



Fraunhofer

TESTED[®]
DEVICE

Bosch Rexroth AG
ACTIVE Shuttle 2.1
Report No. BO 2503-1609

DUPLICATE

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Customer	Bosch Rexroth AG Löwentorstrasse 74 70376 Stuttgart Germany
Tested product	
Category:	Automation Components
Subcategory:	Robotics
Product name:	ACTIVE Shuttle AMR Transport vehicle + CHARGER AS2.1 + CONTACTING MODULE AS2.1 WITH FRAME (manufacturing date: 12/2024; color: traffic white (RAL 9003) and an-thracite gray (RAL 7016); weight: 88 kg (with the battery); article number: 3842560099; serial number: 7211000005498)

Random sampling of particle emissions (airborne) at representative sites in cleanroom under atmospheric conditions

Standards/guidelines:	ISO 14644-1, -14 The norms stated generally refer to the version valid at the time of the tests.
Test equipment:	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 flowRoom temperature:22 °C ± 0.5 °CRelative humidity: 45 % ± 5 %
Test procedure parameters:	<ul style="list-style-type: none">Parameter Set 1:<ul style="list-style-type: none">Max. velocity: $v_{\text{max}} = 1000\text{ mm/s}$Max. linear acceleration: $a = 300\text{ mm/s}^2$Max. linear deceleration: $a = - 600\text{ mm/s}^2$Max. angular velocity:..... $v_{\text{rot}} = 1.05\text{ rad/s}$Max. rotational acceleration/deceleration: $a_{\text{rot}} = 300\text{ mm/s}^2$Attached payload:m = 260 kgSource/sink speed:..... $v_s = 100\text{ mm/s}$Source/sink stroke: $s_s = 16(\text{tolerance } +2)\text{ mm}$Travel path lengths: $x_1 = 1720\text{ mm}$; $x_2 = 4130\text{ mm}$; $x_3 = 1720\text{ mm}$Parameter Set 2:<ul style="list-style-type: none">Attached payload:m = 0 kgFan velocity : $v_{\text{fan}} = 4600\text{ 1/min}$

Test result / Classification	The ACTIVE Shuttle AMR Transport vehicle + CHARGER AS2.1 + CONTACTING MODULE AS2.1 WITH FRAME is suitable for use under the specified test parameters (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %) in cleanrooms of the following Air Cleanliness Classes according to ISO 14644-1:
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Test parameter(s)	Air Cleanlines Class
Running process	5
Charging process	6
Overall result	6

Please note: Transport damages, incorrect installation, oil leakage, aging behavior, 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	BO 2503-1609 Report No. first document	Stuttgart, June 27, 2025 Place, date of first document issued
Business unit Testing and Certification	-- Report No. current document	-- Place, current date
Nobelstrasse 12 70569 Stuttgart Germany	on behalf of Dr.-Ing. Frank Bürger, head of business unit Testing and Certification	