (x) for the corresponding contamination group x is only awarded for the measurement at 23 °C (room temperature).

The measuring equipment used for the qualification is regularly calibrated and is based on national and international standards. In the case where no national standards exist, the measuring procedure used corresponds with technical regulations and norms valid at the time of the measurement. The documents drawn up for this procedure are available for viewing.

The validity of this certificate applies only to the mentioned product in this particular condition for a duration of 5 years.
Further information: www.tested-device.com.

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Stuttgart, July 13, 2012

Place, Date

[Signature]
i.A. Project manager