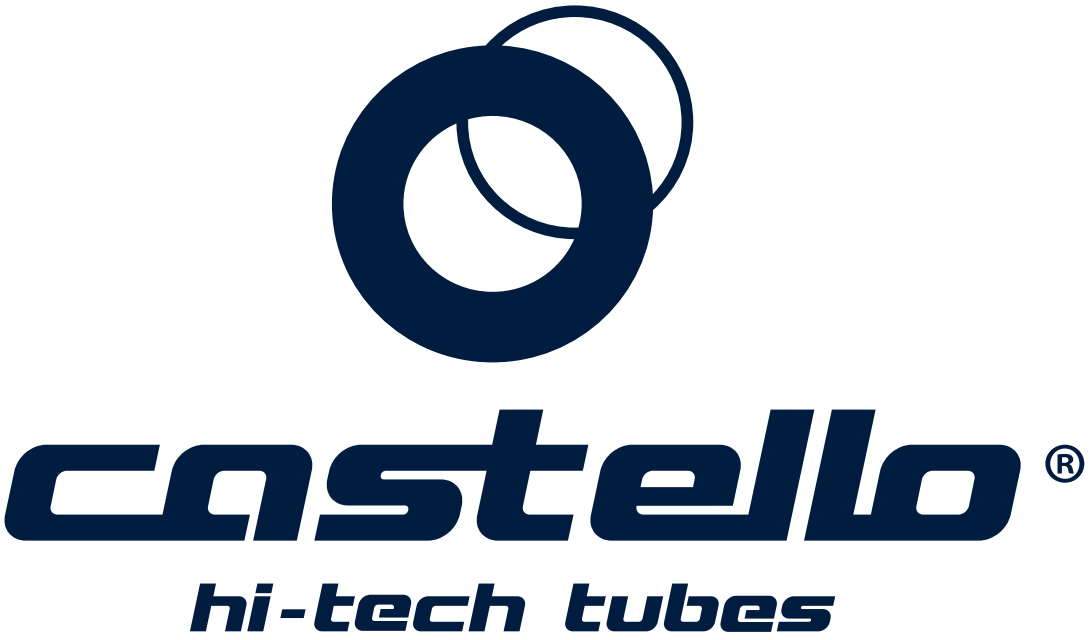
castello®

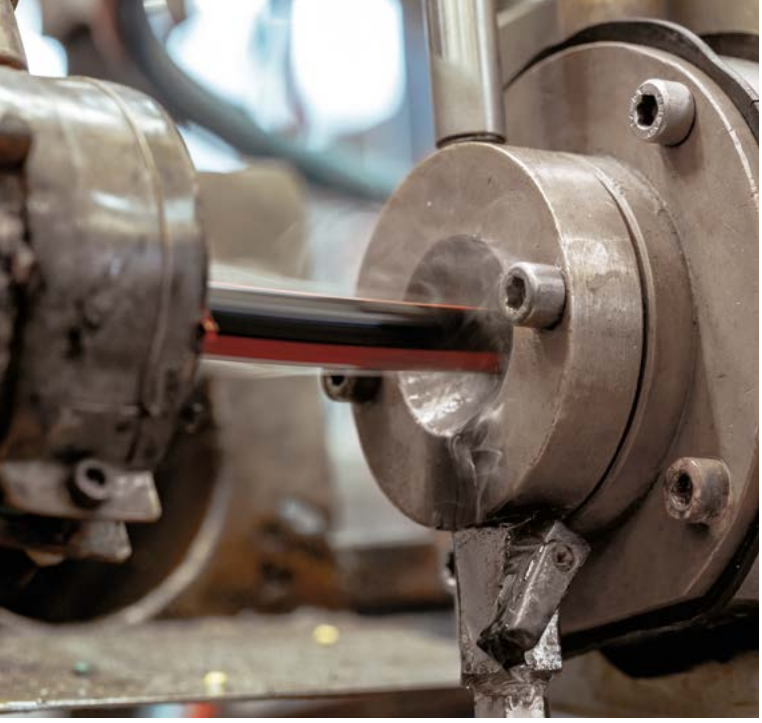
hi-tech tubes

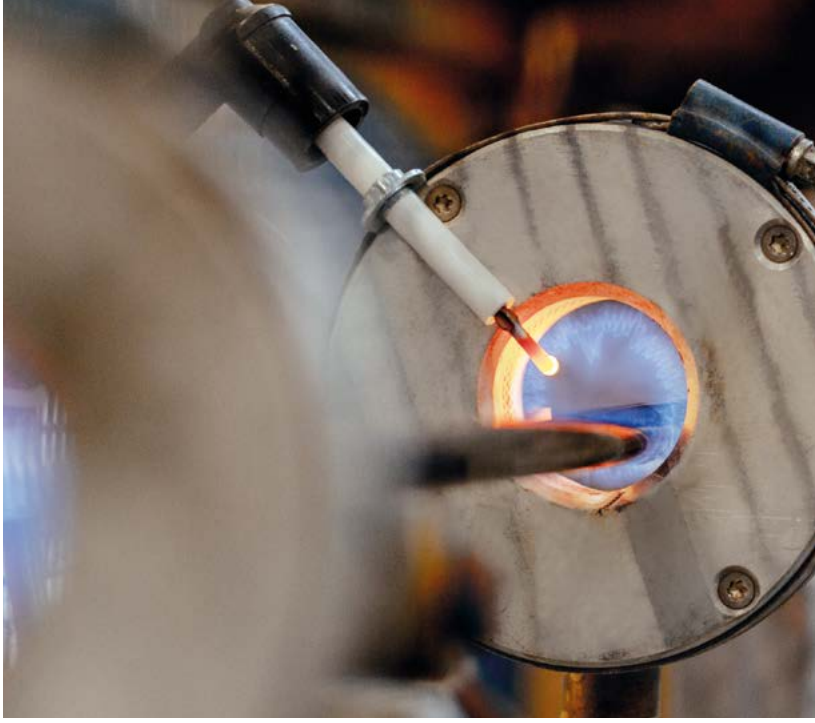
AUTOMOTIVE

EN



The flexible way






MAILLEFER
EXTRUSION

THE COMPANY

A solid, global Italian business

Castello Italia S.p.A. was founded in the 1960s as one of the first companies in Italy specialised in the production of plastic tubing.

In 2010, at the height of a major investment cycle that started ten years before, the company entered the automotive sector and soon became a qualified supplier for polyamide and polyurethane tubing, which today can be found on all vehicles of the world's leading brands.

The production is **100% Made in Italy**, but the commercial network extends into the countries where the production of the main worldwide manufacturers are located: Italy, France, Germany, UK, Sweden, Belgium, the Netherlands, Spain, Poland, Russia, Turkey and Japan.

Quality, expertise, service

In the automotive sector, competition is regulated by quality, which must be absolute. It is thanks to this focus, to the know-how acquired over the years and to the close partnership with customers that Castello Italia S.p.A. has established itself as a worldwide point of reference in the industry.

THE FLEXIBLE WAY

Flexibility as a value

Flexibility is the capacity to give efficient and prompt replies to the requests of the customer. **Castello Italia S.p.A.** has adopted this attitude since the last ten years. To meet the needs of product customization, the company is internally structured to manage all the phases of design, development, production and testing based on the technical specifications and expected performance levels requested by the customer. In the course of time, the company has been able to adapt to market changes through the improvement of its own organization and technological performances, the management of human resources and external relationships.

Custom Made in Castello

Castello Italia S.p.A. does not offer its customers only products, it offers them solutions. Each order is personalised and managed according to the customer's design and production needs. Castello's attitude towards the market is innovative in the way it understands and answers to customer requests.

The customer service

People are the very heart of the company and the company has always invested on people. Customer orientation and quality is a shared mentality at all levels; **Castello Italia S.p.A.** offers an excellent service allowing customer to choose its product as conceived internally. This flexible and customer-centred attitude is always the key to secure loyal and satisfied customers.

CERTIFICATIONS

Castello Italia S.p.A. owns all the necessary certifications to guarantee the customer that the highest production standards are being observed.

All company processes are designed, structured and controlled in full compliance with these regulations and the company welcomes all types of audits by customers.

System Certifications

Our plant is certified according to the following standards:

IATF 16949:2016
UNI EN ISO 9001:2015
UNI EN ISO 14001:2015

Product Certifications

Our products comply with the following standards:

ISO, DIN, SAE, NF
REACH REGULATION
ROHS DIRECTIVES 2011/65/EC
SILICON FREE


CERTIFICATE

The Certification Body of TÜV SÜD Management Service GmbH certifies that

Castello Italia S.r.l.
Via Anelli 52
26020 CASALMORANO (CR)
Italy

has established and applies a Quality Management System for

Manufacture of thermoplastic hoses linear, hot and cold thermoformed for the automotive application (without Product Design as per Chapter 8.3).

An audit was performed and has furnished proof that the requirements according to

IATF 16949
First Edition 2016-10-01

are fulfilled.

Issue date: 2018-08-23
Expiry date: 2021-08-22
Certificate Registration No.: 12 111 46217 TMS
IATF Certificate No.: 0325897
Part of the certificate is an appendix.

Product Compliance Management
Munich, 2018-08-30

Page 1 of 2


CERTIFICATO

Nr. 50 100 8584 - Rev. 006

Si attesta che / This is to certify that

IL SISTEMA QUALITÀ DI / THE QUALITY SYSTEM OF

CASTELLO ITALIA S.r.l.

SEDE LEGALE / REGISTERED OFFICE:
VIA CAMPERIO 14 I-20123 MILANO (MI)

SEDE OPERATIVA / OPERATIONAL SITE:
VIA ANELLI 52 I-26020 CASALMORANO (CR)

È CONFORME AI REQUISITI DELLA NORMA / HAS BEEN FOUND TO COMPLY WITH THE REQUIREMENTS OF

UNI EN ISO 9001:2015

QUESTO CERTIFICATO È VALIDO PER IL SEGUENTE CAMPO DI APPLICAZIONE / THIS CERTIFICATE IS VALID FOR THE FOLLOWING SCOPE

Fabbricazione di tubi lineari in materiale termoplastico, formati a caldo o a freddo (IAF 14)

Manufacture of linear thermoplastic hoses, hot or cold thermoformed (IAF 14)

Per l'Organismo di Certificazione / For the Certification Body
TÜV Italia S.r.l.

Validità / Validity
Dal / From: 2018-09-23
Al / To: 2021-08-22

Data emissione / Printing Date
2018-08-23

Andrea Coscia
Direttore Divisione Management Assurance

PRIMA CERTIFICAZIONE / FIRST CERTIFICATION: 2009-03-30


CERTIFICATO

Nr 50 100 13997

Si attesta che / This is to certify that

IL SISTEMA DI GESTIONE AMBIENTALE DI / THE ENVIRONMENTAL MANAGEMENT SYSTEM OF

Castello Italia S.r.l.

SEDE LEGALE E OPERATIVA / REGISTERED OFFICE:
VIA CAMPERIO 14 I-20123 MILANO (MI)

SEDE OPERATIVA / OPERATIONAL SITE:
VIA ANELLI 52 I-26020 CASALMORANO (CR)

È CONFORME AI REQUISITI DELLA NORMA / HAS BEEN FOUND TO COMPLY WITH THE REQUIREMENTS OF

UNI EN ISO 14001:2015

QUESTO CERTIFICATO È VALIDO PER IL SEGUENTE CAMPO DI APPLICAZIONE / THIS CERTIFICATE IS VALID FOR THE FOLLOWING SCOPE

Progettazione e fabbricazione di tubi in materiale termoplastico per applicazioni automotive e industriali, attraverso le fasi: estrusione, formatura a caldo o a freddo, confezionamento (IAF 14)

Design and production of thermoplastic tubes for industrial and automotive applications through extrusion, cold or hot-forming and packaging (IAF 14)

CERTIFICAZIONE RILASCIATA IN CONFORMITÀ AL REGOLAMENTO TECNICO ACCREDIA RT-09 / CERTIFICATION ISSUED IN ACCORDANCE TO ACCREDIA TECHNICAL REGULATION RT-09

Per l'Organismo di Certificazione / For the Certification Body
TÜV Italia S.r.l.

Validità / Validity
Dal / From: 2017-06-13
Al / To: 2020-06-12

Data emissione / Printing date:
2017-06-13

Andrea Coscia
Direttore Divisione Management Service

APPLICATIONS / MATERIALS TABLE

APPLICATIONS	MATERIALS							
	PA 12 C.BEST	**PA 10.12** C.PRO	**PA 11** C.BIO	**C.MLT 533** MULTILAYER	**PA11** HT C.PPA	**PPS** C.PPS	**C.MLT 9T** MULTILAYER AND **C.MLT 9TC**	**C.MLT 301** MULTILAYER
AIR BRAKE LINES	•	•	•	•				
AIR BRAKE COILS	•	•	•	•				
SCR	•				•			
COOLING	•		•		•	•		•
AIR SUSPENSION	•	•	•					
FUEL	•		•				•	•
CLUTCH	•		•					
BLOW BY	•		•					
VACUUM	•		•					

INDEX

AIR BRAKE LINES

The tubing is the element that allows the free flow of compressed air that is essential for the proper operation of all the elements of the braking system. It plays a fundamental role in the **safety** of all commercial vehicles.

Castello's AIR BRAKE lines have been developed to meet the highest demands of modern braking systems.

The use of high-performance plastics makes it possible to supply products that are highly resistant to **humidity, UV rays, chemical substances** and **fuels**, as well as ensuring total compliance with the most important international regulations such as:

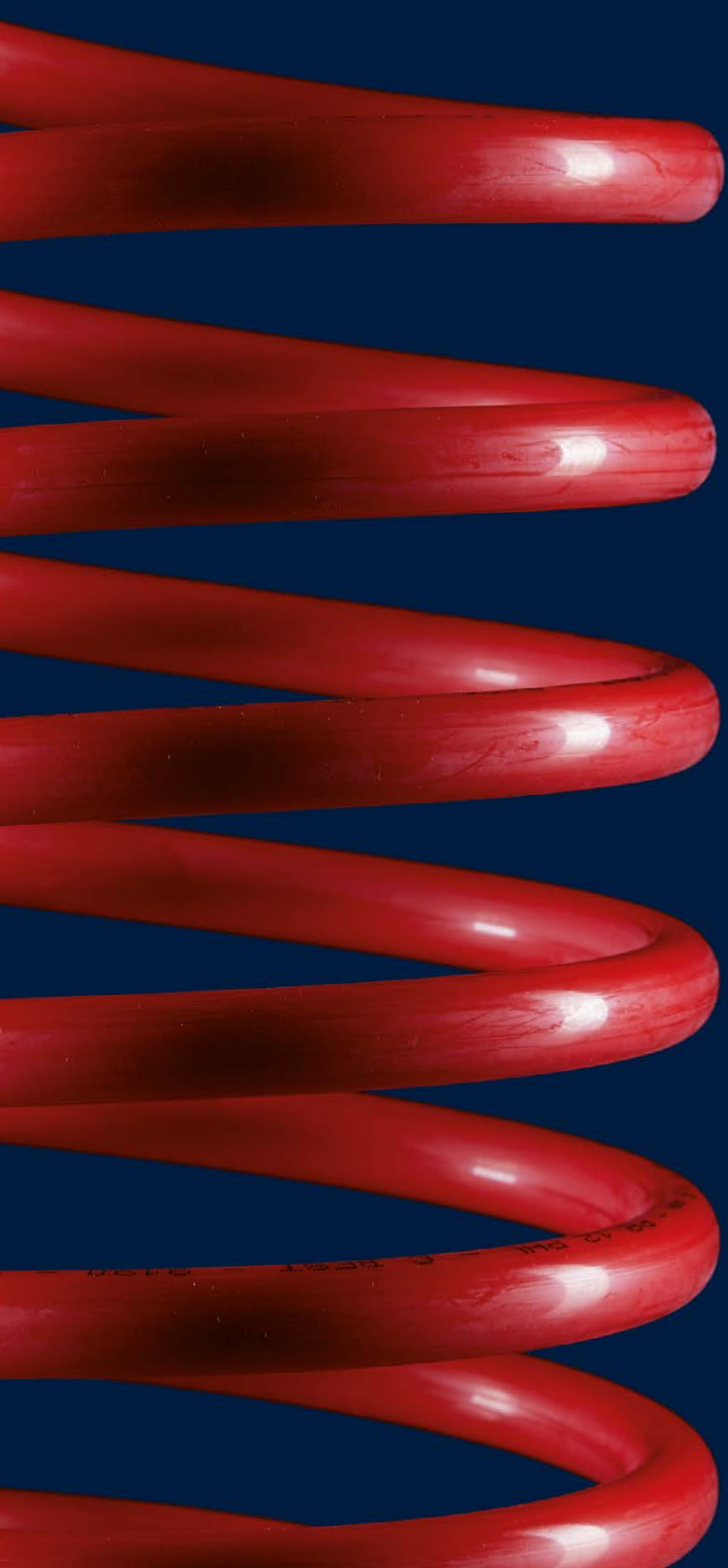
- **DIN 74324** (German)
- **ISO 7628** (International, European)
- **SAE J 844 Type A and B** (American)
- **JASO M317** (Japanese)
- **GB 16897** (Chinese)
- **GOST R 51190-98** (Russian)
- **NF 11 632-2** (French)

Properties:

- **CHEMICAL RESISTANCE** (in particular to Zinc Chloride)
- **HEAT RESISTANCE**
- **IMPACT STRENGTH IN COLD CONDITIONS**
- **WEAR RESISTANCE**
- **RESISTANCE TO HIGH PRESSURES**
- **HIGH DURABILITY**
- **VERY LIGHT WEIGHT**
- **HIGH FLEXIBILITY**
- **HIGH SAFETY COEFFICIENT**

Tube sheet recommended

- **C.PRO IN PA1012**
- **C.BIO IN PA11**
- **C.BEST IN PA12**
- **C.MLT 533 MULTILAYER**



AIR BRAKE COILS

The **brake coil** is a fundamental component that allows you to safely extend braking power from the tractor to the trailer at any time.

Castello's AIR BRAKE COIL lines are suitable for all commercial vehicles, guaranteeing great **durability** over time, exceptional **flexibility** and high **resistance** to weather and chemical agents like lubricants and fuels.

The high quality of the materials selected for the manufacture of these elements allows compliance with the standards:

- **DIN 74323** (German)
- **ISO 7375** (International, European)
- **SAE J 844** (American)

Properties:

- **CHEMICAL RESISTANCE** (in particular to zinc chloride)
- **HEAT RESISTANCE**
- **IMPACT STRENGTH IN COLD CONDITIONS**
- **WEAR RESISTANCE**
- **RESISTANCE TO HIGH PRESSURES**
- **HIGH DURABILITY**
- **VERY LIGHT WEIGHT**
- **HIGH FLEXIBILITY**
- **HIGH SAFETY COEFFICIENT**

Tube sheet recommended

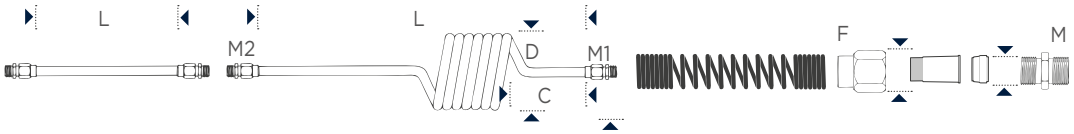
- **C.PRO IN PA1012**
- **C.BIO IN PA11**
- **C.BEST IN PA12**
- **C.MLT 533 MULTILAYER**

AIR BRAKE COILS

SHORT TAILS COILS/ OTHER COILS UPON REQUEST

	STANDARD (mm)	**NARROW** (mm)	**F** (mm)	**M** (mm)
TURNS	17	21		
D	120	95		
L	4,0	4,0	F18 x 1,5	M 16 x 1,5 L 15
C	100	100	F18 x 1,5	M 18 x 1,5 L 34
TUBE	12 x 1,5	12 x 9 x 1,5	F1/2" x 1,5	M 22 x 1,5 L 15

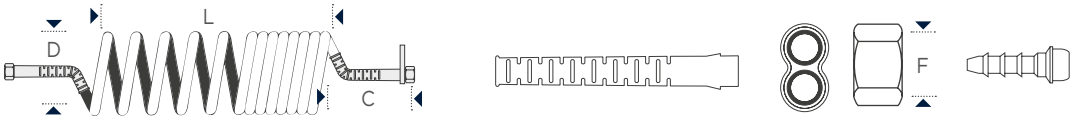
LONG TAILS COILS/ OTHER COILS UPON REQUEST



	STANDARD (mm)	**NARROW** (mm)	**F** (mm)	**M** (mm)
TURNS	0	7	-	-
D	-	95	-	-
L	2,740	4,725	F18 x 1,5	M 16 x 1,5 L 15
C	0	100	F18 x 1,5	M 18 x 1,5 L 34
TUBE	12 x 9 x 1,5	12 x 9 x 1,5	-	-

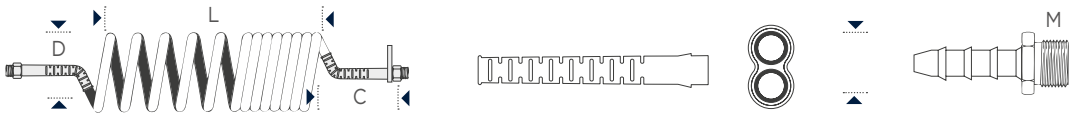
AIR BRAKE COILS

TECHNICAL DATA TYPE A

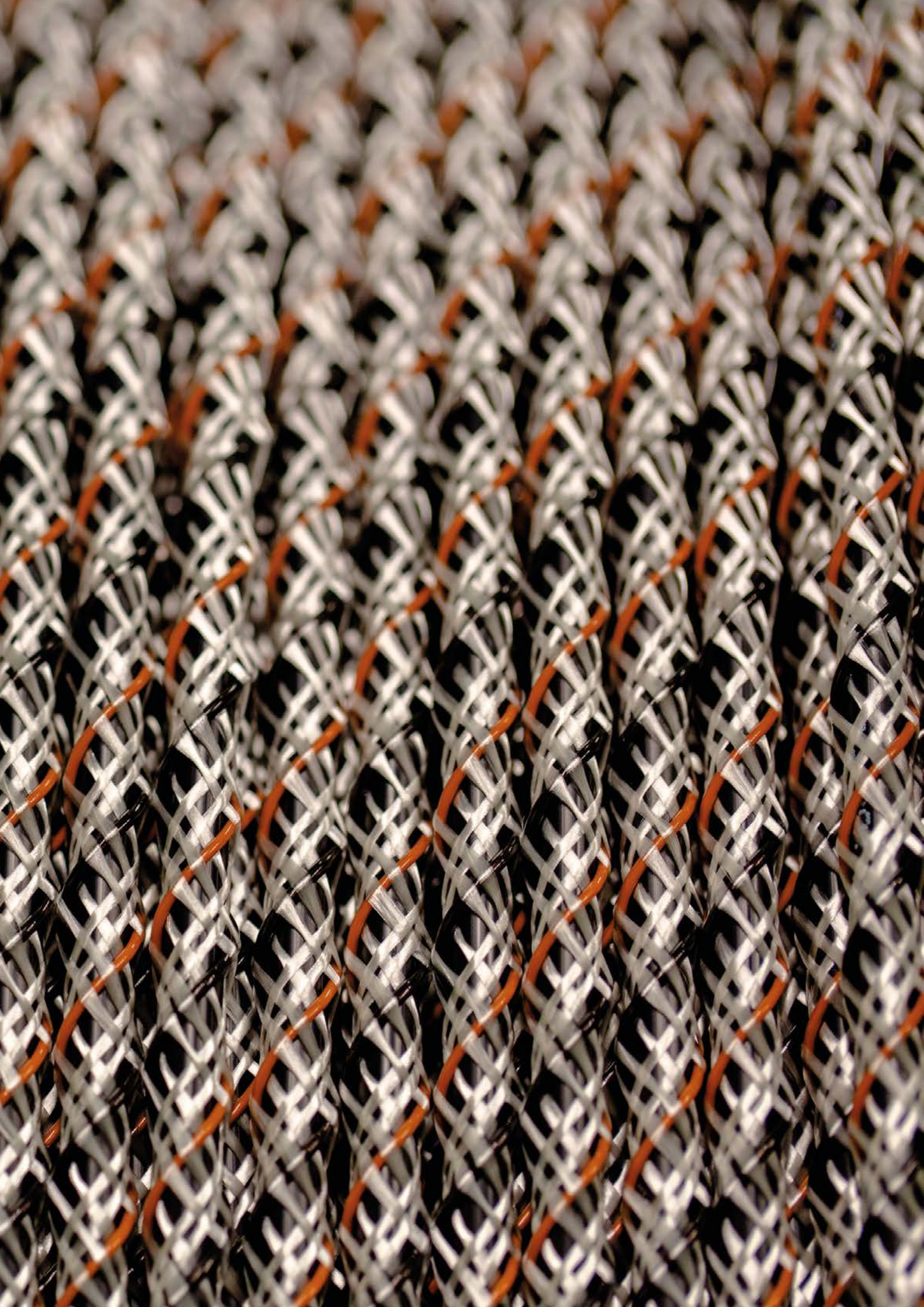


	STANDARD (mm)	**NARROW** (mm)	**F** (mm)	**M** (mm)
TURNS	17	21		
D	120	95		
L	4,0	4,0	F18 x 1,5	M 16 x 1,5 L 15
C	100	100	F18 x 1,5	M 18 x 1,5 L 34
TUBE	12 x 1,5	12 x 9 x 1,5	F1/2" x 1,5	M 22 x 1,5 L 15

TECHNICAL DATA TYPE B



	STANDARD (mm)	**NARROW** (mm)	**M** (mm)
TURNS	17	21	-
D	120	95	-
L	4,0	4,0	M 18 x 1,5
C	100	100	-
TUBE	12 x 9 x 1,5	12 x 9 x 1,5	-



SCR LINES
(SELECTIVE CATALYTIC REDUCTION)

SCR tubes for selective catalytic reduction allow the transporting of urea (AdBlue®) to the catalyst to reduce NOx (nitrogen oxides) in the exhaust gases of all diesel-powered vehicles, with the aim of **reducing pollutant emissions**.

Castello's SCR lines are the result of advanced research aimed at offering all the actors in the market a product that features **excellent thermal**, **mechanical** and **chemical performance**.

A special **heating system** guarantees its perfect operation even at low temperatures (-40°C).

Properties:

- CHEMICAL RESISTANCE
- HEAT RESISTANCE
- IMPACT STRENGTH IN COLD CONDITIONS
- WEAR RESISTANCE
- RESISTANCE TO HIGH PRESSURES
- HIGH DURABILITY
- VERY LIGHT WEIGHT
- HIGH FLEXIBILITY
- HIGH SAFETY COEFFICIENT

Tube sheet recommended

- C.BIO IN PA11*
- C.BEST IN PA12*
- C.MLT MULTILAYER*

* *Contact us*

COOLING LINES

Cooling tubes are used to transport coolant liquids to allow cooling of **both petrol** and **diesel engines** as well as **batteries** for **electric motors**.

Castello's COOLING lines have been developed specifically to guarantee the proper operation of the cooling system, avoiding the overheating of engines that can lead to disastrous consequences.

Technopolymers were chosen specifically to produce **thermoformable** tubes designed to withstand wide thermal variations and the chemical aggression of coolants.

Properties:

- **CHEMICAL RESISTANCE**
- **HEAT RESISTANCE**
- **RESISTANCE TO HYDROLYSIS**
- **RESISTANCE TO HIGH PRESSURES**
- **HIGH DURABILITY**
- **HIGH SAFETY COEFICIENT**

Tube sheet recommended

- **C.BIO IN PA11***
- **C.BEST IN PA12***
- **C.MLT MULTILAYER***
- **OTHER PRODUCTS ON REQUEST***

* *Contact us*

AIR SUSPENSION LINES

To meet the needs of **comfort** on vehicles that are getting heavier, **air suspension systems** are becoming more common on cars and commercial vehicles as an alternative to traditional spring suspension systems.

Castello's AIR SUSPENSION lines offer high quality products that guarantee maximum resistance under **high pressure**, exceptional **chemical resistance** and **durability**.

Thermoformed both cold and hot, the tubes have a very narrow **dimensional tolerance** to avoid air leaks.

Properties:

- CHEMICAL RESISTANCE
- HEAT RESISTANCE
- IMPACT STRENGTH IN COLD CONDITIONS
- WEAR RESISTANCE
- RESISTANCE TO HIGH PRESSURES
- HIGH DURABILITY
- VERY LIGHT WEIGHT
- HIGH FLEXIBILITY
- HIGH SAFETY COEFFICIENT

Tube sheet recommended

- C.PRO IN PA1012
- C.BIO IN PA11
- C.BEST IN PA12
- C.MLT *(on request)*

FUEL LINES

The fundamental role of the fuel lines is to **transfer fuel continuously** and safely from the tank to the vehicle engine.

Castello's FUEL lines guarantee maximum reliability and safety in fuel supply circuits throughout the life of the vehicle.

In addition to offering superior chemical and thermal resistance, thermoformed FUEL tubes also own **antistatic properties** to prevent the formation of static electricity, a source of dangerous sparks.

Properties:

- **CHEMICAL RESISTANCE** *(for all types of fuels)*
- **HEAT RESISTANCE**
- **IMPACT STRENGTH IN COLD CONDITIONS**
- **WEAR RESISTANCE**
- **HIGH DURABILITY**
- **VERY LIGHT WEIGHT**
- **HIGH FLEXIBILITY**
- **HIGH SAFETY COEFFICIENT**

Tube sheet recommended

- **C.BIO IN PA11**
- **C.BEST IN PA12**
- **C.MLT 301** (on request)
- **OTHER PRODUCTS ON REQUEST***

* *Contact us*

CLUTCH LINES

Clutch tubing is the key element for activating the clutch on road vehicles by transporting hydraulic fluid **(DOT 4)**.

Castello's CLUTCH lines are the result of advanced research to replace metal tubes in order to offer the market a product featuring excellent **mechanical properties** and **dimensional stability** under pressure.

Clutch tubing can stand up to aggressive chemical agents, alternating pressure cycles and high temperatures without being deformed and/or altered over time.

Properties:

- **CHEMICAL RESISTANCE** *(DOT 4)*
- **HEAT RESISTANCE**
- **IMPACT STRENGTH IN COLD CONDITIONS**
- **WEAR RESISTANCE**
- **HIGH DURABILITY**
- **HIGH RESISTANCE TO PRESSURE WITHOUT DEFORMATION**
- **VERY LIGHT WEIGHT**
- **HIGH SAFETY COEFFICIENT**

Tube sheet recommended

- **C.BIO IN PA11***
- **C.BEST IN PA12***
- **C.MLT MULTILAYER***
- **OTHER PRODUCTS ON REQUEST***

* *Contact us*

BLOW BY LINES

The **recycling tube** has the task of recovering and redirecting oil vapours present in the engine, injecting them into the cylinders' subsequent combustion phases.

Castello's BLOW BY lines are designed to guarantee superior resistance to **high temperatures** and to the **chemical agents** in the recovered gases.

Their vapour recovery function protects the environment and guarantees excellent engine performance.

Properties:

- **CHEMICAL RESISTANCE**
- **HEAT RESISTANCE**
- **WEAR RESISTANCE**
- **HIGH DURABILITY**
- **VERY LIGHT WEIGHT**
- **HIGH SAFETY COEFFICIENT**

Tube sheet recommended

- **C.BIO IN PA11**
- **C.MLT MULTILAYER***
- **OTHER PRODUCTS ON REQUEST***

* *Contact us*

VACUUM LINES

The **vacuum hose** is a flexible connection that directs the vacuum of the auto collector to supply various components of the vehicle, like the **brake booster**, the positive **crankcase ventilation** (PCV) **valve**, the **heater control valve**, **HVAC control** and **exhaust gas recovery** (EGR valve).

Castello VACUUM lines are distinguished by the **high reliability of its materials**, guaranteeing excellent functionality and durability over time.

Properties:

- CHEMICAL RESISTANCE TO EXTERNAL AGENTS
- HEAT RESISTANCE
- RESISTANCE TO VACUUM DEFORMATION
- HIGH DURABILITY
- VERY LIGHT WEIGHT
- HIGH FLEXIBILITY
- HIGH SAFETY COEFFICIENT

Tube sheet recommended

- C.BEST IN PA12
- C.BIO IN PA11*
- C.MLT MULTILAYER*
- OTHER PRODUCTS ON REQUEST*

* *Contact us*

PACKAGING

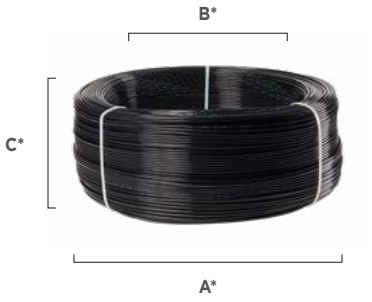
Castello Italia S.p.A. offers a wide range of solutions for the packaging of its products to satisfy all market needs. Depending on their sizes, the hoses can be wound in rolls or in large coils on wooden or plastic supports.

SINGLE ROLLS

STANDARD ROLLS

Available in **25** mt, **50** mt, **100** mt
Other sizes on request

Until diameter **6** x **4**
Tolerance on roll length: **+/- 2%**



ROLL SIZE

Ø **TUBE** (mm)	**A*** **ROLL EXTERIOR** (mm)	**B*** **ROLL INTERIOR** (mm)	**C*** **SHOULDER** (mm)	**ROLL LENGTH** (m)
Ø 6 x 1	Ø 700	Ø 500	500	1000
Ø 8 x 1	Ø 740	Ø 740	430	850
Ø 10 x 1	Ø 725	Ø 725	430	500
Ø 12 x 1,5	Ø 750	Ø 750	430	400
Ø 15 x 1,5	Ø 810	Ø 810	500	250

PACKAGING C.BOX

C.Box packs are specially designed for suppliers of small quantities. Available in **4 different sizes**, depending on the material and the dimensions of the hoses to be contained, and can include **25**, **50** and **100** meter drums.

C.BOX Q
255 x 255 x 70 mm

C.BOX W
300 x 300 x 80 mm

C.BOX Y
400 x 400 x 110 mm

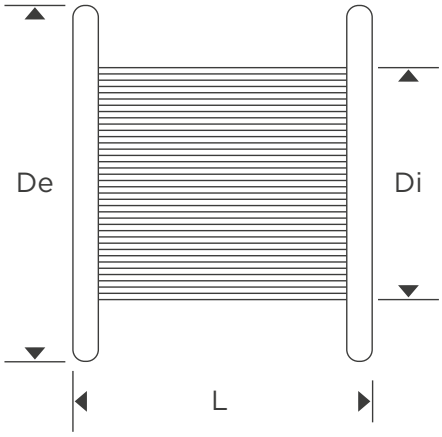
COMBINATION SIZE | LENGTH | C.BOX TYPE

∅ **TUBE EXTERIOR** (mm)	25 m	50 m	100 m
4	Q	Q	W
6	Q	W	Y
8	W	Y	Y
10	Y	-	-
12	Y	-	-

PACKAGING DRUMS

WOOD, PLASTIC AND CARDBOARD

DRUM DIMENSIONS (mm)	**TYPE A** Wood	**TYPE D** Plastic	**TYPE E** Wood	**TYPE G** Cardboard box
DI	250	310	310	280
DE	600	600	750	600
L	300	315	350	300
INNER HOLE	42	82	82	42



MAXIMUM TUBE LENGTH PER DRUM

∅ TUBE EXTERIOR (mm)	**TYPE A** Wood (m)	**TYPE D** Plastic (m)	**TYPE E** Wood (m)	**TYPE G** Cardboard box (m)
4	3000	2500	5000	3000
6	1500	1000	2000	1500
8	850	650	1500	850
10	500	400	1000	500
12	350	280	600	350

TUBE CODE

EX: T Standard for “tube“

T	2F	012	009	NR	0100	S
Tube	Material	External size	Internal size	Colour	Roll lenght	Packaging

MATERIAL

2F *PA12PHL*
2H *PA12HIPHL*
2Y *PA122PHLY*
8F *PA10.12PHL*
1F *PA11PHL*

COLOUR

NR *Black*
BL *Dark blue*
GI *Yellow*
RO *Red*
SG *Yellow striped*
SG *Red striped*
SV *Green striped*
SB *Blue striped*

ROLL LENGHT

0100 *100mt*
1000 *1000mt*
0025 *25mt*

PACKAGING

S *Standard (PE film)*
X *No protective film*
A/H/L/D
Wooden or plastic-drums
W/Y/Q/N
Roll in C.Box
(4 different sizes)

COIL CODE

EX: S Standard for “coil“

S	8F	012	009	NR	L17	A	S
Coil	Material	External size	Internal size	Colour	Roll lenght	Kind of fittings	Packaging

MATERIAL

8F PA10.12PHL
2F PA12PHL
UC PU

COLOUR

NR Black
BL Dark blue
GI Yellow
RO Red

ROLL LENGHT

L17 17 Turns
S21 21 Turns

KIND OF FITTINGS

A 2 Fittings M15x1,5
C 1 Fitting M16x1,5 (internal 18), 1 Fitting M22 (internal 1/2’’)
F 1 Fitting M16x1,5 (internal 18), 1 Fitting M16x1,5 (internal 1/2’’)
G 2 Black plastic protection springs
Q 2 Red plastic protection springs
R 2 Yellow plastic protection springs

PACKAGING

S Standard
I Wrapped spiral

CHEMICAL RESISTANCE AT +23°C

SUBSTANCE	C.BEST PA12	C.BIO PA11	C.PRO PA10.12	C.MECH TPC-ET	C.MLT 533 Multilayer
ACETALDEHYDE	+++	+++	+++	-	+++
ACETIC ACID	+++	+++	+++	+++	+++
ACETONE	+++	+++	+++	+++	+++
ACETYLENE	+++	+++	+++	+++	+++
AMMONIA LIQUID	+++	+++	+++	0	+++
AMYL ACETATE	+++	+++	+++	+++	+++
ANILINE	++	++	++	0	++
ANTIFREEZE	+++	+++	+++	-	+++
BENZOL	++	++	++	++	++
BENZYL ACOHOL	0	0	0	-	0
BROMINE	0	0	0	+++	0
BUTANE	+++	+++	+++	+++	+++
BUTANOL	+++	+++	+++	-	+++
CARBON TETRACHLORIDE	+	+	+	0	+
CHLORINE	0	0	0	0	0
CHLOROBENZOL	0	0	0	0	0
CHLOROFORM	0	0	0	0	0
CITRIC ACID	+++	+++	+++	+++	+++
CONCENTRATED SULPHURIC ACID	0	0	0	0	0
CRESOL	+	+	+	-	+
DECALINE	+++	+++	+++	-	+++
ENGINE OIL	+++	+++	+++	+++	+++
ETHANOL	+++	+++	+++	+	+++
ETHER	+++	+++	+++	+	+++
ETHYL ACETATE	+++	+++	+++	+	+++
ETHYL OXIDE	+++	+++	+++	+++	+++
FORMALDEYDE	+	+	+	+	+
FORMIC ACID	+	+	+	+	+
FRIGEN F 12 LIQUID	++	++	++	++	++
GASOIL	+++	+++	+++	+++	+++

LEGEND +++ ▸ *Good resistance* ++ ▸ *Swelling action* + ▸ *Limited resistance* 0 ▸ *Poor resistance* - ▸ *No information available*

CHEMICAL RESISTANCE AT +23°C

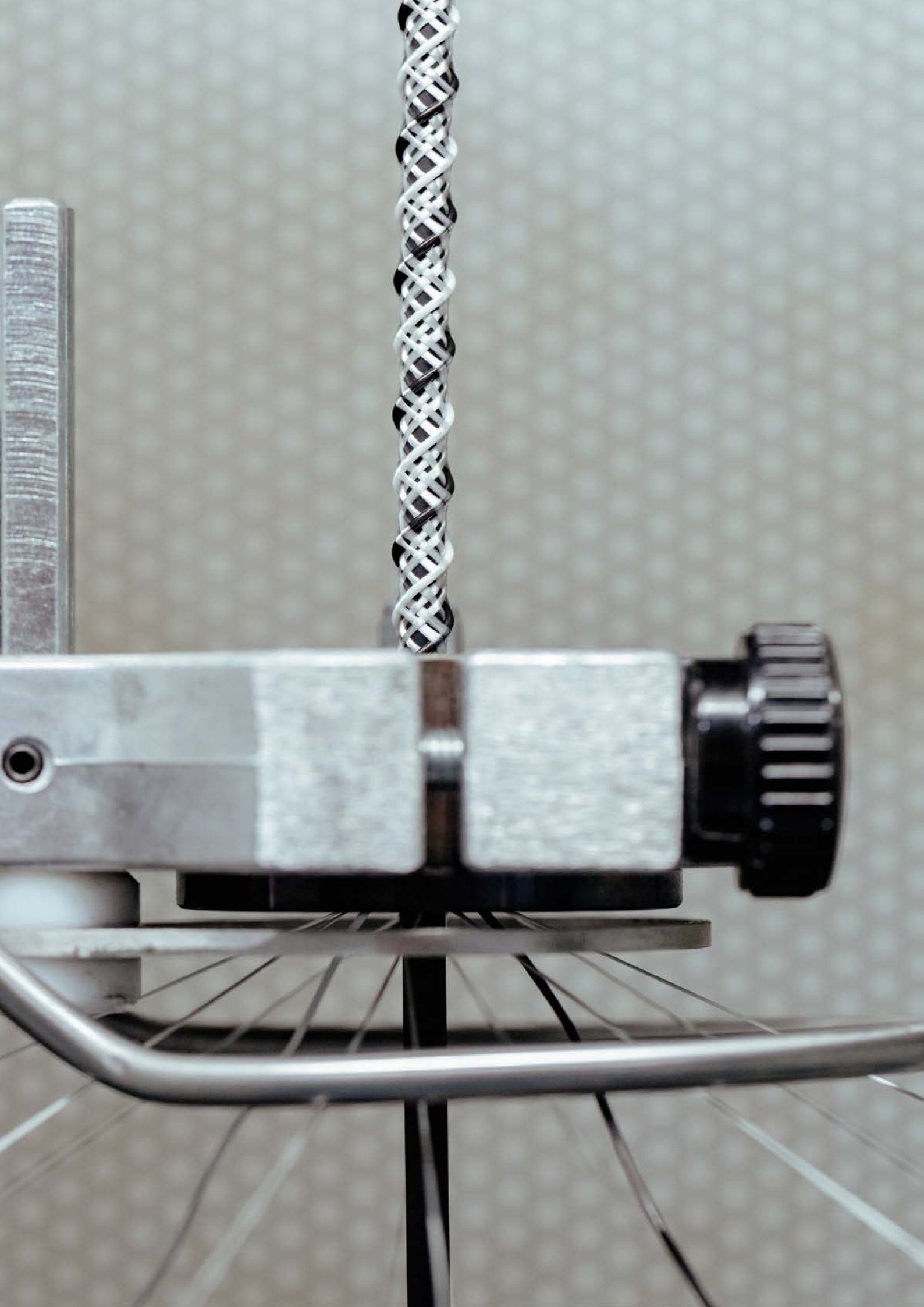
SUBSTANCE	C.BEST PA12	C.BIO PA11	C.PRO PA10.12	C.MECH TPC-ET	C.MLT 533 Multilayer
GLYCERIN	+++	+++	+++	+++	+++
GLYCOLE	+++	+++	+++	-	+++
HEPTANE	+++	+++	+++	-	+++
HYDRAULIC OIL	+++	+++	+++	-	+++
HYDROCLORIC ACID 1%	+	+	+	+	+
HYDROCLORIC ACID 10%	+	+	+	+++	+
HYDROGEN PEROXIDE 20%	+	+	+	+	+
ISOOCTANE	+++	+++	+++	+++	+++
KEROSENE	+++	+++	+++	+	+++
LACTIC ACID	+++	+++	+++	+	+++
MAGNESIUM CHLORIDE 10%	+++	+++	+++	+	+++
MERCURY	+++	+++	+++	+++	+++
METHANOL	+	+	+	-	+
METHYLENE CHLORIDE	+++	+++	+++	0	+++
MINERAL OIL	+++	+++	+++	+++	+++
NAPTHA	+++	+++	+++	+++	+++
NAPTHALENE	+++	+++	+++	+	+++
NITRIC ACID	0	0	0	+++	0
NITROBENZOL	+	+	+	0	+
OILS	+++	+++	+++	+++	+++
OLEIC ACID	+++	+++	+++	+++	+++
OLEUM	+	+	+	0	+
OXALIC ACID	+++	+++	+++	-	+++
OXIGEN	+++	+++	+++	-	+++
OZONE	+++	+++	+++	+	+++
PARAFIN OIL	+++	+++	+++	+	+++
PERCHLOROETHYLENE	0	0	0	0	0
PETROL	+++	+++	+++	+	+++
PHENOL	0	0	0	0	0
POTASSIUM CARBONATE	+++	+++	+++	-	+++

LEGEND +++ ▸ *Good resistance* ++ ▸ *Swelling action* + ▸ *Limited resistance* 0 ▸ *Poor resistance* - ▸ *No information available*

CHEMICAL RESISTANCE AT +23°C

SUBSTANCE	C.BEST PA12	C.BIO PA11	C.PRO PA10.12	C.MECH TPC-ET	C.MLT 533 Multilayer
POTASSIUM HYDROXIDE 10%	+++	+++	+++	+++	+++
POTASSIUM PERMANGANATE	0	0	0	-	0
PROPANE	+++	+++	+++	-	+++
PYRIDINE	0	0	0	0	0
SEA WATER	+++	+++	+++	+++	+++
SILICON OIL	+++	+++	+++	+++	+++
SOAP SUDS	+++	+++	+++	+++	+++
SODA 10%	+++	+++	+++	-	+++
SODIUM CARBONATE 10%	+++	+++	+++	-	+++
SODIUM CARBONATE 50%	+	+	+	-	+
SODIUM CHLORIDE	+++	+++	+++	-	+++
SODIUM SULPHATE	+++	+++	+++	-	+++
STARCH	+++	+++	+++	-	+++
STEARIC ACID	+++	+++	+++	0	+++
STEARINE	+++	+++	+++	-	+++
STYRENE	+++	+++	+++	0	+++
SULOHUR CHLORIDE	+	+	+	-	+
SULPHURIC ACID 10%	+	+	+	+	+
TALLOW	+++	+++	+++	-	+++
TARTARIC ACID	+++	+++	+++	0	+++
TOLUEN	+++	+++	+++	++	+++
TRANSFORMER OIL	+++	+++	+++	0	+++
TRICHLORETHANE	+	+	+	+	+
TURPENTINE	+++	+++	+++	+++	+++
UREA	+++	+++	+++	0	+++
UREIC ACID	+++	+++	+++	0	+++
VASELINE	+++	+++	+++	-	+++
WATER (<70°C)	+++	+++	+++	+++	+++
WAX	+++	+++	+++	-	+++
ZINC CHLORIDE (water based)	+++	+++	+++	+++	+++

LEGEND +++ ▸ *Good resistance* ++ ▸ *Swelling action* + ▸ *Limited resistance* 0 ▸ *Poor resistance* - ▸ *No information available*



POLYAMIDE 10.12 C.PRO

C.PRO tubes are produced with a very innovative bio-sourced polymer named polyamide **1012** (**PA1012**). Developed to overcome **PA12** and **PA11** chronic shortage, **C.PRO** tubes comply fully with **ISO 7628-2010** standard and fulfill the requirements of **DIN 73378** and **74324**. Widely used in the automotive sector since years, **C.PRO** tubes show similar characteristics to **PA12** or **PA11** with excellent resistance to impact at **-70°C** and very good behavior above **125°C**.

NT Natural **NR** Black **BL** Blue **RO** Red **GI** Yellow **VE** Green

Other colours upon request

				PA10.12			
				PHL	PHLY	HL	STANDARD
∅ External mm	∅ Internal mm	Thickness mm	Minimum bend radius mm	Burst pressure at 23°C in bar*			ISO 7628
4	1	2	20	147	180	267	•
6	1	4	30	88	108	160	•
8	1	6	40	63	77	114	•
9	1.5	6	45	88	108	160	•
10	1	8	60	49	60	89	•
10	1.25	7.5	60	63	77	114	•
11	1.5	8	60	69	85	126	•
12	1.5	9	60	63	77	114	•
14	2	10	75	73	90	133	•
15	1.5	12	90	49	60	89	•
16	2	12	95	63	77	114	•
18	2	14	100	55	68	100	•
19	2	15	150	52	64	94	•

* Referred to the nominal diameter of the product Other sizes upon request

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POLYAMIDE 10.12 C.PRO

MARKING Our standard marking is:

ISO 7628	-	CAT.1	-	8x1mm	-	PA1012PHL	-	C.PRO	-	07001485-18-134-14:51
Standard		Product category		External diameter for thickness		Raw material		Product name		Batch number

USE TEMPERATURE

C.PRO tubes have been type-approved according to **ISO 7628-2010** standard

The **ISO 7628-2010** standard classifies the tube resistance to pressure according to the temperature using some categories.

The following tables show the tube resistance:

TOLERANCES

The tolerances on external diameter, according to **ISO 7628-2010**, are:

External diameter from 4 mm to 10 mm ± 0.1 mm
External diameter from 11 mm to 20 mm ± 0.15 mm

Upon special request tubes with narrow tolerances.

TUBE CATEGORY FOR AIR BRAKING SYSTEMS

Category	Maximum operating pressure in bar	Minimum temperature	Maximum temperature
0	10	-40°C	80°C
1	10	-40°C	100°C
2	12.5	-40°C	100°C
3	12.5	-40°C	125°C

BURST PRESSURE ASSOCIATED WITH THE USE CLASS

Test temperature	Maximum operating pressure in bar	Burst pressure in bar
23°C	10 - 12.5	>40 >50
80°C	10	>25
100°C	10 - 12.5	>25 >31.5
125°C	12.5	>25

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POLYAMIDE 12
C.BEST

C.BEST tubes are made of **Polyamide 12** (**PA12**), a polyvalent material, derived from petroleum. **C.BEST** tubes are fully compliant with **DIN 73378** and **DIN 74324** standards. **C.BEST** tubes combine excellent mechanical and chemical resistance from **-40°C** to **+100°C**.

NT Natural **NR** Black **BL** Blue **RO** Red **GI** Yellow **VE** Green

Other colours upon request

				PA12					
				PHL	HIPHL	PHLY	HL	STANDARDS	
⌀ External mm	⌀ Internal mm	Thickness mm	Bend radius mm	Burst pressure at 23°C in bar*				DIN 74324 *Black tubes*	DIN 73378 *Colored tubes*
4	2.5	0.75	20	93	102	126	186		•
4	2.3	0.85	20	108	120	147	216		•
4	2	1	20	132	147	180	267	•	•
5	3	1	30	99	111	135	201		•
6	4	1	30	81	87	108	159	•	•
6	3	1.5	40	132	147	180	267		•
6	2	2	40	201	219	270	399		•
8	6	1	40	57	63	78	114	•	•
8	5.5	1.25	40	75	81	99	147		•
8	5	1.5	40	93	102	126	186		•
8	4	2	40	132	147	180	267		•
9	6	1.5	45	81	87	108	159	•	•
10	8	1	60	45	48	60	90	•	•
10	7.5	1.25	60	57	63	78	114	•	•
10	7	1.5	60	75	72	96	141		•
11	8	1.5	60	63	69	84	126	•	•
12	9	1.5	60	57	63	78	114	•	•
12	8	2	60	81	87	108	159		•
12.5	10	1.25	65	45	48	60	90		•
14	10	2	75	66	72	90	132	•	•
15	13	1	90	30	30	39	57		•
15	12	1.5	90	45	48	60	90	•	•
16	12	2	95	57	63	78	114	•	•
18	14	2	100	51	54	69	99	•	•
20	16	2	180	45	48	60	90		•

*Burst pressure/operating pressure ratio: 3:1**
** Referred to the nominal diameter of the product*

Other sizes upon request

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POLYAMIDE 12
C.BEST

MARKING Our standard marking is:

DIN 73378	-	8x1mm	-	PA12PHL	-	C.BEST	-	07001485-18-134-14:51
Standard		External ø for thickness		Raw material		Product name		Batch number

PRESSURE VARIATION ACCORDING TO TEMPERATURE

PA12PHL

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	87	74	64	57	52	47	44	40	36	33	30

PA12HIPHL

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	83	71	62	55	49	45	41	37	34	31	29

PA12PHLY

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	85	73	65	59	54	50	47	43	39	35	31

PA12HL

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	81	61	50	44	39	34	31	28	26	23	21

**Guidelines*

TOLERANCES

The tolerances on external diameter, according to **DIN 73378**, are:

External diameter from 4 to 10 mm ± 0.2 mm
External diameter from 11 to 20 mm ± 0.3 mm

Upon special request tubes with narrow tolerances.

USE TEMPERATURE

-40°C ÷ 100°C

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POLYAMIDE 11 C.BIO

C.BIO tubes are produced using a fully bio-sourced polymer named **Polyamide 11** (**PA11**). **C.BIO** tubes fulfill all requirements of the well-known standard **DIN 73378** and **DIN 74324**. **C.BIO** tubes are mainly used in low temperature application below **-40°C** or when long term resistance to high temperature is required.

NR Black Other colours upon request

				PA11				
				PHL	PHLY	HL	STANDARDS	
⌀ External mm	⌀ Internal mm	Thickness mm	Minimum bend radius mm	Burst pressure at 23°C in bar*			DIN 74324 *Black tubes*	DIN 73378 *Colored tubes*
4	2.5	0.75	20	93	126	186		•
4	2.3	0.85	20	108	147	216		•
4	2	1	20	132	180	267	•	•
5	3	1	30	99	135	201		•
6	4	1	30	81	108	159	•	•
6	3	1.5	40	132	180	267		•
6	2	2	40	201	270	399		•
8	6	1	40	57	78	114	•	•
8	5.5	1.25	40	75	99	147		•
8	5	1.5	40	93	126	186		•
8	4	2	40	132	180	267		•
9	6	1.5	45	81	108	159	•	•
10	8	1	60	45	60	90	•	•
10	7.5	1.25	60	57	78	114	•	•
10	7	1.5	60	72	96	141		•
11	8	1.5	60	63	84	126	•	•
12	9	1.5	60	57	78	114	•	•
12	8	2	60	81	108	159		•
12.5	10	1.25	65	45	60	90		•
14	10	2	75	66	90	132	•	•
15	13	1	90	30	39	57		•
15	12	1.5	90	45	60	90	•	•
16	12	2	95	57	78	114	•	•
18	14	2	100	51	69	99	•	•
20	16	2	180	45	60	90		•

Burst pressure/operating pressure ratio: 3:1 * Other sizes upon request
* Referred to the nominal diameter of the product

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POLYAMIDE 11 C.BIO

MARKING Our standard marking is:

DIN 73378	-	8x1mm	-	PA11 PHL	-	C.BIO	-	07001485-18-134-14:51
Standard		External ø for thickness		Raw material		Product name		Batch number

PRESSURE VARIATION ACCORDING TO TEMPERATURE

PA11PHL

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	87	74	64	57	52	47	44	40	36	33	30

PA11PHLY

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	85	73	65	59	54	50	47	43	39	35	31

PA11HL

Temp	+23°C	+30°C	+40°C	+50°C	+60°C	+70°C	+80°C	+90°C	+100°C	+110°C	+120°C	+130°C
% Pressure*	100	81	61	50	44	39	34	31	28	26	23	21

**Guidelines*

TOLERANCES

The tolerances on external diameter, according to **DIN 73378**, are:

External diameter from 4 to 10 mm ± 0.2 mm
External diameter from 11 to 20 mm ± 0.3 mm

Upon special request tubes with narrow tolerances.

USE TEMPERATURE

-60°C ÷ 130°C

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MULTILAYER C.MLT 533

C.MLT 533 tubes are produced using state-of-the-art multilayer extrusion technology. They fully comply with **ISO 7628-2010** standards. **C.MLT 533** tubes are offering are a very cost-effective alternative to **PA12** or **PA11** tubes. Developed for Airbrake application using quick connectors, **C.MLT 533** tubes are available in black color only. Based on customer specifications, other **C.MLT** structures can be developed.

NR Black Exclusively black tube

			C.MLT 533			STANDARD
⌀ External mm	⌀ Internal mm	Thickness mm	Bend radius mm	Burst pressure at 23°C in bar*	ISO 7628 category	ISO 7628
6	4	1	30	108	2	•
8	6	1	40	78	2	•
10	8	1	60	60	1	•
12	9	1.5	60	78	2	•
15	12	1.5	90	60	1	•

* Referred to the nominal diameter of the product Other sizes upon request

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MULTILAYER C.MLT 533

MARKING Our standard marking is:

ISO 7628	-	CAT.2	-	12x1.5mm	-	PA12/PA6/PA12	-	C.MLT 533	-	04002154-18-154-09:27
Standard		Product category		External ø for thickness		Raw material		Product name		Batch number

USE TEMPERATURE

C.MLT 533 tubes have been type-approved according to **ISO 7628-2010** standard.

The **ISO 7628-2010** standard classifies the tube resistance to pressure according to the temperature using some categories.

The following tables show the tube resistance:

TOLERANCES

The tolerances on external diameter, according to **ISO 7628-2010**, are:

External diameter from 6 mm to 10 mm ± 0.1 mm
External diameter from 12 mm to 15 mm ± 0.15 mm

Upon special request tubes with narrow tolerances.

TUBE CATEGORY FOR AIR BRAKING SYSTEMS

Category	Maximum operating pressure in bar	Minimum temperature	Maximum temperature
0	10	-40°C	80°C
1	10	-40°C	100°C
2	12.5	-40°C	100°C
3	12.5	-40°C	125°C

BURST PRESSURE ASSOCIATED WITH THE USE CLASS

Test temperature	Maximum operating pressure in bar	Burst pressure in bar
23°C	10 - 12.5	>40 >50
80°C	10	>25
100°C	10 - 12.5	>25 >31.5
125°C	12.5	>25

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