



**Fraunhofer**

**TESTED<sup>®</sup>  
DEVICE**

LAPPKOREA LLC  
CLEANROOM 8110 7G1.5  
**Report No. LA 1904-1112**

DUPLICATE

Statement of  
Qualification

Single product  
Particle Emission

Customer	LAPPKOREA LLC 42, Jangangongdan 8-Gil 18579 Jangan-Myeon, Hwaseong-Si Gyeonggi-Do Korea
Component tested	
Category:	Energy Supply
Subcategory:	Cable Systems
Product name:	ÖLFLEX CLEANROOM 8110 7G1.5 (manufacturing date: 1/25/2019; color: black; serial number: 85130049; batch number: Z04)

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"><li>Cleanroom Air Cleanliness Class (according to ISO 14644-1):..... ISO 1</li><li>Airflow velocity:.....0.45 m/s</li><li>Airflow pattern:..... vertical laminar flow</li><li>Temperature: .....22 °C <math>\pm</math> 0.5 °C</li><li>Relative humidity: ..... 45 % <math>\pm</math> 5 %</li></ul>
Test procedure parameters:	<ul style="list-style-type: none"><li>Energy chain: ..... Igus E61.29.02.150</li><li>Bending radius: .....r = 150 mm</li><li>Stroke length: ..... s = 820 mm</li><li>Parameter Set 1:.....<math>v_1 = 0.5\text{ m/s}</math>; <math>a_1 = 1.0\text{ m/s}^2</math></li><li>Parameter Set 2:.....<math>v_2 = 1.0\text{ m/s}</math>; <math>a_2 = 2.0\text{ m/s}^2</math></li><li>Parameter Set 3:.....<math>v_3 = 2.0\text{ m/s}</math>; <math>a_3 = 4.0\text{ m/s}^2</math></li></ul>

Test result / Classification	When operated under the specified test conditions, the cable ÖLFLEX CLEANROOM 8110 7G1.5 is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:
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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

Please note: Transport damage, incorrect installation, oil leakage, aging behavior and corrosion 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	LA 1904-1112 Report No. first document	Stuttgart, May 28, 2019 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	