HANSPETER TRÜMPI / HEINZ SEEDORF

Multilayer Conduits for Railway

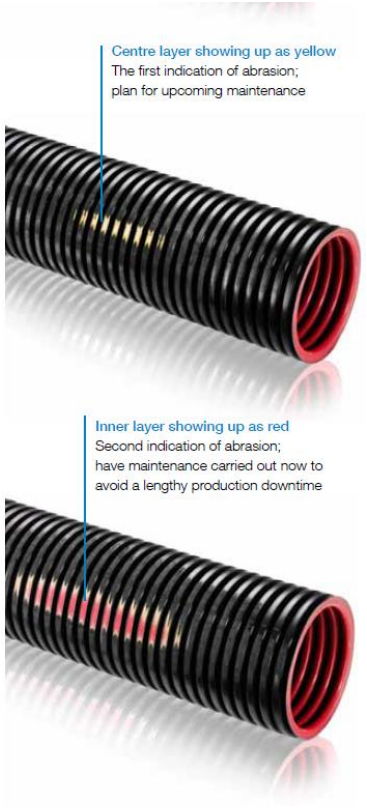
Flexible Cable Protection Systems – highlight properties

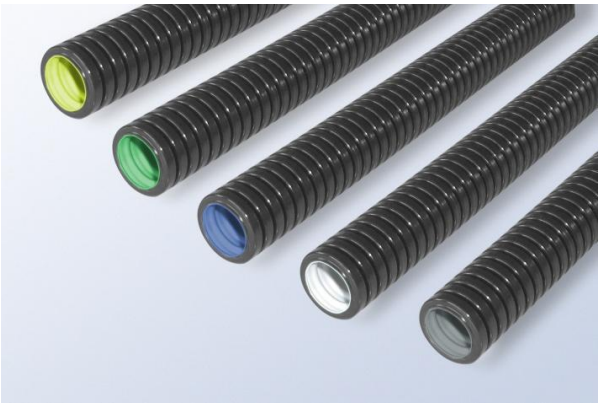
 Document ID.: Rev.:

Multilayer Conduits (X-Series) vs. Monolayer Conduits

Some general aspects

- New material combinations open up new horizons e.g. in regards to **enhanced performance**
- Optimized characteristics possible according to the requirements of the application
- Layers of different material with **variable** thickness
- New applications possible (e.g. within ATEX-Areas)
- New function included: e.g.
  - Abrasion indication
  - Low friction inner layer





Multilayer Conduit types for rail applications

PMA Cable Protection will in future focus upon multilayer technology conduits for the rail segment.

PMA has in the last more than 8 years launched many new conduit types designed to fulfil the requirements of various application areas. e.g.

- in railway infrastructure,
- in the passenger zone,
- on the roof,
- on the bogie
- on inter-carriage jumper harnesses.

Multilayer Conduit types for rail applications

General Characteristics

This range offers multilayer conduits for demanding technical applications and special requirements.

- Produced in Advanced Multilayer Extrusion Technology
- Three-layer conduits
- **Allows combination of the best characteristics of different materials to produce conduits with optimized properties according to application requirements.**
- **Compatible with the entire assortment of PMA Fittings and accessories**
- Available generally in sizes NW 10 up to NW 48
- Some types available already in NW07 and as well as Jumbo sizes NW56 to NW125
- Standard Colours: Outer Layer Black / Inner Layer depending on conduit type:
  - **Green: XPCS**
  - **Orange: XPCSF / JXPCSF**
  - **Blue: XVCSF**

Multilayer Conduit type XPCS

For static and dynamic external applications

PA12/PA6 Multilayer conduit

- Excellent UV resistance, weathering and ageing characteristics.
- Good compression strength and impact resistance at low temperature and humidity
- Good flexibility and resistance to fatigue under continuous bending cycles
- Fire Safety Certification to EN 45545-2, HL2 and **NFPA 130**
- Temperature range: -50°C ... +95°C continuous, +150°C short-term
- Colour coding:
  Outer layer: Black - Inner layer: Green
- Available in sizes from NW10 up to NW48

Multilayer Conduit type XPCSF

For highly dynamic external applications and where HL3 is mandatory

PA12/PA12 Multilayer conduit

- Highest flexibility and resistance to fatigue under continuous bending cycles
- Excellent UV resistance, weathering and ageing characteristics
- Very good compression strength and impact resistance at low temperature and humidity
- Fire Safety Certification to EN 45545-2, **HL3**
- Temperature range: –50°C ... +95°C continuous, +150°C short-term
- Colour coding:
  Outer layer: Black - Inner layer: Orange
- Available in sizes from NW07 up to NW48

Multilayer Conduit type JXPCSF

For dynamic external applications with HL3 requirements

PA12/PA12 Multilayer XPCSF conduit over-extruded with a smooth PA12 outer layer

- Smooth outer layer **reduces significantly the adhesion and accumulation of ice** under extreme weather conditions
- Fire Safety Certification to EN 45545-2, **HL3**
- Excellent UV resistance, weathering and ageing characteristics.
- Very good compression strength and impact resistance at low temperature and humidity
- Temperature range: –50°C ... +95°C continuous, +150°C short-term
- Colour coding:
  Outer layer: Black - Inner layer: Orange
- Available in sizes from NW07 up to NW48

Multilayer Conduit type XVCSF

For applications under carriages and on bogies

Brand New

PA6/PA6 Multilayer conduit

- Very good compression strength and impact resistance at **low temperature and humidity**
- Excellent UV resistance, weathering and ageing characteristics.
- Fire Safety Certification to EN 45545-2, HL2
- Colour coding:
  Outer layer: Black - Inner layer: Blue
- Temperature range: –50°C ... +105°C continuous, +160°C short-term
- Available in sizes from NW10 up to NW48

PMA Conduits for Rolling Stock

Products, Application Areas and Certification – Overview

Conduit Type	Technology	Recommended Application Area	NW	EN45545-2 R22 internal	EN45545-2 R23 external	NFPA-130
XPCS	PA12/PA6 Multilayer	External, dynamic	10-48	HL2	HL2	☑ COMPLIANT
XPCSF	PA12/PA12 Multilayer	External, dynamic	07-48	HL3	HL3	
JXPCSF	PA12/PA12/PA12 Over-extruded multilayer	External, dynamic Prevention of Accumulation of Ice	07-48	HL3	HL3	
XVCSF	PA6/PA6 Multilayer	External, Undercarriage	10-48	HL2	HL2	
VAM/VAML	PA6 Monolayer	Internal, Passenger Zone	07-48	HL3	HL3	☑ COMPLIANT
PLR	PA6 Monolayer	Internal, Passenger Zone	07-48	HL2	HL2	
PACOF	PA6 Divisible	Retrofit, repairs	07-48	HL3	HL3	☑ COMPLIANT

Multilayer Conduits for Rail Vehicle Applications

PMA Recommendations according to Application Areas

1 2 3

XPCS-Multilayer conduit for static and dynamic external applications with a global fire safety specification.
HL2 according to **EN 45545-2**.
NFPA 130 compliant.

1 2 3

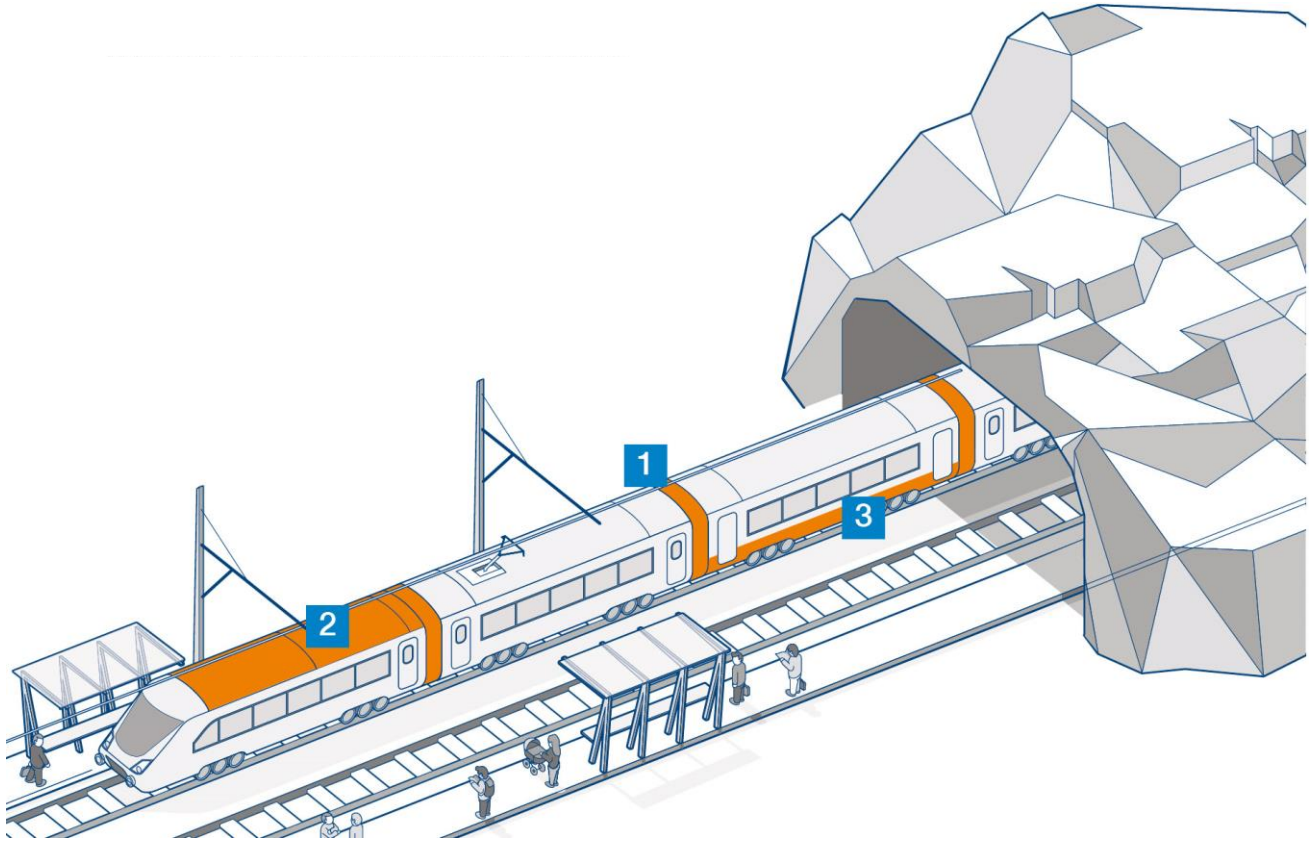
XPCSF-Multilayer conduit for highly dynamic external applications.
HL3 according to **EN 45545-2**.

1 2 3

JXPCSF-Over-extruded conduit for external, dynamic applications on railway vehicles. Designed to prevent the adhesion and accumulation of ice which is potentially dangerous to people and equipment when breaking off.
HL3 according to **EN 45545-2**.

3

XVCSF-Multilayer conduit with high impact resistance for static applications on bogies and on the undercarriage of railway vehicles
HL2 according to **EN 45545-2**.



Further Information on Homepage

Product recommendations for different applications at railway vehicles and much more

[Link to PMA Multilayer Technology]

PMA

FACTSHEET

Product recommendations for traction vehicle applications

PMA conduits, braids, fittings and accessories for traction vehicle applications

Improved performance and safety for the rail industry with PMA cable protection solutions from ABB.

Conduits
On the carriage roof, on couplings and for intercar jumper connections

- **XPCSF:** PA12/PA12 - Heavy-duty, multilayer conduit for dynamic and static applications:
  - Excellent compression and impact strengths under all climatic conditions
  - Excellent flexibility and resistance to fatigue
  - Excellent UV resistance, weathering and ageing characteristics
  - Black outer layer, orange inner layer
  - Wear indicator
  - EN45545-2 HL3 according to R22 & R23
- **XPCS:** PA12/PA6 - Heavy-duty, multilayer conduit for dynamic and static applications:
  - Good compression and impact strengths under all climatic conditions
  - Good flexibility and resistance to fatigue
  - Excellent UV resistance, weathering and ageing characteristics
  - Black outer layer, green inner layer
  - Wear indicator
  - EN45545-2 HL2 according to R22 & R23
  - NFPA 130
- **JXPCSF:** PA12/PA12/PA12 - Heavy-duty, over-extruded multilayer conduit suitable for dynamic and static applications:
  - Made from 2 layers of high-grade, specially formulated polyamide 12 with a smooth over-extruded PA12 jacket
  - Excellent compression and impact strengths under all climatic conditions
  - Excellent flexibility and resistance to fatigue
  - Excellent UV resistance, weathering and ageing characteristics
  - Reduced accumulation of ice and easy cleaning through smooth outer jacket
  - Black outer layers, orange inner
  - EN45545-2 HL3 according to R22 & R23

Under carriages and on bogies

- **XVCSF:** PA6/PA6 - Heavy-duty multilayer conduit for static applications:
  - Outer and Inner layers: specially formulated polyamide 6
  - Excellent compression and impact strengths under all climatic conditions
  - Good flexibility
  - Excellent UV resistance, weathering and ageing characteristics
  - Black outer layer, blue inner layer
  - Wear indicator
  - EN45545-2 HL2 according to R22 & R23
- **XPCSF:** See characteristics above
- **XPCS:** See characteristics above
- **JXPCSF:** See characteristics above
- **PHT:** PA6 Elastomer - Medium-duty conduit for dynamic and static applications:
  - Very good mechanical properties even at very low temperatures down to -50°C

PMA

FACTSHEET

Product recommendations for light rail vehicle applications

PMA conduits, braids, fittings and accessories for light rail vehicle applications

Improved performance and safety for the rail industry with PMA cable protection solutions from ABB.

Conduits
On the carriage roof, on couplings and for intercar jumper connections

- **XPCS:** PA12/PA6 - Heavy-duty, multilayer conduit for dynamic and static applications:
  - Good compression and impact strengths under all climatic conditions
  - Good flexibility and resistance to fatigue
  - Excellent UV resistance, weathering and ageing characteristics
  - Black outer layer, green inner layer
  - Wear indicator
  - EN45545-2 HL2 according to R22 & R23
  - NFPA 130

Under carriages and on bogies

- **XVCSF:** PA6/PA6 - Heavy-duty multilayer conduit for static applications:
  - Outer and Inner layers: specially formulated polyamide 6
  - Excellent compression and impact strengths under all climatic conditions
  - Good flexibility
  - Excellent UV resistance, weathering and ageing characteristics
  - Black outer layer, blue inner layer
  - Wear indicator
  - EN45545-2 HL2 according to R22 & R23

Inside carriages and in the passenger zone

- **PLR:** PA6 - Medium-duty conduit for static applications:
  - EN45545-2 HL2 according to R22 & R23
- **VAML:** PA6 - Medium-duty conduit preferably for static applications:
  - Complies with strictest international fire safety regulations regarding smoke and toxicity
  - EN45545-2 HL3 according to R22&R23
  - NFPA130

Divisible System Conduits for retrofit and repairs

- **PACOF:** PA6 - Medium-duty conduit preferably for static applications:
  - Can be opened and closed along their length at any time
  - Good compression strength
  - Ingress protection to IP40
  - Complies with strictest international fire safety regulations regarding smoke and toxicity
  - EN45545-2 HL3 according to R22&R23
  - NFPA130
  - Compatible with PMA divisible fittings (BLNO) , locknuts (BLN) but also with standard PMA Fittings allowing repairs using existing fittings

Learn more about PMA Multilayer conduits in our video


ABB

Virtual PMA exhibition live webinars

The Webinars:

Tuesday, 22nd September 2020, 9:00 am and 5:00 pm CET (for ½ hour each)

Theme: Ideal positioning and fixation of corrugated conduits and cables

Speakers: Sabine Schuler, Marco Castoldi and Firdes Arikan

Wednesday, 23rd September 2020, 9:00 am and 5:00 pm CET (for ½ hour each)

Theme: Multilayer technology in cable protection systems

Speakers: Heinz Seedorf and Hanspeter Trümpi

Thursday, 24th September 2020 9:00 am and 5:00 pm CET (for ½ hour each)

Theme: Cable protection systems with EMI suppression function

Speakers: Philip Allington and Holger Quest

Friday, 25th September 2020, 9:00 am and 5:00 pm CET (for ½ hour each)

Theme: Pitfalls of practical measurements – sealing tests under dynamic conditions

Speakers: Erich Stünzi and Hanspeter Trümpi