



# Fraunhofer

## TESTED<sup>®</sup> DEVICE

Tsubakimoto Chain Co.  
TKR20H28

**Report No. TS 2511-1693**

DUPLICATE

Statement of  
Qualification

Single product  
Particle Emission  
in Cleanroom  
(atmospheric)

# Statement of Qualification · Single product

**Customer**  
 Tsubakimoto Chain Co.  
 1-1-3 Kannabidai  
 610-0380 Kyotanabe, Kyoto  
 Japan

**Tested product**  
 Category: Energy Supply  
 Subcategory: Cable Systems  
 Product name: TKR20H28  
 (manufacturing date: 7/24/2025; color: black; article number: TKR20H28W50R55)

## 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  $\geq 0.1 \mu\text{m}$ ,  $\geq 0.2 \mu\text{m}$ ,  $\geq 0.3 \mu\text{m}$ ,  $\geq 0.5 \mu\text{m}$ ,  $\geq 1.0 \mu\text{m}$  and  $\geq 5.0 \mu\text{m}$

Test environment parameters:

- Cleanroom Air Cleanliness Class (according to ISO 14644-1):..... ISO 1
- Airflow velocity:.....0.45 m/s
- Airflow pattern:..... vertical laminar flow
- Room temperature: .....22 °C ± 0.5 °C
- Relative humidity: ..... 45 % ± 5 %

Test procedure parameters:

- Installation width: ..... 152 mm
- Bending radius: .....r = 55 mm
- Stroke length:..... s = 820 mm
- Parameter 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

The cable TKR20H28 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:

Test parameter(s)	Air Cleanliness 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
<b>Overall result</b>	<b>1</b>

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

TS 2511-1693  
 Report No. first document

Stuttgart, January 30, 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