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**TESTED[®]
DEVICE**

Ernst & Engbring GmbH
PTFE LAMINATE
Report No. ER 2406-1532

DUPLICATE

Statement of
Qualification

Single product
Particle Emission

Customer	Ernst & Engbring GmbH Industriestrasse 9 45739 Oer-Erkenschwick Germany
Component tested	
Category:	Energy Supply
Subcategory:	Cable Systems
Product name:	PTFE Laminate-Flat-Cable (manufacturing date: 4/29/2024; color: blue, gray; batch number: 22346430)

Random sampling of particle emissions (airborne) at representative sites

Standards/Guidelines:	ISO 14644-1, -14 The norms stated generally refer to the version valid at the time of the tests.
Test devices:	Optical particle counter: LasAir II 110 and LasAir III 110 with measuring ranges $\geq 0.1\text{ }\mu\text{m}$, $\geq 0.2\text{ }\mu\text{m}$, $\geq 0.3\text{ }\mu\text{m}$, $\geq 0.5\text{ }\mu\text{m}$, $\geq 1.0\text{ }\mu\text{m}$ and $\geq 5.0\text{ }\mu\text{m}$
Test environment parameters:	<ul style="list-style-type: none">Cleanroom Air Cleanliness Class (according to ISO 14644-1):..... ISO 1Airflow velocity:.....0.45 m/sAirflow pattern:..... vertical laminar flowTemperature:22 °C \pm 0.5 °CRelative humidity: 45 % \pm 5 %
Test procedure parameters:	<ul style="list-style-type: none">Energy Chain:E61.29.02.075Bending radius:r = 75 mmStroke length: s = 820 mmParameter Set 1:.....$v_1 = 0.5\text{ m/s}$; $a_1 = 1.0\text{ m/s}^2$Parameter Set 2:.....$v_2 = 1.0\text{ m/s}$; $a_2 = 2.0\text{ m/s}^2$Parameter Set 3:.....$v_3 = 2.0\text{ m/s}$; $a_3 = 4.0\text{ m/s}^2$

Test result / Classification	When operated under the specified test conditions, the PTFE Laminate-Flat-Cable is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:										
	<table><tr><th>Test parameter(s)</th><th>Air Cleanlines Class</th></tr><tr><td>$v_1 = 0.5\text{ m/s}$; $a_1 = 1.0\text{ m/s}^2$</td><td>1</td></tr><tr><td>$v_2 = 1.0\text{ m/s}$; $a_2 = 2.0\text{ m/s}^2$</td><td>1</td></tr><tr><td>$v_3 = 2.0\text{ m/s}$; $a_3 = 4.0\text{ m/s}^2$</td><td>1</td></tr><tr><td>Overall result</td><td>1</td></tr></table>	Test parameter(s)	Air Cleanlines Class	$v_1 = 0.5\text{ m/s}$; $a_1 = 1.0\text{ m/s}^2$	1	$v_2 = 1.0\text{ m/s}$; $a_2 = 2.0\text{ m/s}^2$	1	$v_3 = 2.0\text{ m/s}$; $a_3 = 4.0\text{ m/s}^2$	1	Overall result	1
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Overall result	1										
	Please note: Transport damages, incorrect installation, aging behavior, etc. can influence the test result.										

The measuring devices used for the qualification tests are calibrated at regular intervals; their results can be traced back to national and international standards. In cases where no national standards exist, the test procedure implemented complies with the technical regulations and norms applicable at the time of the test. The relevant documentation can be viewed on request at any time.

Detailed information and parameters of the test environment can be found in the Fraunhofer IPA test report.

Fraunhofer Institute for Manufacturing Engineering and Automation IPA	ER 2406-1532 Report No. first document	Stuttgart, July 26, 2024 Place, date of first document issued
Department of Ultraclean Technology and Micromanufacturing	-- Report No. current document	-- Place, current date
Nobelstrasse 12 70569 Stuttgart Germany	on behalf of Dr.-Ing. Frank Bürger, Project Manager Fraunhofer IPA	