IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED®
DEVICE

Tsubakimoto Chain Co.
CLEANVEYOR (CV-2025-0032)
Report No. TS 2511-1693

DUPLICATE

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Fraunhofer
IPA

Fraunhofer
IPA

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: CLEANVEYOR (CV-2025-0032)
(manufacturing date: 7/25/2025; color: white; article number: CV-2025-0032)

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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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: ..... 227 mm
- Bending radius: ..... r = 70 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

Fraunhofer IPA

Test result / Classification

The cable CLEANVEYOR (CV-2025-0032) 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
Germany

TS 2511-1693 — Report No. first document
Stuttgart, January 30, 2025 — Place, date of first document issued
-- — Report No. current document
-- — Place, current date
on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED®
DEVICE

Tsubakimoto Chain Co.
FLATVEYOR (FV-2025-0049)
Report No. TS 2511-1693

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Fraunhofer
IPA

Fraunhofer
IPA

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: FLATVEYOR (FV-2025-0049)
(manufacturing date: 7/25/2025; color: black; article number: FV-2025-0049)

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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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: ..... 309 mm
- Bending radius: ..... r = 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

Fraunhofer IPA

Test result / Classification

The cable FLATVEYOR (FV-2025-0049) 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
Germany

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on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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DUPLICATE

IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
FLATVEYOR ZP Type (R070)
Report No. TS 2511-1693

Statement of Qualification

Single product
Particle Emission in Cleanroom (atmospheric)

Fraunhofer IPA

Fraunhofer IPA

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: FLATVEYOR ZP Type (R070)
(manufacturing date: 7/25/2025; color: white; article number: WS2012-012)

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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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: ..... 227 mm
- Bending radius: ..... r = 70 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

Fraunhofer IPA

Test result / Classification

The cable FLATVEYOR ZP Type (R070) 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	2
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	3
Overall result	**3**

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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
Germany

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Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED®
DEVICE

Tsubakimoto Chain Co.
TKR20H28
Report No. TS 2511-1693

DUPLICATE

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Fraunhofer
IPA

Fraunhofer
IPA

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: white; 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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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 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 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
Germany

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on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED®
DEVICE

Tsubakimoto Chain Co.
TKR15H22
Report No. TS 2511-1693

DUPLICATE

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Fraunhofer
IPA

Fraunhofer
IPA

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: TKR15H22
(manufacturing date: 7/24/2025; color: black; article number: TKR15H22W40R40)

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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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: ..... 110 mm
- Bending radius: ..... r = 40 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

Fraunhofer IPA

Test result / Classification

The cable TKR15H22 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
Germany

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on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED®
DEVICE

Tsubakimoto Chain Co.
FLATVEYOR ZP Type (R100)
Report No. TS 2511-1693

DUPLICATE

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Fraunhofer
IPA

Fraunhofer
IPA

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: FLATVEYOR ZP Type (R100)
(manufacturing date: 9/25/2025; color: white; article number: WS2012-028)

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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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: ..... 303 mm
- Bending radius: ..... r = 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 result / Classification

The cable FLATVEYOR ZP Type (R100) 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	2
Overall result	**2**

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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
Germany

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on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED®
DEVICE

Tsubakimoto Chain Co.
FLATVEYOR ZP Type (R130)
Report No. TS 2511-1693

DUPLICATE

Statement of
Qualification

Single product
Particle Emission
in Cleanroom
(atmospheric)

Fraunhofer
IPA

Fraunhofer
IPA

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: FLATVEYOR ZP Type (R130)
(manufacturing date: 9/25/2025; color: white; article number: WS2012-029)

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 ≥ 0.1 µm, ≥ 0.2 µm, ≥ 0.3 µm, ≥ 0.5 µm, ≥ 1.0 µm and ≥ 5.0 µm

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: ..... 363 mm
- Bending radius: ..... r = 130 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

Fraunhofer IPA

Test result / Classification

The cable FLATVEYOR ZP Type (R130) 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 Cleanlines Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
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

Business unit
Testing and Certification

Nobelstrasse 12
70569 Stuttgart
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on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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DUPLICATE

IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
CLEANVEYOR (CV-2025-0032)
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

has been awarded a Fraunhofer certificate TESTED DEVICE bearing the report number TS 2511-1693.

The cable CLEANVEYOR (CV-2025-0032), color: white, was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
$v_1 = 0.5\,m/s$; $a_1 = 1.0\,m/s^2$	1
$v_2 = 1.0\,m/s$; $a_2 = 2.0\,m/s^2$	1
$v_3 = 2.0\,m/s$; $a_3 = 4.0\,m/s^2$	1
Overall result	**1**

Please note: Transport damages, incorrect installation, aging behavior etc. can influence the test result.

TS 2511-1693
Report No. first document

Stuttgart, January 30, 2026
Place, date of first document issued

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Report No. current document

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Place, current date

on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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

Fraunhofer IPA

IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
FLATVEYOR (FV-2025-0049)
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

has been awarded a Fraunhofer certificate TESTED DEVICE bearing the report number TS 2511-1693.

The cable FLATVEYOR (FV-2025-0049), color: black, was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
$v_1 = 0.5\,m/s$; $a_1 = 1.0\,m/s^2$	1
$v_2 = 1.0\,m/s$; $a_2 = 2.0\,m/s^2$	1
$v_3 = 2.0\,m/s$; $a_3 = 4.0\,m/s^2$	1
Overall result	**1**

Please note: Transport damages, incorrect installation, aging behavior etc. can influence the test result.

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Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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

Fraunhofer IPA

IPA

Cleanroom (atmospheric)

valid until: January 30, 2031

Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
FLATVEYOR ZP Type (R070)
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

has been awarded a Fraunhofer certificate TESTED DEVICE bearing the report number TS 2511-1693.

The cable FLATVEYOR ZP Type (R070), color: white, was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
$v_1 = 0.5\,m/s$; $a_1 = 1.0\,m/s^2$	2
$v_2 = 1.0\,m/s$; $a_2 = 2.0\,m/s^2$	1
$v_3 = 2.0\,m/s$; $a_3 = 4.0\,m/s^2$	3
Overall result	**3**

Please note: Transport damages, incorrect installation, aging behavior etc. can influence the test result.

TS 2511-1693
Report No. first document

Stuttgart, January 30, 2026
Place, date of first document issued

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Report No. current document

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Place, current date

on behalf of
Dr.-Ing. Frank Bürger, head of business unit Testing and Certification

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Cleanroom (atmospheric)

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TESTED® DEVICE

Tsubakimoto Chain Co.
TKR20H28
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

has been awarded a Fraunhofer certificate TESTED DEVICE bearing the report number TS 2511-1693.

The cable TKR20H28 (color: white) was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
Overall result	**1**

Please note: Transport damages, incorrect installation, aging behavior etc. can influence the test result.

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Fraunhofer IPA

IPA

Cleanroom (atmospheric)

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Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
TKR15H22
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

has been awarded a Fraunhofer certificate TESTED DEVICE bearing the report number TS 2511-1693.

The cable TKR15H22 (color: black) was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
$v_1 = 0.5\,m/s$; $a_1 = 1.0\,m/s^2$	1
$v_2 = 1.0\,m/s$; $a_2 = 2.0\,m/s^2$	1
$v_3 = 2.0\,m/s$; $a_3 = 4.0\,m/s^2$	1
Overall result	**1**

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Cleanroom (atmospheric)

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Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
FLATVEYOR ZP Type (R100)
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

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The cable FLATVEYOR ZP Type (R100), color: white, was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
$v_1 = 0.5\,m/s$; $a_1 = 1.0\,m/s^2$	1
$v_2 = 1.0\,m/s$; $a_2 = 2.0\,m/s^2$	1
$v_3 = 2.0\,m/s$; $a_3 = 4.0\,m/s^2$	2
Overall result	**2**

Please note: Transport damages, incorrect installation, aging behavior etc. can influence the test result.

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Fraunhofer

TESTED® DEVICE

Tsubakimoto Chain Co.
FLATVEYOR ZP Type (R130)
Report No. TS 2511-1693

Single product
Particle Emission in Cleanroom (atmospheric)

Qualification Certificate

This is to certify that the product mentioned above, provided by

Tsubakimoto Chain Co.
Kyoto, Japan

has been awarded a Fraunhofer certificate TESTED DEVICE bearing the report number TS 2511-1693.

The cable FLATVEYOR ZP Type (R130), color: white, was assessed in compliance with ISO 14644-14. When operated under the specified test conditions (room temperature: 22 °C ± 0.5 °C; relative humidity: 45 % ± 5 %), it is suitable for use in cleanrooms fulfilling the specifications of the following Air Cleanliness Classes according to ISO 14644-1:

Test parameter(s)	Air Cleanliness Class
v_1 = 0.5 m/s; a_1 = 1.0 m/s²	1
v_2 = 1.0 m/s; a_2 = 2.0 m/s²	1
v_3 = 2.0 m/s; a_3 = 4.0 m/s²	1
Overall result	**1**

Please note: Transport damages, incorrect installation, aging behavior etc. can influence the test result.

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